RESEARCH
FOUNDATIONS:

EVIDENCE BASE

Amira Learning

THE HMH RESEARCH
MISSION
STATEMENT

Houghton Mifflin Harcourt® (HMH®) is committed to developing innovative educational solutions and professional services that are grounded in learning science evidence and efficacy. We collaborate with school districts and third-party research organizations to conduct research that provides information to help improve educational outcomes for students, teachers, and leaders at the classroom, school, and district levels. We believe strongly in a mixed-methods approach to our research, an approach that provides meaningful and contextualized information and results.
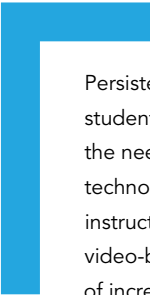
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INTRODUCTION

Persistent trends of declining or stagnant reading proficiency among fourth- and eighth-grade students in the U.S. highlight the need for effective evidence-based reading instruction that meets the needs of students and teachers (U.S. D.O.E., 2019). Over the past few decades, educational technology for reading and language learning has become an integral component of literacy instruction. Today, the use of software programs, m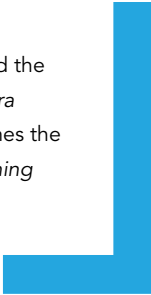obile applications, interactive websites, and video-based platforms for language and literacy learning in K–12 classrooms is a promising means of increasing student achievement in reading.

Modern advances in computer science, machine learning, and artificial intelligence (AI) coupled with literacy instruction have led to the development of *Amira Learning*, an automated AI–powered reading tutor that delivers targeted instruction, practice, and assessment in early learners' literacy skills.

This document highlights the foundational research supporting *Amira Learning*. It provides an overview of the research underlying *Amira Learning*'s AI–powered intelligent reading tutor and the research on key elements of early literacy instruction. It describes the components of the *Amira Learning* pedagogy and the research base supporting each component. The paper also outlines the role of professional development in empowering teachers to effectively integrate *Amira Learning* into the class flow.

PROGRAM OVERVIEW

Powered by artificial intelligence (AI) and evidence-based best practices, *Amira Learning* is a reliable classroom assistant that assesses oral reading fluency (ORF), screens for dyslexia, and provides reading practice.

Oral Reading Fluency Assessment	Dyslexia Screener	Practice
Easily Administer Oral Reading Fluency Assessments—Artificial intelligence and cutting-edge speech recognition remove subjective errors, judgments, and testing biases.	Provide Universal Dyslexia Screening—Effective and efficient, the dyslexia screener is easy to implement and quickly identifies students who may be at risk.	Support students with individualized scaffolded practice

AMIRA LEARNING:

- Listens to and assesses a student's reading.
- Automatically generates a running record.
- Provides teachers with actionable insights accessible via verbal commands.
- Save teachers' time—*Amira* assessments can be administered quickly to multiple students at the same time, providing the teacher with time to focus on instruction.
- Increases students' comfort during assessments—*Amira* guides students through the
- assessment process, reducing reading and test-taking anxiety.
- Maximizes instructional effectiveness—Using verbal commands, teachers are able to
- share automated reports of student results with both peers and parents.

Amira Learning stems from decades of research and development conducted by scientists at Carnegie Mellon University's Project LISTEN. In 1997, Project LISTEN researchers first introduced the Reading Tutor, a computer-based instructional program that used artificial intelligence technology to listen to children read aloud, analyze the accuracy and fluency of each student's reading, and deliver targeted instruction and feedback to each student (Aist & Mostow, 1997; Mostow, 2012). Since the initial introduction of the Reading Tutor, Project LISTEN scientists have collaborated with leading researchers in reading science, speech recognition, and psychometrics to develop *Amira Learning*.

THE *AMIRA LEARNING* JOURNEY

Amira listens to children read

Detects oral reading errors

Assesses & reports

Provides scaffolded practice

Personalizes tutoring

Informs teachers, administrators, & parents

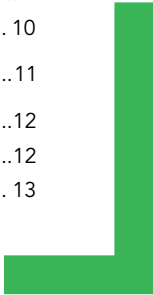# THEORETICAL FRAMEWORK FOR *AMIRA LEARNING*

Technology has permeated the classrooms and schools within the past decade at a rapid rate, transforming the way students learn, educators teach, and administrators manage resources and interpret data. Increased numbers of tablets and laptops in the hands of students, enhancements made on mobile devices, inclusion of multimedia on websites, and the infusion of social media in students' daily lives have altered the very nature of reading. Traditional print books are steadily being replaced by eBooks, audiobooks, online news sources, and even voice-controlled intelligent personal assistant services that provide an immediate answer to a spoken question. In these ways, students access text through more modalities than in the past.

Advances in the fields of artificial intelligence, human-computer interaction and hardware systems, and the development of "intelligent" computer-based assessments and instruction, now known as the Intelligent Tutoring System, have evolved from computer laboratories and are steadily being implemented into mainstream classrooms with positive results.

THEORETICAL FRAMEWORK FOR ARTIFICIAL INTELLIGENCE

ARTIFICIAL INTELLIGENCE AND LITERACY INSTRUCTION

Artificial intelligence scientists have been developing intelligent machines that can perform functions like speech recognition, adaptive learning, and advanced problem solving. Artificial intelligence is increasingly being integrated with common technology used within our daily lives, particularly embedding speech recognition software—smart phones, smart watches, smart speakers, and smart cars, to name a few. Although artificial intelligence has been researched since the 1940s in academic laboratories, its application into mainstream schools and Tier 1 classrooms within the past two decades is becoming more widespread showing promising results. In the area of literacy, AI tools hold great potential, especially for developing students' reading and writing proficiency.

Recent market research predicts that the use of AI in the field of education will grow 47.5% through 2021 (Research and Markets, 2018). One of the driving forces of the widespread uses of AI in education is providing students with adaptive learning paths and integrating AI in educational games to enhance interactivity and motivation. There are numerous ways AI has the potential to transform the educational landscape (eSchool News, 2017; Utermohlen, 2018):

- Automation of Administrative Tasks – Grading homework, accessing students' multiple-choice assessments, and evaluating writing assignments are time-consuming tasks for educators. AI software that can expedite these tasks, archive students' data, and report out on students' progress frees up teachers' time to focus on students who need more one-on-one or small-group instruction.

- Addition of Smart Content - AI can help digitize textbooks or create customizable learning digital interfaces that apply to students of all age ranges and grades.

- Smart Tutors and Personalized Instruction – Professors and teachers may have limited time, but smart tutoring systems allow all students within a classroom to have access to a tutor that provides individualized instructional support.

- Universal Access for All Students – AI tools allow students with specific disabilities to access instructional content using features such as text-to-speech, speech-to-text, translations, etc.

- Out-of-School Time (OST) Instruction – AI software can allow students to access digital content and instruction outside of the school hours. Extending instruction time can assist students who need additional practice or support students in a remote learning environment.

When AI software is implemented effectively within a classroom and students are engaged with online practice on the computer, the classroom teacher is freed to concentrate efforts on individual student needs or to provide targeted small-group instruction. Because AI-based software provides teachers with electronically collected and organized information about students' individual work, the data can be extremely useful for individualizing instruction.

AUTOMATED SPEECH RECOGNITION AND LITERACY INSTRUCTION

A significant technological advance that has enabled the development of intelligent reading tutors is **automated speech recognition** software, which listens to users' oral reading and then provides context-specific feedback (Mostow & Aist, 2001). Automated speech recognition software has shown to be a promising digital technology to enhance students' reading proficiency particularly in the following areas (Mostow & Aist, 1999):

1. **Word identification** – Children often misread a word or cannot identify it at all. Young children often lack the metacognitive skills required to realize when they need help. Technologies using automated speech recognition software "listen" to the students' miscue and provides immediate feedback by speaking (or giving a hint for) a word that the child gets stuck on, clicks on for help, misreads, or is likely to misread based on previous error patterns.

2. **Attention** – When emergent readers are reading word-for-word, or sometimes letter-by-letter, they are not able to attend to the meaning of the sentence and/or text. The technology using the automated speech recognition software is able to detect the disfluent reading and provide appropriate scaffolded supports. These supports allow students to reread the sentence more fluently, thus being able to free up the students' cognitive load to attend to the meaning of the text.

3. **Motivation** – Students who have difficulty reading often struggle with motivation to read. Striving students typically do not like to read aloud; the usage of the automated speech recognition software allows the students to have an "attentive, perceptive, and responsive audience" without judgment, thus providing a safe environment for students to practice and improve their oral reading.

Amira Learning's automated speech recognition capabilities stem from decades of Project LISTEN research in continuous speech recognition (Huang et al., 1993), speech analysis techniques (Mostow et al., 1994), and interactive educational multimedia design (Mostow et al., 1995). Using speech samples from fluent adult speakers and from children, Project LISTEN researchers have generated models of fluent oral reading and identified specific syntactic and lexical features of text that can be used to predict fluency and comprehension and to identify targets for instructional intervention and remediation (Mostow, 2012; Sitaram & Mostow, 2012).

INTELLIGENT TUTORING SYSTEMS AND LITERACY INSTRUCTION

Advances in computer science and artificial intelligence gave rise to "intelligent" computer-based instruction programs beginning in the 1970s (Corbett, Koedinger & Anderson, 1997). Traditionally, human tutors are experts that hold deep knowledge and understanding of a subject matter domain and also of student's learning goals (Reed & Meiselwitz, 2011). Modeled on effective human tutors, intelligent tutoring systems are computer software programs that use AI to provide a personalized, adaptive, and interactive learning experience within a one-on-one tutor-student relationship. Like human tutors, **intelligent tutoring systems** seek to engage students in sustained learning activities and to interact with each student based on a deep understanding of individual needs and preferences (Anderson, 1982; Corbett, Koedinger & Anderson, 1997).

ADVANTAGES OF INTELLIGENT TUTORING SYSTEMS

Researchers from the fields of cognitive psychology and computer science have long been interested in the differences between human tutors and intelligent tutoring systems.

Studies have demonstrated significant improvements in students' literacy achievement for one-on-one literacy tutoring (Snow, Burns, & Griffin, 1998). Some characteristics of individualized tutoring are as follows:

- Individualed tutoring entails extra time on reading (e.g., 30 minutes daily for much or all of a school year).

- Not all tutoring programs are effective and sufficient.

- The effectiveness of tutors can be dependent upon training and supervision of tutors.

- Students' progress needs close monitoring to determine effectiveness of the instruction.

- A key element of effective tutoring is reading connected, engaging text. Extensive assisted oral reading of connected text has been shown to improve overall reading ability, general cognitive processing, and accumulation of background knowledge (Cunningham & Stanovich, 1991).

- Other activities common to effective tutoring include word study and writing.

- Gains by tutored children compared to control groups persist on measures specific to the treatment, yet without extending to other aspects of reading performance.

Individual human tutoring demonstrates positive effects with specific reading and writing tasks, and many times, the benefits are long-lasting.

However, studies of the behavior of human tutors show that they are less likely to ask questions designed to diagnose students' misconceptions (McArthur, Stasz, & Zmuidzinas, 1990), to know which false beliefs their students held (Chi, Siler, & Jeong, 2004), and to change their behavior and

practices when given detailed diagnostic information about their students' misconceptions and false beliefs (Sleeman et al., 1989). Studies found high variability in human tutors' behaviors towards their students, as compared to intelligent tutors that had been programmed for consistency (Reeder et al., 2015). Therefore, human tutoring is time-consuming, variable in its quality of instruction, and likely extremely expensive.

