HMH

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.

TABLE OF **CONTENTS**

INTRODUCTION

Persistent trends of declining or stagnant reading proficiency among fourth- and eighth-grade students in the US highlight the need for effective evidence-based reading instruction that meets the needs of students and teachers (US DOE, 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, mobile 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 judgments in 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 READING* JOURNEY

THEORETICAL FRAMEWORK FOR *AMIRA LEARNING*

Technology has permeated 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 *AMIRA LEARNING*

THEORETICAL FRAMEWORK FOR ARTIFICIAL INTELLIGENCE

ARTIFICIAL INTELLIGENCE AND LITERACY INSTRUCTION

Artificial intelligence scientists have been developing intelligent machines that can perform functions such as 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 has become 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 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 student's miscue and provide 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 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 freeing 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 et al., 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 et al., 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 et al., 1998). Some characteristics of individualized tutoring are as follows:

- Individualized 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, 1997).
- 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 et al., 1990), to know which false beliefs their students held (Chi et al., 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 toward 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., 2003). 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 conventional 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., 2010). 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 (Allmendinger, 2010; Gunawardena & Zittle, 1997). 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*

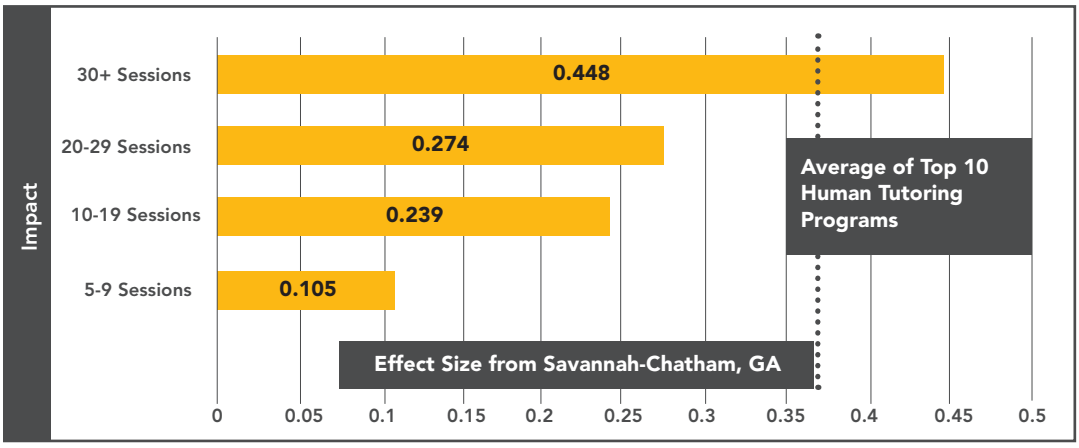
Through decades of rigorous research, *Amira Learning* has demonstrated Strong levels of evidence—the highest rating under the Every Students Succeed Acts (ESSA) criteria—which has been validated by third-party research organizations such as Evidence for ESSA.

The effectiveness of *Amira Learning* has been demonstrated in gold-standard randomized controlled field experiments in real-world classroom settings. Experimental studies have found that students randomly assigned to use the Project LISTEN *Reading Tutor,* which is the original version of *Amira Learning*, 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), (c) participated in sustained silent reading (Mostow et al., 2013), or (d) received "business as usual" classroom instruction (Mostow et al., 2003).

In more recent studies, researchers from the Consortium for Policy Research in Education at Teachers College, Columbia University (CPRE-TC), consistently found that increased usage of *Amira Learning* in kindergarten to third grade students in the Savannah-Chatham County Public Schools was positively associated with student learning. Literacy gains among students who completed 30 or more *Amira Learning* sessions during the fall-to-winter period of the 2020-21 school year were 0.45 standard deviations larger than those of their same-school peers who completed four or fewer sessions. This advantage was equivalent to a shift from the 50th to the 67th percentile.

Studies have also shown that *Amira Learning* is effective for multilingual 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 slightly larger than those made by students in the control condition who received regular classroom instruction with English learning support (Reeder et al., 2015).

Graph 1. *Amira* Usage and Fall-to-Winter Adjusted WCPM Development



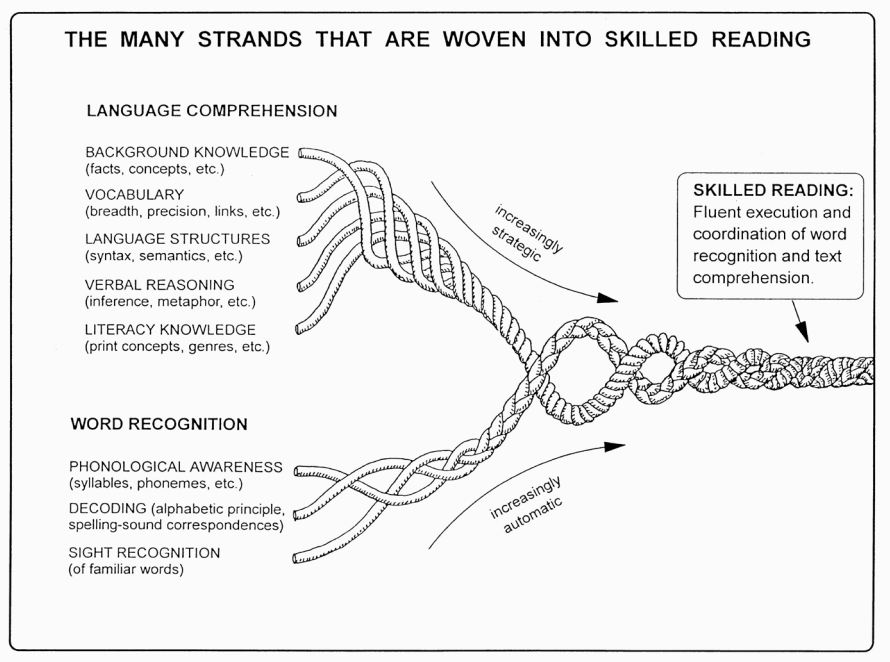
Note: These numbers reflect how much students grew from fall-to-winter (compared to low usage students).
Columbia University, Teachers College Study

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.

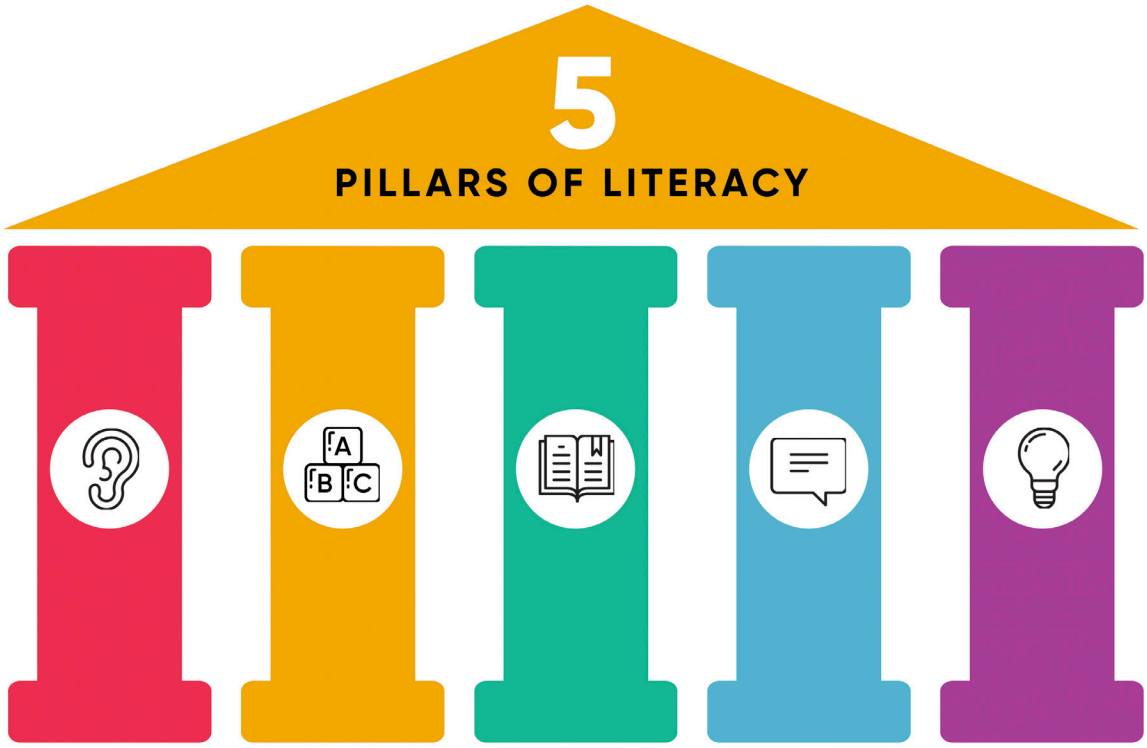


The image, used with permission from the Publisher, originally appeared in the following publication: Scarborough, H. S. (2001). Connecting early language and literacy to later reading (dis)abilities: Evidence, theory, and practice. In S. Neuman & D. Dickinson (Eds.), *Handbook of early literacy research* (Vol. 1, pp. 97–110). Guilford Press.

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.



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 Learning*'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.

THE *AMIRA LEARNING* PEDAGOGY

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 toward 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, 2004).

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 et al., 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., 2010). 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).

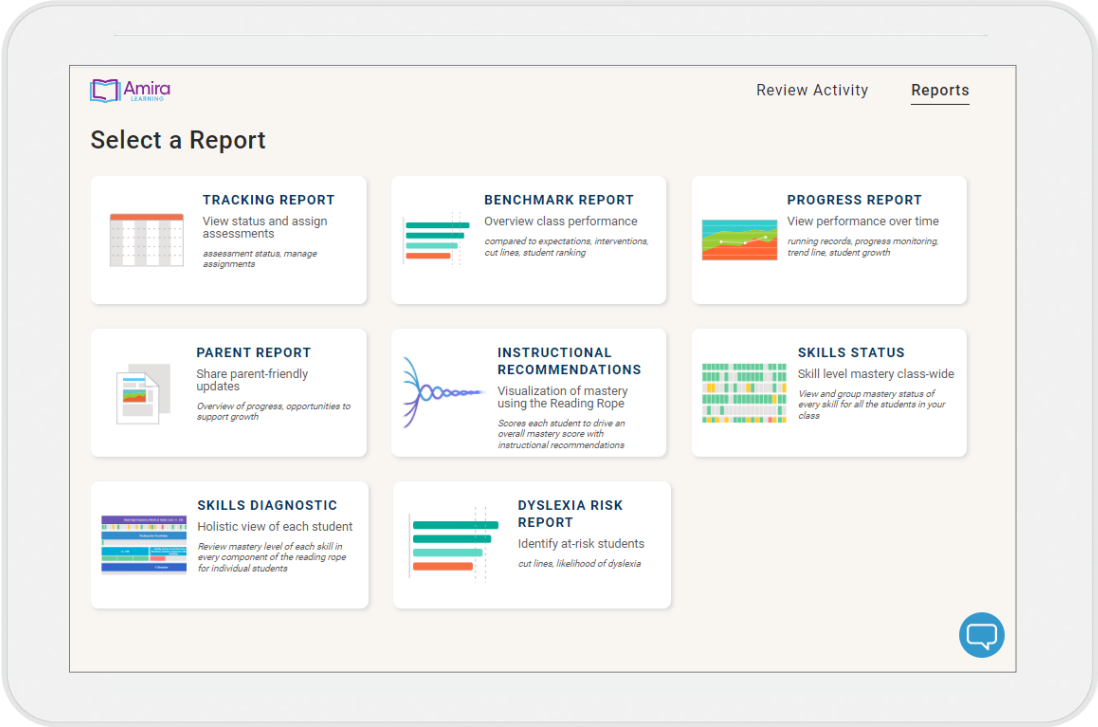
HOW *AMIRA LEARNING* ALIGNS WITH THE RESEARCH

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 Learning* meets the universal screening criteria recommended by the International Dyslexia Association. 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 Learning* 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 Learning*'s Dyslexia Screener delivers a reliable and valid assessment of dyslexia risk. *Amira Learning* 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 Learning* 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 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 or require teachers to administer the assessments one-on-one.
- 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. In addition, instructional resource recommendations based on a student's Oral Reading Fluency assessment performance can be found in the Skills 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

