Paper or Digital Text: Which Reading Medium Is Best for Students with Visual Impairments?

Ramona McLaughlin and Cheryl Kamei-Hannan

Structured abstract: *Introduction:* The purpose of this study was to evaluate the differences in silent and oral reading speed, reading comprehension, and reading errors in two formats, large print paper and the iPad2, for students with visual impairments (that is, those who are blind or have low vision). *Methods:* A single-subject alternating randomized treatment design was used with three participants. The intervention consisted of instruction on the use of an iPad. Data regarding reading speed, reading miscues, and comprehension were collected. Data were analyzed visually and descriptively. *Results:* All participants demonstrated a slightly higher reading speed, equal comprehension rates, and decreased error rates using the iPad2 compared to paper. *Discussion:* Results indicated that using an iPad for reading may have an effect on reading fluency and comprehension for students with low vision. *Implications for practitioners:* Students with low vision, particularly those with more severe vision loss, may benefit from the use of electronic tablets that allow one to adjust font size, style, color, and contrast. Users should be taught how to manipulate the visual display of text and be allowed time to adjust to an electronic medium.

Reading skills are essential for academic achievement, personal development, and participation in daily activities for all students, including students with visual impairments (that is, those who are blind or have low vision) (Kelly, 2011). For some students with low vision, using vision effectively and efficiently to excel can be a challenge. To achieve better reading outcomes, many visually impaired individuals choose to use low vision devices such as magnifiers. These devices, when applied appropriately and used effectively, assist in increasing reading speeds for students with low vision (Farmer & Morse, 2007; Gerritsen, 2010; Jutai, Strong, & Russell-Minda, 2009; Lusk, 2012; Lussenhop & Corn, 2002). However, attitudes towards the devices affect the users' experiences and effectiveness in using them (Jutai et al., 2009). Negative attitudes often contribute to dissatisfaction with reading in general, which may result in lower reading performance (Erin & Sumranveth, 1995; Frank, 2000).

With the growing popularity of tablet electronic devices, reading tasks are

shifting from print to digital media. Many individuals with low vision are adopting mainstream devices over other assistive technology options (Freeland, Emerson, Curtis, & Fogarty, 2010; Soderstrom & Ytterhus, 2010). These user-friendly, compact digital gadgets present high-quality resolution, and they have features that allow students to adjust the presentation of text, including its size, color, and illumination. Using these mainstream devices minimizes social stigmatizations that unconventional devices may bear. Young adults and teenagers gravitate toward their trendier streamlined embedded features over applying a low vision device such as a hand-held magnifier or an oversized, multivolume, large print book.

Low vision, reading speed, and accuracy

When examining reading speeds of students with low vision using printed materials, on average, participants read significantly more slowly than do their sighted peers (Lueck et al, 2003; Mohammed & Omar, 2011). As students aged, the gap in reading speed between visually impaired students and their sighted peers broadened (Corn et al., 2002; Tobin & Hill, 2012). At the time students matriculate to secondary school, reading fluency is assumed to reach its maximum. Therefore, reading fluency skills are not typically addressed for older students (Biancarosa & Snow, 2006) unless a reading disability is diagnosed. Some advocates propose that the use of technology, specifically the use of digital text, may aid in improving reading speed and accuracy for students with low vision (Kelly, 2009). However, research comparing the use of digital text versus printed materials has involved sighted individuals, not individuals with low vision. Dillon's (1992) syntheses of early research found that, on average, reading speeds using digital text were 20% to 30% slower when compared to reading speeds when text on paper was used. Noyesa and Garland (2008) reviewed additional research that supported Dillon's conclusion, and some results suggested that there was little or insignificant difference in reading speed when outcomes on the two media were compared. Dillon (1992) noted that differences in the display characteristics (font size, background color, line length, background lighting, and room lighting) and measurements of accuracy (proofreading or site word tasks vs. passage reading) may have contributed to the variance in findings.

The visual quality of printed and digital texts and the ability to control the text presentation were important factors in early research. Since then, the quality of images has greatly improved. Modern technology incorporates personalized settings such as increased illumination and ability to adjust the font size, style attributes, and color preferences. Previous research frames the context of this study. Current research has not been conducted on the use of digital text presented on tablet devices and reading speeds for individuals with low vision.

Impact on comprehension

Reading fluency is the ability to read with speed, accuracy, and expression (Rasinski, 2006). Readers who struggle with fluency often have poor comprehension. If a reader exerts cognitive demand on decoding, less cognitive capacity is available to gather meaning from the text.

Therefore, reading comprehension may be affected (Kamei-Hannan & Ricci, 2015). Cognitive attention or energy that must be applied to decoding tasks represents cognitive energy that is taken away from the important task of comprehending the text (Rasinski et al., 2005). One might reason that if a reader exerts cognitive demand to see text, less cognitive capacity is available for comprehension of what is being read. However, researchers found that when children with low vision were provided with appropriate access to materials and additional time to read text, they demonstrated comparable reading comprehension scores when compared to children who were sighted (Gompel, Van Bon, Schreuder, & Adriaansen, 2002).