Fortunately, advances in technology that assist in enhancing students' literacy skills provide a robust and cost-effective method to help achieve reading success – namely, automated individual literacy tutoring (Mostow et al., 2002). In a study measuring the effectiveness of an intelligent reading tutor 20 minutes a day compared to 30 minutes or more a day with a human tutor over a six-week period, results demonstrated that the group with the intelligent reading tutor offered time efficiencies over convential human tutoring (Reeder et al., 2015).

Children with reading difficulties often fail to realize when they misidentify a word. This problem is especially prominent in striving readers and children with weak metacognitive

skills. Therefore, intelligent reading tutors have the ability to detect students' errors while reading connected text and can, therefore, provide the support the students' need as they're reading.

Therefore, study findings highlight ways in which AI-powered intelligent tutoring systems can serve to improve efficiency and reduce inconsistencies in the delivery of remediation and intervention in core academic subjects (Reed & Conklin, 2005).

USE OF THE AVATAR IN INTELLIGENT TUTORING

Amira Learning uses an AI-powered avatar named Amira to communicate and interact with students on the platform. An avatar is an animated pedagogical agent that interacts with students and helps them learn by providing hints, clues, feedback, and instruction (McNamara et al., 2009). Research has shown that the use of an avatar in online and virtual learning environments provides a degree of social presence and creates a sense of community for learners (Annetta & Holmes, 2006), and that social presence is a strong indicator of participants' satisfaction with computer-mediated communications (Gunawardena & Zittle, 1997; Allmendinger, 2010). By using realistic avatars that communicate with students via expressions, gestures, and visuals, intelligent tutoring systems can enhance human-computer interactions and thus increase student-tutor engagement (Basori et al., 2011).

EVIDENCE FOR *AMIRA LEARNING*

The effectiveness of *Amira Learning* has been demonstrated in gold-standard randomized controlled trial studies in real-world classroom settings. Experimental studies have found that students randomly assigned to use the Project LISTEN Reading Tutor made greater reading gains than students in the control conditions who: (a) used a comparable commercial reading software program (Mostow et al., 2003), (b) were taught by a human reading tutor (Aist et al., 2001; Mostow et al., 2001), (c) participated in sustained silent reading (Mostow et al., 2002), or (d) received "business as usual" classroom instruction (Mostow et al., 2003).

Studies have also shown that *Amira Learning* is effective for English learners. A study with elementary school students from Spanish-speaking homes in Chicago found that the Project LISTEN Reading Tutor led to significantly greater gains in reading fluency than did the control condition of sustained silent reading (Poulsen et al., 2007). Researchers at the University of British Columbia found that elementary and middle school students from Hindi/Urdu-, Mandarin-, and Spanish-speaking homes who received the Reading Tutor made significant gains on the Word Attack, Word Identification, Word Comprehension, and Passage Comprehension subtests of the Woodcock Reading Mastery Tests-Revised (Reeder et al., 2007; Reeder et al., 2008). Results from a recent follow-up study with elementary and middle school students in Vancouver, Canada indicated that students who used the Reading Tutor made significant gains in oral reading fluency, and that the gains were larger than those made by students in the control condition who received regular classroom instruction with English learning support (Reeder et al., 2015).

THEORETICAL FRAMEWORK FOR READING INSTRUCTION

SIMPLE VIEW OF READING

The **Simple View of Reading** is a prominent theory of reading development that was proposed by educational psychologists Philip Gough and William Tunmer in 1986. According to the Simple View of Reading, reading comprehension is the product of word recognition and language comprehension. In order to read with comprehension, readers must simultaneously decode the words on a page while drawing on their knowledge of language to access the meaning of the text. **Decoding** involves connecting the spellings in words to their sounds and putting them together in order to read.

In 2001, reading scientist Hollis Scarborough elaborated on the simple view framework to develop the **Strand Model of Skilled Reading**—also referred to as the **Reading Rope**. According to the Strand Model, each component of the Simple View of Reading—word recognition and language comprehension—is itself a multifaceted skill. The word recognition strand encompasses phonological awareness, decoding, and sight recognition, while the language comprehension strand includes background knowledge, vocabulary, language structures, verbal reasoning, and literacy knowledge. Given instruction and practice, the word recognition skills become more automatic while the language comprehension skills become increasingly strategic.

Language Comprehension
- Background Knowledge
- Vocabulary Knowledge
- Language Structures
- Verbal Reasoning
- Literacy Knowledge

Increasingly Strategic

Word Recognition
- Phonological Awareness
- Decoding (and Spelling)
- Sight Recognition

*Increasingly Automatic*
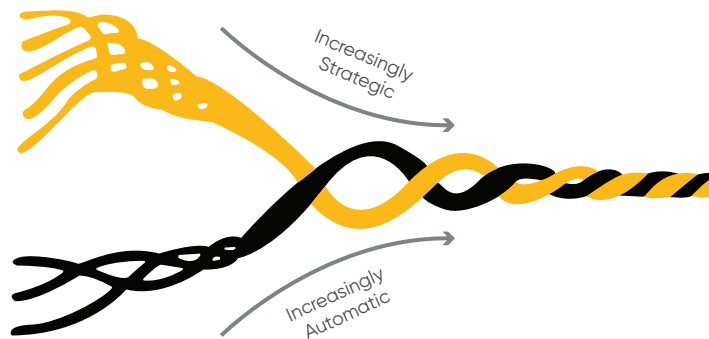
Skilled Reading
Fluent execution and coordination of word recognition and text comprehension

Reading is a multifaceted skill, gradually acquired over years of instruction and practice.

FIVE PILLARS OF LITERACY

In 1997, the United States Congress convened the National Reading Panel to review the scientific research evidence on reading and the resulting implications for reading instruction. In 2000, the experts on the panel produced a report based on decades of research evidence that highlighted five key pillars of early literacy and reading instruction: **Phonemic Awareness, Phonics, Fluency, Vocabulary, and Comprehension** (National Institute of Child Health and Human Development (NICHD), 2000). Numerous independent studies and expert panels have concluded that phonemic awareness and phonics have a direct and positive impact on reading acquisition, and research has also shown that a foundation in phonemic awareness and phonics can positively affect other key elements of literacy, such as fluency, vocabulary development and comprehension. The **5 Pillars of Literacy**—also known as the **Big 5 of Reading**—remain widely accepted by researchers and educators as core elements of effective reading instruction.

Phonemic Awareness | Phonics | Fluency | Vocabulary | Comprehension
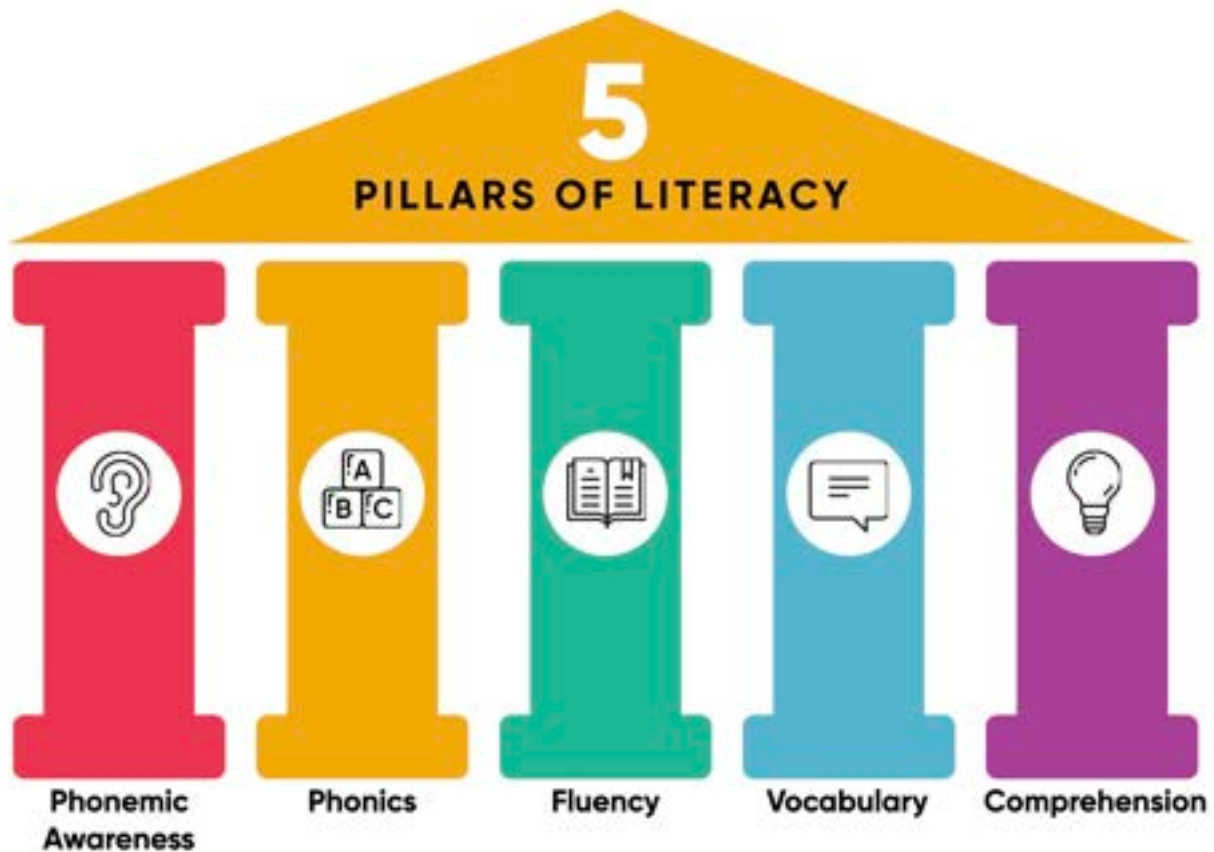
THE *AMIRA LEARNING* PEDAGOGY

Amira Learning uses the power of automated speech recognition and artificial intelligence technology to assess and report on students' skills across key pillars of reading and to enable oral reading practice supported by a variety of micro-interventions tailored to each individual student's specific needs. Each micro-intervention is a scaffold that helps an emerging reader improve skills that *Amira Learning*'s assessments have identified as needing more work toward mastery. In addition, student performance on *Amira*'s oral reading fluency assessment is linked to resource recommendations from HMH's core English Language Arts program, *HMH Into Reading*, to support teachers in providing instruction targeted to their students' needs. This system connects assessment, reporting, instruction, and practice to help teachers understand the impact of their instruction and determine how to target instruction to students' needs in an iterative, data-driven cycle (Pellegrino, 2014; Wiliam, 2014). This section describes the research underlying the essential elements of the *Amira Learning* pedagogy: assessment, reporting, differentiated instructional recommendations, and individual practice supported by micro-intervention scaffolds.

AMIRA ASSESSMENT, REPORTING, AND RECOMMENDATIONS

ORAL READING FLUENCY ASSESSMENT

Reading fluency is accurate, expressive reading at a rate appropriate for enabling comprehension. **Oral reading fluency** is a measure of the number of words a student can read aloud correctly and with natural ease per minute (Valencia et al., 2010). Measures of words correct per minute (wcpm)—also commonly referred to as **running records**—are used by literacy and language teachers across the United States to assess oral reading fluency in elementary school students (Armbruster, 2010; Hasbrouck & Tindal, 2006; Manzo, 2007). Fluency is an essential early literacy skill that has been described as a "bridge" between decoding and comprehension, enabling readers to shift their cognitive resources away from decoding and towards constructing meaning from text (Pikulski & Chard, 2005). Over time, the oral reading fluency assessment has become key to identifying at-risk students, placing students in remediation or special education, improving instructional programs, and predicting performance on high-stakes assessments (Klein & Jimerson, 2005; McGlinchey & Hixson, 2002).