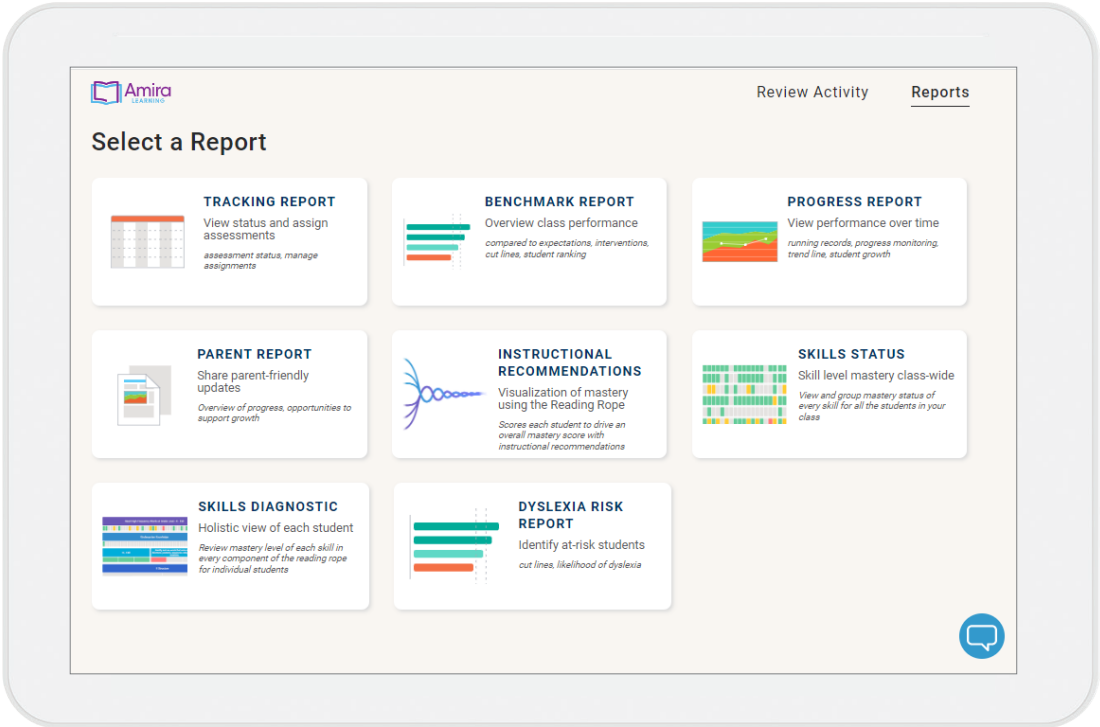
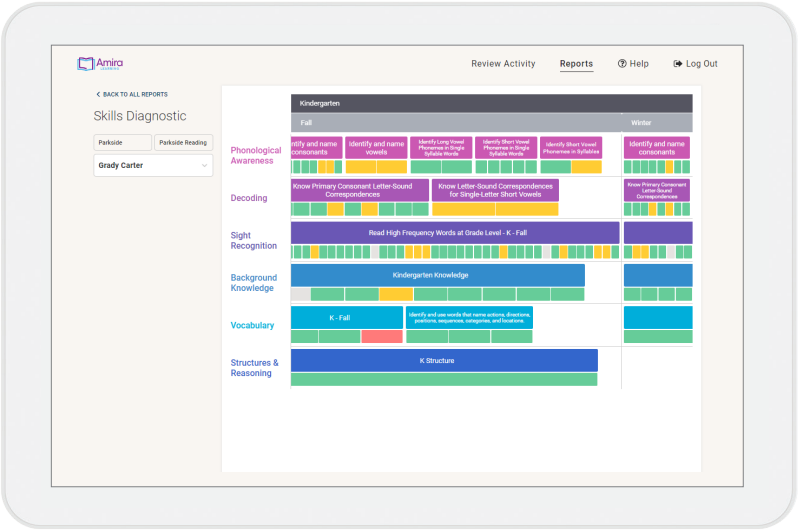


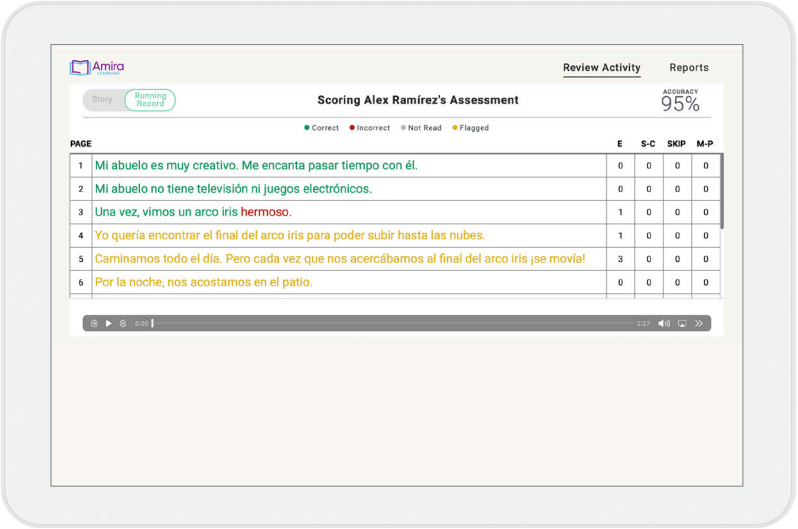
TABLE 1. ***Amira Learning*'s Reports**

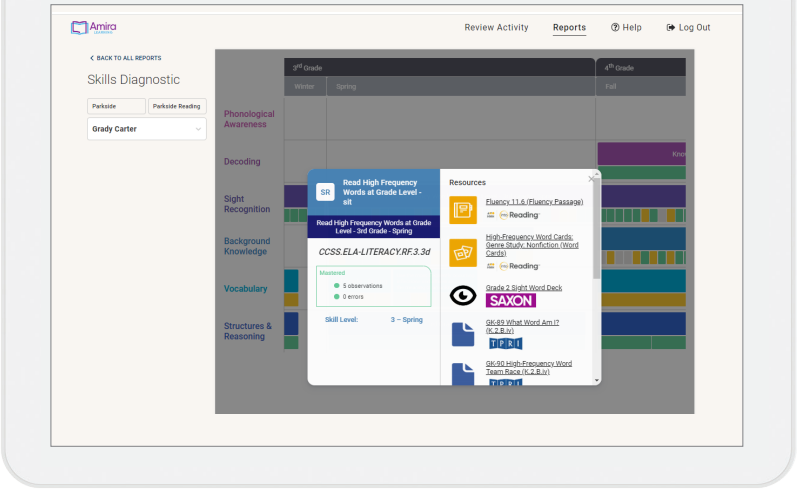
Reports Based on Oral Reading Fluency Assessment	
Running Record	The Running Record view displays students' word-level miscues from their oral reading fluency assessment scores on a single screen. The student's assessment is audio-recorded, allowing the teacher to listen to samples of student reading 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 also 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 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, cut lines, and other students. Benchmark results and performance expectations are refreshed each assessment season to reflect grade-level reading performance for that time of year.
Instructional Recommendations Report	The Instructional Recommendations Report provides detailed information about individual student skills through a visualization of Scarborough's Reading Rope for an individual student. It weaves the six different components into scores (Comprehension and Word Recognition) for an overall mastery score. A teacher can see at a glance where a student is "strong" and where a student is "weak".
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 future performance based on performance trends. Teachers can find and review previous assessments or practice sessions in the Progress Report.
Skills Status Report	The Skills Status Report, organized by Scarborough's Reading Rope, allows teachers to visually see the status of their entire class in every reading skill. Skills are mapped across the report and each student displays an easy-to-read color-coded box for each skill, depending on their mastery level.
Skills Diagnostic Report	The Skills Diagnostic Report, organized by Scarborough's Reading Rope, allows teachers to see the full profile of one student's reading abilities. This report allows teachers to compare all students' reading skills and mastery levels and consider them holistically.
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 below 30 (No Risk) are colored green, and scores at or above 30 (At Risk) are yellow or red.



Amira's **Skills 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's Skills Diagnostic Report with **Resource Recommendations** contains instructional support for educators using *HMH Into Reading*.

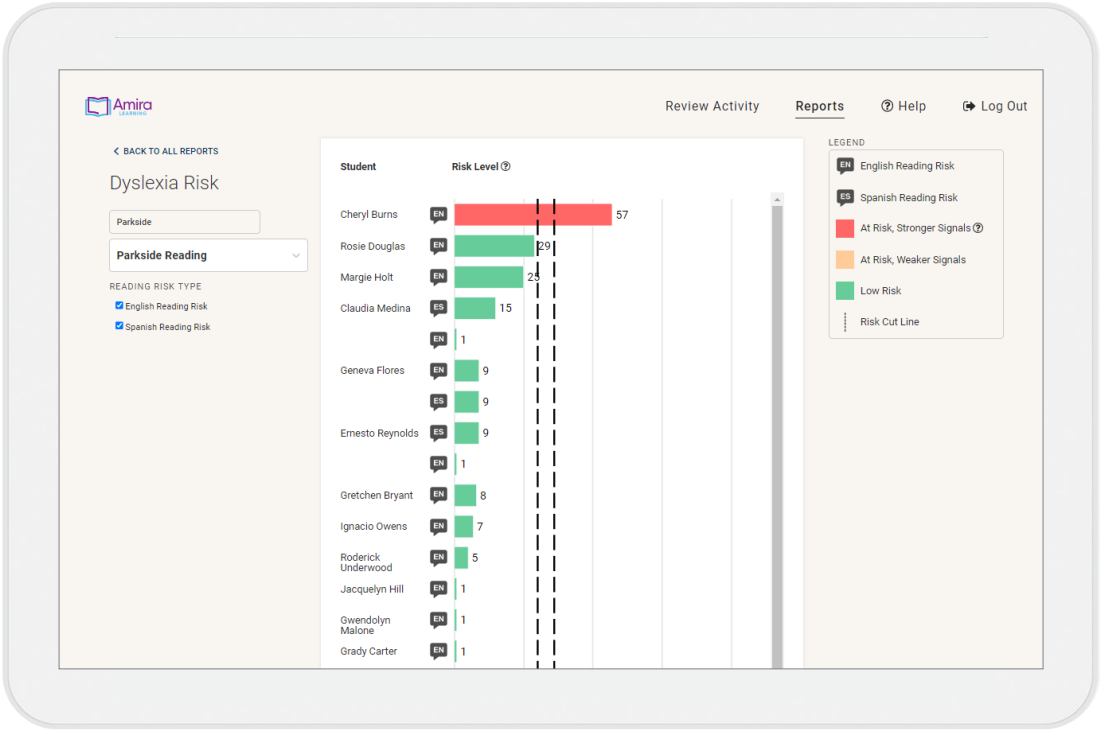
SPANISH ASSESSMENTS AND REPORTING

SPANISH DYSLEXIA SCREENER AND ORAL READING FLUENCY ASSESSMENT

Given the increasing number of Spanish-speaking English learners in the United States, *Amira Learning* has expanded our assessment offering to include a Spanish Dyslexia Screener. The *Amira* Spanish Screener has tests for all the reading tasks included in the English version: phonemic awareness, spelling and encoding, decoding, alphabetic knowledge, dyslexia risk, vocabulary, and reading and listening comprehension. Educators are able to toggle between the Spanish and English assessments when assigning the screener or ORF to their students.

