Meta-Analysis Of Research On Amira

Intelligent Tutoring's Impact

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Abstract:
This meta-analysis examined the effectiveness of using Amira's intelligent tutoring with students in K-5 classrooms. Amira is an example of an intelligent tutoring system (ITS). ITSs are defined as, a computer-based learning environment that provides customizable and immediate feedback to the learner.

In aggregate, eight formal, independent studies incorporating approximately 10,000 students are included in this analysis. The meta-analysis indicates that the overall random effect size of ITSs on reading fluency is 0.62 (using a mix of standardized and researcher-designed measures) with a 95% confidence interval 0.37 to 0.85 ($p < 0.001$). This review is consistent with previously published meta-analysis on the efficacy of Intelligent Tutors in accelerating reading comprehension.

Contents:
The document includes:

I. A summary of the research
II. An overview of other meta-analysis and independent reviews of Amira's efficacy
III. A synopsis of some of the published research.
IV. A few case studies of results from Districts and schools using Amira.

I. Summary of the Research Supporting Amira's Impact

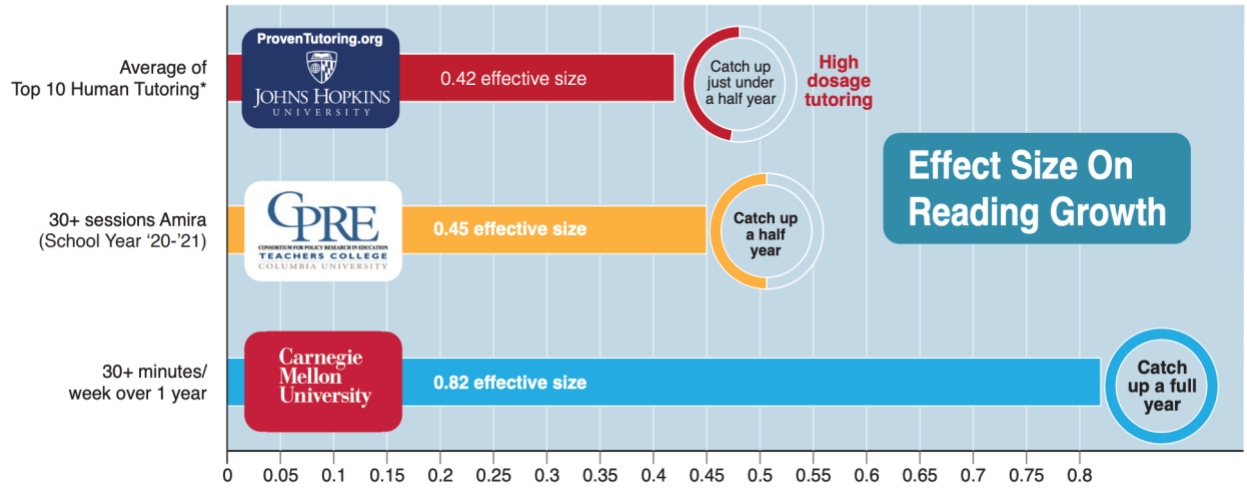
Amira is an intelligent reading assistant for teachers. The software is able to listen to students read out loud, assess mastery and deliver 1:1 bespoke coaching. The software employs instructional techniques validated in the science of reading research.

Amira Learning's technology is a result of the research conducted over two decades through Carnegie Mellon University's PROJECT LISTEN. In its initial incarnation during PROJECT LISTEN, Amira was referred to as "RoboTutor." Upon licensing the technology and research from CMU, the software has been hardened to ensure that students, teachers, and families could benefit from the well-studied and evidence-based platform at scale. Today, 800,0000 students in 6 countries and all 50 U.S. states are receiving tutoring from Amira.

The effectiveness of Amira Learning's technology basis has been demonstrated in gold-standard randomized controlled trial studies in real-world classroom settings. Overall, a range of studies spanning geographies, grade levels, implementation approaches and subpopulations have found that students using Amira made greater reading gains than students in the control conditions.

RESEARCH

Amira's Impact Matches Human Tutoring



Amira's research and evidence base meets the ESSA "STRONG" criteria.

II. Previous Research, Meta-Analysis and Independent Evaluation

The Meta-Analysis of the Amira research is consistent with other studies on the impact of Intelligent Tutoring Systems 9ITSs) on reading proficiency.