HOW *AMIRA LEARNING* ALIGNS WITH THE RESEARCH

Amira Learning's Oral Reading Fluency assessment uses automated speech recognition and artificial intelligence technology to listen to children read aloud and analyze their oral reading accuracy and rate. *Amira Learning* was developed by scientists at Project LISTEN in conjunction with psychometricians, neuroscientists, and reading scientists to produce reliable and valid assessments of oral reading fluency. After a 5-7 minute oral reading fluency assessment, *Amira Learning* analyzes students' reading, produces a running record of errors, and reports scores with actionable insights.

DYSLEXIA SCREENER

Early Identification. Research shows that early screening and detection is critical for students with reading difficulties. There is wide consensus among researchers and educators about the importance of administering screening tests as students first enter school and again at the beginning and middle of each year from kindergarten through Grade 3 (Gersten et al., 2008). Early and frequent screening using high-quality instruments that are efficient, reliable, and valid are needed to provide timely identification of students who might be at risk for reading failure, learning disabilities, and/or dyslexia (Washington, Compton, & McCardle, 2010). Repeated administrations of screening tests help schools track students' progress and rate of growth, adjust instruction as needed, and provide additional services to prevent later problems (Gersten et al., 2008).

Prevention and Intensive Intervention. Petscher and colleagues (2019) state that early screening and intervention services are critical for students with undiagnosed literacy-related disabilities, including dyslexia. Effective prevention and early reading intervention services should focus on the literacy-related problems. This includes providing intervention to students who are not yet diagnosed with literacy-related disabilities, including dyslexia, as well as those students who are experiencing literacy-related difficulties for other underlying reasons (Shaywitz & Shaywitz, 2020). Students' reading skills are developed and established in the early elementary years and are stable over time unless additional support and interventions are supplied to accelerate students' literacy growth (Petscher et al., 2019; Torgesen, 2000). Longitudinal data suggest that reading interventions that begin prior to the third grade are more effective than those that begin later in students' schooling (Juel, 1988; Torgesen et al., 2001). No matter the cause of the literacy issues (e.g., dyslexia, other learning disabilities, low oral language skills, etc.), early, systematic, and intensive intervention is the best solution to prevent long-term effects of reading difficulties over a period of the students' schooling and lifespan (Connor et al., 2014).

HOW *AMIRA LEARNING* ALIGNS WITH THE RESEARCH

Amira Learning's Dyslexia Screener uses automated speech recognition and artificial intelligence to listen to students respond to a set of measures and analyzes their phonological awareness, alphabetic awareness, word reading, and rapid automatized naming (RAN) skills. Developed in conjunction with psychometricians, neuroscientists, and reading scientists, *Amira*'s Dyslexia Screener is the electronic version of the TPRI assessment. The reliability and the validity of the TPRI assessment was measured and established through the research conducted by the University of Texas-Health and the Children's Learning Institute. *Amira*'s Dyslexia Screener meets the universal screening criteria recommended by the International Dyslexia Association. With more than two decades of research supporting its effectiveness (including Project Listen, on which *Amira* was based), the content/technolgy built into *Amira Learning*'s Dyslexia Screener has demonstrated consistent and reliable results with strong predictive validity.

In 7–9 minutes, *Amira*'s Dyslexia Screener assesses and identifies students who may be at risk for dyslexia. *Amira* can also screen multiple students at the same time, saving teachers valuable time for instruction and planning. Furthermore, there are multiple versions of the screener for each grade level so students can be screened multiple times each year. *Amira* automatically generates a Dyslexia Risk report that helps teachers identify next steps for intervention and further evaluation.

AMIRA LEARNING'S DYSLEXIA SCREENER

- Utilizes rapid automatized naming (RAN)—*Amira* employs multiple techniques found to be reliable indicators of brain function associated with dyslexia.

- Provides fully automated screening—Neither administration nor scoring requires teacher time or training.

- Listens directly to students read—Other assessments employ proxies for reading instead of listening directly to the student.

- Takes fewer than seven minutes per student—Entire classes can be screened in minutes.

- Generates actionable reports to empower timely intervention—*Amira's* reporting provides at-a-glance data to drive instruction and differentiation.
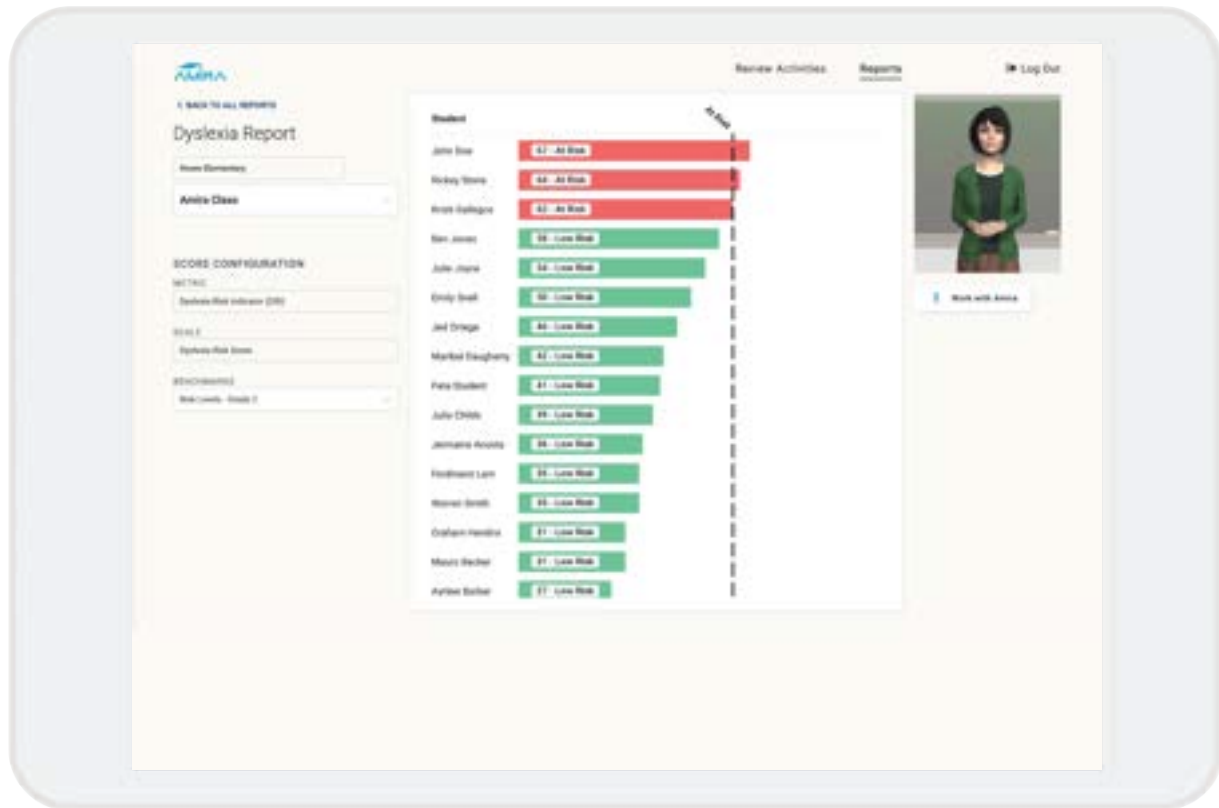
Amira displays dyslexia risk scores, enabling the teacher to recommend additional screening and intervention.

REPORTING AND RECOMMENDATIONS

Amira Learning automatically scores and records each student's oral reading and/or responses to the Dyslexia Screener, and allows the teacher to choose among the numerous types of reports generated. Instructional resource recommendations based on a s tudent's Oral Reading Fluency assessment performance can be found in the Diagnostic Report. *HMH Into Reading* resources are recommended to support teachers in providing targeted instruction and/or practice for the skills that *Amira* identifies for each student.

The Reporting Dashboard provides data that can be used to inform instruction. Specifically, teachers can:

■ Get automated reporting within one click

■ Access via voice commands, laptop, tablet, and more

■ Track progress at a single point in time and over time

■ Share reports with parents, literacy coaches, and administrators
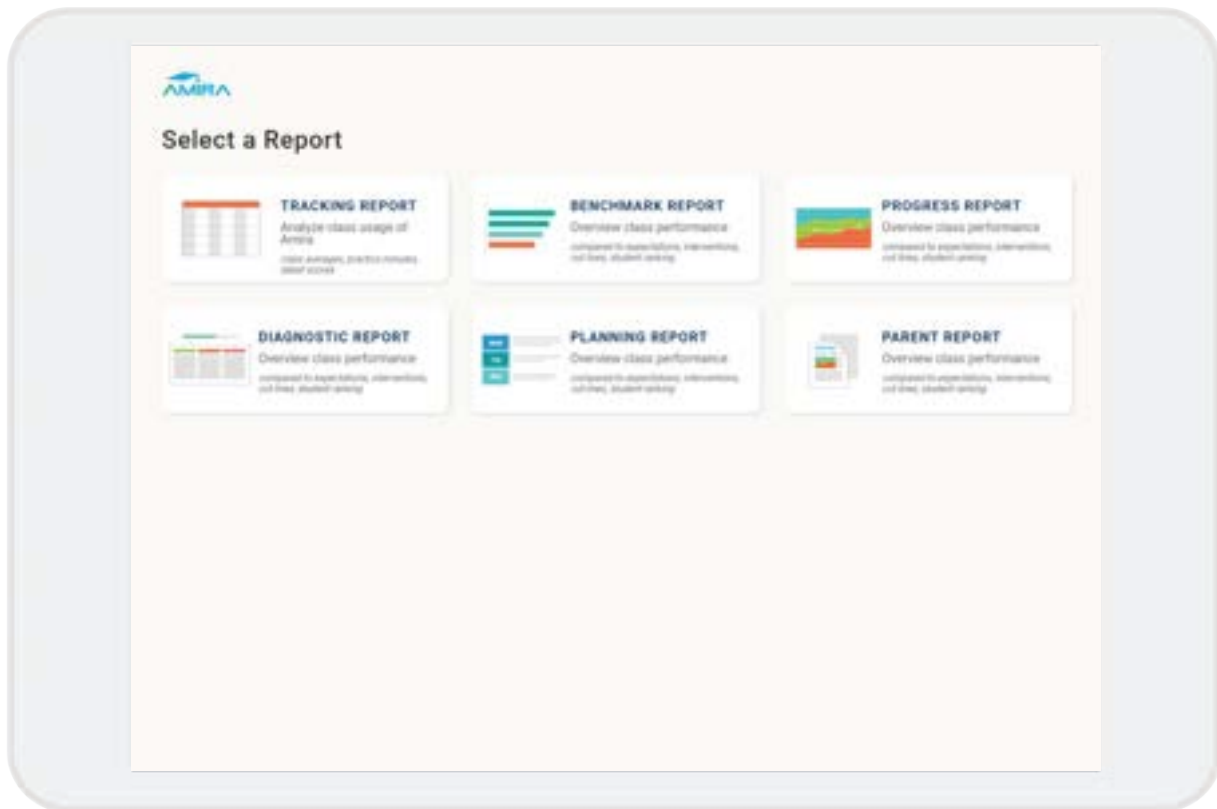
TABLE 1. *Amira Learning*'s Reports

