Text-to-Speech Technology as Inclusive Reading Practice: Changing Perspectives, Overcoming Barriers

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ABSTRACT

Many students struggle to read well enough to support learning in various areas of the curriculum. Drawing on an eight-month inquiry, with 28 grade five students, this article discusses text-to-speech technology as an inclusive reading practice that allows students entry into their literacy communities, access to a variety of texts, and enhanced meaning making. It seeks to illuminate concerns and questions teachers, students, and parents might have with regard to the use of text-to-speech technology.

> Everyday, children come to school unable to read despite the best efforts of their teachers. They are slow to recognize the letters of the alphabet and have great difficulty learning the sounds each letter makes. Their knowledge of sight words is minimal. They have limited interest looking at books or listening to stories. By the time they reach fourth grade, their reading skills have advanced to a level equivalent of a mid-year first-grade student. Year after year, these children, their parents, and teachers have tried new instructional approaches; used a variety of instructional materials; devoted extra time to reading activities; engaged peer readers to work with them; and used a host of motivational techniques to model, reward, and even coerce them to read. Despite everyone's best efforts, these children have not developed the reading skills that allow them to derive meaning from text with adequate speed, fluency, and comprehension. (adapted from Edyburn, 2007, p. 146)

The Dilemma

> If a child repeatedly fails to read and to understand printed text, how much data documenting this failure needs to be gathered before we have enough evidence that the child can't perform the task? (Edyburn, 2006) When do we intervene? And what do we do? (Edyburn, 2007, p. 149)

The reading research has long investigated reader differences, why readers struggle, what happens when readers struggle, how best to intervene, and how best to support. Traditional reading interventions (Dolan, Hall, Banerjee, Chun, & Strangman, 2005; Rose & Meyer, 2000) are often designed to support readers' ability to decode and make the connection between the sounds heard and letters read. While systematic phonics instruction (Adams, 1994; National Reading Panel, 2000) benefits many children, there is a group of students who may never achieve a level of speed, fluency, and accuracy that supports their emotional, social, cognitive, and intellectual development. The problem is one of information processing: by the time they have successfully decoded the word, they have little to no energy or capacity left to solve the word, let alone make sense of it, and then do something with it (i.e., comprehend, respond) (Hirsch, 2003). As a result, many of these students enter into a vicious cycle of withdrawal from text, which widens the gap between those who read well and those who don't, referred to as the Matthew Effect (Stanovich, 1986).

Bypassing decoding issues, TTST may prevent the cycle of withdrawal often attributed to inaccessible curricula, low levels of motivation, lack of confidence, and/or reading deficits in phonemic and phonic awareness (Bryant & Bryant, 1998; Day & Edwards, 1996; Dolan et al., 2005; Hitchcock & Stahl, 2003; Hodge, 2003; Lewis, 1998; Kellner, 2004; Raskind & Higgins, 1998; Sipe, 1999). It may also reduce reliance on "human" supports in a variety of contexts, therefore enhancing independence (Cople & Ziviani, 2004; Labbo & Reinking, 1999; LDOnline, 1998; Pisano, 2002).

Despite this compelling research, parents and teachers continue to be plagued with questions of: *What do we do with students who struggle to read despite numerous interventions focused on decoding, speed, and fluency? Do we continue to teach decoding, or do we try something new? And in trying something new, how do we ensure that students who struggle to read the conventional/traditional way are not stigmatized, perceived by others as privileged, or accused of cheating?*

These are honest questions and real concerns discussed by many in the field—ones that I have encountered on multiple occasions. I often find myself

defending and rationalizing in a way that supports these students and their rights to be readers…

Opening the Conversation

Regardless of whether I'm talking to teacher candidates, teachers in the field, parents, or even students, I begin with a conversation about fairness, accommodation, and sensitivity. I open with some simple yet insightful questions:

How do we learn best? How are you smart? How can we each be taught in a way that matches our strengths, needs, and interests?

Hands go up and discussions circle, but we come to a tentative agreement that each of us deserves to be taught in a way that is fair and equitable, responsive to our strengths, needs, and interests. We acknowledge that the best learning occurs when what is taught is what is needed in a way that is meaningful, relevant, and allows students to be part of their classroom communities.

Gradually I push the conversation toward reading, asking, *What do you remember about learning to read? What do you do when you come to a word you don't know? What happens when you don't read or can't read what is required? How can we, or do we, support students who struggle with reading?*

At this point, we discuss what happens when teachers have exhausted available interventions and specialized supports, and students are still not reading at an age, grade, even cognitively appropriate level. We talk about not reading well enough to access the texts that support learning. I know they know what I am talking about. I know that every single person in the room has either observed this frustration or experienced it somehow over the course of their lifetime. And I know that at times, they have felt every bit as powerless as I have or my students have…

They are ready, they are thinking, and I know that I am about to tread on thin ice, but out I skate…

I enter into a discussion of technology and the promise and possibility that text-to-speech offers students who struggle. If I close my eyes, I can already see not one but five hands about to go up. I know I have their attention, especially as we enter into the inevitable discussion of high interest, low vocabulary texts, the concept that we learn to read by reading, and the importance of access to their age, grade, and cognitive reference groups.

