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LAUNCHING SUCCESSFUL READERS: THE ROLE OF ICT IN EARLY-GRADE LITERACY SUCCESS

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For those seeking to improve their lives, expand their opportunities, and build a better future, literacy is a necessary and powerful enabler. In recognition of the importance of literacy to global health and economic improvement, USAID, AusAID, and World Vision launched a "Grand Challenge" in the fall of 2011. Their goal: to improve literacy in low-resource settings during the first three years of schooling. According to their research estimates, equipping all children in low-income countries with basic reading skills would result in a 12% drop in world poverty.

For anyone focused on improving early-grade literacy, whether in developed or developing nations, one of the key questions is: What is the role of Information and Communications Technology (ICT)? Clearly ICT is not a pre-requisite for early-grade literacy achievement; throughout history many children have learned to read and write well without it. In addition, formal research on literacy benefits from ICTs, particularly computing technologies, shows that past investments have often been ineffective. For example, a recent multi-million-dollar evaluation on the effects of five major reading software programs in U.S.A. first-grade classrooms found no significant effects; another meta-analysis of 85 studies on reading software across K – 12 classrooms concluded that the types of reading software programs most commonly used in U.S.A. classrooms over the past few decades "are not producing educationally meaningful effects in reading for K – 12 students."[1]

Nonetheless, many schools and students around the world still struggle with literacy development in the first three years of schooling. This suggests that there are fundamental barriers to literacy that continue to exist and that are exceedingly difficult to overcome by traditional means. With new and evolving ICTs, there are now new opportunities and supports for reading and writing, and new research has expanded our understanding about literacy development and educational reform. Therefore, new investments in ICTs for early-grade literacy—aimed at going beyond ineffective approaches from the past—may provide a significant opportunity to create solutions for early-grade literacy improvement, especially for students and communities with challenging literacy problems.

We believe that a judicious way to focus new investments on ICTs in early-grade literacy, given that not all children need ICTs to begin their literate lives as highly successful readers and writers, is to focus on the most critical role for ICTs:

The most critical role for ICTs in early-grade literacy is in removing literacy barriers that continue to exist for some communities and students.

[1]For more information on these studies, see:

Campuzano, L., Dynarski, M., Agodini, R., & Rall, K. (2009). Effectiveness of reading and mathematics software products: Findings from two student cohorts. Washington, DC:Institute of Education Sciences, U. S. Department of Education. http://ies.ed.gov/pubsearch/pubsinfo.asp?pubid=NCEE20094041

Cheung, A., & Slavin, R.E. (2011, May). The Effectiveness of Education Technology for Enhancing Reading Achievement: A Meta-Analysis. Baltimore, MD: Johns Hopkins University, Center for Research and Reform in Education. http://www.bestevidence.org/reading/tech/tech.html

If ICTs can remove persistent barriers to literacy development in the first three years of schooling, then they could have a profound effect on early-grade outcomes and greatly increase students' chances for success in later grades.

In order for this promise to be realized—and to avoid repeating past mistakes—we believe that technology developers and policy makers must commit to creating and implementing literacy-improvement programs built on an understanding of how research in the learning sciences can inform them about:

- What really matters for literacy growth in the first three years of schooling,
- Barriers to literacy growth, including those in developed and developing nations; and
- Key considerations in structuring and evaluating a comprehensive literacy program.

The purpose of this paper is to begin promoting more effective investments in technology for early-grade literacy by providing policy makers with a brief overview of these areas, along with descriptions of the latest technologies that appear to hold promise for launching successful readers.

What Really Matters for Early-Grade Literacy Success?

Research shows that what really matters for successful literacy acquisition in the early grades—and beyond—is access to and promotion of these factors: ***Sounds and Letters, Comprehension, Knowledge, Quantity of Practice, Motivation, and Personalization***. Each of these factors is described below, along with common barriers and promising ICT solutions.

SOUNDS AND LETTERS MATTER.

Most written languages are alphabetic: letters correspond to spoken sounds within words. Young children can learn to recognize some words through memorization, but in order to become highly-skilled and efficient readers, they need to:

- Grasp the underlying relationship between letters and sounds;
- Know how to match different letters and letter combinations to sounds;
- Understand that letter-sounds correspond to speech sounds within words;
- Become skilled at seeing a string of letters, matching the letters to sounds, and blending those sounds into whole words.