Digital reading opportunities for sighted students have been found to have a positive effect on reading comprehension for second- (Doty, Popplewell, & Byers (2001), fourth- (Ortlieb, Sargent, & Moreland, 2014), fifth- (Dalton, Proctor, Uccelli, Mo, & Snow, 2011), and sixth-grade students (Moran, Ferdig, Pearson, Wardrop, & Blomeyer, 2008). Research evaluating the comprehension of students who are visually impaired using digital text compared with printed materials has not been conducted.

In this study, researchers investigated differences between students' performance using print versus electronic text presented on an iPad in the following reading areas: speed, accuracy, and comprehension. Researchers questioned whether teaching students to adjust digital features of electronic text would affect user attitudes, and if using an iPad would improve reading outcomes. A technology intervention was provided, and the impact of technology use on reading fluency and comprehension was measured. Researchers felt this study was timely because of the influx of e-book and tablet use in school settings and the increased demand for iPad technology. Guiding research questions were: Are reading fluency and comprehension comparable using large print paper text versus text displayed on an iPad2? and Do students show differences in the number and type of reading errors when they use the iPad2 compared to large print paper?

Methods

Participants

The study involved a convenience sampling of three participants aged between 12 and 17 years (see Table 1). All participants were diagnosed with a visual impairment that qualified them for services from a teacher of students with visual impairments. All had large print books and magnification devices included in their Individualized Education Program (IEP). The research and consent documents were approved by the Human Subjects Institutional Review Board at California State University, Los Angeles.

Sam (all student's names are pseudonyms) was a seventh-grade student enrolled in advanced academic classes who loved to read and preferred to use large print when available. When asked to describe his vision, he stated that the lens in both of his eyes was absent, resulting in fuzzy vision, and he was sensitive to bright lighting. His commitment to getting good grades helped him overcome concerns with using large print books and magnification devices at school. His parents had been provided with information about

Table 1
Characteristics of the participants.

Student	Gender	Age	Grade	Reading level*	Eye condition	Estimated OU near acuity**
Sam	Male	12	7th	12th	Retinopathy of prematurity, aphakia, and estropia	20/100
Scully	Male	16	10th	12th	Optic nerve hypoplasia	20/200
Cody	Male	17	11th	12th	Charge syndrome, coloboma, micro-corneas, glaucoma, blind in the left eye, reduced field in the right eye	20/70

Note: * Highest reading level on the Basic Reading Inventory (Johns, 2010).
** Lighthouse near acuity chart presented at 16 inches; students were asked to wear best correction prescribed by their medical professional.

Bookshare (Bookshare, 2017), an online library resource for individuals with print disabilities, but had not signed up for an account. Sam said he used a mobile phone and personal computer at home.

Scully was a 10th-grade student. He enjoyed reading and considered himself a good reader. He attended a mix of supported and general education classes. He was challenged with organizational skills. When asked to describe his functional vision, he said he experienced sensitivity to bright light and generally was unable to see things written on the board from his seat. He reported that large print textbooks were available but that he chose not to use them. He preferred to use standard print text even if he had difficulty seeing it. His parents signed him up for an individual Bookshare membership (Bookshare, 2017), but he had never used it. He used a mobile phone, personal computer, and Kindle at home.

Cody was an 11th-grade student who attended general education classes. He said he enjoyed reading for leisure. He experienced a congenital hearing loss and demonstrated a slight speech impediment. When asked to describe his functional vision, he said he was unable to see much out of his left eye, causing his right eye to become fatigued with use. Towards midmorning, his vision would become blurry and he was unable to see well. He preferred to use standard print textbooks at school, even though a typical font size contributed to eye fatigue. He used a mobile phone, personal computer, and Android tablet at home. He applied for an individual Bookshare membership (Bookshare, 2017), but had not used it prior to participation in this study.

Research design and intervention

A single-subject alternating treatment design with randomization (Barlow & Hayes, 1979; Herrera & Kratochwill, 2005) and a baseline was used (Onghena, 2005). Data on reading speed and comprehension were taken for each of the participants, who were given two treatments, paper and iPad. Researchers alternated the testing elements and randomized the order in which the paper or iPad was presented (for example, AABABABB). Randomization was used to minimize the effect of test anxiety and anticipation if students knew ahead of time which treatment was going to be given. Although alternating treatment design does not typically include baseline

Table 2
List of books chosen by students.

	Book title	Author	ATOS range
Sam	*Merchant of Death*	D. J. MacHale	5.0
Scully	*77 Shadow Street*	Dean Koontz	8.4
Cody	*How We Die*	Sherwin B. Nuland	11.2

data (Onghena, 2005), it was collected to document student performance prior to the intervention phase and to provide the student with time to become familiar with the text format and device.

The intervention consisted of training, including how to adjust the size and color of the font, the background color, and page formatting using the Read2Go mobile application (Apple, 2017). It was delivered by a credentialed teacher for visually impaired students two to three times per week for 10 to 30 minutes. After four weeks of training, students were asked to determine their preferred settings. Additional training included how to download books using Read2Go and features such as searching by pages and setting bookmarks.

Data collection and analysis

The independent reading levels of the students were established using the Johns Basic Reading Inventory (Johns, 2012), presented in 24-point, New Times Roman font on paper at 16 inches. Students chose an independent-level reading book to be used for reading assessments. To ensure cognitive processes did not affect the reading speed and comprehension, ATOS (2013) (average sentence length + average word length + vocabulary grade level + number of words in a book) readability scores were used as a guideline (see Table 2). Students chose a book that interested them that was no lower than three reading levels below their actual grade level and no higher than the highest reading level attained on the Johns Inventory (2012).