I can see some sitting there thinking, that was me… I never got to read the same as the others. And I can see some sitting there, those who never struggled, struggling now with the question of, *But how, if we give them a computer, will they ever learn to read?*

And I know that as sure as this question gets posed, I'll also hear, *But, when we take it away, they won't be able to read on their own. And here I ask: Why take it away? Would you take a guide dog from an individual with a visual impairment?*

I steel myself for the debate and conversation about to surface. I know that there are as many viewpoints in the room as there are individuals. And I am satisfied with the response. I know that it will not change overnight, but instead, it is far more important to get them thinking, encourage them to step outside their experience, and look at things from a different perspective. If I have disrupted what they have come to accept as commonplace—that it is not enough to simply modify the reading materials to the level students can read with 90-95% accuracy regardless of whether this is what interests them or not, regardless of whether this is age, grade, or cognitively appropriate—then I have done enough for today.

Ultimately though, what I want to share is that text-to-speech technology (TTST) offers a solution to this dilemma, particularly if it is viewed as an inclusive practice or way of reading. Now, this is not to recommend that TTST be used as a teaching reading program, nor that we bypass decoding issues in lieu of teaching decoding. Instead, I am suggesting that TTST may circumvent frustration and reader withdrawal due to inadequate decoding and fluency, freeing readers to do the real work of reading, which is making meaning. In this way, TTST supports the overall acquisition of literacy, and learning, as students continue to receive other forms of intervention such as systematic phonics instruction.

Unpacking TTST: What It Does and Does not Do

Text-to-speech technology (TTST) transforms print text into electronically read, computer synthesized text. Different than audio-texts, TTST allows any text, at any time, to be accessed (Anderson-Inman & Horney, 2007; Rose & Meyer, 2000) provided that a computer with scanning and TTST is available. The view inside a text reader (such as Kurzweil©) is the same as the view inside the print text, regardless of whether it is predominantly print, a website, or a text with multiple images and/or graphics (see Figure 1).

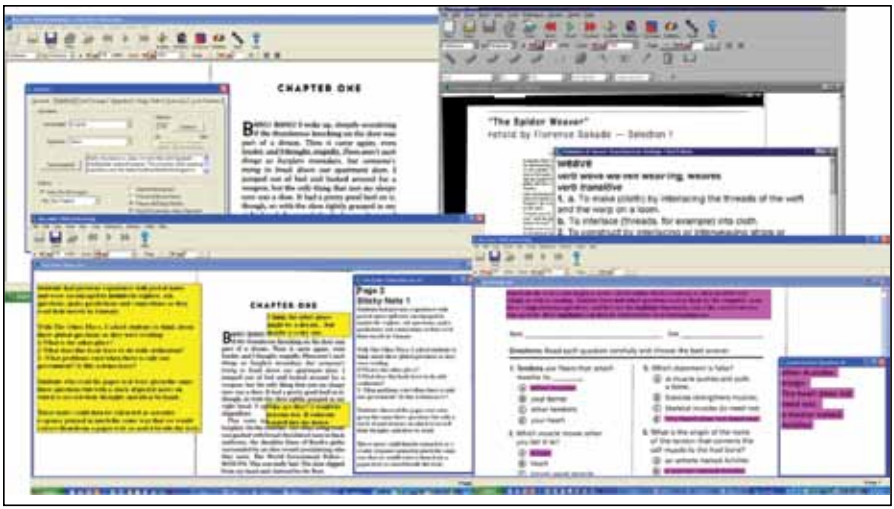

Fig. 1: The view inside Kurzweil©

TTST decodes for students with an accuracy and fluency that they cannot attain on their own: it does not think about text, make connections, or solve words. Take for example the following proverb, translated into very technical language:

CLICK SENTENCE BELOW TO HEAR TTST AUDIO FILE

Missiles of ligneous or petrous consistency have the potential of fracturing my osseous structure, but appellations will eternally remain innocuous.

Can you read it with a high level of accuracy? Understand it? Make sense of it? Apply it to your life? Now imagine reading it with a computer that is decoding the letters and sounds into words. Would that make a difference? Would you be able to understand it? Make sense of it? Apply it to your life? This is the task faced by readers who struggle, and often, it is not the meaning or even understanding of words that interfere. It is often the most basic level of letters and sounds that stops them dead in their tracks, not allowing them to go any further. They still have to think, to make sense of, to connect, to solve the puzzle of words. TTST cannot do any of this for them. TTST offers a similar level of support as read-alouds, but without expression of any nature. It is monotone, leaving the reader to bring what he/she feels is an appropriate level of expression to the text.

Traditionally, TTST was reserved for students with special needs but today's availability of technology, ranging from the free Adobe Reader© to the sophisticated

Kurzweil©, offers TTST possibilities to all readers both in and out of the classroom. This consideration of TTST as inclusive practice, however, raises many questions:

What are the implications of offering TTST as a text format to all readers? How does it fit in to what we already do? Will all readers want to use it? Will we have enough computers? Will reading the "decoding" way become a way of the past in the same way that we are seeing handwriting, even proper keyboarding, lose importance in favour of contemporary ways of being with technology? Will readers who can decode accurately and fluently on their own benefit from TTST; enhancing the gap instead of reducing it?