SPANISH REPORTING

In addition, student assessment data from *Amira in Spanish* populates the same reports as the standard *Amira Learning* data. Educators are able to track student mastery in both the Spanish and English screeners by selecting the "Bilingual Programs" option. There are Skills Diagnostic Reports for the students' Spanish skills as well as progress monitoring that can be administered in Spanish. The dashboard also enables views of the data for English, Spanish, or both.



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 and to 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 learners as they become 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 allows the students to complete the task independently (you do) (Fisher & Frey, 2007; Fisher, 2003). The gradual release of responsibility model of instruction has been documented as an effective approach for improving literacy achievement (Fisher & Frey, 2007), 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. People's 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 phonics and utilizes a range of interventions to enable appropriate instruction and progression from simple to more complex words, syllable types, and multisyllable 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

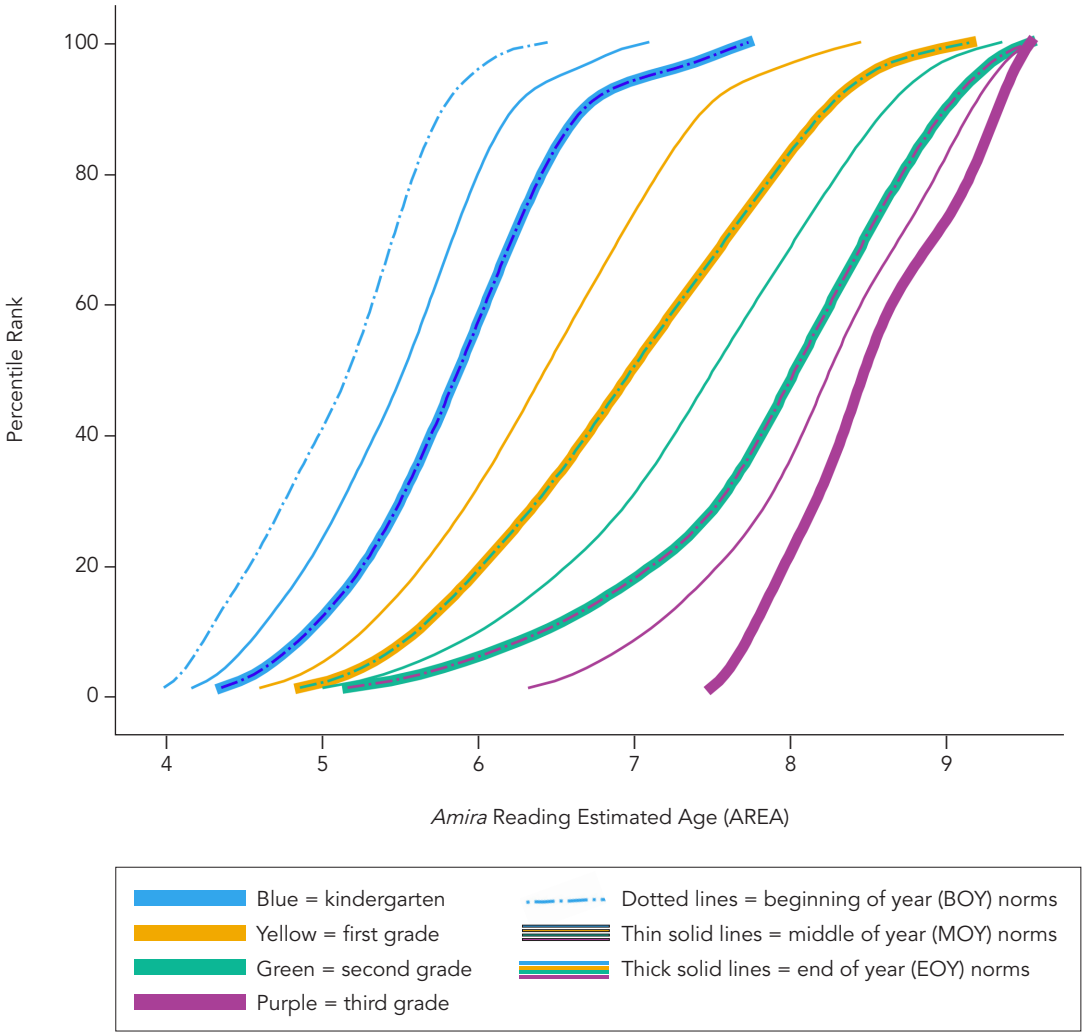
A cumulative approach to reading instruction is based on evidence from research studies conducted over decades and established on learning progressions theory. **Learning progressions** have been defined as empirically grounded and testable hypotheses about how students' understanding of core concepts within a subject domain grow and becomes more sophisticated over time (Corcoran et al., 2009). Skills follow a logical order of the language, and skills are organized with the easiest and most basic concepts first and then 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.

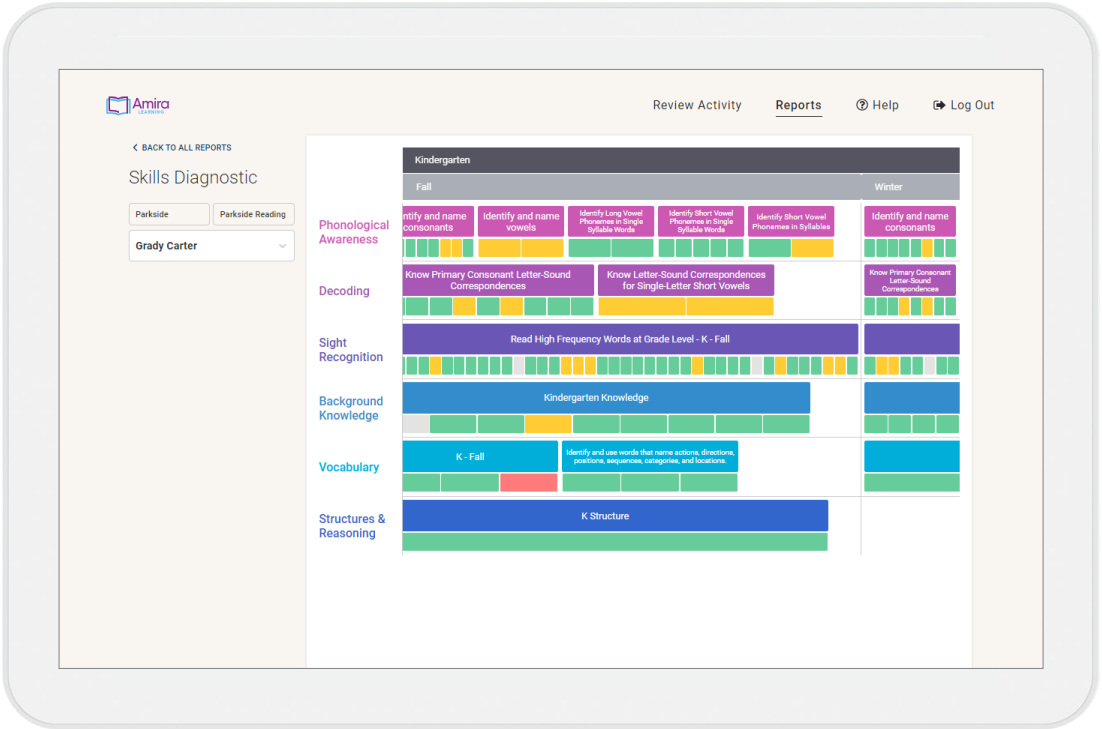
Percentile Rank Values for *Amira* Reading Estimated Age (AREA) scores



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.

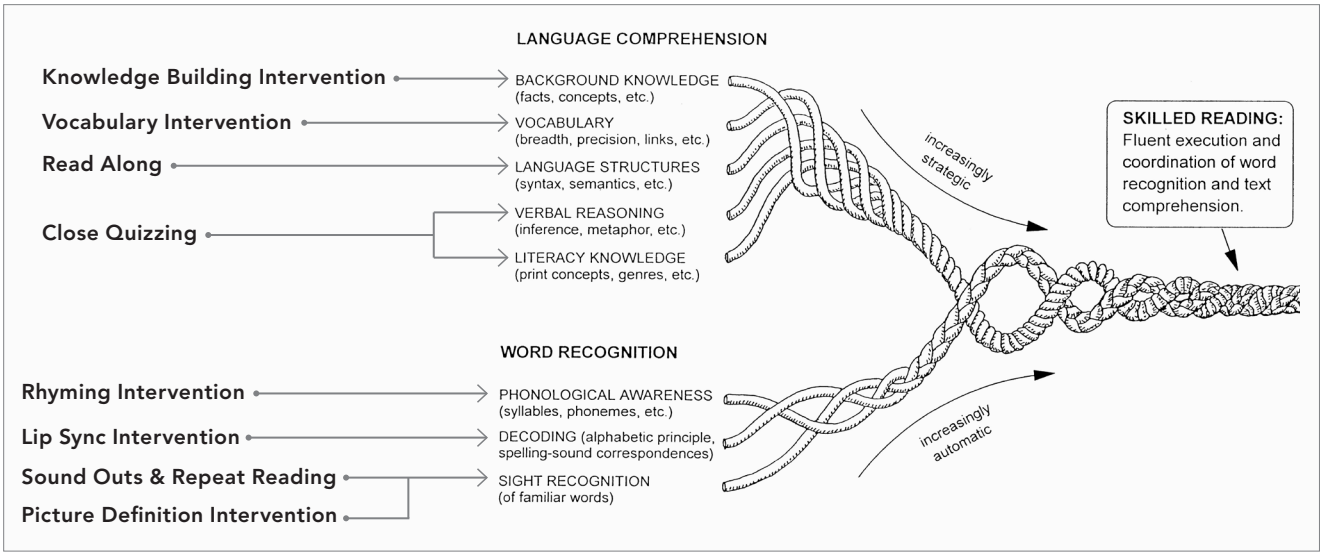
Via the AI avatar, *Amira*, the program delivers targeted scaffolded instruction in component skills like decoding, segmentation, blending, and pronunciation. What makes *Amira Learning* unique is its ability to respond to each student's reading errors in the moment by providing explicit modeling and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

SCAFFOLDED PRACTICE FOR READING SKILLS

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 students through the reading material at hand and tutors them to build critical foundational skills. *Amira Learning* offers personalized instruction, corrects errors, and delivers feedback at three different moments within the reading session:

- Word level – *when the student is stuck on a particular word*
- Phrase level – *when a student has struggled and misread words within a sentence*
- Story level – *as a wrap-up, Amira helps students build comprehension and understanding at the end of the story*

The scaffolded support and instructional techniques, referred to as micro-interventions, employed by *Amira Learning* are based on evidence from reading science. Therefore, this inventory of micro-interventions is organized by the critical elements of effective literacy instruction as outlined in Scarborough's Reading Rope.