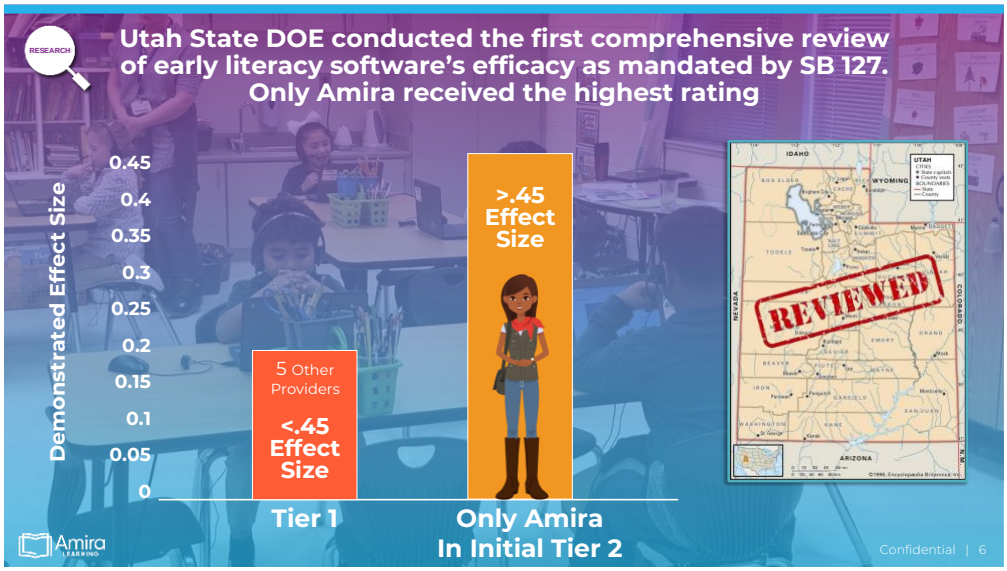
Abstract: A team from Texas A&M conducted a comprehensive meta-analysis on Intelligent Tutors efficacy in improving reading comprehension.
Meta-Analysis of Intelligent Tutoring Systems

- Researchers: Xu Zhihong, Wikekumar, Kausalai; Hu, Xueyan, Ramirez, Gilbert; Texas A&M University; 2019
- Summary: The study analyzed 19 studies of Intelligent Tutors. Amira, in its academic incarnation as Amira/Robotutor from Project Listen, was one of the tutoring solutions included. Intelligent tutors were found to consistently accelerate reading comprehension. The average effect size across the different studies was 0.6. Amira was determined to be **significantly more sophisticated, proven, and powerful** than most Intelligent Tutoring Systems (especially in reading) because of its cutting edge A.I. and speech recognition functionality.
- Conclusion From The Research: "This review found that ITSs produced a larger effect size on reading comprehension when compared to traditional instruction (0.86) for mixed measures and (0.26) for standardized measures."

Abstract: Following a mandate from State Legislation, the Utah State DOE conducted a comprehensive evaluation of the evidence of efficacy for early literacy programs. Only Amira was initially placed in the State's Tier 2 for significant impact.
Utah State DOE Early Literacy Software Review

- Reviewers: Utah State Department of Education

Summary: Utah State DOE concluded the first comprehensive review of early literacy software as mandated by SB137. Only Amira received the highest rating and met the state standards for efficacy.

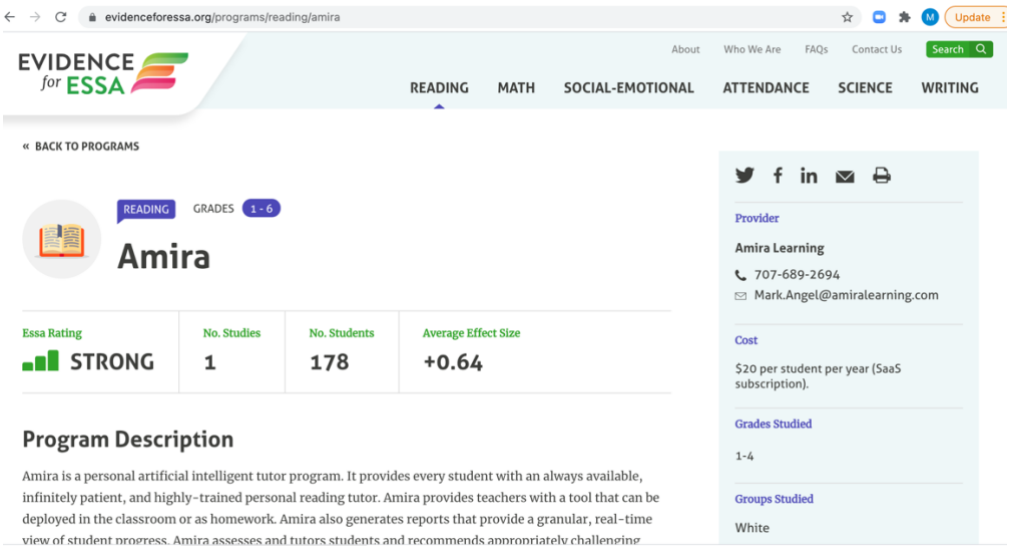


Abstract: HMH Research conducted an evaluation of the evidence for Amira's efficacy and determined that the studies met the standard of "ESSA Strong".
HMH Analysis Of Amira Efficacy

- Reviewers: HMH Research
  Summary: The Houghton, Mifflin, Harcourt research organization evaluated the published studies and research .

Abstract: Johns Hopkins Evidence For ESSER site published an effect size of .45 for the Amira program.
Johns Hopkins Evidence For ESSA

- Reviewers: Johns Hopkins Evidence For ESSA Project
  Summary: The Evidence For ESSA organization reviewed Amira's evidence and posted a Strong Rating with a .64 effect size.