Research into the use of electronic text readers as support for reading consistently demonstrates that the effect is different for individual students. Studies that focus on word recognition, decoding, and sentence level awareness demonstrate some positive effect but are often limited due to factors such as lack of control group or limited length of study (e.g., three sessions to three weeks) (Farmer, Klein, & Bryson, 1992; Higgins & Raskind, 2000; Olson & Wise, 1992; Wise, 1992). The effect of TTST on reading comprehension varies depending on reading proficiency, with less proficient readers demonstrating elevated scores on reading comprehension and more proficient or confident readers showing depressed levels (Disseldorp & Chambers, 2002; Elkind, 1998; Elkind, Cohen, & Murray, 1993; Higgins & Raskind, 1997; Montali & Lewandowski, 1996). From a more general perspective, Hasselbring and Bausch (2005/2006) suggest that as a reading support, TTST helps students with learning disabilities access grade-level texts; as a reading intervention, it helps "students strengthen and improve their overall reading skills" (p. 73).

Although the research base appears to be ambiguous on which students benefit most from TTST, it underscores what we know about readers, particularly those who struggle—each learner presents with a unique set of behaviours and characteristics in diverse contexts, and therefore must be considered on a case-by-case basis (Disseldorp & Chambers, 2002; Montali & Lewandowski, 1996; Balajthy, 2005; Garrison, 2009; Hitchcock, Meyer, Rose, & Jackson, 2002; MacArthur, Ferretti, Okolo, & Cavalier, 2001; Zabala, 2000). While TTST may not produce generalized effects on reading, it is critical to determine which students benefit, in which contexts, for what purposes (Hirsch, 2003). The voices of students described below provide evidence that TTST positively influences the motivation, confidence, and self-efficacy of those who struggle most; in fact, TTST enables students to struggle with success instead of withdrawing from the task of reading.

Student Voices: What Works Best?

For many years, I heard from struggling readers, "But I don't want to be different," or from confident readers, "Why don't I get to use the computer?" From parents and teachers, I often heard, "But if you give them a computer, they will never learn to read. I don't want him/her to have a privilege that others don't have." My counterargument was, and is, "If you don't allow them to read with a computer, they may never learn to read in a way that supports their overall development. Others are privileged in the sense that they can read independently. Without TTST, some may never have this privilege." When TTST is offered as inclusive practice, as simply one more way to access text in the regular classroom, it is not overused but instead becomes a matter of choice, self-efficacy, and self-advocacy, as demonstrated by the following vignettes derived from an eight-month ethnographic inquiry, based on the implementation of TTST as a level of support, in a regular Grade 5 classroom with 28 students. Indeed what these students had to say was more than interesting.

Mackenzie — A confident reader, a justifiably confident refuser of TTST.

I'm using the computer to my benefit.

I made the technology work for me, but … I felt Kurzweil© was controlling reading for me, and I like to be in control of my reading… I think it is a good program, just not for me.

~letter to Kurzweil©

It interferes with the voices in my head.

Fig. 2: Mackenzie's voice

Mackenzie is an internally motivated reader who recognizes the benefits of reading; he believes that reading is valuable, embraces its goals, and believes that he reads well (See Figure 2 for direct quotes and images of Mackenzie). He approaches challenging texts with the expectation that he will master them (Guthrie & Humenick, 2004). Confident readers, like Mackenzie, have fluent and accurate decoding, strong oral reading, and diverse reading interests, often reflecting "the rich get richer" end of the Matthew Effect (Stanovich, 1986). While willing to suspend judgment and give TTST a chance, these readers find comfort in what they have learned, but prefer to

read without it. Their primary complaint with TTST is that the computer voice interferes with the voices in their head, thus interfering with comprehension and disrupting engagement. It is unlikely that these students will use TTST as a way to access print; some even prefer the notion of audio-texts as they feel there is far more expression of voice offered. TTST, in their opinion, requires them to do more work than they were doing on their own.

James — A contextual chooser.

Everybody should have a chance to try it.

James' cohort:
James asked, "*Can I change to a book?*"
Ryan turned and said incredulously, "*You want to change*?"
James responded, "*Yeah, [do you] want to change*?"
Ryan: "*No. Why are you changing?*"
James: "*I don't know. I just want to try it out.*"

~Fieldnote

Fig. 3: James' voice

Contextual choosers, like James, read when they need to read (See Figure 3 for direct quotes and images of James). These students are often characterized by low levels of internal motivation, self-efficacy, and reader engagement (Guthrie & Humenick, 2004; Smith, 1988), which can be offset by legitimate opportunities to interact, collaborate, and make decisions. For contextual choosers, TTST is not necessarily a support for accuracy and fluency but instead acts as a scaffold, a motivator, and a regulator that maintains focus, enhances concentration, and supports engagement. It is one more way to familiarize themselves with author, genre, and text difficulty (Edyburn, 2007). TTST may alleviate the initial stages to the Matthew Effect (Stanovich, 1986) by allowing access in various ways to multi-level texts and appropriate literacy communities. Perhaps most important to this group is choice and control: Use of TTST is a decision they feel entitled to make—an issue of privilege and social justice. They no longer believe that the computer does "all the work" for them and understand that TTST simply reads the decoding way.

Jacqueline — An enabled user.

I can't read it on my own, you know!

I don't like to read, because it is too hard.

~reading inventory

I think now is the best time to learn text-to-speech. If you learn text-to-speech, it will help you to read. It is better to get the kids who know Kurzweil© to teach the other kids about it.