The image, used with permission from the Publisher, originally appeared in the following publication: Scarborough, H. S. (2001). Connecting early language and literacy to later reading (dis)abilities: Evidence, theory, and practice. In S. Neuman & D. Dickinson (Eds.), *Handbook of early literacy research* (Vol. 1, pp. 97–110). Guilford Press.

WORD RECOGNITION: PHONOLOGICAL 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 (2000) 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 et al., 2011).

HOW *AMIRA LEARNING* ALIGNS WITH THE RESEARCH

Amira Learning provides the following phonological awareness support:

TABLE 5. *Amira Learning*'s Phonological Awareness Micro-Interventions

Micro-intervention	What happens?	What the student does	What is the goal?	When does the intervention occur?
Fast Sound Out (Word)	*Amira* articulates the word, syllable by syllable	Repeats the word	Keep the student going	At the word level, when there is a significant hesitation or stall
Phonemic Sound Out (Word)	*Amira* articulates the word, phoneme by phoneme	Repeats the blending	Build skills around phonemic awareness	At the word level, when there is a significant hesitation or stall
Phonemic Sound Out (Sentence)	*Amira* articulates the word, phoneme by phoneme	Repeats the blending	Build skills around phonemic awareness	At the end of the sentence, when there is a skip or mispronunciation
Rhyming Word (Word)	*Amira* provides a rhyming word	Tries to re-read the correct word	Build skills around phonemic awareness, and keep the student going	At the word level, when there is a significant hesitation or stall
Rhyming Word (Sentence)	*Amira* provides a rhyming word	Tries to re-read the correct word	Build skills around phonemic awareness	At the end of the sentence, when there is a skip or mispronunciation
Elkonin Box	*Amira* shows a sound box	Moves each grapheme into place and utters the phoneme	Build segmentation and blending skills	At the word or sentence level, when the student is struggling to word attack

DECODING

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).

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 supports that focus on developing students' grapheme-phoneme correspondence skills, decoding skills, recognition of high-frequency words, and knowledge of morphology:

TABLE 6. *Amira Learning's* Decoding Micro-Interventions

Micro-intervention	What happens?	What does the student do?	What is the goal?	When does the intervention occur?
Give the Word (no prompt)	*Amira* gives the word	Nothing	Keep the student going	At the word level, when there is a significant hesitation or stall
Give the Word (prompt)	*Amira* gives the word	Repeats the word	Keep the student going	At the word level, when there is a significant hesitation or stall
Gives the Word with Graphemes Displayed	*Amira* says the word while displaying a pop-up that breaks the word into graphemes	Repeats the word	Build skills around phonemic awareness while keeping the student going	At the word level, when there is a significant hesitation or stall
Elkonin Box	*Amira* shows an Elkonin box with letters shown above the boxes	Student drags letters into boxes and then blends the word	Build decoding skills	At the end of the sentence, when there is a skip or mispronunciation
Articulate by Syllable (Word level)	*Amira* shows a video of an adult's lips pronouncing the word	Student repeats the word	Build decoding skills	At the word level, when there is a significant hesitation or stall
Articulate by Syllable (Sentence level)	*Amira* shows a video of an adult's lips pronouncing the word	Student repeats the word	Build decoding skills	At the end of the sentence, when there is a skip or mispronunciation
Articulate by Phonemes (Sentence level)	*Amira* shows a video of an adult's lips pronouncing the word at the phoneme level	Student repeats the word	Build decoding skills	At the end of the sentence, when there is a skip or mispronunciation

Micro-intervention	What happens?	What does the student do?	What is the goal?	When does the intervention occur?
Definition with Sound Out	*Amira* shows a pop-up of the word, an image that depicts what the word means and then claps through the phonemes	Claps through the phonemes	Build vocabulary and decoding skills	At the end of the sentence, when there is a skip or mispronunciation
Name Pronunciation	*Amira* sounds out a name and gives information about what the name means	Student repeats the name	Build a student's ability to decode words	At the word or sentence level
Tensing Awareness	*Amira* corrects a mispronunciation or misread associated with omitting or adding a tense	Moves each grapheme into place and utters the phoneme	Build awareness of tenses	At the sentence level

SIGHT RECOGNITION

The term "sight words," in the context of early reading development, refers to "high-frequency words," which are the most commonly used words in printed text. These words can be regular (decodable) or irregular in their spelling. The ability to fluently comprehend text—the goal of all reading instruction—depends on reading high-frequency words with automaticity (Adams, 1990). The importance of mastering high-frequency words is made clear by the fact that only 14 of the 150 most frequently used words in English follow sound-symbol generalizations that early readers are likely to have encountered (Adams, 1990). Indeed, some of the most common words in English, such as *does*, *to*, *were*, *there*, and *one*, are irregular by any standard. The 25 most common words in English represent about a third of all printed material, forming the glue that holds text together (Fry & Kress, 2006). Because of their frequency, students must master high-frequency words before they can fluently read connected redundant text or decodable text. Adams (1990; 2001; 2009) advises that to avoid confusion in early learners, early instruction of irregularly spelled sight words should be discrete from regular phonics instruction. Approaches that enable children to manipulate words through categorization, word association, or semantic analysis have been shown to be effective with both native speakers and English learners (Carlo et al., 2004; Marzano & Pickering, 2005; Nagy, 1997).

HOW *AMIRA LEARNING* ALIGNS WITH THE RESEARCH

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

TABLE 7. ***Amira Learning's*** Sight Recognition Micro-Interventions

Micro-intervention	What happens?	What does the student do?	What is the goal?	When does the intervention occur?
Spell Out	*Amira* shows a pop-up with the letters and spells out the word	Reads the words	Build mapping between orthography and the pronunciation of the word	At the end of the sentence, when there is a skip or mispronunciation
Flash Cards for Sight Words	*Amira* does a flash card exercise and asks students to repeat the word three times	Reads words as fast as possible	Build sight recognition	At the end of the sentence, when there is a skip or mispronunciation

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 and 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 (2006), 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 supports that help students focus on their reading rate, clarity of voice, and prosody when reading aloud connected text:

TABLE 8. *Amira Learning's* Fluency Micro-Interventions

Micro-intervention	What happens?	What does the student do?	What is the goal?	When does the intervention occur?
Down-Leveling	*Amira* suggests a new story to read	Nothing	Provide student with text at the instructional level	Whenever *Amira* detects that the text is beyond the capabilities of the student
Slow Down	*Amira* asks the student to slow down	Hopefully slows down	Build prosody	At the end of a sentence when *Amira* detects overly fast reading
Repeat Sentence (No Read Back)	*Amira* rereads a sentence	Nothing	Build understanding and prosody	At the end of the sentence where a number of errors have occurred
Repeat Sentence (Read Back)	*Amira* rereads a sentence	Student does a reread	Build understanding and prosody	At the end of the sentence where a number of errors have occurred
Repeat Sentence (Error Focus)	*Amira* rereads a sentence	Nothing	Build understanding and prosody	At the end of the sentence where a number of errors have occurred
Speak Up	*Amira* asks the student to read more clearly and loudly	Hopefully reads more forcefully	Build prosody	Whenever *Amira* cannot detect student reading

LANGUAGE COMPRENSION: VOCABULARY KNOWLEDGE

From the very beginning, high-quality early literacy instruction must also include instruction and practice on vocabulary (Beck et al., 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 support students in understanding the meaning, context, and usage of academic and content-specific vocabulary words:

TABLE 9. ***Amira Learning's*** Vocabulary Micro-Interventions

Micro-intervention	What happens?	What does the student do?	What is the goal?	When does the intervention occur?
Provide the Definition (Word)	*Amira* shows a pop-up of the word and its definition, and says the definition.	Reads the word	Build vocabulary	At the word level, when there is a significant hesitation or stall
Provide the Definition (Sentence)	*Amira* shows the word, an image that depicts what the word means, and speaks the definition.	Reads the word	Build vocabulary	At the end of the sentence, when there is a skip or mispronunciation
Vocabulary & Sound out	*Amira* shows a pop-up of the word, an image that depicts what the word means and speaks the definition, and then claps through the phonemes.	Claps through the phonemes	Build vocabulary and build decoding	At the end of the sentence, when there is a skip or mispronunciation
Cognate Intervention	*Amira* shows the cognate in print and pronounces it in Spanish. Amira shows the vocabulary image.	Says the English word	Build mapping between 1st and 2nd language	At the end of the sentence, when there is a skip or mispronunciation

Micro-intervention	What happens?	What does the student do?	What is the goal?	When does the intervention occur?
First Language Definition	*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.	Says the word in English	Build vocabulary and build decoding	At the end of the sentence, when there is a skip or mispronunciation
Vocabulary with Pictures Quiz	*Amira* shows a set of pictures and asks the student which depicts the target word.	Student chooses one of the options	Build vocabulary	At the end of a sentence
Morphemic Awareness – Prefixes	*Amira* shows a prefix, provides an example of its use and its meaning.	Student provides another word that uses the suffix	Build morphological awareness	At the end of a sentence
Morphemic Awareness – Suffixes	*Amira* shows a suffix, provides an example of its use and its meaning.	Student provides another word that uses the root	Build morphological awareness	At the end of a sentence
Morphemic Awareness - Roots	*Amira* shows a root, provides an example of its use and its meaning.	Repeats the word	Build morphological awareness	At the end of a sentence
Morphemic Awareness -- Tenses	Amira explains a misuse of an ending and the correct reading	Repeats the word	Build morphological awareness	At the end of a sentence

BACKGROUND KNOWLEDGE

Content knowledge and reading are inextricably intertwined—reading will never progress beyond decoding without a foundation of content knowledge. The ability to comprehend a text depends greatly on the knowledge of the subject that the reader brings to that text. Researchers find that readers' levels of background knowledge and the ways in which they organize the knowledge in long-term memory predict their reading ability (Cabell & Hwang, 2020). A program that enriches the knowledge of students is crucial for reading improvement (Hirsch, 2014). Wide and deep knowledge of a range of meaningful topics is central to reading success and enables students to become effective members of their communities. When literacy instruction is structured to build knowledge systematically over time, students will be more likely to comprehend what they are reading and continually build on what they already know to become better readers and communicators. As students learn new concepts, they can use knowledge networks (sets or interconnected ideas) to build schema, connecting new ideas to existing ones, and to map ideas onto a web of knowledge to make sense of them and hold them in their memory (Bransford et al., 2000).