Reading materials for the assessments on both media were presented on a book stand using 24-point Arial font at 16 inches. The paper text was presented on unbound 8½ × 11 paper. Digital text was accessed using Bookshare (Bookshare, 2017) downloads and the Read2Go (Apple, 2017) application on the iPad2. Initial settings on the digital display were established by the researcher that were equal to the paper presentation. Scully was allowed to adjust the brightness of the screen for eye comfort. Otherwise, participants were not allowed to make alterations to the font and screen framework.

An oral assessment for each medium was followed by a silent assessment, which was then followed by a comprehension probe. A total of 156 reading assessments were completed (48 by Sam, 48 by Scully, and 60 by Cody), timed by a stopwatch using passages from student-selected novels. Each participant completed 24 assessments on paper (12 oral and 12 silent) and 24 assessments on the iPad2 (12 oral and 12 silent). The number of assessments completed varied (two to six each session) depending on the amount of time that was available (one to three times per week). To minimize the

effects of reading media anticipation, format order was chosen randomly by the researcher.

Rate, accuracy, and comprehension data were gathered using the novel the student chose and a stopwatch. Participants completed reading assessments that lasted two minutes each. Words per minute (WPM) were calculated and reading miscues were analyzed. In counting errors, the researcher included substitutions, omissions, additions, and reversals. Repeated errors were counted once. Reading comprehension was measured using a Johns (2012) retelling rubric. The Johns suggested scoring method was followed.

Students completed an informal teacher-made assessment to assess task execution on the iPad2 before and after the intervention. After four weeks of training on iPad use, participants were asked to choose a preferred setting in the Read2Go application. Researchers anticipated that participants would choose personalized settings that demonstrated the differences in their eye conditions. Sam and Scully indicated they did not want to change text settings. Cody chose an alternate setting on the iPad2. Therefore, Cody completed 12 additional (six paper, six digital) randomly integrated assessments using his preferred setting.

Results

Overall, reading speeds of all three students were moderately higher when they used an iPad compared to paper text (see Figures 1, 2, and 3). These results were consistent in both silent and oral reading. Interestingly, four of the six conditions involving paper text resulted in moderate negative slopes during the intervention phase, showing that participants read slightly more slowly on paper at the end of the study compared to the beginning of the study. Scully showed a slight decrease in reading speed when reading silently using both digital text and print text. In fact, the discrepancy between reading speeds on the iPad2 and paper were consistent over time. Cody experienced a negative slope during the intervention when reading orally on the iPad with the teacher-chosen settings. However, he showed a minimal positive slope when he was able to direct the settings of the display. In four of the six conditions, the students showed an overall moderate improvement of more than 10 words per minute using an iPad as compared with paper. Also, in two of the six conditions improvements were more than five words per minute. Overall, the results indicated that using an iPad2 had a mild positive impact on reading fluency.

Sam

Sam's overall reading rates were the highest of the three participants. He achieved his highest oral and silent reading rates using the iPad2. His book was rated lowest on the ATOS (ATOS, 2013) reading levels of the three participants (5.0), which may have influenced his higher reading rates. Sam read with a lot of expression and he enjoyed reading the book. After the assessments were done, he read the remainder of the assessment book for leisure reading.

Scully

Scully achieved his highest oral reading rate on the iPad2. Furthermore, by using it he increased his silent rate on average by 10 WPM. When Scully read orally, he took time to articulate well. The book he chose