| Reports Based on Oral Reading Fluency Assessment	
Running Record	The Running Record view displays a student's oral reading fluency assessment scores on a single screen. The student's assessment is audio-recorded, allowing the teacher to listen to samples of student reading at different times throughout the year. This functionality enables administration of the assessment without requiring the immediate presence of a qualified literacy specialist.
Tracking Report	The Tracking Report enables at-a-glance management of the assessment process. The report enables easy assignment of the test. Teachers can see which students have completed the assessment and how they have done. Any students that need to be screened are clearly designated.
Benchmark Report	The Benchmark Report compares students' fluency against national, state, or local norms. It uses color-coded bars to indicate risk and displays nationally-normed percentiles for comparison. Teachers can immediately view individual student scores, make whole-class comparisons, and view performance against benchmarks in a single report. Teachers can compare against expectations, interventions, cut lines, and student rankings. Benchmarks are updated each assessment season to represent students' grade-level reading skills for that time of year.
Progress Report	The Progress Report allows teachers to view the performance of a student over time. Teachers can monitor student improvement and click through to review specific assessments. The Progress Report also projects current mastery into the future. Teachers can find and review previous assessments or practice sessions in the Progress Report.
Diagnostic Report	The Fluency Diagnostic Report provides detailed information about individual student skills. Within each skill area, teachers are provided with a list of concepts or skills that are "likely mastered," "appropriately challenging," and "very challenging." These skills-based insights are linked to resource recommendations from the Into Reading core program to support teachers with materials that appropriately target their students' needs for instruction and practice. Color-coded percentiles are also displayed to alert teachers to any areas in which a student may benefit from additional assistance.
Parent Report	The Parent Report provides a snapshot of the status of a student at a given moment in time. It displays the most current metrics to share with parents and provides actionable reading tips parents can use at home with students to help them build fundamental reading skills. This report is printable to facilitate sharing—teachers can share this report with parents via email and/or print the report for parent-teacher conferences.
Report based on Dyslexia Screener	
Dyslexia Report	The Dyslexia Report displays results from the Dyslexia Screener in the form of a Dyslexia Risk Index (DRI). Cut points are provided between scores categorized as At Risk or Low Risk, which for every grade corresponds to a DRI score greater than or equal to 30 or less than 30, respectively. Students are sorted from highest to lowest scores, with color-coded score bars. Scores falling above 30 (At Risk) are colored red, and scores at or above 30 are red.
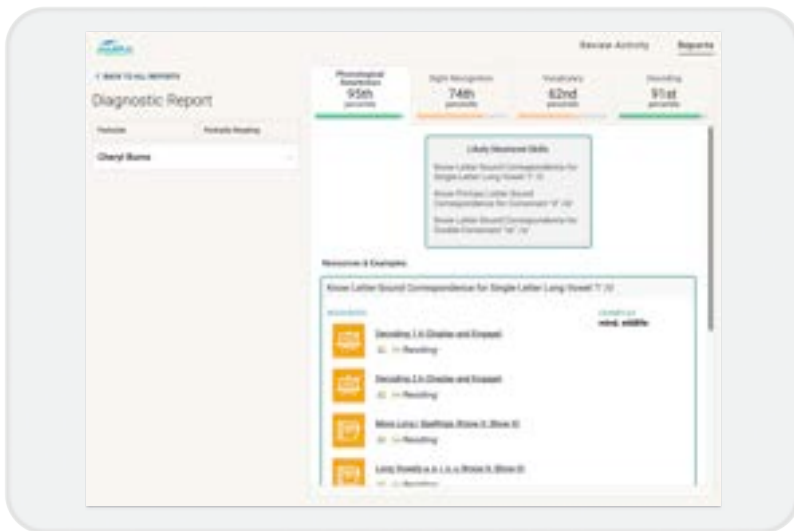
Amira's **Diagnostic Report** breaks down individual student skills into Word Knowledge; Language, Logic, & Literacy; Vocabulary; Sight Recognition; Decoding; and Phonological Awareness. This automatic, detailed, skills-based analysis makes targeted instruction possible.

Amira Assessment is the only program that automates **running records.**
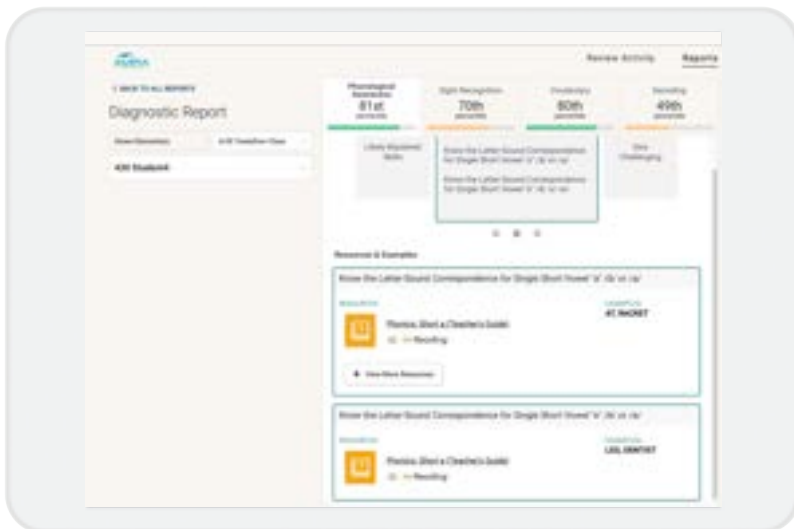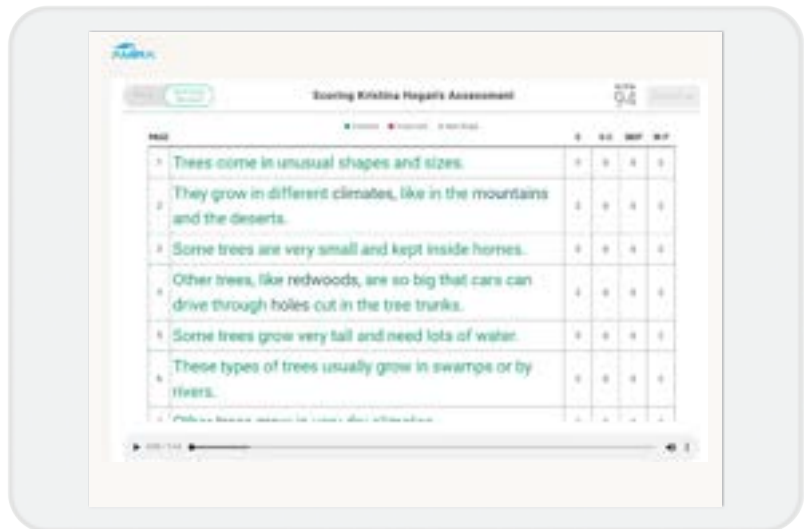
Amira Learning's Diagnostic Report with **Resource Recommendations** contains instructional support for educators using *HMH Into Reading*.

INSTRUCTIONAL STRATEGIES

SCAFFOLDED PRACTICE

Scaffolding is the temporary assistance the teachers provide for the students in order to assist the students to complete a task or develop new understandings, so that they will later be able to complete similar tasks alone (Hammond, 2001). Hammond notes several essential features of scaffolding:

- **Extending understanding** – Through teachers' quality of instruction, support, and guidance, they are able to clarify, challenge, and extend what students are able to do on their own. When students are challenged beyond their current abilities in a developmentally appropriate manner, it deepens and extends students' understanding of new concepts and skills. With low or high challenge but low support, little learning will occur. However, in environments with the right amount of challenge and high support, optimal learning can take place.

- **Temporary support** – Scaffolds, by nature, should be temporary in its usage. The main goal is for students to learn independently, so teacher support is gradually minimized as the learners become increasingly more skillful, and thus independent.

- **Macro and micro focuses** - Scaffolding needs to be thought of in relation to the development of overall programs and curricula, as well as to selection and sequencing of tasks andto the specific classroom interactions that are part of those tasks.

Scaffolding is also known as the **gradual release of responsibility**, where teachers initially take on most of the responsibility for learning but gradually transfer it to the learner as he or she becomes more skilled. A common form of scaffolded practice is the "I do, we do, you do" model, where the teacher first models how to complete a task (I do), then works on the task together with the students (we do), and finally allow the students to complete the task independently (you do) (Fisher & Frey, 2008; Fisher, 2003). The gradual release of responsibility model of instruction has been documented as an effective approach for improving literacy achievement (Fisher & Frey, 2008), reading comprehension (Lloyd, 2004), and literacy outcomes for English language learners (Kong & Pearson, 2003).

The practice of scaffolding is widespread in formal K-12 education systems and also in digital learning environments (Dalton & Rose, 2008). Research has demonstrated that embedding scaffolds such as vocabulary definitions, additional contextual information, main ideas of text, and reading strategy prompts supports comprehension of digital text (Anderson-Inman & Horney, 1998).

HOW *AMIRA LEARNING* ALIGNS WITH THE RESEARCH

Amira Learning uses data obtained from its reading assessments to deliver scaffolded reading practice that is personalized based on each student's specific needs. *Amira Learning*'s automated reading tutor delivers targeted instruction, practice, and feedback in all five key elements of early literacy: phonemic awareness, phonic, fluency, vocabulary, and comprehension. *Amira Learning* uses artificial intelligence technology to measure, define, and report each student's learning progression in order to ensure that advanced skills are not introduced prior to acquisition of prerequisite skills.

Amira Learning uses the following metrics and scales to identify needs for scaffolded practice:

Metric	Scale	Description
Oral Reading Fluency (ORF)	Words Correct Per Minute (WCPM)	ORF measures a student's ability to read aloud with natural ease. WCPM incorporates accuracy (words correct) and speed (minutes spent reading aloud).
Reading Mastery	Amira Reading Estimated Age (AREA)	AREA measures a student's ability to read accurately, compared to average age of acquisition for story words. Accuracy is defined in terms of reading age level.
Decoding	Nonsense Word Fluency (NWF)	NWF measures a student's ability to combine letter sounds for unfamiliar words. Person names and high-level vocabulary words are considered "novel" whereas sight words are considered "familiar." *Amira Learning* listens to a student read to understand progress in phonemic awareness, and utilizes a range of interventions to enable appropriate instruction and progression from simple to more complex words, syllable types, and multi-syllable words.
Phonological Awareness	Phoneme Segmentation Fluency (PSF)	PSF measures a student's ability to pronounce phonemes within words accurately. Students are scored on how well all phonemes have been pronounced. *Amira Learning*'s corpus of words is based on a mapping of every word to the 44 distinct phonemes recognized by the International Phonetic Alphabet.
Sight Recognition	Estimated Sight Recognition Inventory (ESRI)	ESRI measures the estimated percentage of sight words a student has mastered. *Amira Learning*'s corpus of sight words comes from the Dolch Sight Words list, the most commonly used set of sight words (https://sightwords.com/pdfs/word_lists/dolch_all.pdf).
Vocabulary Size	Estimated Words in Vocabulary	Vocabulary size is an estimate of how many words are likely to be in a student's expressive vocabulary. Estimates are based on published research on vocabulary development as a function of age. *Amira Learning* understands over 30,000 words in the English language to both assess and support students' vocabulary development.