~ scribed response

Fig. 4: Jacqueline's voice

With TTST, Jacqueline possesses both self-efficacy and self-advocacy as a reader (Guthrie & Humenick, 2004). She believes that she is reading, realizes its benefits, and has learned to use TTST effectively as a support system (See Figure 4 for direct quotes and images of Jacqueline). Without TTST, students like Jacqueline would be denied access to age, grade, and cognitively appropriate texts that allow them to learn at the same rate as their peers. With the exception of one student in 28 (Jacqueline), the enabled users in this inquiry could decode at grade level with 95% accuracy, but decoding is so slow and capacity demanding that comprehension suffers, energy to engage fully in the reading process is drained, and as a result, they often withdraw from the text. TTST helps students like Jacqueline sustain access to texts of their choice, ultimately enhancing engagement with content, dialogue, and independent response. Without TTST, these students will likely suffer from reduced exposure to print and the deleterious effects of the Matthew Effect (Stanovich, 1986). For readers who need it, TTST will never be just a reading tool: it will be an enabling tool, likely for the rest of their lives (Elkind, 2005).

Those who benefit most.

Students for whom TTST is most beneficial may be characterized by one or all of the following: a) slow or inaccurate decoding that does not correlate to their cognitive and intellectual potential (i.e., less than 90% accuracy); b) lower levels of fluency, typically 24 to 92 words per minute; c) high levels of listening comprehension

that can be activated by TTST; d) low levels of confidence and/or internal motivation that lead to reader reluctance and withdrawal; e) pacing and attentional difficulties that can be regulated by TTST; and f) the need for multiple readings.

Conditions for the Successful Implementation of TTST

Mackenzie, James, and Jacqueline demonstrate that decisions about technology need to be made on a case-by-case basis, considering individual strengths and needs, environmental and contextual demands placed on a student, and demands of the task (Zabala, 2000). In traditional frameworks, the basis for this decision making often lies within the control of the teacher or the instructional team. These students, however, demonstrate that they are more than capable of participating in this decision.

Allowing students legitimate choice and control with regard to the use of technology builds student interest, motivation, and engagement, all of which are especially important for students like Jacqueline who may otherwise become reluctant readers (Reinking, 2005). TTST allows students to customize viewing, interacting, and pacing with text (See Figure 5), all of which enhance student engagement and motivation (Strangman & Dalton, 2006).

- TTST gives you more choice over what is read. With the computer, you can read everything, but the computer can't do it all. It can't do the thinking for me. I still have to think about the words, but the computer becomes my eyes.
- TTST allows you to read all of a book without help; you can slow it down and speed it up when you want to.
- If you don't know a word, you can stop, try to figure it out on your own. If it is a hard word, you can right click on it, and Kurzweil© will give the definition.
- TTST helps us read, write, proofread, download… it just helps us read.

Fig. 5: Student reflections about the purposes and functions of TTST (Source: Parr, 2012, p. 1425)

Offering TTST as one more text format reduces the risk that is often inherent in specialized supports, where we often hear of students who refuse the supports because they do not want to appear different than their peers. When given the option to explore, students accept TTST as another form of support in the regular classroom; it is not overused but instead fits within reading practices they already use.

Fitting TTST Into Existing Reading Practices

TTST easily fits within a balanced literacy framework grounded in multiple intelligences, multi-modalities, multiple literacies, and universal design for learning. In a regular classroom, readers have control over such things as genre and author; just as they will move in and out of authors and genres, so, too, do many move in and out of TTST. Listening to the computer read or simply viewing material on a computer screen does not bring "about superior reading skill: the electronic medium, however does offer unique opportunities to reformat and enhance the text in ways that can support reading comprehension" (Anderson-Inman & Horney, 2007; MacArthur, Ferretti, Okolo, & Cavalier, 2001 in Berkely & Lindstrom, 2011). Similar to shared reading, students are encouraged to join in and read along when they feel comfortable, bringing appropriate intonation and expression to the text. Texts mediated by TTST can be read and reread just as with a human reader, thus tapping into the notion of repeated readings designed to improve student engagement and comprehension (Samuels, 2002), fluency, and accuracy. Viewing and hearing words spoken within the context of a passage helps to build word recognition and vocabulary without disturbing the flow of comprehension (Silver-Pacuilla, Ruedel, & Mistrett, 2004). Most importantly, TTST supports decoding, which frees the listener to focus on the meaning of the text (Wise, Ring, & Olson, 2000), in turn facilitating student dialogue and collaboration, access to content area texts, and spontaneous written responses.

TTST as support for student dialogue and collaboration.

Despite the fact that students wear earphones to read with the computer, this does not isolate students nor does it interfere with the collaborative sense-making and spontaneous dialogue about texts. Students in this inquiry discovered that if they dropped one earphone, they could keep one ear (and two eyes) on the text as it was being read with the computer, and the other ear on the conversation occurring within their group. Recognizing the role of collaboration in the reading process (Guthrie & Humenick, 2004), these students adapted TTST to suit their purposes and ensure that they did miss out on dialogue due to their engagement with TTST. For example, one literature circle elected to discuss *The Other Place* by Monica Hughes, a novel that deals with a family moved to a penal colony in a not-so distant future. As they read with both TTST and the paper text, three students were observed trying to understand what some of the less common phrases meant and how this connected to what they had been learning (see Figure 6). John and Taylor were reading a print text, where Eric was reading with TTST; without TTST, Eric would have been prevented access to this text, this particularly rich conversation about government and democracy, and the opportunity to engage in collaborative sense-making.