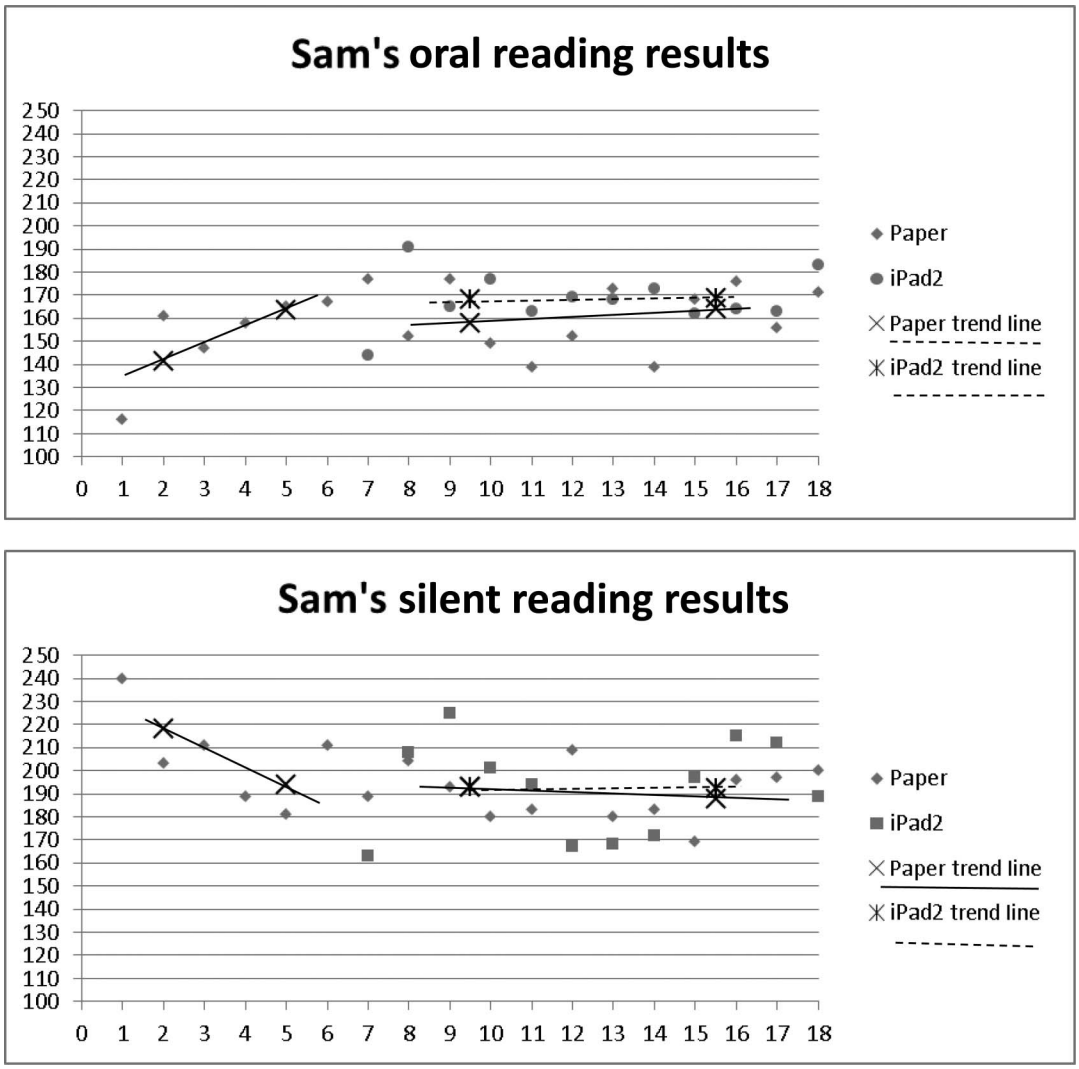

Figure 1. Sam's results.

contained vocabulary that was sophisticated but not too advanced (8.4). He read with minimal expression but paid attention and emphasized words.

Cody

Cody was the only participant who chose an alternate setting for the iPad2, white 27-point font presented on a black background. He experienced the largest increase in a single probe on the iPad2 using his preferred setting. He said that having the ability to choose an alternate setting on the iPad2 facilitated more efficient eye function while reading and resulted in less fatigue.

He chose a book with the highest ATOS rating (Renaissance Learning, 2018) of the three participants (11.2). The book contained a lot of medical vocabulary with which Cody may have been unfamiliar. He took time to decode words and relied on the context of the text. His reading rates were slower than were those