Amira Learning assesses skills each time a student uses the software, and does not introduce new skills before a student has mastered the prerequisite skills. *Amira Learning* uses the learning progression to recommend reading resources aligned to each student's skills. *Amira Learning* has an extensive library of high-quality reading selections, and also allows schools and districts to upload their own reading selections. *Amira Learning* provides teachers with automatically-generated score reports of each student's progress along with actionable insights for instruction and remediation.

CUMULATIVE INSTRUCTION

A cumulative approach to reading instruction is based on evidence from research studies conducted over decades and established on learning progressions theory. **Learning progressions** have been defined as empirically grounded and testable hypotheses about how students' understanding of core concepts within a subject domain grow and becomes more sophisticated over time (Corcoran, Mosher, & Rogat, 2009). Skills follow a logical order of the language, and skills are organized with the easiest and most basic concepts and progress methodically to more difficult concepts and elements from grade to grade. **Cumulative** means each step must be based on concepts previously learned. Cognitive science research has shown that learning is cumulative. Complex cognitive skills can be broken into simpler skills, which can in turn be broken into even simpler skills, and lower-level skills must be mastered before higher-level skills can be mastered (Gagne & Briggs, 1974).

HOW *AMIRA LEARNING* ALIGNS WITH THE RESEARCH

Amira Learning takes a systematic, explicit, and cumulative approach to reading instruction. Based on the Simple View of Reading, *Amira Learning*'s multi-threaded learning progression spans the five key pillars of early literacy and reading instruction: **Phonemic Awareness**, **Phonics**, **Fluency**, **Vocabulary**, and **Comprehension**. The essential design of *Amira Learning*'s multi-threaded learning progression is that skills are integrated by literacy thread or area. Instruction is systematic and cumulative in that within a thread, easier prerequisite skills are mastered before more difficult skills are introduced. *Amira Learning*'s diagnostic score reports provide data about each student's mastery of the skills within a thread (**intra-thread linkage**). Within each thread, *Amira Learning* categorizes skills into a vertical stack based on student's level of mastery. The vertical mastery stack serves to illustrate intra-thread linkage of literacy skills within a pillar and also to present the key skills as a spectrum and highlight the skills currently within a given student's Zone of Proximal Development (ZPD).

Mastery level	Level description
Developed	The student has mastered the skill and achieved deep fluency.
Likely mastered	The student is adept at the skill but lacks consistency and may need reinforcement.
Appropriately challenging	The skill is still developing.
Very challenging	The skill is out of reach.

Percentile Rank Values for *Amira* Reading Estimated Age (AREA) scores
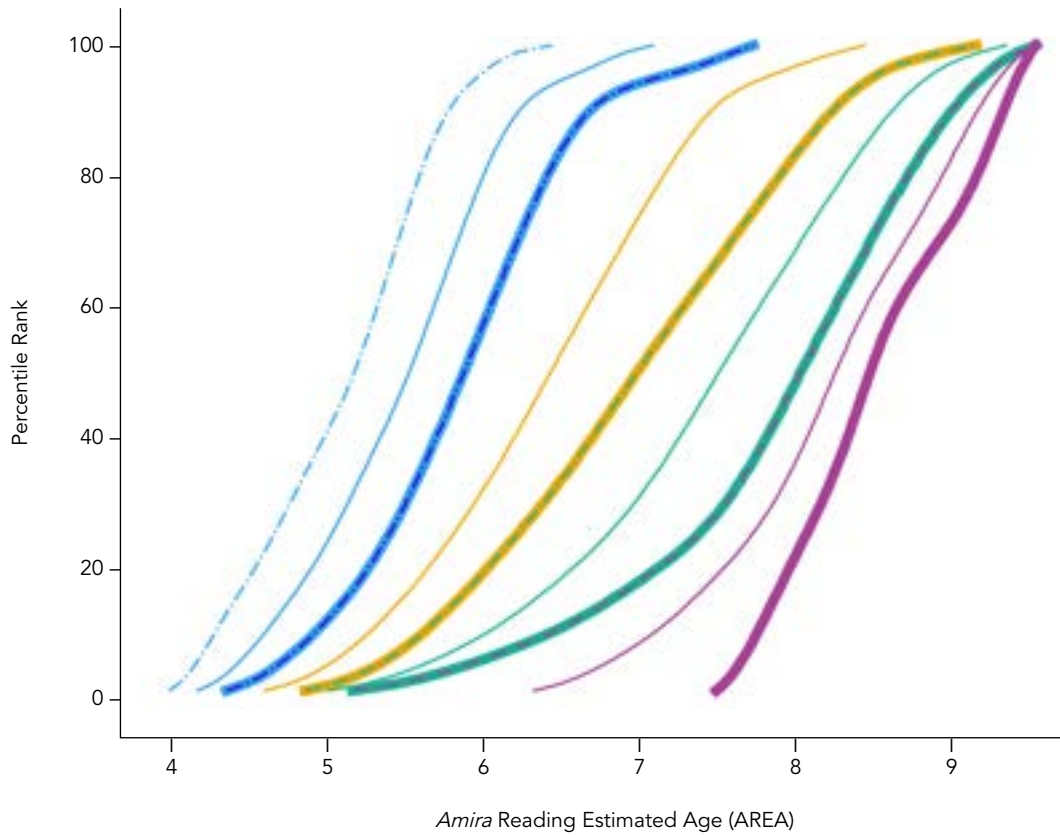
Blue = kindergarten
Yellow = first grade
Green = second grade
Purple = third grade
Dotted lines = beginning of year (BOY) norms
Thin solid lines = middle of year (MOY) norms
Thick solid lines = end of year (EOY) norms

Note: Because *Amira* assessments are administered throughout the year (fall, winter, spring, and summer months), EOY norms for a given grade overlap with BOY norms for the next higher grade level (e.g., EOY kindergarten norms overlap with first-grade BOY norms).

Amira Learning also links skills and mastery horizontally across the threads (**inter-thread linkage**) to show how multiple threads are woven together to form the two components of the Simple View of Reading—word recognition and language comprehension (Gough & Tunmer, 1986; Scarborough, 2001).

Strand	Threads
Word recognition	Phonological awareness, decoding, sight recognition
Language comprehension	Background knowledge, vocabulary, language structures, verbal reasoning, literacy knowledge
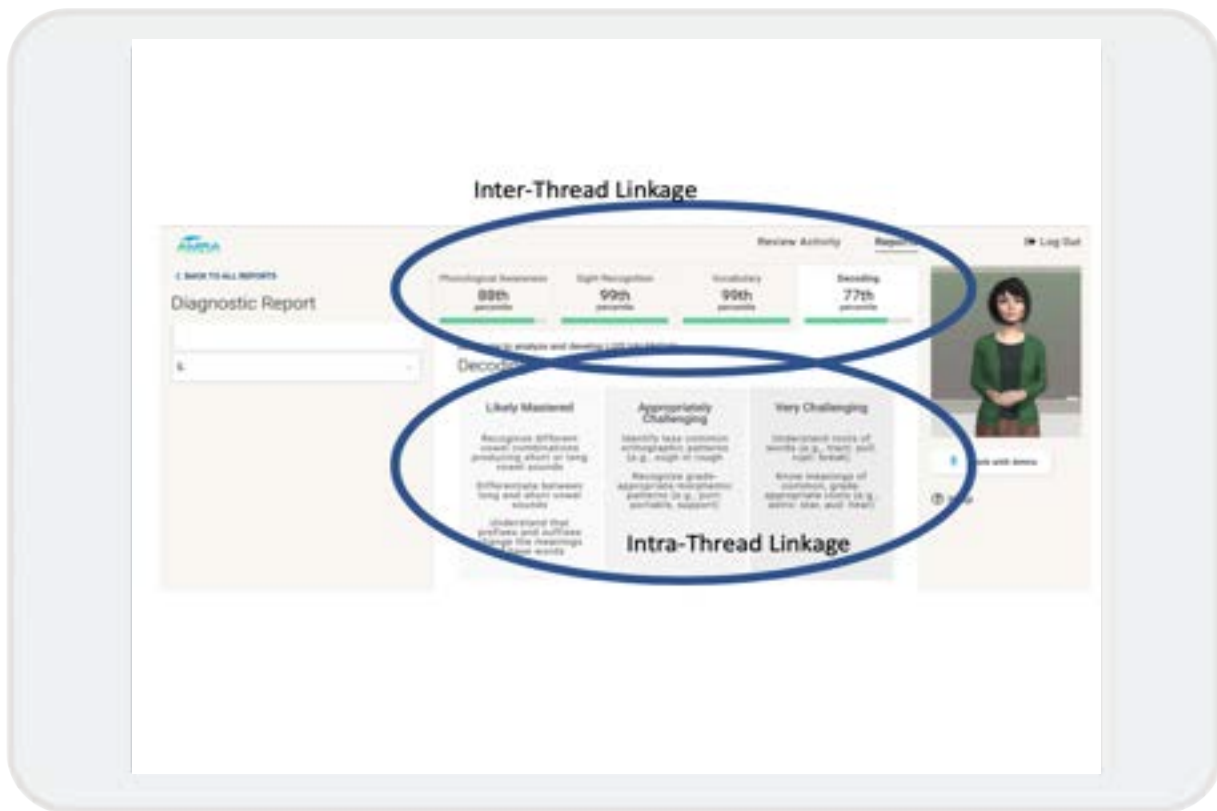
Amira Learning obtains frequent assessments of each student's mastery of key skills across the multiple threads that make up each strand of literacy, and reports the data along with actionable insights to help the teacher plan targeted instruction.

Via the AI avatar, *Amira*, the program delivers targeted scaffolded instruction in component skills like decoding, segmentation, blending, and pronunciation. What makes *Amira Learning* unique is its ability to respond to each student's reading errors in the moment by providing explicit modeling and instruction that is tailored to the student's needs.

SCAFFOLDED SUPPORT FOR THE FIVE PILLARS OF LITERACY

Each scaffolded support within *Amira Learning* is a response to errors in the assessment phase and a means by which *Amira*, the AI avatar, guides student through the reading material at hand and tutors them to build critical foundational skills. *Amira Learning* offers three classes of interventions that differ in when Amira, the AI avatar, corrects errors and delivers feedback: at the moment a word is being (incorrectly) read, at the end of a sentence, and at the end of a page or passage. *Amira Learning*'s interventions are based on evidence from reading science. Therefore, this inventory of scaffolded support, also referred to as **micro-interventions**, is organized by the Five Pillars of Literacy—those skills identified as critical elements of effective early literacy instruction.

PHONEMIC AWARENESS

Effective reading instruction in the early grades focuses on helping students understand the role that phonemic awareness plays in learning to read and write. Phonemic awareness refers to the ability to identify and manipulate individual speech sounds in oral language (NICHD, 2000). A phoneme is the smallest unit of sound in a given language that can be recognized as being distinct from other sounds in the language. For example, the word cap has three phonemes (/k/, /a/, /p/), and the word clasp has five phonemes (/k/, /l/, /a/, /s/, /p/). Phonemic awareness is essential to reading because hearing the individual component sounds in words is key to matching them with alphabet letters when learning to decode.

The importance of phonemic awareness in learning to read has been well documented. The National Reading Panel reviewed decades worth of reading research and concluded that phonemic awareness and letter knowledge are the two best indicators of how well children will learn to read during the first two years of instruction. Recent research also shows that phonemic awareness is an essential precursor to reading, and that listening to and using language helps many, though not all students gain this awareness prior to entering school (Brady, Braze, & Fowler, 2011).