III. Published Studies On Amira

Abstract: The Columbia University Teachers College research team tracked Amira's impact during the 20/21 School year. The effect size on reding fluency was measured at .45.
Study: *Amira Learning in Savannah-Chatham Public Schools*

- Researchers: The Consortium for Policy Research in Education (CPRE) at Teachers College at Columbia University
- Summary: An analysis of students using Amira in the 2020-21 School Year in Savannah-Chatham Public Schools, a diverse urban school district found **that students using Amira for 30 sessions produced an equal or higher effect size of 0.45 in reading ability**. This effect size is greater **than the average of an analysis of ten human tutoring programs.** Further, the study authors note, "Students who received a greater percentage of the recommended dosage of Amira Learning practice sessions gained more than their peers who received smaller dosages." The more that students used Amira, the more they benefited.
- Due to the results, Amira was also recently deployed district wide for K-3 students in Savannah in 2020. The district has a total population of 38,000 students. The results at Savannah have been in-line with Amira's national results. Fluency gains for students working frequently with Amira have been approximately twice the measured growth of non-using students.

Growth Across Every Measure:

Table 5. Fall, Winter, and Spring Test Scores by Number of Weeks Used Categories

	Fall-to-Winter			Winter-to-Spring		
	Low Usage 0-4 Weeks (*n*=758)	Med Usage 5-9 Weeks (*n*=807)	High Usage 10+ Weeks (*n*=740)	Low Usage 0-4 Weeks (*n*=992)	Med Usage 5-9 Weeks (*n*=921)	High Usage 10+ Weeks (*n*=392)
Adj. WCPM						
Fall	34.37	34.77	42.60***	---	---	---
(SD)	(30.52)	(29.97)	(33.52)			
Winter	41.90	47.32**	57.23***	46.49	46.96	58.50***
(SD)	(33.68)	(32.49)	(35.95)	(33.92)	(33.36)	(37.36)
Spring	---	---	---	43.97	47.29~	57.18***
(SD)				(31.67)	(30.85)	(34.36)
ESRI						
Fall	68.52	69.91	74.98***	---	---	---
(SD)	(23.30)	(23.15)	(22.40)			
Winter	65.69	71.46***	77.17***	69.51	70.72	77.76***
(SD)	(26.59)	(24.42)	(22.48)	(25.61)	(24.67)	(23.11)
Spring	---	---	---	73.79	76.45*	80.80***
(SD)				(24.35)	(22.54)	(21.81)
Vocab Size						
Fall	3,363	3,488	3,886***	---	---	---
(SD)	(1,696)	(1,770)	(1,871)			
Winter	3,235	3,512**	3,963***	3,436	3,478	4,097***
(SD)	(1,595)	(1,600)	(1,720)	(1,623)	(1,607)	(1,795)
Spring	---	---	---	3,712	3,857	4,410***
(SD)				(1,675)	(1,660)	(1,863)
Phonological Awareness						
Fall	68.29	69.83	74.57***	---	---	---
(SD)	(25.39)	(24.66)	(23.46)			
Winter	70.40	76.38***	81.64***	74.51	75.44	81.69***
(SD)	(27.18)	(23.60)	(20.36)	(25.29)	(24.25)	(20.99)
Spring	---	---	---	74.81	77.52*	81.88***
(SD)				(25.15)	(22.86)	(21.62)
Lexile score						
Fall	-15.63	6.48	91.18***	---	---	---
(SD)	(359)	(368)	(372)			
Winter	1.82	75.66***	164.53***	53.67	62.87	186.34***
(SD)	(366)	(359)	(362)	(364)	(362)	(372)
Spring	---	---	---	86.69	121.91~	221.06***
(SD)				(351)	(345)	(361)

~p<.10; *p<0.05; ** p<0.01; ***p<0.001. Significance tests compared to low-usage students.

Conclusion From The Research: "This report examines the association between *Amira Learning* participation and student literacy development. We consistently found that increased usage was associated with stronger literacy development across all outcomes. Overall, these results consistently suggest that students who received a greater percentage of the recommended dosage of *Amira Learning* practice sessions gained more than their peers who received smaller dosages."

Abstract: Carnegie Mellon's RCT of 2nd and 3rd graders identified significant gains in vocabulary.

Study: *Computer-assisted oral reading helped third graders learn vocabulary better than a classroom control--about as well as one-on-one human-assisted oral reading.*

- Researchers: Aist, Mostow, Tobin, Burkhead, Corbett, Cuneo, Junker and Sklar, Carnegie Mellon University
- Summary: The study of second grade and third grade students (assigned either regular classroom instruction, human tutoring or computer tutoring) showed **students using Amira/Robotutor showed an advantage over traditional classroom instruction for gains in word comprehension and vocabulary acquisition.** The study found an overall effect size of .56 for students using the Intelligent Tutor.

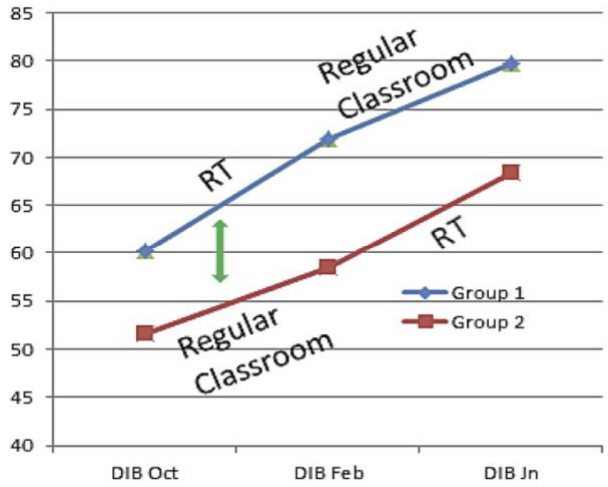
Conclusion From The Research: "The students on the Intelligent Tutor in grade 3 did better than their peers receiving classroom treatment, with an estimated advantage on Word Comprehension normed score gains of 3.90 points ± standard error 1.54; for grade 3, effect size1 = 0.56, and p = 0.042, with Bonferroni correction for multiple pairwise comparisons."