Children who have difficulty with letter-sound skills often become highly frustrated with reading lessons. This frustration can lead to side effects such as poor reading strategies and negative attitudes toward reading. To avoid these side effects, teachers should teach decoding skills in playful ways that maintain and build enthusiasm for reading.[2]

Common Barriers:

- Some children may have underlying structural or processing differences in areas of the brain responsible for speech and hearing that make it more difficult for them to hear and identify the individual sounds within words.
- Children who live in homes where a different language is spoken than the one at school can also need more teaching on letter-sound skills, particularly if there are sounds in the language used at school that are unfamiliar in their home language.[3]
- Children who come to school from homes where they have had low exposure to complex language, rhymes, or language play often have difficulty with letter-sound skills.
- In many classrooms in developing countries, teachers write letters on a blackboard that is too small or too scratched for children to adequately see. Children who have not been exposed to print prior to school cannot mentally encode and learn letters and their sounds without clear, large visual models. Without access to this basic first stage of literacy learning, children have little chance for literacy success.

[2]Research at the preschool level shows that children's letter-sound knowledge can be effectively increased with video clips. For more information, see Penuel, W., et al. (2011). Supplementing literacy instruction with a media-rich intervention: Results of a randomized controlled trial. Early Childhood Research Quarterly, 27, 115-127.

[3]Whenever possible, children should be taught beginning reading skills in their home language before being taught to read in a second language.

ICTs For Removing Barriers:

A major drawback of traditional print for early readers is that letters and words on a blackboard or paper are silent. Now, however, computers can not only provide greater visual improvement over blackboards, they can also enable written print to be linked to sound, aiding both group and individual reading practice. For example:

- Software can give children the power to manipulate clearly visible letters and words on a screen and simultaneously hear their sounds. This type of experience can help children overcome letter-sound learning difficulties and decoding-related difficulties that have been difficult to address in traditional ways. In addition, new gaming technologies allow children to act with their whole body as an on-screen character. These technologies can provide ways for teachers to engage children around letter-sound and decoding lessons with higher levels of enthusiasm than ever before.
- Text-to-speech technology means that children can practice writing independently, while still getting feedback on how their written words sound with the letters they've used.
- Some children's e-books and games give children the ability to click on any word they can't read and instantly hear how it is pronounced. With help being only a click-away, it is possible that the frustration experienced by many children over decoding difficulties —something that too often leads them to avoid the reading practice they need—could be largely eliminated. Ideally the decoding support provided in these activities is not limited to whole-word help but also shows children how the word is "sounded out," strengthening their knowledge of letter-sound connections within words.

COMPREHENSION MATTERS.

The ultimate goal of reading is comprehension: understanding the messages that writers want to communicate. To adequately focus children's attention on comprehension, teachers must move beyond simply asking children questions about what they read. Using reading material that includes information children want to know—such as messages from someone they care about, material that involves humor, and material that relates to children's personal interests or to something important in their lives outside of school—is an effective way to focus teaching on active comprehension. Also effective for comprehension-building are projects that provide real-life and social-emotional purposes for reading. These purposes can include connecting with others, creating useful objects and art, and finding ways to improve their own lives or the lives of those in less-fortunate communities. Such projects can also provide opportunities for early readers to be exposed to thoughtful, complex, and interactive spoken language that will provide a critical foundation for comprehending more complex written language in years to come.

Common Barriers:

- Teachers may not have access to engaging reading materials for all students and may find it difficult to create unique materials that they know will be of interest to each of their students.
- Teachers may lack the tools to ensure that reading material adequately matches students' individual skill levels. Children who are given reading material that is consistently too difficult and frustrating to decode can also fail to develop good comprehension competencies.
- Teachers often need support in offering thought-provoking language and project opportunities that integrate valuable early reading and writing practice with real-life reading purposes. If not carefully structured, projects can end up taking too much time for non-literacy activities—such as drawing, cutting, and pasting—and diminish the value of available instructional time for reading.

ICTs For Removing Barriers:

- E-mail, texting, and other digital messaging programs—when supported by adults—can add a social dimension to young children's reading practice. These tools can allow teachers to provide students with opportunities to read and write in ways that focus their attention on comprehension because of the relevance to important people in their lives outside of school.
- Books have high costs associated with printing and paper: e-books increase the potential to provide teachers with larger collections to better match student interests and skills to reading material.
- Search technology can provide teachers with the instant ability to find books, e-books, and other reading material on subjects that children are curious about, at the moment when curiosity is high.
- Digital cameras, desktop publishing software, and e-book publishing software mean that teachers and their students can now more easily create texts with locally-relevant messages for reading practice.
- ICT-based education networks, such as iEARN (International Education and Resource Network) provide teachers with support for project-based learning that can be integrated with reading and writing and often involve connecting via technology with students in other countries. Students in iEARN projects are as young as five years in age; each iEARN project addresses the question, "How will this project improve the quality of life on this planet?"

KNOWLEDGE MATTERS.

Even if children care about the message of a text, and even if the text is within their decoding ability, children can still fail to comprehend the text if they lack essential knowledge about the world and the meanings of words. For example, children with no knowledge about a modern airport could experience substantial confusion reading a scene about travelers in the baggage claim area of a New York City airport.