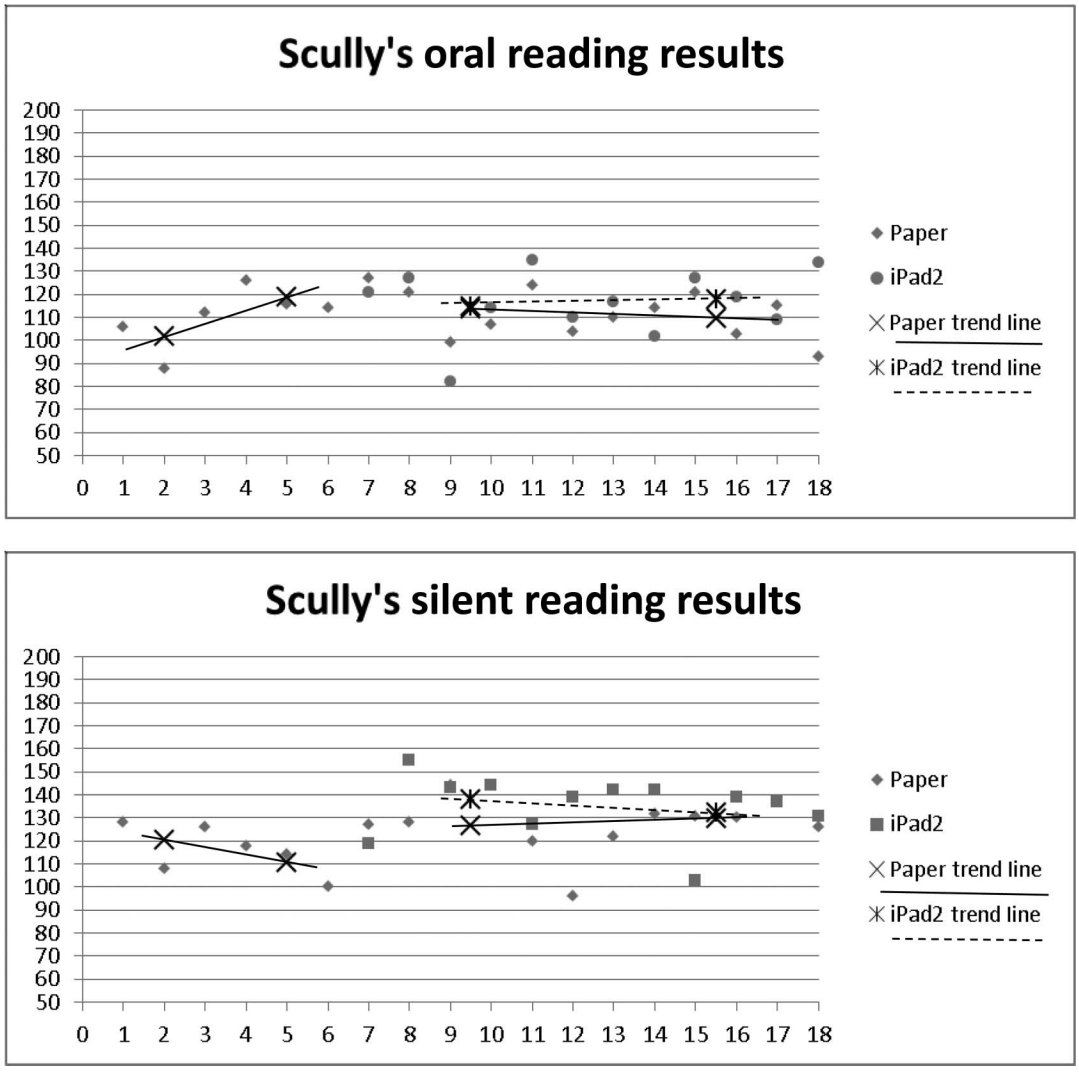

Figure 2. Scully's results.

of other participants comparatively in both media, possibly influenced by limited background knowledge. His outcomes are similar to the findings of Gompel, Van Bon, & Schreuder (2004): When they investigated reading outcomes of children with low vision, they found that as long as they were given enough time to read, comprehension of the text was not impeded.

To compare overall differences in fluency and comprehension, the mean WPM for each condition was calculated, and discrepancy between oral and silent reading on the iPad2 versus paper was calculated (see Table 3). Students did not have many miscues per passage, therefore only WPM is provided. All students had higher WPMs using the iPad2 over paper. When evaluating each student's highest discrepancy, the difference ranged from 4.9% to 19.8%. In regards to reading comprehension, students showed no significant difference based on format for oral or silent reading conditions.