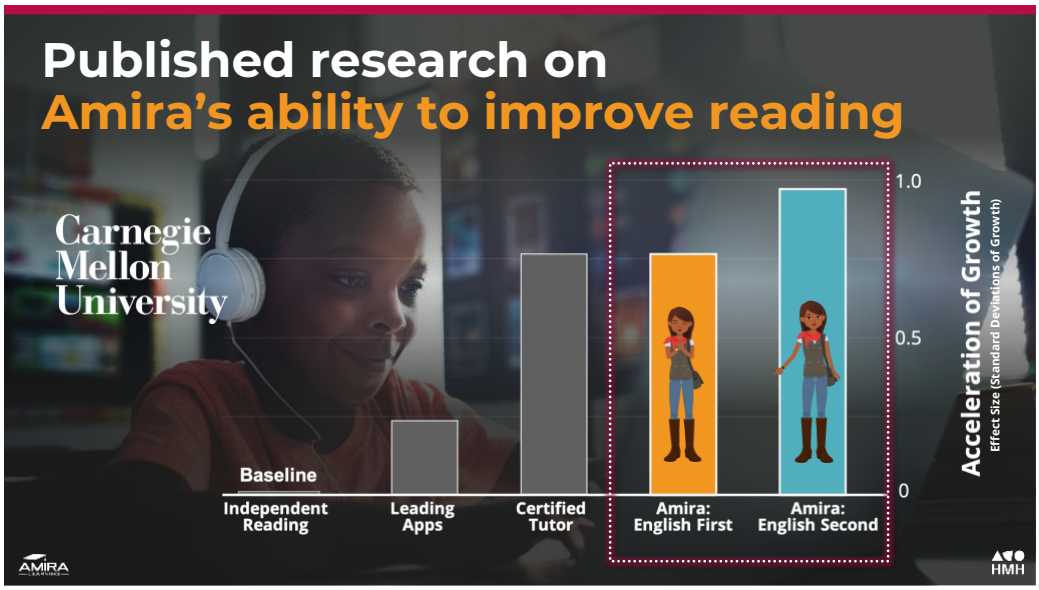
Abstract: The University of British Columbia focused on Amira's impact for a diverse population of Els and found gains in all dimensions of reading mastery.

Speech Recognition Software Contributes to Reading Development for Youth Learners of English

- Researchers: Reeder, Shapiro, Wakefield, D'Silva; University of British Columbia, Vancouver; 2015.
- Summary: Determined English Language Learners (children of immigrants with assessments indicating they were struggling) improved reading mastery faster when working with Amira/Robotutor than when receiving only classroom instruction. The effect size was determined to be between .41 and .68 for various measures of reading mastery.

The segments of lines labeled "RT" below demonstrate the faster gains while using the Amira Intelligent Reading Tutor.