Common Barriers:

- Children come to school with vast differences in their experiential, vocabulary, and world knowledge. Researchers have found that in the United States, an average child in a professional family has heard 45 million words by the age of four, while a typical child in a family living in poverty has heard 13 million.
- Children who come to school from homes where there has been little access to books or videos can have substantially less knowledge about the world than peers from more advantaged homes.
- Teachers often lack the time and transportation facilities to take children on field trips for building knowledge about the world.
- Teachers often lack access to enough material with visual information. Visual information can greatly increase comprehension and knowledge when it is used to explain unfamiliar concepts and places that children read about.

ICTs For Removing Barriers:

- Internet capabilities are making it possible for teachers to bring the world into the classroom, providing the class with pictures and video of any unfamiliar word or concept at the moment they encounter it.
- Internet and Skype technologies can allow children in remote and harsh areas—where teachers cannot or do not want to go—to build knowledge about the world beyond their communities. Experiments with "The Granny Cloud"—in which British grandmothers volunteered an hour of their time during the week to read with, talk with, and discuss pictures with disadvantaged children in India—demonstrate the potential for new socially-active global solutions to help support literacy through knowledge support.

QUANTITY OF PRACTICE MATTERS.

Experience shapes the brain, so it is no surprise that children who read more are highly likely to have better comprehension skills, better vocabulary, and better fluency than children who read less. Without sufficient reading practice, children will not develop the ability to read basic texts fluently by the end of second grade, and they will be at high risk for continued reading failure.

Common Barriers:

- Children in many low-resource settings, in both developed and developing nations, do not have sufficient access to reading material that interests them and is at a level they can read.
- In places where children's homes do not have access to electricity and light, time for reading after dark is often not possible.
- In remote areas of some countries, teacher absenteeism runs as high as 25 – 30% of school days, so there is an urgent need to provide children with more independent reading opportunities.

ICTs For Removing Barriers:

- Digital devices—especially mobile devices—can make quantities of reading material available to students on a previously unimaginable scale. This greatly increases the chances that children can find reading material that matches their skill levels and interests, increasing their opportunities to read for comprehension in the quantity needed for literacy success. The International Children's Digital Library (ICDL) project, for example, currently offers free access to 4649 children's books in 61 languages.
- Mobile digital devices, charged at school, can be used for reading at night even in homes with little or no access to electric light.
- Many devices can also enlarge print for students with vision difficulties.[4]

[4]For children with additional or other needs, the Center for Literacy and Disabilities at the University of North Carolina, USA, provides a free library of over 21,000 e-books for beginning readers of all ages, in English and German. These e-books are downloadable as SlideShows in a variety of formats, and they are accessible with multiple assistive interfaces, including touchscreens, IntelliKeys (enlarged keyboards) with custom overlays, text-to-speech, and 1 to 3 switches. To date the books have been read in 173 countries. For more information, see http://www.med.unc.edu/ahs/clds and http://tarheelreader.org/.

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MOTIVATION AND PERSONALIZATION MATTER.

Becoming a skilled reader is largely a self-teaching process. It requires decoding skills plus vast amounts of engaged, independent practice that will only happen if children are motivated to spend time reading at school and at home. Estimates of the amount of practice to become an expert in many skills are in the thousands of hours, and there is no indication that expertise for reading is any different in this regard than expertise in these other skills. Teachers' ability to personalize learning is key to maximizing the development of motivated reading, by tuning into children's individual interests, needs, and skill levels.

Common Barriers:

- Teachers can find it difficult and time-consuming to keep track of each child's reading level and to learn about their personal interests outside of school. As a result, it can be difficult to ensure that young children are personally interested in the material they read and not frustrated by the material they read. Lack of interest in reading material or frustration in reading are two main reasons that children lack motivation to spend the amount of time on reading necessary for high levels of literacy success.
- Even if teachers have sufficient information about children's interests and reading levels, it can be difficult to have enough reading material in the classroom to match these levels and interests. Without experience gained in the classroom in engaged reading, many children will not build the habits for spending time reading at home.
- Teachers typically have students with widely-varying skill levels. This makes it difficult to track and manage the grouping of students into personalized schedules of teacher-led or independent small groups that either provide learning on what is most needed—in decoding-focused, comprehension-focused, and/or knowledge-building activities—or provide opportunities for guided and independent practice.