LITERACY KNOWLEDGE

Literacy knowledge is a specific form of background knowledge developed from experience with reading. Examples of reading-specific background knowledge include knowledge of common genres (e.g., fiction, nonfiction, poetry) and typographical features (e.g., titles, heading, italics, paragraph indenting, etc.) (Duke & Cartwright, 2021).

In a recent meta-analysis of 45 studies involving students in grades 2-12, Hebert et al., (2016) found that text structure instruction designed to improve literacy knowledge led to gains in students' expository reading comprehension. Other studies involving beginning readers have shown that basic understanding of print and graphics is related to reading ability (e.g., Lonigan et al., 2008).

HOW *AMIRA LEARNING* ALIGNS WITH THE RESEARCH

Amira Learning embeds the following comprehension supports that help students understand the meaning of the text, develop broader content knowledge, and apply comprehension strategies to novel stories.

TABLE 10. ***Amira Learning's*** Background Knowledge Micro-Interventions

Micro-intervention	What happens?	What does the student do?	What is the goal?	When does the intervention occur?
Fun Facts	*Amira* provides a fun fact featuring the target word	Student repeats the word	Build world knowledge and understanding	At the end of a sentence

LANGUAGE STRUCTURES

Language structures include the ways in which organization of language at the word and sentence levels conveys meaning (Duke & Cartwright, 2021).

At the word level, *morphological awareness* involves the smallest units of meaning in language (Duke & Cartwright, 2021). Studies have shown that the knowledge of and ability to analyze morphemes (e.g., suffixes, prefixes, roots, contractions) supports comprehension (e.g., Gottardo et al., 2018; Levesque et al., 2019; Zhang & Ke, 2020). Research also suggests that morphological awareness acts as a bridge connecting word recognition to language comprehension; other bridging processes include reading fluency, vocabulary knowledge, and letter-sound-meaning flexibility (Duke & Cartwright, 2021). To support the bridging role of morphological awareness, studies have shown that instruction in morphological analysis not only improves comprehension but also contributes to gains in word recognition, spelling, and vocabulary knowledge (e.g., Ash & Baumann, 2017; Goodwin & Ahn, 2013).

At the sentence level, language structure includes knowledge of syntax (rules of grammar and sentence construction) and semantics (meaning of a sentence). In a longitudinal study involving 3rd and 4th graders, Deacon and Kieffer (2018) found that syntactic awareness significantly and strongly predicted reading comprehension. In another study involving 139 students in 3rd grade, Mimeau et al. (2018) found that students' semantic learning directly predicted their reading comprehension.

VERBAL REASONING

Verbal reasoning involves the ability to go beyond vocabulary and the printed text in order to make inferences and interpret metaphors and figurative language (Duke & Cartwright, 2021). In a recent meta-analysis of 25 studies involving K-12 students, Elleman (2017) found that instruction in inference improved comprehension among both skilled and less-skilled readers. In another study involving 62 students in the 6th grade, Daugaard et al. (2017) found that inference making mediates the role of vocabulary knowledge on reading comprehension, even after controlling for verbal working memory. According to the researchers, a reason for this finding is that inference making requires the reader to focus on the semantic relationships among words, which in turn facilitates their comprehension (Daugaard et al., 2017).

TABLE 11. ***Amira Learning's*** **Structures and Reasoning Micro-Interventions**

Micro-intervention	What happens?	What does the student do?	What is the goal?	When does the intervention occur?
Cloze Questions (End of Story)	*Amira* shows two cloze questions at the end of the story	Student selects the correct answers	Build comprehension questions	At the end of the story
Cloze Questions (End of page)	*Amira* shows two cloze questions	Student selects the correct answers	Build comprehension skills	At the end of the page
Open-ended Questions	*Amira* asks an open-ended question	Student orally answers the question	Build comprehension skills	At the end of the story
Riddles	*Amira* tells a riddle	Student provides an answer	Build reasoning skills	At the end of a sentence
Predictions	*Amira* asks the student to predict how the story will turn out in some major dimension	Student chooses an answer	Encourage students to predict while reading as an aid to comprehension	At the end of a sentence

In addition, *Amira Learning* contains a wide array of text types that covers multiple genres. Students have exposure to both fictional and informational texts at various reading levels.

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, 2014). 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 the desire to complete 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 students read with *Amira*, they receive 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 students to view their latest performance scores and also their progress over time.

Additionally, *Amira Learning* is aligned to research on effective use of praise and 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 (International Dyslexia Association, 2002).

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 et al., 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 meets 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 that 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.

MULTILINGUAL 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).

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

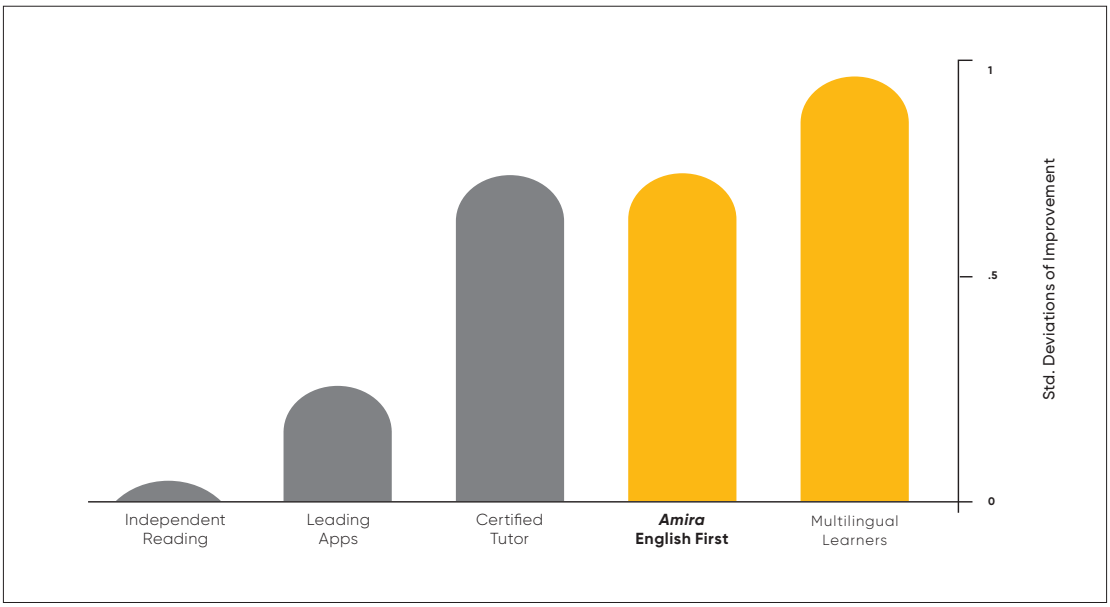
Teachers can accelerate the language proficiency of multilingual learners by explicitly teaching the conventions, vocabulary, and structures of academic language in specific domains (Dutro & Kinsella, 2010). Many multilingual learners need to acquire new phonemes or orthographic patterns as well as new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

HOW *AMIRA LEARNING* ALIGNS WITH THE RESEARCH

While a student reads, *Amira Learning* recognizes the subtleties of various dialects, speech deficits, and accents to deliver results free of bias. The effectiveness of *Amira Learning* for multilingual 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 multilingual 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 multilingual 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 multilingual students.**



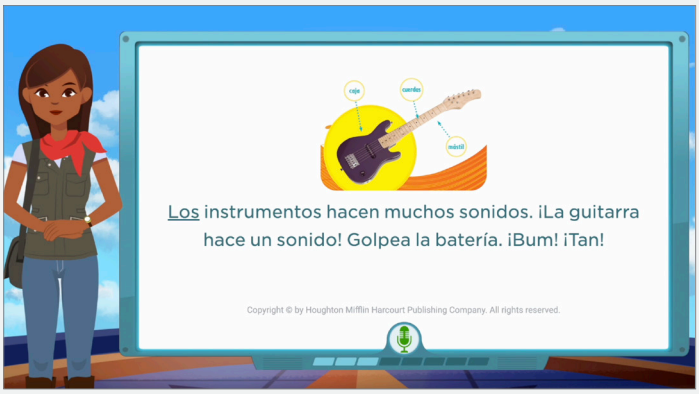
SPANISH SUPPORTS IN *AMIRA PRACTICE*

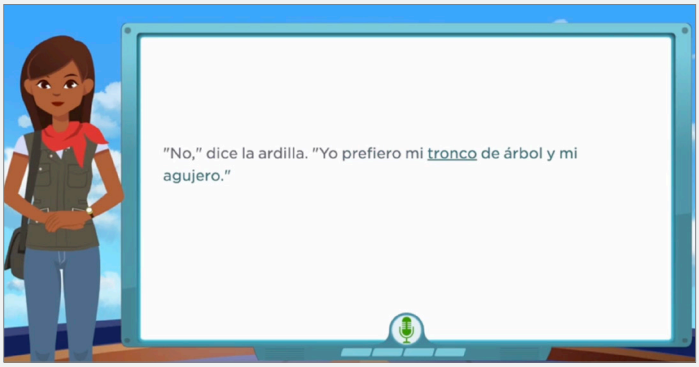
To assist students coming from homes where Spanish is primarily spoken, *Amira in Spanish* delivers tutoring in Spanish to provide first language support. *Amira in Spanish* operates precisely the same as the English version, except that the AI avatar, *Amira*, delivers directions, micro-interventions, and feedback in Spanish. *Amira Learning* supports Spanish-speaking multilingual learners in two ways:

- Spanish-only
- Spanish-English

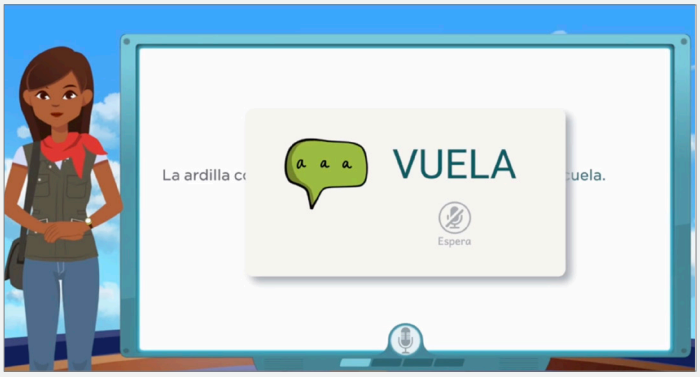
The **Spanish-only** feature allows students to be assessed for Spanish reading mastery and students can practice reading stories in Spanish with *Amira* coaching in Spanish, as well.