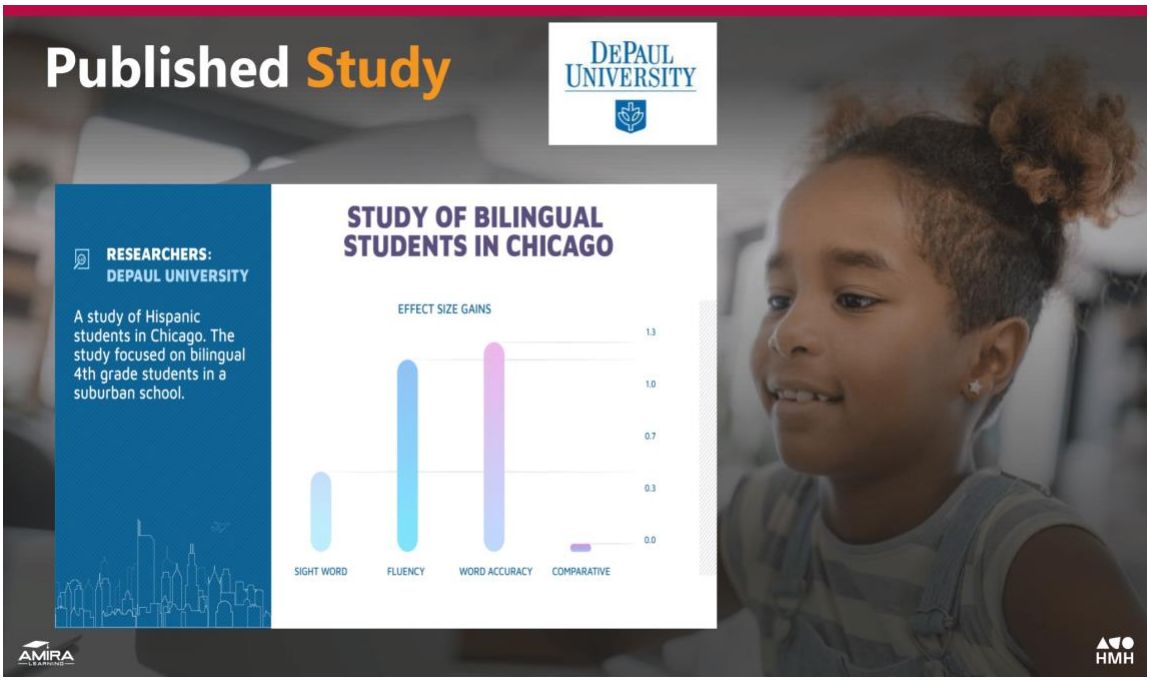


Conclusion From The Research: "It is safe to conclude that the Reading Tutor was clearly associated with the observed strong gains in oral reading fluency when measured independently or within the intervention's own assessment tools, and with significant grade level gains in passages mastered."

Abstract: Research at DePaul University found gains for Hispanic students at Chicago Public Schools.

Tutoring Bilingual Students With an Automated Reading Tutor That Listens: Results of a Two-Month Pilot Study

- Researchers: Robert Poulsen, DePaul University
- Summary: English Language Learners in Chicago (Hispanic 4th grade students) using **Amira/Robotutor outperformed the control group not using Amira/Robotutor in every measure of fluency, sight word recognition and comprehension.** The study author noted, "The (Amira/Robotutor) Tutor group out-gained the control group in every measure during both halves of the crossover experiment." Effect sizes were 0.55 for sight words, a robust 1.16 for total fluency and an even larger 1.27 for fluency controlled for word accuracy.

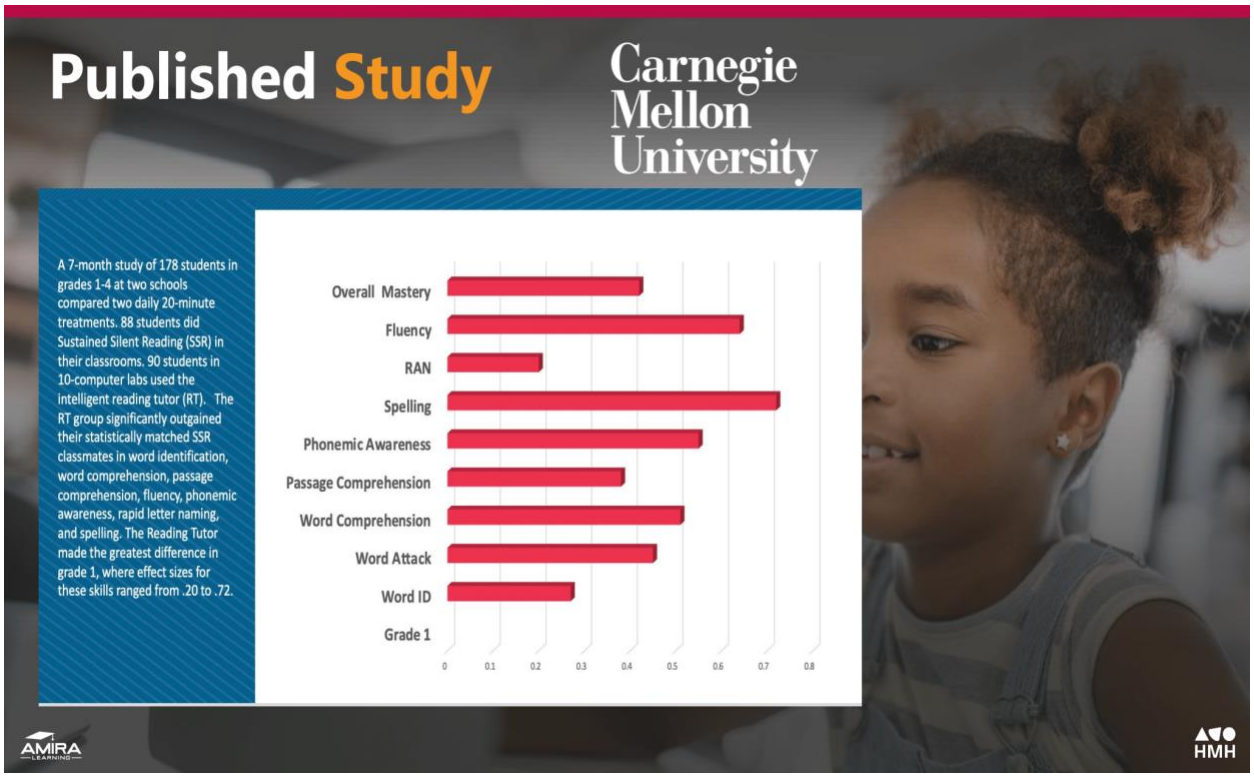


Conclusions From The Research: "The Reading Tutor group out-gained the control group in every measure during both halves of the crossover experiment. Within subject results from a paired T-Test indicate these gains were significant for one sight word measure ($p = .056$) and both fluency measures ($p < .001$). Effect sizes were 0.55 for timed sight words, a robust 1.16 for total fluency and an even larger 1.27 for fluency controlled for word accuracy. These dramatic results observed during treatment indicate this technology may have much to offer English language learners."

Abstract: Carnegie Mellon's RCT in Pittsburgh area schools showed large effect size compared to silent reading.