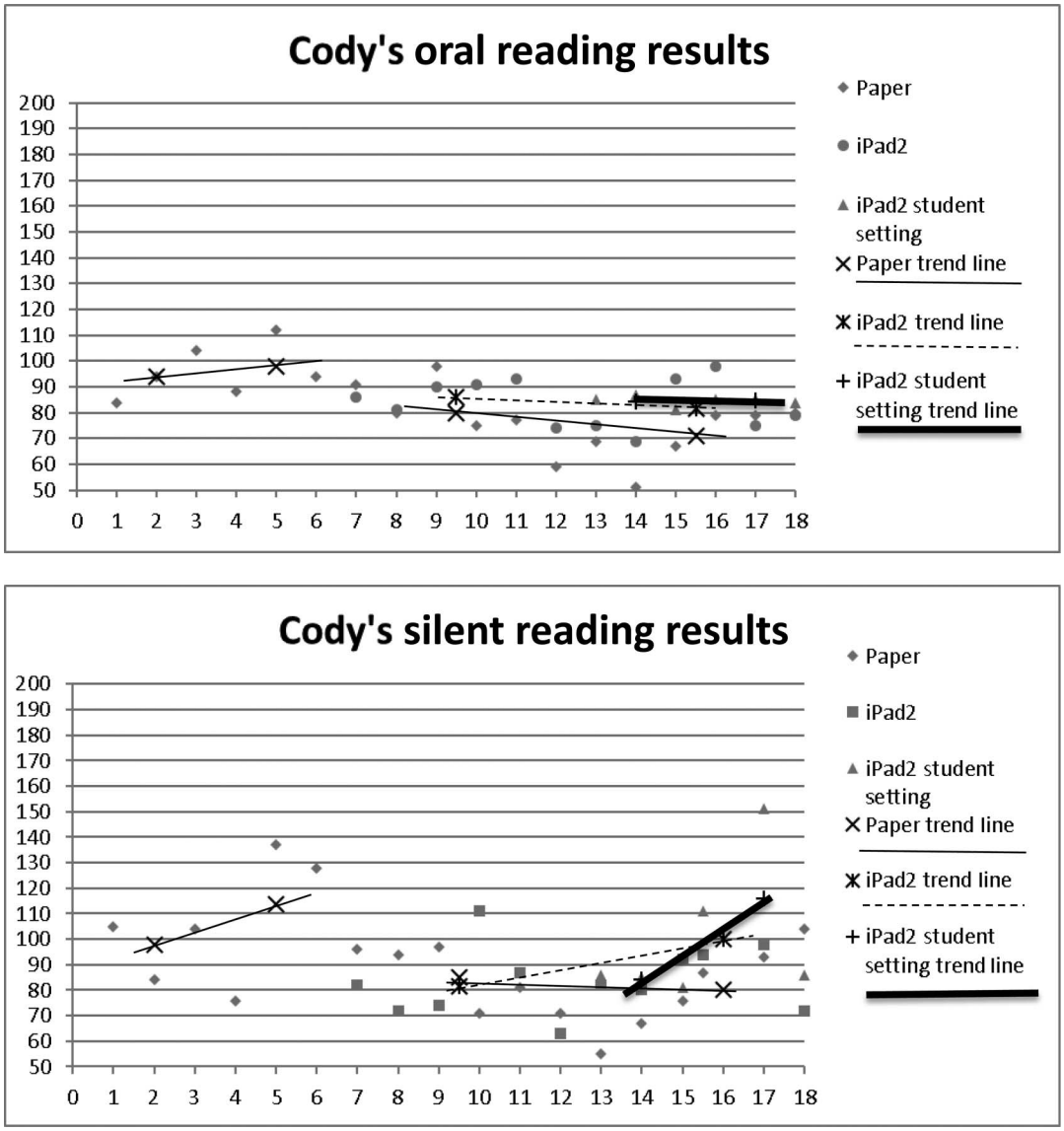

Figure 3. Cody's results.

Reading errors

Table 4 shows the disbursement of errors for each participant. Differences were not found between conditions. All students made errors, but none of the errors were significant enough to influence comprehension rates. Sam made 9 errors on paper and 16 on the iPad2 (out of 24 passages each). He made more errors than did the other participants, but he also had the highest reading rate. Most of his errors were substitutions (for instance, *wasn't* for *weren't* and *wouldn't* for *won't*), or additions (for instance, *a, the*, and *s* on the end of words). Scully made a total of 12 errors on paper and 2 on the iPad2. Most of the errors he made were substitutions (for instance, *no* for *not* and

Table 3
Reading fluency and comprehension.

Student	Oral RF paper	Oral RF iPad2	Discrepancy	Silent RF paper	Silent RF iPad2	Discrepancy	RC paper	RC iPad2
Sam	*M* = 160	*M* = 168	5.0%	*M* = 190	*M* = 192	1.0%	40	40
Scully	*M* = 94	*M* = 96	2.1%	*M* = 128	*M* = 135	7.8%	39.41	39.45
Cody	*M* = 75	*M* = 83	10.6%	*M* = 82	*M* = 83	1.2%	40	40
Cody Alternate setting		*M* = 84	12.0%		*M* = 100	21.5%		40

RF = reading fluency; RC = reading comprehension (maximum score = 40).

more for *most*). Cody made 5 errors on paper and 11 on the iPad2. He reduced errors to only 2 when using his preferred settings.

Discussion

Results of the study indicated that the use of an iPad2 had a moderate impact on reading speed. All students showed differences in their reading speeds when using the iPad2 compared with print. Generally, differences were stable over time, as illustrated by a minor slope in performance across all conditions. The iPad intervention provided access to print, but not direct reading instruction. Similarly, Corn et al. (2002) found that when optical devices were offered, participants received a means for deciphering text, but not support in the mechanics of reading.

Although minimal differences were found in the number of miscues made or in reading comprehension, the ability to increase reading speed has positive outcomes for students with low vision. Given that these students typically perform more slowly than do their sighted peers in reading speed, the ability to increase reading speed by using a technology device such as an iPad2 may allow them to bridge the gap in performance. Furthermore, these students were successful readers who were participating in secondary education, a time in which reading fluency rates typically stabilize. Increases in reading speed are not usually emphasized in the

Table 4
Reading miscues of the participants.

Student	Additions	Substitutions	Omissions	Reversals	Total	Least*	Most**
Sam							
Paper	2	4	3	0	9	0	2
iPad2	3	6	7	0	16	0	3
Scully							
Paper	3	7	2	0	12	0	4
iPad2	0	1	1	0	2	0	1
Cody							
Paper	1	3	1	0	5	0	4
iPad2	3	3	5	0	11	0	3
iPad2	1	1	0	0	2	0	1

* Least errors in one assessment; ** Most errors in one assessment.

secondary general education curriculum (Biancarosa & Snow, 2006; National Governors Association Center for Best Practices [NGA] & Council of Chief State School Officers [CCSSO], 2010) unless a reading disability has been diagnosed. Therefore, the ability to increase reading speed as a result of a technology intervention accomplishes dual objectives: developing technology skills and improving reading foundational skills.

Researchers anticipated that participants would choose customized settings given their varied eye conditions. Participant choices were expected to provide a self-selected optimal character size. Cody's choices as compared with the other participants' indicate that reader preferences are not always for the expected purpose of optimal character font size and display setting. When readers are afforded the ability to address the emotional and personal comfort needs they attach to reading tasks, setting choices may not be conventional. This finding suggests that support from a credentialed teacher of visually impaired students is essential to student navigation of personal reading preferences and to balance efficient tool use for best reading outcomes.

Limitations

As with any study, this research has limitations. Due to the single-subject design, generalizations cannot be made to the broader population of students with visual impairments. Although an attempt was made to minimize the cognitive demands (such as background and context knowledge) that text difficulty had on reading speeds, students were allowed to choose a book that may have been challenging for them to read. Also, reading outcomes could have been influenced by the natural maturation over time. However, all participants were fluent grade-level readers who did not require reading interventions or skill development in reading fluency and would not typically receive any, since they had met competencies at their grade level. Therefore, the authors believe that the effect of maturation was minimal in this study's outcomes. Also, its focus was to measure the effect of technology on specific reading skills. Thus, the intervention focused on technology skills, not on reading skills.