HOW *AMIRA LEARNING* ALIGNS WITH THE RESEARCH

Amira Learning provides the following phonemic awareness activities:

Scaffolded Support	What the avatar does	What the student does	Research evidence
Rhyming word (word level)	Amira provides a rhyming word at the word level	Rereads the correct word	Foorman et al., 2016; Lane et al., 2007; Mitchell & Fox, 2001
Rhyming word (sentence level)	Amira provides a rhyming word at the end of the sentence	Rereads the correct word	Foorman et al., 2016; Lane et al., 2007; Mitchell & Fox, 2001
Sounding out by syllable (word level)	Amira pronounces the word, chunking it syllable by syllable, at the word level	Repeats the word	Foorman et al., 2016; Oulette & Senechal, 2008; Torgesen et al., 2010
Sounding out by phoneme (word level)	Amira articulates the word, segmenting it phoneme by phoneme at the word level	Repeats the word by blending the phonemes	Foorman et al., 2016; Oulette & Senechal, 2008; Torgesen et al., 2010
Sounding out by phoneme (sentence level)	Amira articulates the word, segmenting it phoneme by phoneme at the end of ththe sentence	Repeats the word by blending the phonemes	Foorman et al., 2016; Oulette & Senechal, 2008; Torgesen et al., 2010

PHONICS

Effective reading instruction in the early grades focuses on helping students learn letter-sound correspondences. After learning to hear the sounds of speech, the next step for students is to learn **phonics**—the relationships between written letters (called **graphemes**) and the individual sounds they represent (**phonemes**). As these understandings fall into place, students begin to decode.

Initially, they may recognize familiar words on sight, but gradually they should apply what they know about letter-sound correspondences to decode words as they read and to encode words as they write (Foorman et al., 2016). Thus, in addition to learning letter-sound patterns, beginning readers must become fluent in decoding—the process of segmenting letter-sound patterns within words and blending them back together to access that word in their lexicon.

For some students, the transition from the understanding of how oral language functions to applying the same principles in understanding print requires patient, consistent teacher support. Once students know a few consonant and vowel sounds and their corresponding letters, they can start to sound out and blend them into words in isolation and in context. In this process, they must use their recognition of letter shapes, understand the order of letters in words, access the sounds of these letters, and put together the meanings of the words to create a basic understanding of the words on the page or screen (Adams, 1990; Cunningham & Allington, 2011).

As these understandings of the sounds of the letters and the written letters fall into place, students begin to decode. Initially, they may recognize familiar words by sight, but gradually they should apply what they know about letter-sound correspondences to decode words as they read and encode words as they write. The development of automatic word recognition depends on intact, proficient phoneme awareness, knowledge of sound-symbol correspondences, recognition of print patterns such as recurring letter sequences and syllable spellings, and recognition of meaningful parts of words (Moats, 2020).

Effective reading teachers also include instruction in **syllable structure**, which can help guide pronunciation of a written word, and **morphology** (knowledge of word parts like roots and affixes), which can also provide reliable information about pronunciation and meaning. Mastering advanced decoding skills like syllable structure and morphology can facilitate reading multisyllabic words. Effective reading instruction helps students master sound-symbol associations in two directions: visual to auditory (reading), and auditory to visual (spelling). Reading requires segmenting of whole words into the individual sounds, while **spelling** involves the blending of sounds and letters into whole words. As such, learning to spell reinforces learning to read; spelling and reading are the productive and receptive sides of the same coin.

Strong teachers teach these skills explicitly with detailed explanations, modeling, and practice (Strickland, 2011). In these ways, teachers demonstrate the utility of the sophisticated concepts and skills students are working to master. Students should also be encouraged to try the skills out themselves by reading simple text or beginning to write on their own. This mixing of explicit instruction and practice activities strengthens students' understanding and gives them confidence as beginning literacy users. Students can also practice phonics skills by taking dictation from teachers; the resulting products give teachers valuable informal data about students' understanding of letter-sound correspondences and of letter formation.

HOW *AMIRA LEARNING* ALIGNS WITH THE RESEARCH

Amira Learning provides the following activities that focus on developing students' grapheme-phoneme correspondence skills, decoding skills, recognition of high-frequency words, and knowledge of morphology:

Scaffolded Support	What the avatar does	What the student does	Research evidence
Word correction without repetition prompt	Amira says the word immediately following significant hesitation or stall	Listens to correction	Foorman et al., 2016; O'Connor et al., 2010; Scanlon et al., 2005; Stevens et al., 2016
Word correction with repetition prompt	Amira says the word and asks student to repeat the word immediately following significant hesitation or stall	Listens to correction, repeats word correctly, and continues to read	Foorman et al., 2016; O'Connor et al., 2010; Scanlon et al., 2005; Stevens et al., 2016
Blending phonemes with Elkonin Box (sentence level)	Amira shows an Elkonin box with letters shown above the boxes	Drags letters into boxes and then blends phonemes to say word	Foorman et al., 2016; Oulette & Senechal, 2008; Torgesen et al., 2010
Sounding out by syllable with articulation (word level)	Amira shows a video of an adult's lips pronouncing the word, syllable by syllable, at the word level	Repeats the word	Foorman et al., 2016; Torgesen et al., 2010
Sounding out by syllable with articulation (sentence level)	Amira shows a video of an adult's lips pronouncing the word, syllable by syllable, at the end of the sentence	Repeats the word	Foorman et al., 2016; Torgesen et al., 2010
Sounding out by syllable with graphemic segmentation visual (immediate)	Sounding out by syllable with graphemic segmentation visual (immediate)	Repeats the word	Foorman et al., 2016; Oulette & Senechal, 2008; Torgesen et al., 2010

Scaffolded Support	What the avatar does	What the student does	Research evidence
Sounding out by phoneme with articulation (sentence level)	Amira shows a video of an adult's lips segmenting the word phoneme by phoneme at the end of the sentence	Repeats the word by blending the phonemes	Foorman et al., 2016; Torgesen et al., 2010
Sounding out by phoneme with vocabulary visual (sentence level)	Amira shows a pop-up of the word, an image depicting what the word means, and articulates the word while clapping through the phonemes	Repeats the word while clapping through the phonemes	Foorman et al., 2016; Oulette & Senechal, 2008
Spelling out the word with visual (sentence level)	Amira shows a pop-up with the letters and spells out the word at the end of the sentence	Reads the word	Foorman et al., 2016; Oulette & Senechal, 2008; Torgesen et al., 2010
High-frequency word practice with flash cards (sentence level)	Amira does a flash card exercise with the target high-frequency word and other related words at the end of the sentence	Recognizes and reads the high-frequency words as quickly as possible	Foorman et al., 2016; Vadasy & Sanders, 2011
High-frequency word practice with flash cards with repetition (sentence level)	Amira does a flash card exercise with a single high-frequency word at the end of the sentence	Repeats the high-frequency word three times	Foorman et al., 2016; Vadasy & Sanders, 2011
Morphological correction (sentence level)	Amira emphasizes the morphological error (eg. *hairs* instead of *hair* or *ended* instead of *end*) and models the correct pronunciation at the end of the sentence	Repeats the word	Foorman et al., 2016; Savage et al., 2003; Wright & Jacobs, 2003; Baker et al., 2014

FLUENCY

Fluency refers to the ability to read letters, sounds, words, sentences, and passages, both orally and silently, with speed, accuracy, and the appropriate expression (NELP, 2008). Fluency is a reading skill that acts as a bridge between decoding and comprehension (NICHD, 2000).

A key component of fluency is **accuracy**, the ability to read or pronounce the words in a text correctly. Findings from research show that fluent reading depends on accurate and automatic word recognition, which in turn requires mastery of phonemic awareness and letter naming (Rasinski et al., 2006).

The **rate** or speed at which words are read is an essential component of reading fluency. The ability to accurately and quickly recognize letters, spelling patterns, and whole words with automaticity and effortlessness is essential to reading comprehension (Adams, 1990). When students' word identification becomes fast and accurate, they have freed up some "cognitive space" to draw on their broader knowledge of language and to comprehend what they are reading (Baker et al., 2017; Hoover & Gough, 1990).

Researchers at the Language for Reading Research Consortium (LRRC) found that that word recognition fluency– a measure that includes both accuracy and rate– significantly predicted reading comprehension of students in Grades 1-3 (LRRC, 2015). Additionally, the researchers found that the importance of rate increases as students' literacy skills develop; accuracy is a stronger predictor of reading comprehension for first and second graders, but for third graders, measures of fluency that include rate predict reading scores better than accuracy scores alone (LRRC, 2015).

Prosody refers to the ability to read aloud with appropriate phrasing, intonation, and expression. Prosody also refers to the ways in which tone of voice and inflection convey meaning in oral language—for example, the way one expresses sarcasm or irony. Prosody is important because reading involves more than reading quickly and accurately– readers must also comprehend the meaning of text. Fluency is intricately linked to reading comprehension because strong readers demonstrate silent reading fluency as they recognize words and their meaning automatically and can attend primarily to making sense out of what they read (NICHD, 2000). Fluency– or lack thereof– may indicate to readers that they may have to go back to reread sections or to look up the meanings of some words.

According to Kuhn and colleagues (2010), prosody is separate from accuracy and rate in beginning readers: children cannot both read very quickly and with proper prosody at the same time. Research from cognitive psychology suggests that one of the functions of prosody is to help the reader retain an auditory sequence of sounds and words in working memory so that they can work to comprehend the meaning of text (Frazier et al., 2006; Swets et al., 2007). Taken together, these findings indicate the need to develop students' prosody in addition to accuracy and rate.

As teachers help students to become fluent readers, they need to reassure them that fluency means reading with comprehension, not merely saying the words as quickly as possible. Teachers model this distinction in their oral reading by pausing to question the meaning of words, the implications of word choice, or other aspects of the texts they are reading.

HOW *AMIRA LEARNING* ALIGNS WITH THE RESEARCH

Amira Learning provides the following fluency activities that help students focus on their rate and prosody of reading aloud connected text:

Scaffolded Support	What the avatar does	What the student does	Research evidence
Down-leveling	Amira suggests a new story that is easier to read whenever Amira detects that the text is too challenging for the student	Switches to new appropriately challenging story	Foorman et al., 2016; Christ & Davie, 2009; Denton et al., 2013; Stevens et al., 2016
Slow down	Amira asks the student to slow down	Reads the text more slowly	Foorman et al., 2016
Repeat sentence without reread prompt	Amira rereads the sentence	Listens to correction and continues to read	Foorman et al., 2016; O'Connor et al., 2010; Scanlon et al., 2005; Stevens et al., 2016
Repeat sentence with reread prompt	Amira rereads the sentence and asks student to repeat the sentence	Repeats the sentence	Foorman et al., 2016; O'Connor et al., 2010; Scanlon et al., 2005; Stevens et al., 2016
Repeat sentence with error focus	Amira rereads the sentence while focusing on the errors	Listens to correction and continues to read	Foorman et al., 2016; O'Connor et al., 2010; Scanlon et al., 2005; Stevens et al., 2016
Speak up	Amira asks student to read more clearly and loudly	Reads more forcefully	Savage et al., 2013; Stevens et al., 2016

VOCABULARY

From the very beginning, high-quality early literacy instruction must also include instruction and practice on vocabulary (Beck, McKeown, & Kucan, 2013; Cunningham & Stanovich, 1997; Foorman et al., 2016). The extent of students' vocabularies varies widely when they enter school, often reflecting variety in home environments and prior experiences, such as differences between the language of home and of school or preschool attendance (Toub et al., 2018; Hart & Risley, 1995; Kieffer & Stahl, 2016). Teachers' everyday conversations with students can minimize these differences and expand students' oral vocabularies and concepts, in addition to their efforts to teach students academic language skills such as how to talk about books and about their own reading and writing (Foorman et al., 2016; Shanahan et al., 2010). Students' vocabularies expand from repeated encounters with new words, both in the literacy block and in content-area instruction (Connor & Morrison, 2012); vocabularies also grow from listening, reading, and talking to others.