ICTs For Removing Barriers:

- In addition to providing increased access to interesting reading material, computing technologies can dramatically reduce the time and skills needed for teachers to effectively track and use data on children's skills and interests. Software can allow teachers to automatically link and customize student data with grouping algorithms, so that they can assign children to a personalized schedule of learning experiences based on strengths and needs.
- Search technology and Internet access can enable children to engage in self-teaching of not only of literacy skills but also of sophisticated concepts. For example, work by Sugata Mitra shows that even early-grade children can work in small groups around an Internet-connected computer to read and write, as they answer deep questions such as "Where does language come from?" Such work appears to make long-lasting contributions to children's knowledge, further supporting their ongoing literacy growth. The topics children investigate in these situations are posed and motivated by the teacher, which underscores the answer to the following question:

WHAT MATTERS MOST FOR EARLY-GRADE LITERACY SUCCESS? HIGHLY-EFFECTIVE TEACHERS, PARENTS, AND MENTORS

ICTs will never replace effective teachers; they can only offer teachers—as well as parents and other mentors—more ways to provide children with what really matters for success, especially when conditions make it difficult to do so without technology. True, scalable literacy success from ICT projects will only come about through teachers who are knowledgeable enough to design activities that use technology in ways that maximize its potential. This is why any effective ICT educational strategy must provide teachers with sufficient and ongoing access and support on how to integrate ICTs into their teaching practice. Many of the barriers we described above for literacy success directly relate to barriers that teachers often encounter to effective teaching. By lifting those barriers, ICTs would directly raise teaching effectiveness. Other ways that ICTs could raise teacher-effectiveness include:

- **Increased support for teachers' knowledge about all aspects of what really matters for early-grade literacy.** Videos delivered to teachers on a variety of ICT devices can provide effective teaching models, as well as examples of common benchmarks for student reading and writing performance in the early grades. Networking tools can also help teachers participate in online learning communities.

> The teacher's job is to create or allow situations where children want to read and are willing to work hard at it.
> - Joanne Yatvin, Ph.D., Commentary on the National Reading Panel Report, 2000.
>
> [A]ttempts to use technology as a stand-in for capable instruction are bound to fail.
> - Kentaro Toyama, "There are no technology short-cuts to a good education," January 2011, EdTechDebate.org

- **Increased ability to manage small group and individual learning.** Teachers know that learning happens best when students get help at the moment they need it. However, many early grade teachers find it enormously difficult to keep the rest of the class engaged and supported while they help a small group or an individual student. ICTs can play an important role in solving this problem: when a teacher is working with an individual student or small group, digital devices can allow the rest of the class to practice reading material with support. Using these devices, children can either access word-help on their own, or, if speech-recognition technology is available, they can read to a computer that will provide help when it senses difficulty.
- **Increased ability to connect with parents or other adults in children's homes.** E-mail, mobile phones, and Skype are all new avenues to help teachers, parents, and mentors communicate and work together to provide students with what really matters for literacy learning.
- **Increased ability to offer intergenerational literacy support in students' homes.** Teachers and students face additional obstacles when parents, grandparents, and other caregivers have difficulty supporting literacy practice, due in some cases to their own lack of skills or knowledge. A central challenge for increasing early literacy success involves moving beyond the classroom to find ways of uniting generations in literacy activities. The Joan Ganz Cooney Center in New York City is leading efforts to develop new supports for intergenerational learning through media that can meet this challenge.

STRUCTURING AND EVALUATING A COMPREHENSIVE EARLY-GRADE LITERACY INVESTMENT PROGRAM

Any significant investment in ICT solutions for literacy improvement—or in non-ICT solutions—should only be made as part of a comprehensive literacy strategy. Piecemeal approaches to improving early-grade literacy will likely fail to result in substantial improvements: ignoring some of the factors for early success can make attention to others ineffective.

Therefore, we recommend that stakeholders investing in early-grade literacy improvements carefully consider which barriers to early-grade literacy exist in the communities that will be served. In considering solutions to removing these barriers and increasing the effectiveness of teachers, stakeholders will also need to consider such questions as:

- Are there substantial health-related issues—inadequate access to food, sleep, eyeglasses, medical and dental care—that will render our literacy investments ineffective because children will not be able to concentrate at school?
- Will any ICT solutions pose substantial implementation challenges, including: lack of Internet connectivity, lack of cell network access, lack of electricity for charging devices, risk of student access to inappropriate Internet materials, risk of student access to potential dangers from Internet predators, arguments over ownership of devices, and theft?
- Are there social or cultural challenges that will make it difficult for young students to read at home, even with all these investments?

If so, how will all of these challenges be addressed?

No single ICT or non-ICT vendor will likely have solutions for all aspects of a comprehensive literacy strategy, but it is critical that policy makers coordinate vendor solutions to ensure that a comprehensive early literacy strategy is achieved. The strategy should include a set of solutions that will remove existing barriers to all the key factors for success in early-grade literacy. It should also address general implementation challenges, and include a plan for evaluating and adjusting the strategy once it is in place.

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