Independent versus Computer-Assisted Reading: Equal-time Comparison of Sustained Silent Reading to an Automated Reading Tutor that Listens

- Researchers: Mostow, et. al, Carnegie Mellon University
- Summary: **Students using Amira/Robotutor significantly outgained their classmates who participated in silent reading in word identification, word comprehension, passage comprehension, fluency, phonemic awareness, rapid letter naming, and spelling**. 180 students grades 1-4 were studied. Half of the population engaged in Silent Reading and the other half used Amira/Robotutor. The study authors note, "The Robotutor-helped students – especially first graders -- gain significantly more in almost every reading skill we measured than their statistically matched classmates who spent the same time in Sustained Silent Reading, even though the experiment manipulated only 20 minutes out of a day full of excellent instruction." The study found an effect size of .64 for students using Amira.

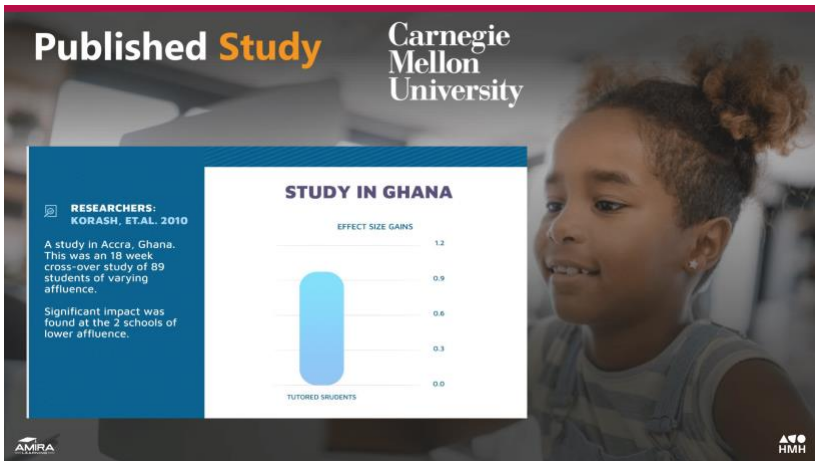


Conclusions From The Research: "A 7-month study of students in grades 1-4 compared two daily 20-minute treatments. The RT group significantly outgained their statistically matched Silent Reading classmates in word identification, word comprehension, passage comprehension, fluency, phonemic awareness, rapid letter naming, and spelling."

Abstract: CMU field studies in Africa showed that low affluent students made disproportionate gains using Amira/Robotutor.

Improving Child Literacy in Africa: Experiments with an Automated Reading Tutor

- Researchers: Mills-Tettey et. al, Project LISTEN/Carnegie Mellon University
- Summary: Students who used an intelligent Reading Tutor technology gained considerably more in fluency than those who did not use the tutor in **developing communities.** Study was an 18-week cross over study of 89 students of varying socioeconomic levels with significant impact found at the 2 schools of **lower affluence.**

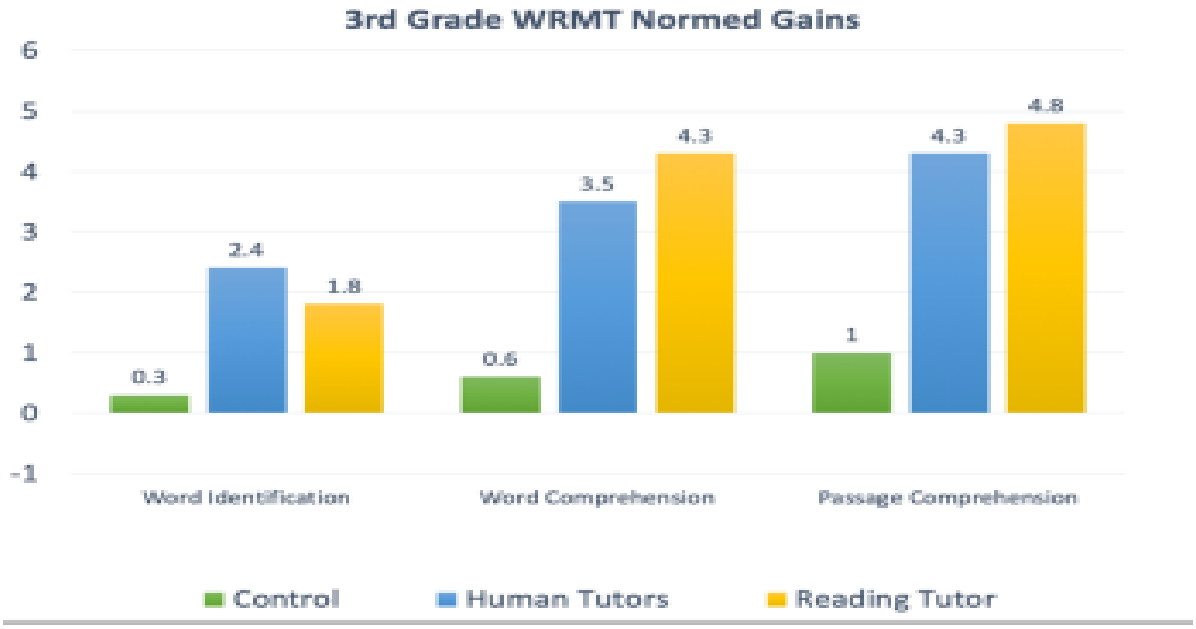


Conclusion From The Research: "The results provide evidence that during the school term, the students who used the Intelligent tutor gained considerably more than those who did not use the tutor."