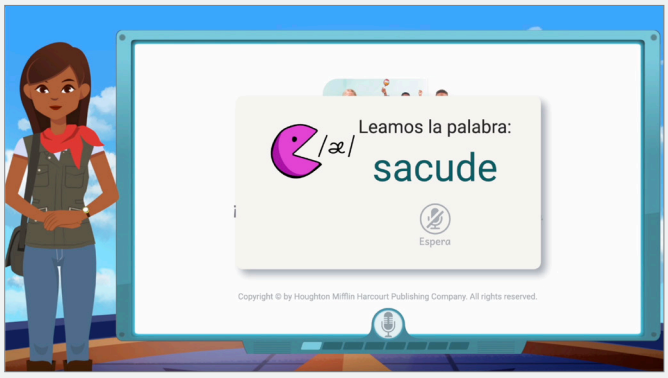
The **Spanish-English** feature allows students to be tested first in Spanish and then in English. Once the assessment is complete, students can select either the Spanish or English passages in the *Amira Practice* portion when reading the stories. Once students select the language, they can go back to switch to another language at any time. Also, although a student is reading in and learning English, the AI avatar, *Amira*, can interact with the student in Spanish.





Whether a student works with *Amira Learning* in English or Spanish, the software delivers a range of micro-interventions specialized to help multilingual learners.





Amira is "trained" to understand different accents and dialects of various speakers by actually working with the students. *Amira* has worked with thousands of Spanish-speaking students with diverse accents and a broad range of origins to deliver effective support that provides an equitable learning experience for multilingual learners.

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 also 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*:

A 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.

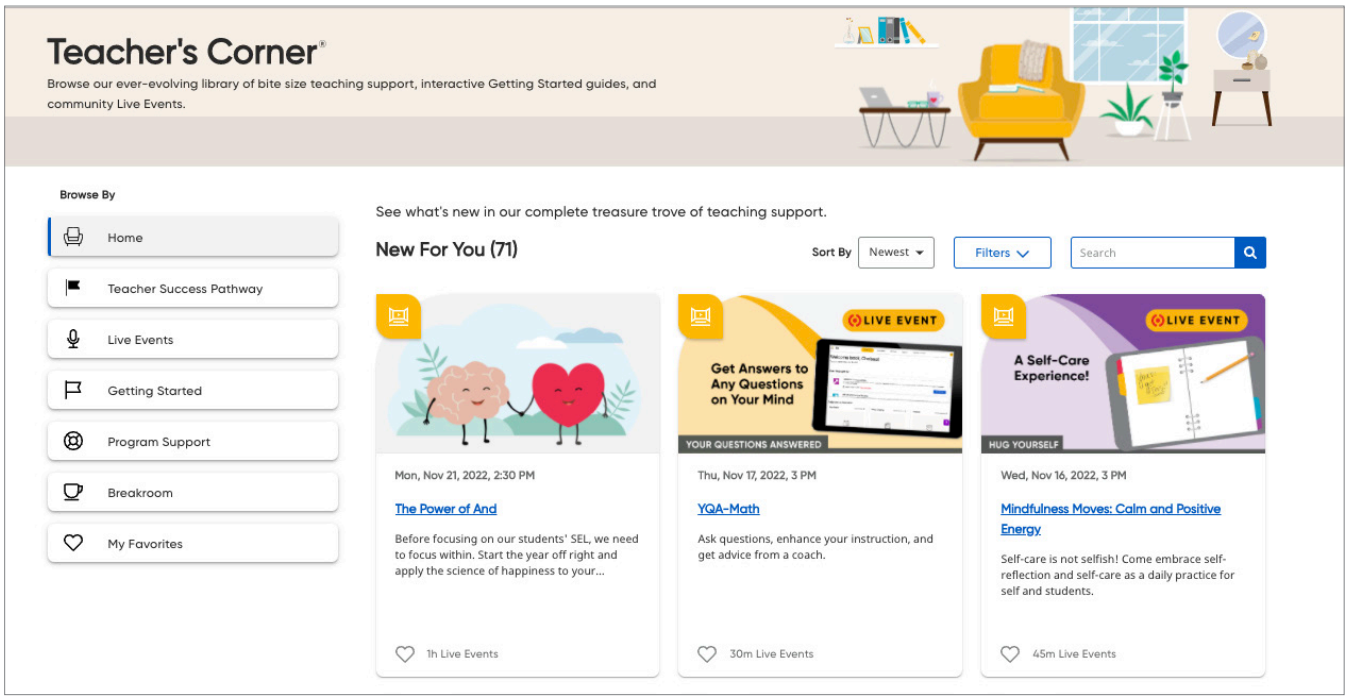
Blended coaching continues to foster collaboration and provides teachers with personalized support focused on lesson design, instructional practices, content, and data-driven decision-making to promote continuous improvement over time. HMH literacy coaches build strong relationships with teachers by 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 access to additional resources and interactive collaboration:

- 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

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.



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.

REFERENCES

Adams, M. J. (1990). *Beginning to read: Thinking and learning about print.* Cambridge, MA: MIT Press.

Adams, M. J. (2001). Alphabetic anxiety and explicit, systematic phonics instruction: A cognitive science perspective. In S. B. Neuman & D. K. Dickinson (Eds.), *Handbook of early literacy research* (p. 66–80). New York, NY: Guilford Press.

Adams, M. J. (2009). Decodable text: Why, when, how? In E. H. Hiebert & M. Sailors (Eds.), *Finding the right texts* (p. 23–46). New York, NY: Guilford Press.

Aist, G. S., & Mostow, J. (1997). When speech input is not an afterthought: A reading tutor that listens. *Proceedings of the Workshop on Perceptual User Interfaces,* Banff, Canada, October, 1997. Reprinted in *Proceedings of the Conference on Automated Learning and Discovery* (CONALD98), June 11-13, 1998, Carnegie Mellon University, Pittsburgh, PA.

Aist, G., Mostow, J., Tobin, B., Burkhead, P., Corbett, A., Cuneo, A., ... & Sklar, M. B. (2001). Computer-assisted oral reading helps third graders learn vocabulary better than a classroom control—About as well as one-on-one human-assisted oral reading. *Artificial intelligence in education: AI-ED in the wired and wireless future*, 267-277.

Allmendinger, K. (2010). Social presence in synchronous virtual learning situations: The role of nonverbal signals displayed by avatars. *Educational Psychology Review, 22*(1), 41-56.

Anderson, J. R. (1982). Acquisition of cognitive skill. *Psychological Review, 89*(4), 369–406.

Anderson-Inman, L. (2009). Supported etext: Literacy scaffolding for students with disabilities. *Journal of Special Education Technology, 24*(3).

Anderson-Inman, L., & Horney, M. (1998). Transforming text for at-risk readers. In D. Reinking, L. Labbo, M. McKenna, & R. Kieffer (Eds.), *Handbook of literacy and technology: Transformations in a post-typographic world* (pp. 15–43). Mahwah, NJ: Lawrence Erlbaum.

Anderson-Inman, L., & Reinking, D. (1998). Learning from text in a post-typographic world. *Learning from text across conceptual domains*, 165-191.

Annetta, L. A., & Holmes, S. (2006). Creating presence and community in a synchronous virtual learning environment using avatars. *International Journal of Instructional Technology and Distance Learning, 3*(8), 27-43.

Armbruster, B. B. (2010). *Put reading first: The research building blocks for teaching children to read: Kindergarten through Grade 3*. Diane Publishing.

Ash, G.E., & Baumann, J.F. (2017). Vocabulary and reading comprehension: The nexus of meaning. In S.E. Israel (Ed.), *Handbook of research on reading comprehension* (2nd ed., p. 377–405). New York, NY: Routledge.

Baker, S. K., Fien, H., Nelson, N. J., Petscher, Y., Sayko, S., & Turtura, J. (2017). Learning to read: *"The simple view of reading."* Washington, DC: U.S. Department of Education, Office of Elementary and Secondary Education, Office of Special Education Programs, National Center on Improving Literacy. Retrieved April 9, 2020 from http://improvingliteracy.org

Baker, S., Lesaux, N., Jayanthi, M., Dimino, J., Proctor, C. P., Morris, J., Gersten, R., Haymond, K., Kieffer, M. J., Linan-Thompson, S., & Newman-Gonchar, R. (2014). *Teaching academic content and literacy to English learners in elementary and middle school* (NCEE 2014-4012). Washington, DC: National Center for Education Evaluation and Regional Assistance (NCEE), Institute of Education Sciences, U.S. Department of Education. Retrieved from the NCEE website: http://ies.ed.gov/ncee/wwc/publications_reviews.aspx.

Basori, A. H., Tenriawaru, A., & Mansur, A. B. F. (2011). Intelligent avatar on e-learning using facial expression and haptic. *Telkomnika, 9*(1), 115.

Beck, I. L., McKeown, M. G., & Kucan, L. (2013). *Bringing words to life: Robust vocabulary instruction*. Guilford Press.

Brady, S. A., Braze, D., & Fowler, C. A. (Eds.) (2011). *Explaining individual differences in reading*. New York: Psychology Press.

Bransford, J., Brown, A., & Cocking, R. (2000). *How people learn: Brain, mind, experience, and school*. Expanded Edition. Committee on Developments in the Science of Learning with additional material from the Committee on Learning Research and Educational Practice. Washington, D.C.: National Academy Press.

Cabell, S. Q., & Hwang, H. (2020). Building content knowledge to boost comprehension in the primary grades. *Reading Research Quarterly*, 55, 99-107.

Carlo, M. S., August, D., McLaughlin, B., Snow, C. E., Dressler, C., Lippman, D. N., Lively, T. J., & White, C. E. (2004). Closing the gap: Addressing the vocabulary needs for English language learners in bilingual and mainstream classrooms. *Reading Research Quarterly, 39*(2), 188-215. doi:10.1598/RRQ.39.2.3

Chi, M. T., Siler, S. A., & Jeong, H. (2004). Can tutors monitor students' understanding accurately? *Cognition and instruction, 22*(3), 363-387.

Connor, C. M., Alberto, P. A., Compton, D. L., & O'Connor, R. E. (2014). *Improving reading outcomes for students with or at risk for reading disabilities: A synthesis of the contributions from the institute of education sciences research centers* (No. NCSER 2014-3000). Washington, D.C: National Center for Special Education Research.

Connor, C. M., & Morrison, F. J. (2012). Knowledge acquisition in the classroom: Literacy and content area knowledge. In A.M. Pinkham, T. Kaefer, and S.B. Neuman,(Eds.), *Knowledge development in early childhood: How young children build knowledge and why it matters* (pp.220-241).

Corbett, A. T., Koedinger, K. R., & Anderson, J. R. (1997). Intelligent tutoring systems. In *Handbook of human-computer interaction* (pp. 849-874). North-Holland.

Corcoran, T. B., Mosher, F. A., & Rogat, A. (2009). Learning Progressions in Science: An Evidence-Based Approach to Reform. *CPRE Research Reports.*

Corpus, J. H., McClintic-Gilbert, M. S., & Hayenga, A. O. (2009). Within-year changes in children's intrinsic and extrinsic motivational orientations: Contextual predictors and academic outcomes. *Contemporary Educational Psychology, 34*, 154-166.