In regard to the research design and data collection, although single-subject alternating treatment designs do not typically have a baseline, researchers collected baseline data. Although a stable baseline was not obtained, it provided a period of time in which participants could gain familiarity with the text prior to the introduction of technology. The alternating design allowed equal treatment for both variables.

The conditions under which data were collected were artificial and short in duration. Participant reading behaviors may have been considerably different under conventional circumstances. Likewise, if one- or five-minute probes had been used rather than two-minute probes, results might have been different. Since reading passages were only two minutes in length, there was no opportunity to evaluate visual fatigue during probes. However, Cody reported that using his preferred settings on the iPad during leisure reading minimized fatigue and enabled him to read with comfort for longer periods. Future research should explore extended reading periods comparing print and digital text to determine if one might be

better than the other in combatting fatigue. In addition, excerpts from a single book were used for each reading assessment. Therefore, the effect of contextual cues was not controlled, and these cues may have had an effect on reading speed. Similarly, participants had years of experience in navigating and manipulating printed paper text compared to a limited time in engaging with digital text on an iPad2. This variable could not be remedied. Finally, this study looked at the iPad2 exclusively. Other devices are available that offer electronic text that may also provide visually impaired students with conveniences and enhanced reading opportunities.

Implications for practitioners

In practice, one major goal of teachers of students who are visually impaired is to provide students with access to educational materials. This study has implications for the procurement of equipment. Electronic tablets have become popular tools for providing access. However, evidence documenting the effect of using tablets on the reading skills of students who have low vision is not documented in the literature. Evidence from the study showed that the use of electronic tablets for reading provided students with low vision with a slight advantage in reading speeds compared to paper text.

One interesting finding of this study was that students' reading speeds were stable over time, suggesting that the medium (paper or digital text) had a greater impact on reading speed than training on how to use the iPad. However, research shows that optimum performance relies on familiarization with the task (Ortlieb et al., 2014), and on training that leads to proficiency in using the device. In this study, the researcher chose settings that were most appropriate for each student based on functional vision assessment data and experience in working with the student. However, if these students were given factory settings, additional training to select optimum font size, color, and illumination would be needed. Time must be dedicated to building tool acquaintance to ensure the greatest outcomes and to transition students from being basic users to proficient users.

Unlike previous studies that showed no differences between paper and digital text, the presentation of electronic text combined with the ease of use of the iPad2 and students' general familiarity with technology may have contributed to the immediate improvement in reading speeds. Further, overall increases in reading speed did not occur over time in any of the conditions, indicating that a specific intervention is needed to improve reading speed. Finally, the ability to adjust settings to personal preference may make a difference in individual performance, but using optimum font size may not be as important to visually impaired readers as is shedding the physical demands and social stigmas of other low vision devices. Instruction on adjusting these settings and practice in using them is recommended.

References

Apple. (2017). Read2Go Application. Retrieved from https://itunes.apple.com/us/app/read2go/id425585903?mt=8

Barlow, D. H., & Hayes, S. C. (1979). Alternating treatments design: One strategy for comparing the effects of two treatments in a single subject. *Journal of Applied Behavior Analysis*, *12*(2), 199–210. Retrieved

from http://doi.org/10.1901/jaba.1979.12-199

Biancarosa, G., & Snow, C. (2006). *Reading Next: A vision for action and research in middle and high school literacy: A report to Carnegie Corporation of New York* (2nd ed.). Washington, DC: Alliance for Excellent Education.

Bookshare. (2017). *How Bookshare works*. Retrieved from https://www.bookshare.org/_/gettingStarted/overview

Corn, A. L., Wall, R. S., Joe, R. T., Bell, J. K., Wilcom, K., & Perez, A. (2002). An initial study of reading and comprehension rates for students who received optical devices. *Journal of Visual Impairment & Blindness*, *96*(5), 322–334.

Dalton, B., Proctor, C. P., Uccelli, P., Mo, E., & Snow, C. E. (2011). Designing for diversity: The role of reading strategies and interactive vocabulary in a digital reading environment for fifth-grade monolingual English and bilingual students. *Journal of Literacy Research, 43*(1), 68–100.

Dillon, A. (1992). Reading from paper versus screens: A critical review of the empirical literature. *Ergonomics*, *35*(10), 1297–1326.

Doty, D. E., Popplewell, S. R., & Byers, G. O. (2001). Interactive CD-ROM storybooks and young readers' reading comprehension. *Journal of Research on Computing in Education, 33,* 374–384.

Erin, J., & Sumranveth, P. (1995). Teaching reading to students who are adventitiously blind. *RE:view, 27*(3), 103–112.

Farmer, J., & Morse, S. E. (2007). Project Magnify: Increasing reading skills in students with low vision. *Journal of Visual Impairment & Blindness, 101*(12), 763–768.

Frank, J. (2000). Requests by persons with visual impairment for large-print accommodation. *Journal of Visual Impairment & Blindness, 94*(11), 716–720.

Freeland, A. L., Emerson, R. W., Curtis, A. B., & Fogarty, K. (2010). Exploring the relationship between access technology and standardized test scores for youths with visual impairments: Secondary analysis of the National Longitudinal Transition Study. *Journal of Visual Impairment & Blindness, 104*(3), 170–182.