Abstract: This Carnegie Mellon RCT focused on 2nd and 3rd graders and resulted in an effect size of .48 across word recognition and reading comprehension skills.

Evaluation of an Automated Reading Tutor that Listens: Comparison to Human Tutoring and Classroom Instruction

- Researchers: Mostow et al, Project LISTEN/Carnegie Mellon University
- Summary: A year-long study of 131 second and third graders in 12 classrooms comparing daily 20 minute treatments of Amira/Robotutor and human tutoring. Findings revealed Amira/Robotutor generated significant gains relative to the control group and **was effective as a certified human tutor in achieving reading outcomes.** The overall effect size of Amira/Robotutor was determined to be .48.



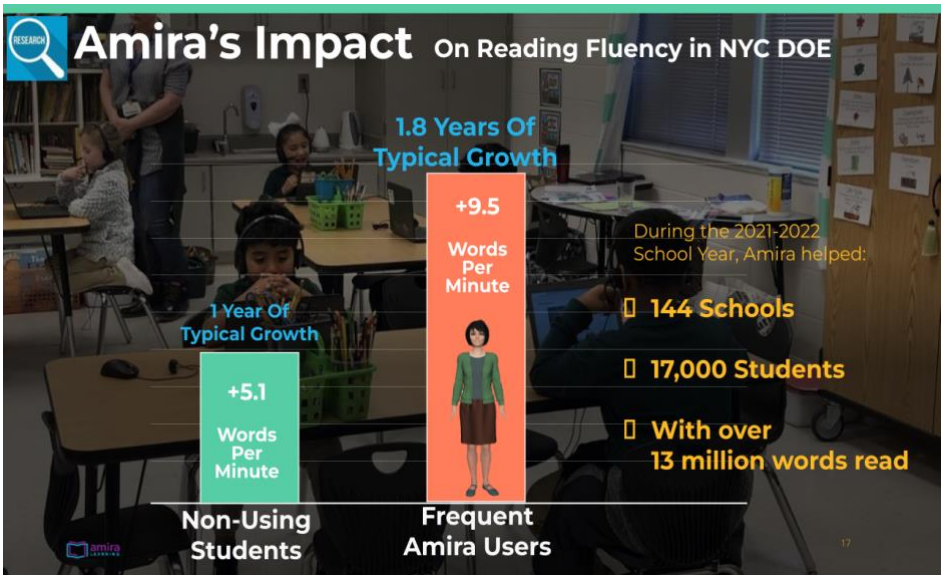
Conclusion From The Research: The study authors noted, "We found surprisingly few significant differences among treatments. We expected the human tutors to lead across the board. Instead, human tutoring significantly outgained the Intelligent Tutor only in Word Attack (p=.02, ES=.55). Human and computer tutoring both surpassed the control in grade 3 Word Comprehension gains."

IV. Summary of Evidence and Findings of Effectiveness from use of Amira in Schools

Today, Amira Learning is used by over 800,000 students across 3,000+ schools and nearly 800 school districts. In keeping with our commitment to ensuring a positive impact on student learning, we continue to conduct evaluations, using both experimental studies and case studies. As a result, there have been several recent evaluations and studies of the performance of students using Amira as a reading support or intervention. Overall, these evaluations and case studies continue to find the same outcome as the formal research. Students using Amira continue to show growth in reading at rates significantly higher than their peers who do benefit from the use of Amira. The following are highlights of these findings and case studies:

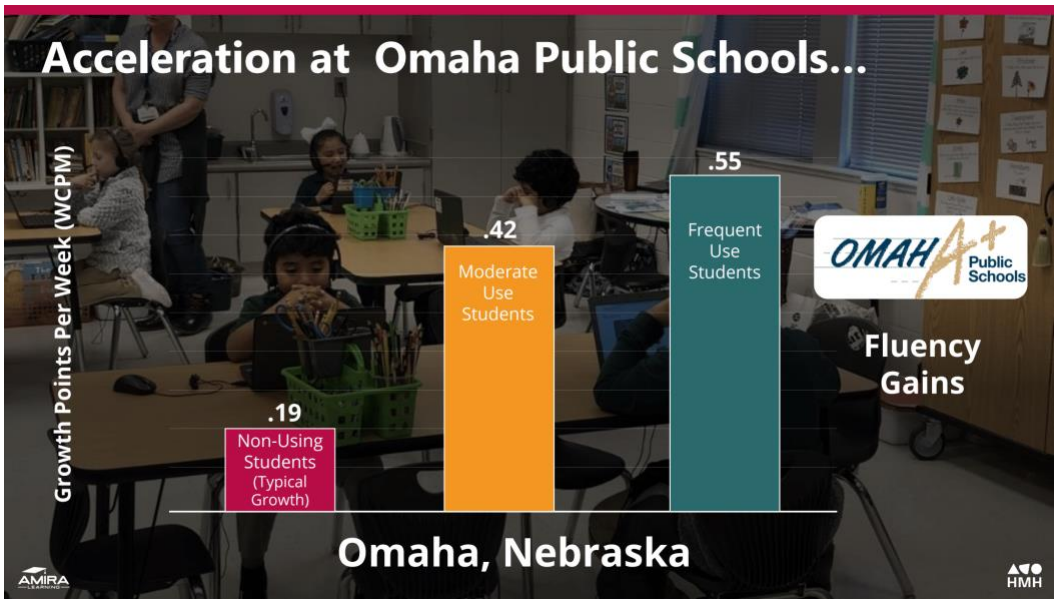
Case study: Amira's Impact on Reading Fluency in NYC DOE