Cunningham, P. M., & Allington, R. L (2011). *Classrooms that work: They can all read and write* (6th ed.). Boston: Allyn and Bacon.

Cunningham, A. E., & Stanovich, K. E. (1997). Early reading acquisition and its relation to reading experience and ability 10 years later. *Developmental psychology, 33*(6), 934.

Dalton, B., & Rose, D. (2008). Scaffolding digital comprehension. *Comprehension instruction: Research-based best practices*, 347-361.

Daugaard, H.T., Cain, K., & Elbro, C. From words to text: inference making mediates the role of vocabulary in children's reading comprehension. *Read Writ* 30, 1773–1788 (2017). https://doi.org/10.1007/s11145-017-9752-2

Deacon, S. H., & Kieffer, M. (2018). Understanding how syntactic awareness contributes to reading comprehension: Evidence from mediation and longitudinal models. *Journal of Educational Psychology*, *110*(1), 72–86. https://doi.org/10.1037/edu0000198

Duke, N. K., & Cartwright, K. B. (2021). The science of reading progresses: Communicating advances beyond the simple view of reading. *Reading Research Quarterly*, 56, S25-S44.

Durgunoglu, A., Nagy, W. E., & Hancin-Bhatt, B. J. (1993). Cross-language transfer of phonological awareness. *Journal of Educational Psychology, 85*, 453–465.

Dutro, S., & Kinsella, K. (2010). *English language development: Issues and implementation at grades six through twelve. In Improving education for English learners: Research-based approaches. S*acramento, CA: CDE Press.

Dweck, C. S. (2007). The perils and promises of praise. *Educational Leadership, 65*(2), 34-39.

Elkind, K., & Elkind, J. (2007). Text-to-speech software for reading. *Perspectives, 33*(3), 11-16.

Elleman, A.M. (2017). Examining the impact of inference instruction on the literal and inferential comprehension of skilled and less skilled readers: A meta-analytic review. *Journal of Educational Psychology*, *109*(6), 761–781. https://doi.org/10.1037/edu0000180

eSchool News. (2017). *Brace yourselves: AI is set to explode in the next four years.* Retrieved from: https://www.eschoolnews.com/2017/05/22/brace-ai-set-explode-next-4-years/

Fisher, D. (2003). Writing instruction for struggling adolescent readers: A gradual release model. *Journal of Adolescent & Adult Literacy, 46*(5), 396.

Fisher, D., & Frey, N. (2007). Implementing a schoolwide literacy framework: Improving achievement in an urban elementary school. *The Reading Teacher, 61*(1), 32-43.

Foorman, B., Coyne, M., Denton, C. A., Dimino, J., Hayes, L., Justice, L., Lewis, W., & Wagner, R. (2016). *Foundational skills to support reading for understanding in kindergarten through 3rd grade: A practice guide (NCEE 2016-4008).* Washington, DC: National Center for Education Evaluation and Regional Assistance (NCEE), Institute of Education Sciences, U.S. Department of Education. Retrieved from http://whatworks.ed.gov.

Frazier, L., Carlson, K., & Clifton Jr, C. (2006). Prosodic phrasing is central to language comprehension. *Trends in Cognitive Sciences*, *10*(6), 244-249.

Froiland, J. M., & Oros, E. (2014). Intrinsic motivation, perceived competence and classroom engagement as longitudinal predictors of adolescent reading achievement. *Educational Psychology, 34*(2), 119-132.

Fry, E. B., & Kress, J. E. (2006). *The reading teacher's book of lists* (5th ed.). San Francisco, CA: Jossey-Bass.

Gaggi, O., Galiazzo, G., Palazzi, C., Facoetti, A., & Franceschini, S. (2012, July). A serious game for predicting the risk of developmental dyslexia in pre-readers children. In *2012 21st International Conference on Computer Communications and Networks (ICCCN)* (pp. 1-5). IEEE.

Gagne, R. M., & Briggs, L. J. (1974). *Principles of instructional design*. Fort Worth, TX: HBJ College Publishers.

Georgiou, G. K., Parrila, R., Cui, Y., & Papadopoulos, T. C. (2013). Why is rapid automatized naming related to reading? *Journal of Experimental Child Psychology, 115*(1), 218-225.

Gersten, R., Compton, D., Connor, C. M., Dimino, J., Santoro, L., Linan-Thompson, S., & Tilly, W. D. (2008). *Assisting students struggling with reading: Response to Intervention and multi-tier intervention for reading in the primary grades. A practice guide. (NCEE 2009-4045).* Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education. Retrieved April 9, 2020 from http://ies.ed.gov/ncee/wwc/publications/practiceguides/

Goldenberg, C. (2013). Unlocking the research on English learners. *American Educator, 37*(2), 4–11, 38.

Goodwin, A. P., & Ahn, S. (2013). A meta-analysis of morphological interventions in English: Effects on literacy outcomes for school-age children. *Scientific Studies of Reading*, *17* (4), 257–285. https://doi.org/10.1080/10888438.2012.689791

Gottardo, A., Mirza, A., Koh, P. W., Ferreira, A., & Javier, C. (2018). Unpacking listening comprehension: The role of vocabulary, morphological awareness, and syntactic knowledge in reading comprehension. *Reading and Writing*, *31*(8), 1741–1764. https://doi.org/10. 1007/s11145-017-9736-2

Gough, P. B., & Tunmer, W. E. (1986). Decoding, reading, and reading disability. *Remedial and Special Education*, *7*(1), 6–10.

Gunawardena, C. N., & Zittle, F. J. (1997). Social presence as a predictor of satisfaction within a computer-mediated conferencing environment. *American Journal of Distance Education, 11*(3), 8-26.

Hammond, J. (2001). *Scaffolding: Teaching and learning in language and literacy education*. Primary English Teaching Association.

Hart, B., & Risley, T. R. (1995). Meaningful differences in the everyday experience of young American children. Paul H Brookes Publishing.

Hasbrouck, J., & Tindal, G. A. (2006). Oral reading fluency norms: A valuable assessment tool for reading teachers. The Reading Teacher, *59*(7), 636-644.

Hebert, M., Bohaty, J. J., Nelson, J. R., & Brown, J. (2016). The effects of text structure instruction on expository reading comprehension: A meta-analysis. *Journal of Educational Psychology*, *108*(5), 609–629. https://doi.org/10.1037/edu0000082

Hirsch, E. D. (2014). Sustaining the American experiment. In C. E. Finn & M. J. Petrilli (Eds.), *Knowledge at the core: Don Hirsch, Core Knowledge, and the future of the Common Core* (pp. 31–47). Washington, DC: Thomas Fordham Institute.

Hoover, W. A., & Gough, P. B. (1990). The simple view of reading. *Reading and writing, 2*(2), 127-160.

Huang, X., Alleva, F., Hon, H.-W., Hwang, M.-Y., Lee, K.-F., and Rosenfeld, R. (1993). The SPHINX-II speech recognition system: an overview (http://sourceforge.net/projects/cmusphinx/). Computer Speech and Language, 7(2), 137-148.

International Dyslexia Association (2002). Definition of dyslexia. Retrieved from https://dyslexiaida.org/definition-of-dyslexia/

Izzo, M. V., Yurick, A., & McArrell, B. (2009). Supported eText: Effects of text-to-speech on access and achievement for high school students with disabilities. *Journal of Special Education Technology, 24*(3), 9-20.

Jain, K., Manghirmalani, P., Dongardive, J., & Abraham, S. (2009). Computational diagnosis of learning disability. *International Journal of Recent Trends in Engineering, 2*(3), 64.

Jones, M. W., Branigan, H. P., Hatzidaki, A., & Obregón, M. (2010). Is the 'naming' deficit in dyslexia a misnomer? *Cognition, 116*(1), 56-70.

Juel, C. (1988). Learning to read and write: A longitudinal study of 54 children from first through fourth grades. *Journal of Educational Psychology, 80*(4), 437-447. http://dx.doi.org/10.1037/0022-0663.80.4.437

Kieffer, M. J., & Stahl, K. D. (2016). Complexities of individual differences in vocabulary knowledge: Implications for search, assessment, and instruction. In *Handbook of Individual Differences in Reading: Reader, Text, and Context* (pp.120-137).

Klein, J. R., & Jimerson, S. R. (2005). Examining ethnic, gender, language, and socioeconomic bias in Oral Reading Fluency Scores among Caucasian and Hispanic students. *School Psychology Quarterly, 20*(1), 23.

Kong, A., & Pearson, P. D. (2003). The road to participation: The construction of a literacy practice in a learning community of linguistically diverse learners. *Research in the Teaching of English*, 85-124.

Kuhn, M. R., Schwanenflugel, P. J., Morris, R. D., Morrow, L. M., Woo, D. G., Meisinger, E. B., Sevcik, R. A., Bradley, B. A., & Stahl, S. A. (2006). Teaching children to become fluent and automatic readers. *Journal of Literacy Research, 38*(4), 357-387.

Language and Reading Research Consortium. (2015). Learning to read: Should we keep things simple? *Reading Research Quarterly, 50*(2), 151-169.

Levesque, K. C., Kieffer, M. J., & Deacon, S. H. (2019). Inferring meaning from meaningful parts: The contributions of morphological skills to the development of children's reading comprehension. *Reading Research Quarterly, 54*(1), 63–80.

Lloyd, S. L. (2004). Using comprehension strategies as a springboard for student talk. *Journal of Adolescent & Adult Literacy, 48*(2), 114-124.

Lonigan, C. J., Schatschneider, C., & Westberg, L. (2008). *Developing early literacy: Report of the National Early Literacy Panel*. Washington, DC: National Institute for Literacy.

Manzo, K. K. (2007). State Data Show Gains in Reading. *Education Week, 26*(34), 1-27.

Marzano, R. J., & Pickering, D. J. (2005). *Building academic vocabulary: Teacher's manual*. Alexandria, VA: Association for Supervision and Curriculum Development.

McArthur, D., Stasz, C., & Zmuidzinas, M. (1990). Tutoring techniques in algebra. *Cognition and Instruction, 7*(3), 197-244.

McGlinchey, M. T., & Hixson, M. D. (2004). Using curriculum-based measurement to predict performance on state assessments in reading. *School Psychology Review, 33*(2),193-203.

McNamara, D. S., Jackson, G. T., & Graesser, A. (2010). Intelligent tutoring and games (ITaG). In *Gaming for classroom-based learning: Digital role playing as a motivator of study* (pp. 44-65). IGI Global.

Mimeau, C., Ricketts, J., & Deacon, S. H. (2018). The role of orthographic and semantic learning in word reading and reading comprehension. *Scientific Studies of Reading*, 22(5), 384-400.

Moats, L. C. (2020). *Teaching Reading Is Rocket Science. What expert teachers of reading should know and be able to do.* American Federation of Teachers.

Mostow, J. (2012, June). Why and how our automated reading tutor listens. In P*roceedings of the International Symposium on Automatic Detection of Errors in Pronunciation Training (ISADEPT)* (pp. 43-52).

Mostow, J., & Aist, G. (1999). Giving help and praise in a reading tutor with imperfect listening–because automated speech

recognition means never being able to say you're certain. *CALICO Journal, 16*(3), 407-424.