HOW *AMIRA LEARNING* ALIGNS WITH THE RESEARCH

Amira Learning embeds the following vocabulary activities that help students understand the meaning, context, and usage of academic and content-specific vocabulary words:

Scaffolded Support	What the avatar does	What the student does	Research evidence
Provide the definition (word level)	Amira shows a pop-up of the word and its definition, and says the definition immediately after a significant hesitation or stall	Reads the word	Foorman et al., 2016; Baker et al., 2013; Goodson et al., 2010
Provide the definition with image (sentence level)	Amira shows a pop-up of the word, an image that depicts what the word means, and says the definition at the end of the sentence	Reads the word	Foorman et al., 2016; Baker et al., 2013; Goodson et al., 2010
Sounding out by phoneme with vocabulary visual (sentence level)	Amira shows a pop-up of the word, an image depicting what the word means, and articulates the word while clapping through the phonemes	Repeats the word while clapping through the phonemes	Foorman et al., 2016; Baker et al., 2013; Goodson et al., 2010

Spanish Supports

In addition, *Amira Learning* supports Spanish-speaking English learners with Spanish supports for the vocabulary words throughout the software:

Scaffolded Support	What the avatar does	What the student does	Research evidence
Provide Spanish cognate with image (sentence level)	Amira shows the cognate in print, pronounces it in Spanish, and shows a vocabulary image	Reads the English word aloud	Baker et al., 2014; August et al. (2009); Carlo et al. (2004); Lesaux et al. (2010)
Provide definition in Spanish with image (sentence level)	Amira shows a pop-up of the word in English and Spanish, an image that depicts what the word means, and then says the word aloud	Reads the English word aloud	Baker et al., 2014; August et al. (2009); Carlo et al. (2004); Lesaux et al. (2010)

COMPREHENSION

Comprehension is the ultimate goal of learning to read, and even beginning readers benefit from instruction that introduces them to a variety of strategies to help them understand different kinds of texts and their text structures (Duke, 2000; Shanahan et al., 2010). Part of beginning comprehension instruction is the teacher "externalizing" or modeling the comprehension strategies mature readers use automatically. The daily read-aloud period is an ideal means for this instruction—so long as teachers remember that merely reading aloud isn't enough. Students need to be actively involved in asking and answering questions, making predictions, or explaining characters' motivations or other actions in what they are hearing (Duke & Pearson, 2002; Reutzel et al., 2008; Shanahan et al., 2010). Researchers have found positive relationships between students' reading growth and the extent to which they have engaged in "analytic talk" during the back-and-forth with teachers during read alouds (McGee & Schickendanz, 2007). This makes sense because the listening comprehension of young learners far surpasses their emerging reading comprehension skills.

Of course, this kind of instruction is most effective when teachers have access to high-quality children's literature in a variety of genres and representing different cultural backgrounds and experiences. It is especially important that students experience high-quality informational books in addition to narrative literature representing different cultural backgrounds and experiences (Duke, 2000). One of the great advantages of introducing students to reading comprehension skills by giving them opportunities to read on their own in books at the right level is that the experience reinforces that the students themselves do indeed have the capacity to become successful readers (Sisk et al., 2018). Empirical studies have demonstrated that children's independent reading provides a unique mechanism to increase reading fluency, academic vocabulary (Cunningham, 2005), and general world knowledge (Cunningham & Stanovich, 1998; Stanovich & Cunningham, 1993).

HOW *AMIRA LEARNING* ALIGNS WITH THE RESEARCH

In addition to ensuring that students have mastered decoding and word recognition skills, *Amira Learning* provides comprehension support on all texts to ensure that students are understanding the passages they are reading.

Scaffolded Support	What the avatar does	What the student does	Research evidence
Cloze questions (end of page)	Amira shows 2 cloze questions at the end of the page	Selects the correct answers	Mostow et al., 2017; Shanahan et al., 2010
Cloze questions (end of story)	Amira shows 2 cloze questions at the end of the story	Selects the correct answers	Mostow et al., 2017; Shanahan et al., 2010
Open-ended questions (end of story)	Amira asks an open-ended question	Answers the questions orally	Shanahan et al., 2010; Beck & McKeown, 2006
Fun fact (end of sentence)	Amira shows a pop-up with the word, an amusing image, and gives a "fun fact"	Listens to the fun fact to build vocabulary and background knowledge	Baker et al., 2014; Carlo et al., 2004; Lesaux et al., 2010

DIFFERENTIATED INSTRUCTION

MOTIVATING ALL LEARNERS

Educators and researchers often distinguish between two types of motivation: **intrinsic** and **extrinsic**. Intrinsically motivated learners are those who are driven by a love for learning and desire for self-satisfaction, while extrinsically motivated learners are driven by a quest for external rewards like praise, high scores, good grades, and money (Corpus et al., 2009). Research has shown that both forms of motivation are related to learning, with intrinsic motivation having stronger effects on learning and achievement. A longitudinal study of middle school students found that 5th graders' intrinsic motivation, perceived competence, and

engagement with school were significant predictors of their reading achievement in 8th grade (Froiland & Oros, 2013). Research on motivation and mindset demonstrates that how teachers deliver praise has an effect on students' beliefs about their own intelligence (Dweck, 2007). Students who are praised for their effort and grit rather than their talent or ability are more likely to develop malleable growth mindsets, resilience to setbacks, and increased motivation to learn (Dweck, 2007).

HOW *AMIRA LEARNING* ALIGNS WITH THE RESEARCH

Amira Learning was designed to be a patient and non-threatening program that provides support as needed. Within the comfort zone that the software provides, students are motivated by effective praise, targeted feedback, entertaining and high-interest content, algorithms that recommend content based on student interests, having agency in choosing what to read (at an appropriate level), and completing a story.

Amira Learning is designed to build motivation, foster a sense of agency, and encourage grit and stamina in young readers. The software is centered on the reading cycle— selection, practice, skill building, reward, and progress monitoring. *Amira Learning* is aligned with the considerable research that shows that providing students with choice is effective in increasing motivation. On entry, each student is presented with a set of appropriately-leveled reading resources selected by *Amira Learning*'s AI technology to build the skills within the student's ZPD and allowed to choose which text to work with.

As a student reads with Amira, he or she receives instantaneous feedback. This breakthrough aspect of the *Amira Learning* software prevents lack of immediacy from sapping motivation and interest. In addition to immediate formative feedback, *Amira Learning* also provides summative reports of student progress upon completion. *Amira Learning*'s progress reports allow a student to view his or her latest performance scores and also their progress over time.

Additionally, *Amira Learning* is aligned to research on effective use of praise. Amira follows evidence-based best practices in praising students for effort, determination, and persistence rather than success or achievement. *Amira Learning* is designed to deliver praise whenever students show that they are trying to exercise and extend their skills.

TEACHING EXCEPTIONAL LEARNERS

STUDENTS WITH DISABILITIES

Early and frequent screening of students in Kindergarten to Grade 3 provides the first means of identifying students with disabilities and students with dyslexia (Gersten et al., 2008). Results from screening tests may suggest that more focused diagnostic testing is advisable to pinpoint the causes of students' potential struggles. Data from such testing that indicates students are at risk for reading failure should set into motion development of a Response to Intervention (RTI) plan and, if needed, further evaluation and the development of an individualized education program (IEP). To maximize success for these students, classroom teachers and specialists need to work together to ensure that the plan is followed and the interventions are successful. Students' RTI plans and IEPs most likely provide guidance for the Tier 1 instruction.

Literacy scaffolding is vital for students with disabilities, and computer-based literacy instruction offers many ways to provide necessary supports for students with disabilities. Research has shown that assistive technology software providing text-to-speech features along with built-in supports improves access to learning and also leads to large performance gains for students with visual impairments and learning disabilities (Elkind & Elkind, 2007; Izzo et al., 2009). Researchers have discovered that compared to traditional static text, supported electronic text with interactive multimedia links and resources has been helpful to readers who struggle to acquire word meanings (Anderson-Inman & Reinking, 1998; Anderson-Inman, 2009).

STUDENTS WITH DYSLEXIA

Dyslexia is a specific learning disability that is neurobiological in origin that is characterized by an "unexpected difficulty in reading for an individual who has the intelligence to be a much better reader, most commonly caused by a difficulty in the phonological process, which affects the ability of an individual to speak, read, and spell" (Shaywitz & Shaywitz, 2020, p.100). Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge (IDA, 2020).

Early identification, remediation, and providing accommodations such as assistive technology where necessary are critical for minimizing these secondary consequences and others such as the detrimental effects of experiencing repeated failure. Developing a dislike for reading can make problems worse if students avoid reading and thereby fall further behind.

Over the past couple of decades, the development of methods of detection and interventions for dyslexia have increased, and many have incorporated the use of technology. Conventional dyslexia detection processes are now augmented with computational intelligence techniques (Jain et al., 2009; Gaggi et al., 2012; Perera et al., 2016).

Research indicates that students with dyslexia perform worse in reading irregular and nonsense-words compared to regular words, suggesting that impairments in decoding are characteristic of dyslexia (Ziegler et al., 2008). Recent research has highlighted the importance of rapid naming skills in fluent reading. The ability to quickly and automatically process, identify, and name familiar text and objects is related to reading (Georgiou, 2013), and this skill is impaired in students with dyslexia (Jones et al., 2010).

Moreover, students who struggle with reading may lack the "reading stamina" needed during a literacy block that requires independent work in addition to working with teachers and students. Students with reading difficulties need extra practice, extra time, and books aligned with their proficiency that engage their interests.

HOW *AMIRA LEARNING* ALIGNS WITH THE RESEARCH

Amira Learning provides both the Dyslexia Screener for early detection and identification of students who are at risk for reading difficulties and subsequent personalized practice that meet each students' unique needs.

Amira Learning integrates assistive technology supports that allow learners with visual and auditory disabilities to access text. *Amira Learning* uses the power of automated speech recognition and artificial intelligence to listen to students read aloud and analyze their phonological awareness, alphabetic awareness, word reading, and rapid automatized naming skills, allowing frequent and early screening for dyslexia. Because *Amira Learning* is designed to adapt and personalize practice, the software quickly identifies striving readers and optimizes interactions for these students.

- **Continuous Re-Leveling** As a student works with Amira, a real-time frustration index is maintained, based on WCPM and accuracy metrics. When a passage is proving too difficult, Amira will suggest an alternative text, where a more appropriate level of productive struggle will occur. By constantly adapting the reading resources being utilized to the current, ever-evolving skill level of a student (while still enabling students to choose their own stories at their level), Amira helps striving students build grit and engagement, while working within their ZPD.

- **Reinforcement Triggered by Error** Amira's mastery model ensures a focus on the skills that are likely developing now. But, unlike other software, Amira is constantly listening to students read. As a student makes errors, Amira can use these concrete, observed miscues to reinforce the appropriate skills. This constant but targeted scaffolding is especially constructive for striving readers.