- Evidence: Analysis of reading fluency (words correct per minute), a measure of how effectively students can read.
- Summary: Amira began pilots in NYC during the summer of 2019. Students using Amira frequently improved reading fluency at a rate nearly two times that of students who did not use Amira. As a result of its effectiveness, Amira is now used in 144 of the city's elementary schools reaching over 100,000 K-3 students.



Case study: Amira Creates 2x Acceleration In Fluency Growth in Omaha, NE

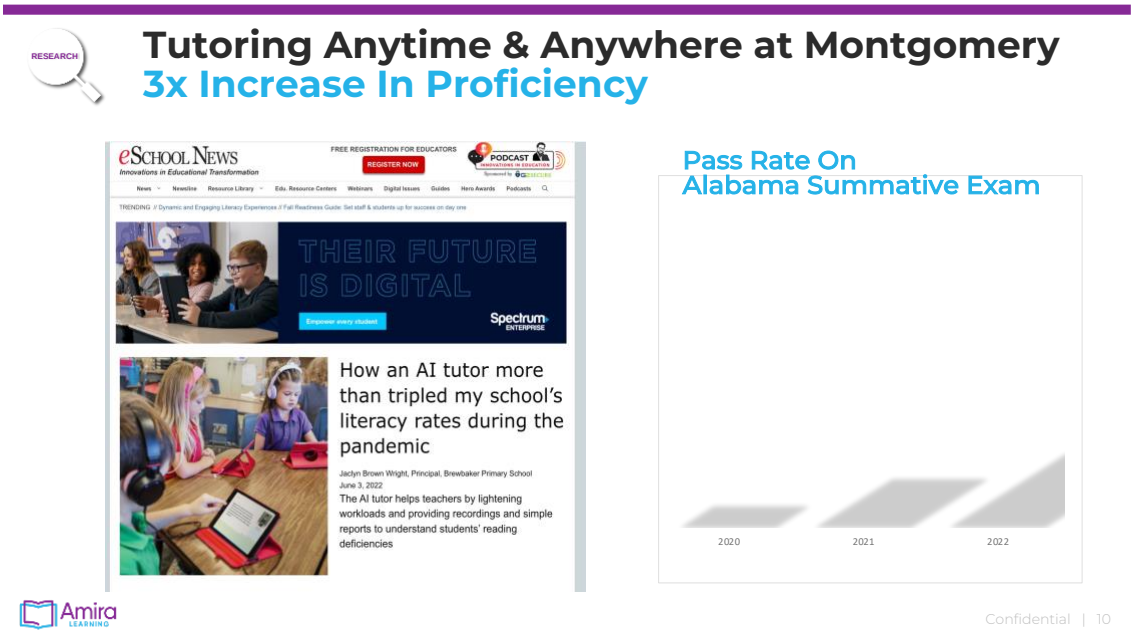
- Evidence: Analysis of reading fluency (words correct per minute), a measure of how effectively students can read.
- Summary: Omaha began using Amira in the 2020-21 school year, district-wide. The district employs the Amira software for tutoring practice, dyslexia screening and universal screening. Consistent with results from other case studies, students using Amira experienced significant gains in reading fluency relative to students who did not use Amira (.19 words per week of improvement in reading fluency gains for non-users compared to .45 words per week in frequent users).



Case Study: *Increase in Reading Proficiency in Montgomery, AL using Amira*

- Evidence: Alabama State Summative Exam

- Summary: Brewbaker Primary School used Amira with 1st and 2nd graders. In two school years using Amira, notwithstanding COVID, the pass rate on the ELA Alabama State exam jumped from 18% to 63%.



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V. Conclusion:

During the 2021/22 school year, Amira worked with several hundred thousand students frequently. These students gained fluency (as measured by WCPM) 1.8x faster than the typical non-using student.

Across a range of methodologies, time frames, Districts, grade levels and demographics, the data on Amira has demonstrated material effect size.

More Information:

For an enumeration of the more than 100 published studies conducted during PROJECT LISTEN on Amira/Robotutor: PROJECT LISTEN.

For information on the reading science research at the foundation of Amira's intelligent tutoring: Amira's Research Foundations.

For more information on recognition of Amira's impact:

Amira Is Gaining Widespread Recognition As A Breakthru Innovation.

- **Only Edtech Company On The 2022 Forbes AI 50 (link)**
- **2022 CODiE Awards - Finalist for Best Virtual Learning Solution (link) (3rd Year Running)**
- **A Time Magazine Best Invention of 2021 (link)**
- **EdTech Digest "Best Literacy/Reading Solution" with HMH IntoReading (link)**
- **Breakthrough Award for "Best Language Learning Tool of the Year" (link)**
- **Fast Company's World Changing Ideas Awards (link)**
- **Tech & Learning Awards of Excellence: Best of 2021 (link)**