Gerritsen, B. (2010). Contrast sensitivity function scores, choices of illuminated stand magnifiers, and reading. *Journal of Visual Impairment & Blindness*, *104*(4), 239–243.

Gompel, M., Van Bon, W. H. J., & Schreuder, R. (2004). Reading by children with low vision, *Journal of Visual Impairment & Blindness, 98*(2), 77–89.

Gompel, M., Van Bon, W. H. J., Schreuder, R., & Adriaansen, J. J. M. (2002). Reading and spelling competence of Dutch children with low vision. *Journal of Visual Impairment & Blindness*, *96*(6), 435–447.

Herrera, G. C., & Kratochwill, T. R. (2005). Alternating treatment designs. In B. S. Everitt (Ed.), *Encyclopedia of statistics in behavioral science* (Vol. 1, pp. 44–46). West Sussex, UK: Wiley & Sons.

Johns, J. L. (2012). *Basic Reading Inventory* (11th ed.). Dubuque, IA: Kendall Hunt Publishing.

Jutai, W., Strong, J. G., & Russell-Minda E. (2009). Effectiveness of assistive technologies for low vision rehabilitation: A systematic review. *Journal of Visual Impairment & Blindness, 103*(4), 210–222.

Kamei-Hannan, C., & Ricci, L. A., (2015). *Reading connections: Strategies for teaching students with visual impairments.* New York, NY: AFB Press.

Kelly, M. (2009). Use of assistive technology by students with visual impairments: Findings from a national survey. *Journal of Visual Impairment & Blindness*, *103*(8), 470–480.

Kelly, M. (2011). The use of assistive technology by high school students with visual impairments: A second look at the current problem. *Journal of Visual Impairment & Blindness*, *105*(4), 235–239.

Lueck, A. H., Bailey, I. L., Greer, R. B., Tuan, K. M., Bailey, V. M., & Dornbush, H. G. (2003). Exploring print-size requirements and reading for students with low vision. *Journal of Visual Impairment & Blindness, 97*(6), 335–354.

Lusk, K. E. (2012). The effects of various mounting systems of near magnification on reading performance and preference in school-age students with low vision. *British Journal of Visual Impairment*, *30*(3), 168–181.

Lussenhop, K., & Corn, A. L. (2002). Comparative studies of the reading performance of students with low vision. *RE:view*, *34*(2), 57–69.

Mohammed, Z., & Omar, R. (2011). Comparison of reading performance between visually impaired and normally sighted students in Malaysia. *British Journal of Visual Impairment, 29*(3), 96–207.

Moran, J., Ferdig, R. E., Pearson, P. D., Wardrop, J., & Blomeyer, R. L. (2008). Technology and reading performance in the middle-school grades: A meta-analysis with recommendations for policy and practice. *Journal of Literacy Research, 40*(1), 6–58.

National Governors Association Center for Best Practices (NGA) & Council of Chief State School Officers (CCSSO). (2010). *Common Core state standards for English language arts and literacy in history/social studies, science, and technical subjects*. Washington, DC: Authors.

Noyesa, J. M., & Garland, K. J. (2008). Computer- vs. paper-based tasks: Are they equivalent? *Ergonomics, 51*(9), 1352–1375.

Onghena, P. (2005). Alternating treatment designs. Case studies designs. (2005). In B. S. Everitt (Ed.), *Encyclopedia of statistics in behavioral science* (Vol. 2, pp. 1850–1854). West Sussex, UK: Wiley & Sons.

Ortlieb, E., Sargent, S., & Moreland, M. (2014). Evaluating the efficacy of using a digital reading environment to improve reading comprehension within a reading clinic. *Reading Psychology, 35*(5), 397–421.

Rasinski, T. V. (2006). A brief history of reading fluency. In S. Samuels & A. Farstrup (Eds.), *What research has to say about fluency instruction* (pp. 70–93). Newark, DE: International Reading Association.

Rasinski, T. V., Padak, N. D., McKeon, C. A., Wilfong, L. G., Friedauer, J. A., & Heim, P. (2005). Is reading fluency a key for successful high school reading? *Journal of Adolescent & Adult Literacy, 54,* 22–27. doi:10.1598/JAAL.49.1.3

Renaissance Learning. (2018). *Star assessments for reading abridged technical manual*. Retrieved from https://help.renaissance.com/US/PDF/SR/SRAbridgedTechnicalManual.pdf

Soderstrom, S., & Ytterhus, B. (2010). The use and non-use of assistive technologies from the world of information and communication technology by visually impaired young people: A walk on the tightrope of peer inclusion. *Disability & Society*, *25*(3), 303–315.

Tobin, M., & Hill, E. W. (2012). The development of reading skills in young partially sighted readers. *British Journal of Special Education*, *39*(2), 80–86.

Ramona McLaughlin, M.Ed., *teacher of students with visual impairments, Corona Norco Unified School District, 2820 Clark Avenue, Norco, CA 92860; e-mail: rmclaughlin@cnusd.k12.ca.us.*
Cheryl Kamei-Hannan, Ph.D., *professor and coordinator of the education specialist credential in visual impairment and blindness division of special education and counseling, Charter College of Education, California State University, Los Angeles, 5151 State University Drive, Los Angeles, CA 90032; e-mail: ckameih@calstatela.edu.*