Eric*:	What does this mean? [referring to crimes of subversion]
Mackenzie:	When you're spreading messages and you're trying to get into someone's head, without actually telling them what you are doing.
John:	Oh, like a newspaper. Oh, I think that's why he's going to prison. Because of the articles he wrote . . . I wonder what they said.
Eric*:	What's a penal colony? Oh, I think it's like a prison. Why would they say, "Long live the world government organization?" Does that mean that one government rules the world? That's like democracy. This is getting more interesting!

*Eric was reading with TTST.

Fig. 6: Collaborative sense-making with TTST (Source: Parr & Campbell, 2012, p. 47)

TTST as access to grade-appropriate content area texts.

Access to content area print texts can be facilitated through TTST, regardless of whether it is a periodical, a textbook, or a website. TTST allows students to struggle, persist, and succeed appropriately with content as opposed to being limited by their ability to crack the letter-sound codes of print texts. While TTST provides a different way of accessing and travelling through content, students are still in control of their thinking, learning, and creating. While some students were more than content to refuse TTST for content texts, they did agree that it was a great way to encounter content, where intonation and expression have less of an effect on meaning.

Engaged in a unit on the human body, students were invited to choose whether they wanted to access content about muscles and the way our body moves through a print text or through TTST. The snippets of content learned by students (presented in Figure 7) demonstrate that there is no difference in the acquisition of content between students who accessed the traditional print text and those who accessed the content through TTST. The processes required to acquire and recall content do not differ in relation to the way the text is presented.

Edward*:	I learned that it takes 40 muscles to frown and 17 muscles to smile.
Jacqueline*:	When you bring your arm up and down like this, and ask someone to touch your muscle, you can tell that it has grown.
Noah:	I learned that the eyes are the muscles that move most often and that we blink more than 1000 times a day.

*students reading with TTST.

Fig. 7: TTST as access to grade-appropriate content text

TTST as support for spontaneous written reader response.

TTST offers students opportunities to spontaneously respond in writing in much the same way they might with a paper text (See Figure 8). Built into TTST is the ability to record written sticky notes and/or voice notes. For the one student in 28, Jacqueline, whose decoding and encoding was prohibitive to written response, she independently recorded her voice notes that were later transcribed, helping her to make the connection between oral and written language. Without TTST, she would have been prohibited independent access to Black Beauty. With TTST, however, she was able to read, make sense of, and make connections without reliance on human supports. Jacqueline's responses are contrasted with those offered by Diana, a confident reader, while reading Peter Pan. In Diana's response, we see more in-depth discussion about the author's choice of words and the computer's ability to replace a word that she felt was inappropriate to be read out loud (with paper, she felt she could ignore it; with TTST, she wanted the same option, but because the computer said the word, she didn't have that option).

Jacqueline's Written Response
I like everything and what's going to happen next is that the horse is going to get buried and the other horses are going to feel bad for the black horse named Charlie.
I don't like this story very much because a horse died. Next I think Black Beauty is going to die.

Diana's Written Response
I don't like it when Tinker Bell said or called Peter a silly a**. But I did like when Wendy gave Peter Pan a kiss, a very polite kiss and Peter Pan gave Wendy a thimble kiss or a real kiss but I don't really know what he gave her but I'm pretty sure he gave her a thimble Kiss!
Today, I liked when Peter Pan got to Neverland safely with Wendy, John, and Michael… and that Tinkerbell didn't say you silly a** to Peter Pan.

Fig. 8: Spontaneous written responses (Source: Parr, 2012, p. 1424)

Extending the Conversation

Many teachers, students, and parents are unaware of the potential of text-to-speech technology (TTST), to empower students struggling to read/work independently at their age, grade, and cognitively appropriate levels (Hasselbring & Bausch, 2005/2006; Johnson, 2009). Lack of awareness, traditional conceptualizations

of reading, attitude, and perception need to be addressed in systematic and respectful ways, with both students and teachers, in order to maximize the potential of students who struggle to read the conventional/traditional way. What I learned about developing awareness, broadening conceptualizations of reading, challenging attitudes, and changing perspectives from the enabled users like Jacqueline, I now use when discussing TTST with diverse populations.

I often find myself drawn back into that initial conversation about text-to-speech technology and how *they* will ever learn to read if they read with a computer… I find that today, I am better situated to answer some of the outstanding questions and alleviate some of the concerns left unaddressed. Here I offer what I feel might be an extended conversation, as part of a hands-on workshop for those participants interested in learning about text-to-speech technology. This represents insights that I have gained along the way, conversations I continue to have, and philosophies that have now become part of who I am and part of the story that I now tell.

But how, if we give them a computer, will they ever learn to read?

Offering students a computer with text-to-speech technology does not mean that they don't have to be skilled readers. It means that the computer has become their decoding eyes. They still have to add expression, reread with fluency, create pictures in their mind, make connections, and make sense of it all. The computer works best for those students who have decoding or fluency needs. As a matter of fact, students who have strong decoding skills and high fluency opt out of the technology because they feel that it slows them down.