- **Foundational Interventions** While many students benefit from lightweight interventions, Amira includes many tutoring techniques which are especially appropriate for readers with severe difficulties. The research shows that the antidote for many language and reading disorders (such as dyslexia) is structured and repetitive work on word recognition. Amira provides scaffolded support in decoding skills and building phonemic awareness.

ENGLISH LEARNERS

The best practices included in the report "Teaching Academic Content and Literacy to English Learners in Elementary and Middle School" published by the Institute of Education Sciences outlines four recommendations:

- Teach a set of academic vocabulary words intensively across several days using a variety of instructional activities.=

- Integrate oral and written English instruction into content-area teaching.

- Provide regular, structured opportunities to develop written language skills.

- Deliver small-group instructional intervention to students struggling in areas of literacy and English development (Baker et al., 2014).

English learners may have difficulty mapping standard English phonology, conventions, and syntax due to differences between English and their primary language.

The research on effective instruction for English learners points to three important principles: 1) generally effective practices are likely to be effective with English learners; 2) English learners require additional instructional supports; and 3) the home language can be used to promote academic development. Additionally, English learners need plenty of opportunities to develop proficiency in English (Goldenberg, 2013).

Teachers can accelerate the language proficiency of English learners by explicitly teaching the conventions, vocabulary, and structures of academic language in specific domains (Dutro & Kinsella, 2010). Many English learners need to acquire new phonemes or orthographic patterns as well as new matches between phonological segments and orthographic patterns (Durgunoglu, Nagy, & Hancin-Bhatt, 1993). Additionally, teaching vocabulary as it is used in specific genres prepares English learners to succeed with academic writing tasks (Schleppegrell, 1998).

HOW *AMIRA LEARNING* ALIGNS WITH THE RESEARCH

While a student reads, *Amira* recognizes the subtleties of various dialects, speech deficits, and accents to deliver results free of bias. The effectiveness of *Amira Learning* for English learners has been illustrated in experimental studies by Project LISTEN researchers and by independent researchers at the University of British Columbia and DePaul University. Results from the studies have demonstrated that English learners who used *Amira Learning* made significant gains in reading scores and outgained students in the control conditions (e.g., Poulsen et al., 2007; Reeder et al., 2007; Reeder et al., 2008; Reeder et al., 2015). *Amira Learning*'s success with English learners is grounded in a set of accommodations and adjustments specifically aimed at the special needs and challenges of these students.

Amira Practice, **powered by AI, provides higher results for EL students.**
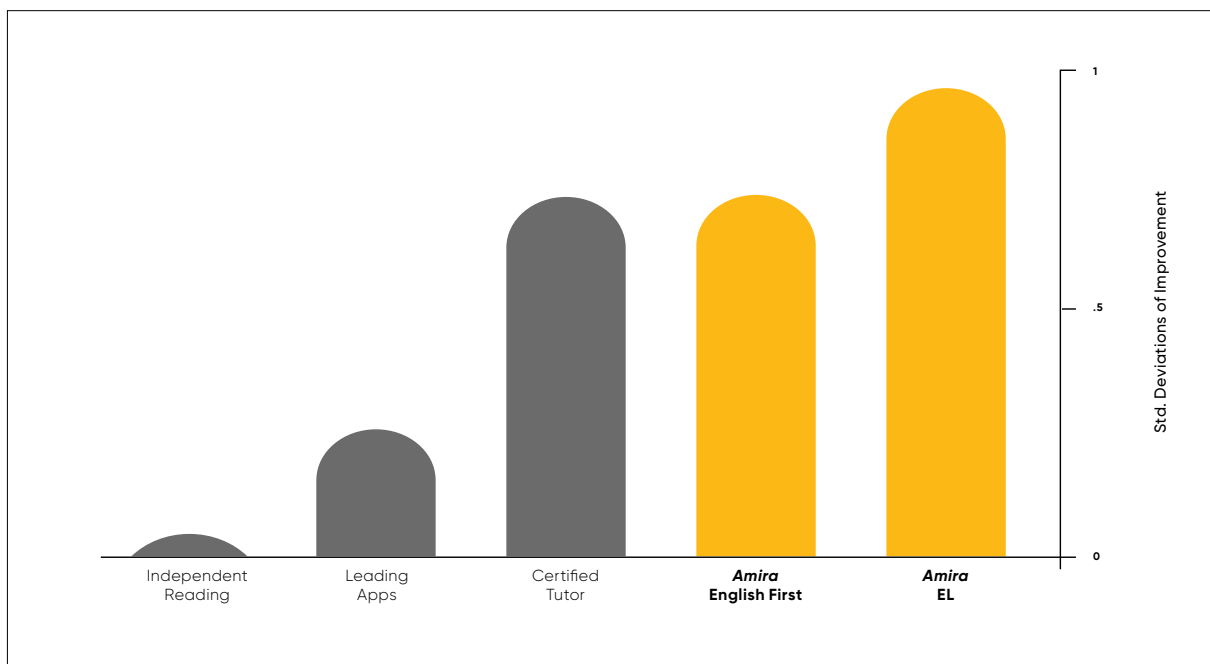
AMIRA IN SPANISH

To assist students coming from homes where Spanish is primarily spoken, *Amira in Spanish* delivers tutoring in Spanish to provide first language support. Although the student is reading in and learning English, the AI avatar, Amira, interacts with the student in Spanish.

Amira in Spanish operates precisely the same as the English version, except that the AI avatar, Amira, delivers directions, scaffolded support, and feedback in Spanish. In addition, student assessment data from *Amira in Spanish* populates the same reports as the standard *Amira Learning* data.

Whether a student works with *Amira Learning* in English or Spanish, the software delivers a range of scaffolded support specialized to help English learners. These targeted tutoring techniques include:

- **Cognates:** Amira uses cognates to link difficult or unfamiliar English words back to familiar territory.

- **Sound Boxes:** Elkonin boxes help ELs understand differences in how graphemes sound in English.

- **Phonemic Transfer:** English learners often struggle with phonemic shifts. Amira will work the "j" sound for native Spanish speakers, helping to build fluency.

PROFESSIONAL SERVICES

Amira Learning does much of the heavy lifting for teachers by delivering assessments, generating score reports, and proctoring students. HMH provides a continuum of professional learning to not only support a successful *Amira* implementation but help teachers use *Amira* data to strengthen teaching and learning. Through strategic planning, live online and on-demand professional learning courses, and coaching HMH partners with districts and schools to provide implementation support grounded in agency, collaboration, and teacher success.

Getting Started with *Amira Learning*:

Getting Started live online 2-hour session provides the hows and whys of *Amira* through exploration and collaborative experiences. Teachers will spend time digging into the program to gain a real-world application of *Amira* and how best to use it in their classroom. The goal is to build deeper understanding and confidence to begin implementing *Amira*.

- Use *Amira* to provide students with targeted, one-on-one reading practice

- Track progress and measure growth with *Amira* reports

- Differentiate instruction using data provided by *Amira*

Continue Collaboration with HMH Professional Learning Live Online Courses and Blended Coaching

To strengthen teacher practices and maximize their investment in *Amira*, HMH provides live online professional learning courses aligned to district's strategic literacy plan. We partner with districts to design a personalized live online course experience to cultivate the next generation of critical thinkers through reading and writing. Each live online course experience includes one hour of consultative planning and six 1-hour shared learning sessions that can be delivered over time to meet your needs.

Blended coaching continues to foster collaboration and provides teachers with personalized support focused on lesson design, instructional practices, content, and data-driven decision-making to promote continuous improvement over time. HMH literacy coaches build strong relationships with teachers by modeling high-impact instructional strategies, answering program and practice questions, leading grade-level program sessions centered on evidence of student learning, and helping teachers select, monitor, and achieve goals. The online and blended coaching experience includes access to the HMH Coaching Studio, which provides have access to additional resources and interactive collaboration such as:

- Access a library of on-demand lesson-modeling videos

- Upload your own resources

- Set and track progress on your goals

- Stay connected with your coach in between visits

- Record video of your teaching for self-reflection or share it

TEACHER'S CORNER

HMH **Teacher's Corner**, our easy to use, approachable professional learning site located on the Ed platform, offers program and lesson-integrated support and access to a constantly growing library of resources. Teacher's Corner resources range from authentic classroom videos to tips from other teachers, plus content and support from experienced HMH professional coaches. The fresh content, clean format, and friendly faces of peer educators create a welcome space for teachers to learn and grow at their own pace. Please visit https://www.hmhco.com/programs/teachers-corner for a quick video tour.

- The **Live Events** area supports instructional practice and program implementation. Monthly general sessions feature motivating and relevant content delivered by prominent speakers and HMH thought leaders. Subject-specific sessions focus on specific topics to extend professional learning and program-specific sessions offer teachers a chance to share bright spots, learn from each other, and connect with HMH coaches.

- The **Getting Started** area offers teachers support in learning about Amira in a digestible, actionable format. Content contributors include HMH coaches, teachers currently using HMH programs, and academic thought leaders.

- The **Program Support** area provides more specific content for teaching *Amira* using authentic model lessons, articles, videos, tips, and best practices.

- The Breakroom extends professional learning beyond the program and inspires teachers to stay engaged with program-agnostic resources in a multitude of formats such as quizzes with adaptive feedback for teachers.
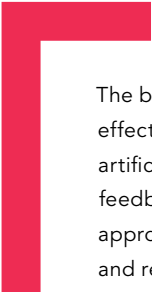

Welcome to Teacher's Corner!

A place for you—to get started with a new program, dive deeper into instructional best practices, or pick up tips from other teachers.

Browse our treasure trove of bite-size professional learning and tips from teachers.

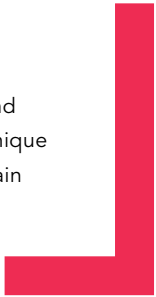Live Events　Getting Started　Program Success　Instructional Practices　Breakroom　All

CONCLUSION

The basic pillars of literacy instruction used in *Amira Learning* have long been shown to be effective. Drawing on decades of research in computer science, cognitive psychology, and artificial intelligence, *Amira Learning* delivers targeted instruction, practice, assessment, and feedback in phonemic awareness, phonic, fluency, vocabulary, and comprehension. This unique approach is highly effective with students of varying ability levels and allows students to gain and retain critical literacy skills essential for lifelong learning.

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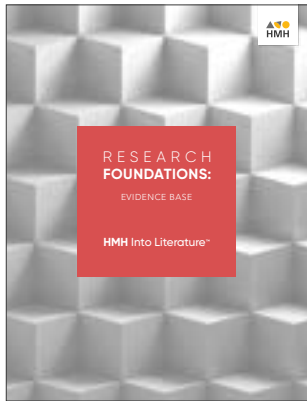
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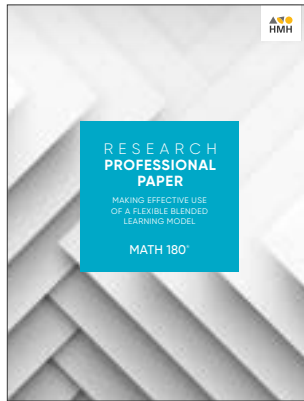
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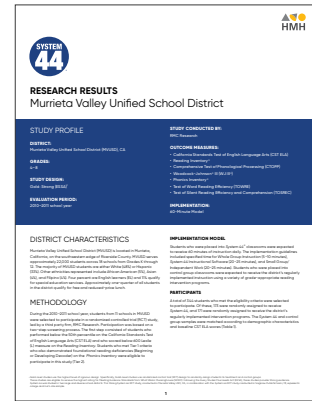
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