Mostow, J., & Aist, G. (2001) Evaluating tutors that listen: An overview of Project LISTEN. In K. Forbus and P. Feltovich, (Eds.) *Smart Machines in Education* (pp. 169-234). MIT/AAAI Press.

Mostow, J., Aist, G., Burkhead, P., Corbett, A., Cuneo, A., Eitelman, S., ... & Tobin, B. (2003). Evaluation of an automated Reading Tutor that listens: Comparison to human tutoring and classroom instruction. *Journal of Educational Computing Research, 29*(1), 61-117.

Mostow, J., Hauptmann, A., & Roth, S. (1995). Demonstration of a reading coach that listens. In *Proceedings of the Eighth Annual Symposium on User Interface Software and Technology* (pp. 77-78).

Mostow, J., Nelson-Taylor, J., & Beck, J. E. (2013). Computer-guided oral reading versus independent practice: Comparison of sustained silent reading to an automated reading tutor that listens. *Journal of Educational Computing Research, 49*(2), 249-276.

Mostow, J., Roth, S. F., Hauptmann, A. G., & Kane, M. (1994, August). A prototype reading coach that listens. In AAAI (pp. 785-792).

Nagy, W. (1997). On the role of context in first- and second-language vocabulary learning. In N. N. Schmitt & M. McCarthy (Eds.), *Vocabulary: description, acquisition and pedagogy* (pp. 64–83). Cambridge, England: Cambridge University Press.

National Early Literacy Panel. (2008). Developing early literacy: Report of the National Early Literacy Panel. Washington, DC: National Institute for Literacy. Available at http://www.nifl.gov/earlychildhood/NELP/NELPreport.html.

National Institute of Child Health and Human Development (NICHD). (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. Retrieved April 9, 2020 from https:/www.nichd.nih.gov/sites/default/files/publications/pubs/nrp/Documents/report.pdf

National Reading Panel (NRP). (2000). *Report of the National Reading Panel: Reports of the subgroups.* Washington, DC: National Institutes of Health.

Pellegrino, J. W. (2014). Assessment as a positive influence on 21st century teaching and learning: A systems approach to progress. Keynote address in *Proceedings of the 2014 Conference of the International Association for Educational Assessment, Singapore*.

Perera, H., Shiratuddin, M. F., & Wong, K. W. (2016). Review of the role of modern computational technologies in the detection of dyslexia. In Kim K., Joukov N. (Eds.), *Information Science and Applications (ICISA) 2016* (pp. 1465-1475). Springer.

Petscher, Y., Fien, H., Stanley, C., Gearin, B., Gaab, N., Fletcher, J. M., & Johnson, E. (2019). *Screening for Dyslexia.* Washington, DC: U.S. Department of Education, Office of Elementary and Secondary Education, Office of Special Education Programs, National Center on Improving Literacy. Retrieved from improvingliteracy.org.

Pikulski, J. J., & Chard, D. J. (2005). Fluency: Bridge between decoding and reading comprehension. *The Reading Teacher, 58*(6), 510-519.

Poulsen, R., Hastings, P., & Allbritton, D. (2007). Tutoring bilingual students with an automated reading tutor that listens. *Journal of Educational Computing Research, 36*(2), 191-221.

Rasinski, T. V., Blachowicz, C., & Lems, K. (Eds.). (2006). *Fluency instruction: Research-based best practices.* New York, NY: Guilford Press.

Reed, C. B., & Conklin, K. D. (2005). Enrolling in college, ready or not. *The Chronicle of Higher Education, 52*(8), B16.

Reed, K., & Meiselwitz, G. (2011, July). Teacher agents: the current state, future trends, and many roles of intelligent agents in education. In *International Conference on Online Communities and Social Computing* (pp. 69-78). Springer.

Reeder, K., Shapiro, J., & Wakefield, J. (2007). The effectiveness of speech recognition technology in promoting reading proficiency and attitudes for Canadian immigrant children. In 1*5th European Conference on Reading.*

Reeder, K., Shapiro, J., Early, M., Kendrick, M., & Wakefield, J. (2008). A computer-based reading tutor for young language learners. In *Handbook of research on computer-enhanced language acquisition and learning* (pp. 159-188). IGI Global.

Reeder, K., Shapiro, J., Wakefield, J., & D'Silva, R. (2015). Speech recognition software contributes to reading development for young learners of English. I*nternational Journal of Computer-Assisted Language Learning and Teaching (IJCALLT), 5*(3), 60-74.

Research and Markets. (2018). *Artificial intelligence market in the US education sector 2018-2022.* Retrieved from: https://www.researchandmarkets.com/reports/4613290/artificial-intelligence-market-in-the-us

Schleppegrell, M. J. (1998). Grammar as resource: Writing a description. *Research in the Teaching of English*, 182–211.

Scarborough, H. (2001). Connecting early language and literacy to later reading (dis)abilities: Evidence, theory, and practice. In S. Neuman & D. Dickinson (Eds.), *Handbook of early literacy research* (pp. 97–110). New York: Guilford Press.

Shanahan, T., Callison, K., Carriere, C., Duke, N. K., Pearson, P. D., Schatschneider, C., & Torgesen, J. (2010). *Improving reading comprehension in kindergarten through 3rd grade: IES practice guide.* NCEE 2010-4038. What Works Clearinghouse.

Shaywitz, S. & Shaywitz, J. (2020). *Overcoming Dyslexia.* New York: Alfred A. Knopf.

Sitaram, S., & Mostow, J. (2012, May). Mining data from Project LISTEN's Reading Tutor to analyze development of children's oral reading prosody. In *Twenty-Fifth International FLAIRS Conference.*

Sleeman, D., Kelly, A. E., Martinak, R., Ward, R. D., & Moore, J. L.

(1989). Studies of diagnosis and remediation with high school algebra students. *Cognitive Science, 13*(4), 551-568.

Snow, C. S., Burns, S. M., & Griffin, P. (1998). *Preventing reading difficulties in young children.* Washington, DC: National Academy Press.

Strickland, D. S. (2011). *Teaching phonics today: Word study strategies through the grades.* International Reading Association.

Swets, B., Desmet, T., Hambrick, D. Z., & Ferreira, F. (2007). The role of working memory in syntactic ambiguity resolution: A psychometric approach. *Journal of Experimental Psychology: General, 136*(1), 64.

Torgesen, J. K., Wagner, R. K., Rashotte, C. A., Herron, J., & Lindamood, P. (2010). Computer-assisted instruction to prevent early reading difficulties in students at risk for dyslexia: Outcomes from two instructional approaches. *Annals of dyslexia*, *60*(1), 40-56.

Torgesen, J. K. (2000). Individual differences in response to early interventions in reading: The lingering problem of treatment resisters. *Learning Disabilities Research & Practice, 15*(1), 55-64. http://dx.doi.org/10.1207/SLDRP1501_6

Toub, T. S., Hassinger-Das, B., Nesbitt, K. T., Ilgaz, H., Weisberg, D. S., Hirsh-Pasek, K., ... & Dickinson, D. K. (2018). The language of play: Developing preschool vocabulary through play following shared book-reading. *Early Childhood Research Quarterly, 45*, 1-17.

U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. (2019). The nation's report card: Results from the 2019 mathematics and reading assessments. Washington, DC: U.S. Government Printing Office. Retrieved April 9, 2020, from https://nces.ed.gov/nationsreportcard/

Utermohlen, K. (2018). *Four ways AI is changing the education industry*. Towards Data Science. Retrieved from: https://towardsdatascience.com/4-ways-ai-is-changing-the-education-industry-b473c5d2c706

Valencia, S. W., Smith, A. T., Reece, A. M., Li, M., Wixson, K. K., & Newman, H. (2010). Oral reading fluency assessment: Issues of construct, criterion, and consequential validity. *Reading Research Quarterly, 45*(3), 270-291.

Washington, J. A., Compton, D. L., & McCardle, P. (2010). *Dyslexia: Revising etiology, diagnosis, treatment, and policy.* Baltimore, MD: Paul H. Brookes.

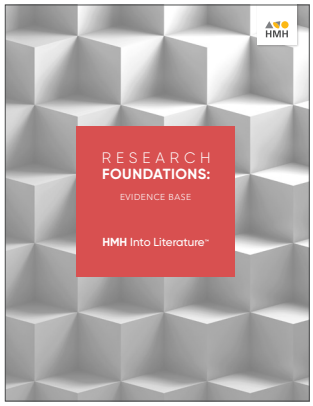
Wiliam, D. (2014, April). Formative assessment and contingency in the regulation of learning processes. In A*nnual Meeting of the American Educational Research Association*, Philadelphia, PA.

Zhang, D., & Ke, S. (2020). The simple view of reading made complex by morphological decoding fluency in bilingual fourth-grade readers of English. *Reading Research Quarterly*, *55*(2), 311–329. https://doi. org/10.1002/rrq.287

Ziegler, J. C., Castel, C., Pech-Georgel, C., George, F., Alario, F. X., & Perry, C. (2008). Developmental dyslexia and the dual route model of reading: Simulating individual differences and subtypes. *Cognition, 107*(1), 151-178.

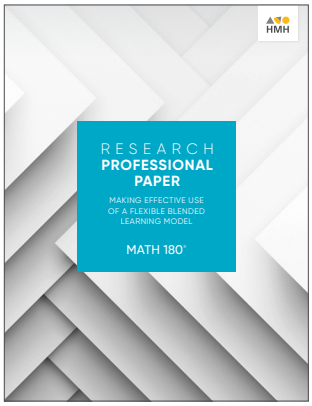
HMH RESEARCH PUBLICATIONS

Research Into Practice Into Results



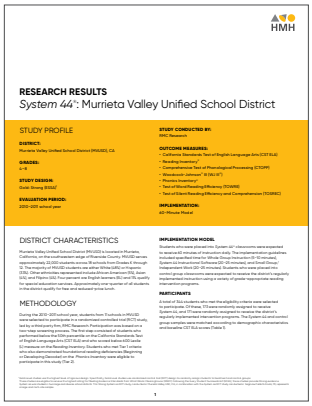
RESEARCH EVIDENCE BASE PAPERS

Research Evidence Base papers provide an in-depth account of the theoretical underpinnings, evidence base, and expert opinions that guide the design and development of new and revised programs. These papers map known research and design principles to practical applications of the program.



RESEARCH PROFESSIONAL PAPERS

Research Professional Papers highlight an important theoretical construct, practical application, program component, or other topic related to learning in the context of HMH programs. They are authored by experts in the field, researchers, and thought leaders within the industry.



RESEARCH RESULTS PAPERS

Research Results papers summarize the findings from research studies conducted on HMH programs, including research conducted internally by HMH and externally by third-party research firms. Research Results papers document the efficacy of a program in terms of ESSA evidence levels: strong evidence, moderate evidence, promising evidence, and evidence that demonstrates a rationale for program effectiveness.

To learn more about HMH's dedication to research and efficacy, visit

hmhco.com/research

Amira Learning

RESEARCH EVIDENCE BASE

Browse our library of research at **hmhco.com/researchlibrary**.