I often begin with a simulation of what it means to read with a computer, large group or individually, exploring specific functions and characteristics of TTST (See Author, 2011 for a detailed implementation plan for inclusive classrooms). When I ask, *How is this reading?* I hear responses similar to, *It's not reading. It's listening. And if the computer reads to you, it's kind of cheating*. These responses stem from traditional conceptualizations or experiences of reading as decoding. Here, I find it important to review contemporary conceptualizations that view reading, or more globally literacy, as a complex negotiation of the following tasks and processes: understanding the codes of diverse texts (experiential, print, multimedia, digital, etc.); making sense of texts in multiple contexts, from multiple perspectives, for different purposes; critical thinking and analysis of the purposes and functions of texts; and transformational practices related to the creation of new texts (Freebody & Luke, 1990; Luke, 2000; Luke & Freebody, 1999; Parr, 2012; Parr & Campbell, 2012). I quote research and

literacy documents that state that *struggling readers should not be limited to low-level activities focused on decoding and literal comprehension* (Ontario Expert Panel on Literacy in Grades 4 to 6, 2004). I proceed by deconstructing exactly what the computer does—decode—one tiny component of reading.

We then consider the use of TTST in independent reading and discuss why being read to by a human is not the same as reading independently. Here, I also point out that many academic and work institutions have accepted this view: TTST is an acceptable accommodation on standardized tests for students who struggle to read and are formally identified as a student with a reading exceptionality; TTST is an accommodation that must be offered in the workplace when necessary. While I still encounter resistance, I see an increasing acceptance that decoding does not a reader make, that reading with TTST is not listening or cheating, and that TTST just provides a different way of decoding letters and sounds.

As we near the end of our discussion, I still hear some participants sitting back asking that philosophical question:

But how is this real reading? How will they ever learn to read if we give them a computer that reads to them? And, what happens when we take it away?

Well, the goal is to have each student reading on his or her own, but we must also recognize that not all students are going to be able to read with a high level of fluency. Most of the students with whom I worked could decode with between 90 and 95% accuracy, but their fluency rates were incredibly low—some of them were reading at 32 words a minute in order to decode with 95% accuracy. When they got to the task of meaning-making and comprehension, they had no energy left. They could not remember what they had read. So it's not always that these kids can't read, but instead the amount of time it takes them to read and then the amount of energy they have left over for something else. Long term, these students will be able to read what they need on a daily basis (e.g., prescription bottles, directions, menus, etc.), but in terms of long-term learning, they have far greater potential if offered the support of TTST.

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We must remember that TTST is a support, a tool, a scaffold for pre-reading, a way to gain familiarity with such things as text structures and author styles, and a way to access the texts of their peer groups—the students with whom I have worked

will tell you this. They will tell you that one or two chapters read with text-to-speech technology gives them enough confidence and independence to continue on their own. It sets them up for success. And when we provide access to all students, we are eliminating the stigma attached to text-to-speech technology, the privilege of text-to-speech attributed by others, and we are simply adding one more text format to our repertoire. In this case, we are providing supports that will foster student ownership over the reading process and we are allowing students to choose what works best in a given situation. "Ultimately, adaptive technology [can be] responsible for two paramount outcomes; it encourages independence and enhances self-confidence" (Hunt, 2003, p. 1). Students "failed [or restricted] by conventional schooling, and thus who have limited engagement and accumulated reading resources, could be offered by new technologies new ways back into school as a context for learning experiences" (Freebody & Hornibrook, 2005, p. 373).

We circle back to this question of "Would you ever take a guide dog from an individual with a visual impairment?" and I offer that it is not our role to take something away, especially if it is enabling student engagement and self-efficacy. It is the readers' role to self-advocate, to identify their own strengths and needs, and to retain ownership over their reading processes. If this means that they need TTST to keep up with the demands of their schooling, so be it… we need to provide the tools needed to be successful.

So, would you ever take a guide dog from an individual with a visual impairment? We would never take it away, but there may be times when a guide dog is no longer necessary; there may be times when the individual has a great enough support system that he or she chooses to let the dog rest… it is all about choice, self-efficacy, and self-advocacy. Your lifelong users will help you to understand fully this technology.

As readers, it is tough for us to fully understand, but if you introduce it, if you encourage it, and if you see the promise, you'll be amazed at just how far your students can go...

References

Adams, M.J. (1994). Modeling the connections between word recognition and reading. In R.B. Ruddell & N. J. Unrau (Eds.), *Theoretical models and processes of reading* — (5th Ed., pp. 1210–1243). Newark, DE: International Reading Association.

Anderson-Inman, L., & Horney, M.A. (2007). Supported eText: Assistive technology through text transformations, *Reading Research Quarterly, 42*:153–160.

Balajthy, E. (2005). Text-to-speech software for helping struggling readers. Reading Online, 8(4). Retrieved from http://www.readingonline.org/articles/art_index.asp?HREF=balajthy2/index.html.

Berkely, S., & Lindstrom, J.H. (2011). Technology for the struggling reader: Free and easily accessible resources. *Teaching Exceptional Children*, 4, 48–55.

Bryant, D.P., & Bryant, B.R. (1998). Using assistive technology adaptations to include students with learning disabilities in cooperative learning activities. *Journal of Learning Disabilities, 31*(1), 41–54.

Copley, J., & Ziviani, J. (2004). Barriers to the use of assistive technology for children with multiple disabilities. *Occupational Therapy International, 11*(4), 229–243.

Day, S.L., & Edwards, B.J. (1996). Assistive technology for postsecondary students with learning disabilities. *Journal of Learning Disabilities, 29*(5), 486–494.

Disseldorp, B., & Chambers, D. (2002). Independent access: Which students might benefit from a talking computer? In S. McNamara and E. Stacey (Eds), Untangling the Web: Establishing Learning Links. Proceedings ASET Conference 2002. Melbourne, 7-10 July. Retrieved from http://www.aset.org.au/confs/2002/disseldorp.html

Dolan, R.P., Hall, T. E., Banerjee, M., Chun, E., & Strangman, N. (2005). Applying principles of universal design to test delivery: The effect of computer-based read-aloud on test performance of high school students with learning disabilities. *Journal of Technology, Learning, and Assessment, 3*(7). Retrieved from http://escholarship.bc.edu/jtla/vol3/7/

Edyburn, D.L. (2006). Assistive technology and mild disabilities. *Special Education Technology Practice, 8*(4), 18–28.

Edyburn, D.L. (2007). Technology-enhanced reading performance: Defining a research agenda, *Reading Research Quarterly, 42*:146–152.

Elkind, D. (2005). Assistive technology – More than a reading tool, a life tool. LD Resources. Retrieved from http://www.ldresources.org/2004/11/27/assistive-technology-more-than-a-reading-tool-a-life-tool/

Elkind, J. (1998). Computer reading machines for poor readers. *Perspectives, 24*(2), 9–14.

Elkind, J., Cohen, K., & Murray, C. (1993). Using computer-based readers to improve reading comprehension of students with dyslexia. *Annals of Dyslexia, 43*, 238–259.

Farmer, M. E., Klein, R., & Bryson, S. E. (1992). Computer-assisted reading: effects of whole-word feedback on fluency and comprehension in readers with severe disabilities. *Remedial and Special Education, 13*(2), 50–60.

Freebody, P., & Hornibrook, M. (2005). The relationship of reading ICT to opportunity structure: An object to study? *Reading Research Quarterly, 40*(3), 371–376.

Freebody, P., & Luke, A. (1990). Literacies programs: Debates and demands in cultural context. *Prospect: Australian Journal of TESOL, 5*(7), 7–16.

Garrison, K. (2009). An empirical analysis of using text-to-speech to revise first-year college students' essays. *Computers and Composition*, 26, 288–301.

Guthrie, J.T., & Humenick, N.M. (2004). Motivating students to read: Evidence for classroom practices that increase reading motivation and achievement. In P. McCardle & Chhabra, V. *The Voice of Evidence in Reading Research* (pp. 329–354). Baltimore: Paul H Brookes Publishing Co.

Hasselbring, T. S., & Bausch, M. E. (2005/2006). Assistive technology for reading: Text reader programs, word-prediction software, and other aids empower youth with

learning disabilities. *Education Leadership, 63*(4), 72–75

Higgins, E.L., & Raskind, M.H. (1997). The compensatory effectiveness of optical character recognition/speech synthesis on reading comprehension of postsecondary students with learning disabilities. *Learning Disabilities: A Multi-disciplinary Journal, 8*(2), 75–87.

Higgins, E. L., & Raskind, M. H. (2000). Speaking to read: The effects of continuous vs. discrete speech recognition systems on the reading and spelling of children with learning disabilities. *Journal of Special Education Technology, 15*(1), 19–30.

Hirsch, E.D. Jr. (2003). Reading comprehension requires knowledge – of words and the world: Specific insights into the fourth-grade slump and the nation's stagnant comprehension scores. *American Educator*, Spring, 10–29.

Hitchcock, C., Meyer, A., Rose, D., & Jackson, R. (2002). Access, participation, and progress in the general curriculum. Wakefield, MA: National Centre on Accessing the General Curriculum, Retrieved from: http://cast.org/publications/ncac/ncac_techbrief.html.

Hitchcock, C., & Stahl, S. (2003). Assistive technology, universal design, universal design for learning: Improved learning opportunities. *Journal of Special Education Technology, 18*(4), Retrieved from http://jset.unlv.edu/18.4/hitchcock/first.html.

Hodge, R. (2003). *A review of recent ethnographies of literacy, Working Paper No. 1*. Lancaster, UK: Literacy Research Centre, Lancaster University.

Hunt, J. (2003). Adaptive technology – A tool from the literacy toolbox. *Connect, 5*(2), 1–2.

Johnson, T. (2009). Electronic textbooks: Set to take over? *University Affairs*, Retrieved from http://www.universityaffairs.ca/electronic-textbooks-set-to-take-over.aspx.

Kellner, K. (2004). Technological transformation, multiple literacies, and the re-visioning of education. *E-Learning, 1*(1), 9–37.

Labbo, L., & Reinking, D. (1999). Theory and research into practice: Negotiating the multiple realities of technology in research and instruction. *Reading Research Quarterly, 34*(4), 478–492.

LDOnline. (1998). Taking the mystery out of assistive technology. Retrieved from http://www.ldonline.org/ld_indepth/technology/tfl_mystery.html, reprinted with permission from Learning Disabilities and Assistive Technology: An Emerging Way to Touch the Future.

Lewis, R.B. (1998). *Reading software for students with learning disabilities: Hypermedia-based children's literature*. Retrieved from http://ldonline.org/ldindepth/technology/lewisrdgsftware.html.

Luke, A. (2000). Critical literacy in Australia: A matter of context and standpoint. *Journal of Adolescent and Adult Literacy, 43*(5), 396–398. Retrieved from http://www.paddle.usp.ac.fj/collect/paddle/index/assoc/pride024.dir/doc.pdf

Luke, A., & Freebody, P. (1999). *A map of possible practices: Further notes on the four resources model*. Retrieved from http://www.readingonline.org/research/lukefreebody.html.

MacArthur, C.A., Ferretti, R.P., Okolo, C.M., & Cavalier, A.R. (2001). Technology applications for students with literacy problems: A critical review. *Elementary School Journal, 101*(3), 273–301.

Montali, J., & Lewandowski. L. (1996). Bimodal reading: Benefits of a talking computer for average and less skilled readers. *Journal of Learning Disabilities*, *29*(3), 271–279.

National Reading Panel. (2000). Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction. Retrieved from http://www.nichd.nih.gov/publications/nrp/report.cfm.

Olson, R. K., & Wise, B. W. (1992). Reading on the computer with orthographic and speech feedback. *Reading and Writing: An Interdisciplinary Journal, 4*, 107–144.

Ontario Expert Panel on Literacy in Grades 4 to 6. (2004). *Literacy for learning: The report of the expert panel on literacy in Grades 4 to 6 in Ontario*. Toronto, ON: Queen's Printer for Ontario.

Parr, M. (2011). The voice of text-to-speech technology: One possible solution for struggling readers, *What Works? Research into Practice, Literacy and Numeracy Secretariat, OADE, Research Monograph #35*, Retrieved from http://www.edu.gov.on.ca/eng/literacynumeracy/inspire/research/whatWorks.html (French Translation: La technologie de synthèse de la parole: est-elle une solution possible pour les élèves éprouvant des difficultés en lecture? (May 2012)

Parr, M. (2012). The future of text-to-speech technology: How long before it's just one more thing we do when teaching reading? *ICEEPSY 2012 Proceedings: Elsevier.*

Parr, M., & Campbell, T. (2012). *Balanced literacy essentials: Weaving theory into practice for successful instruction in reading, writing, and talk*, Toronto, ON: Pembroke Publishers.

Pisano, L. (2002). What happens when assistive technology doesn't work: The need for an integrated approach. Retrieved from http://www.ldonline.org/ld_indepth/technology/assistive_technology_when_it_doesnt_work.html.

Raskind, M.H., & Higgins, E.L. (1998). Assistive technology for postsecondary students with learning disabilities: An overview. *Journal of Learning Disabilities, 31*(1), 27–41.

Reinking, D. (2005). Multimedia learning of reading. In R. E. Mayer (Ed.), *The Cambridge handbook of multimedia learning*, 355–376. New York: Cambridge University Press.

Rose, D.H., & Meyer, A. (2000). *The future is in the margins: The role of technology and disability in educational reform*. A report prepared for the U.S. Department of Education Office of Special Education Technology. Washington, DC: USDOE.

Samuels, S.J. (2002). Reading fluency: Its development and assessment. In A.E. Farstrup & S.J. Samuels (Eds.). *What research has to say about reading instruction* (3rd ed., pp. 166–183). Newark, DE: International Reading Association.

Silver-Pacuilla, H., Ruedel, K., & Mistrett. S, (2004). *A review of technology-based approaches for reading instruction: Tools for researchers and vendors*. Buffalo. NY: The National Centre for Technology Innovation.

Sipe, L. (1999). Children's response to literature: Author, text, reader, context. *Theory into Practice, 38*(3), 120–129.

Smith, F. (1988). *Joining the literacy club: Further essays into education*. Portsmouth, NH: Heinemann.

Stanovich, K.E. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly, 21*(4), 360–407.

Strangman, N., & Dalton, B. (2006). Improving struggling readers' comprehension through scaffolded hypertexts and other computer-based literacy programs. In M. C. McKenna, L. D. Labbo, R. D. Kieffer, & D. Reinking (Eds.), *International handbook of literacy and technology, Volume II*, 75–92. Mahwah, NJ: Lawrence Erlbaum Associates.

Treiman, R. (2001). Reading. In M. Aronoff & J. Rees-Miller (Eds.), *Blackwell Handbook of Linguistics* (pp. 664–672). Oxford, UK: Blackwell.

Wise, B.W. (1992). Whole words and decoding for short-term learning: comparisons on a "talking-computer" system. *Journal of Experimental Child Psychology, 54*, 147–167.

Wise. B., Ring. J., & Olson. K. (2000). Individual differences in gains from computer assisted-remedial reading. *Journal of Experimental Child Psychology*, 77, 197–235. doi: 10,1006/jecp, 1999.2559

Zabala, J.S. (2000). Setting the stage for success: Building success through effective selection and use of assistive technology systems. Retrieved from http://www.ldonline.org/ld2/test/article.php?id+505&loc=72.

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