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Print Awareness: a Comparison Between Print and Electronic Assessments in Typically Developing Preschool Children

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PRINT AWARENESS: A COMPARISON BETWEEN PRINT AND ELECTRONIC ASSESSMENTS IN TYPICALLY DEVELOPING PRESCHOOL CHILDREN

by

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ABSTRACT

PRINT AWARENSS: A COMPARISON BETWEEN PRINT AND ELECTRONIC ASSESSMENTS IN TYPICALLY DEVELOPING PRESCHOOL CHILDREN

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This study compared print and electronic formats of the Concepts About Print (CAP) assessment in typically developing preschool children. The researchers were interested in comparing print awareness skills using two different reading modalities. Independent variables were mode of presentation and age, dependent variables were the CAP scores. To account for a learning curve, two different versions of the CAP assessment were used and counterbalanced. Modes of presentation was also counterbalanced. Examiners achieved a 98.24% agreement (K = 0.964) across 40% of all assessments.

A significant correlation (r =.919) was found between the scores on the CAP and scores on the eCAP. A paired samples t-test showed no significant difference in scores based on mode of presentation (t (14) = .29, p = 0.779, 95% CIs [-.86757, 1.13423]). Further research is needed to increase the sample size, the diversity of the sample

population, and examine interaction effects between age and mode of presentation. Additional research is also needed to investigate effect of gender, socioeconomic status, multiple languages, and amount of exposure to electronic text on eCAP performance.

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Introduction

The term "emergent literacy" is attributed to Marie Clay and describes a developmental continuum of skills children acquire prior to full independent reading (Teale & Sulzby, 1986; Whitehurst & Lonigan, 1998; Lonigan, Burgess, & Anthony, 2000; Justice, Bowles, & Skibbe, 2006). As they begin to read independently, children develop an awareness of print and an understanding of the linguistic features of text such as letter identification, word form, and word boundaries (Clay, 1982; Goodman, 1986). Print awareness has been identified as a literacy precursor in which children begin to associate written language with linguistic significance (Goodman, 1986). Children become aware of print in their environment and in media specifically for written communicative discourse, such as books, magazines, and newspapers (Goodman, 1986; Clay, 1993). These skills of awareness in both environmental print and written discourse begin developing in the preschool years (Clay, 1993).

During these preschool years, children begin to associate written text and meaning (Goodman, 1986), typically between four and five years of age (Justice & Ezell, 2004). They also develop the motor and cognitive skills needed to physically manipulate books in appropriate orientations, visually follow the directionality of printed text, and distinguish text from images (Goodman, 1986). Children at this age begin to segment spoken and written language into individual units, noticing syntactic boundaries, helping the child grasp the fundamental concept of words (Goodman, 1986; Justice & Ezell,

2004). Understanding these concepts of print serves as a foundation upon which more advanced literacy skills can be built (Clay, 1982).

Assessment of Print Awareness

The Concepts About Print (CAP) tasks were developed by Clay as a diagnostic tool to measure early school-age students' knowledge of print awareness. Using specially designed books written by Clay for the CAP assessments, twenty-four tasks showcasing skills in book manipulation, book and page orientation, knowledge of text and pictures, and letter and word knowledge are evaluated (Clay, 1985; Goodman, 1982). Sample tasks include distinguishing the front of the book from the back, correctly identifying reading directionality as left-to-right, recognizing inverted illustrations or text, and identifying punctuation and their meanings (Clay, 1979; 2013). The assessments allow the evaluator to determine to which components of the book children attend during the emergent literacy stage and track changes within the first two years of schooling (Clay, 1989). Clay correlated the CAP against the Word Reading assessment using 100 children in 1966, achieving a correlation of 0.79 in children 6;0 years of age (Clay, 1979). Since its development, many researchers have adopted the CAP test as a valid way to measure print awareness skills. It even has been adapted for Braille, Spanish, Danish, Hebrew, and other languages (Clay, 1985, 1989). A new edition of the CAP was released in 2000 with the addition of two new titles: *Follow Me, Moon* (Clay, 2000a) and *No Shoes* (Clay, 2000b). Full-color illustrations and new storylines were created for the newer edition of the assessment to appeal to a more modern audience; Clay reinforced that the CAP is an effective way to observe print awareness skills. (Clay, 2013); however the CAP assessment is not sensitive enough to adequately measure the complex interplay

of all linguistic skills needed for reading readiness (Clay, 1989; Goodman, 1982). Thus, the CAP was not designed to be a predictive tool of future reading ability (Clay, 2013).

Data from Clay (1979) showed that in a sample of 320 urban children between the ages of 5;0 and 7;0, 50% of the children were able to pass half of the test items by 5 years 6 months. Day and Perkins assessed 56 Texas kindergarten children in 1978 with a test-retest reliability coefficient of 0.73-0.89 (Clay, 1979). Corrected split-half coefficients were 0.84-0.88 (Clay, 1979). Recent published data from the New Zealand Ministry of Education shows that six weeks after formal schooling began, 58% of five-year-old children achieved CAP scores between nine and sixteen points out of a possible 24 (Clay, 2013). The reliability analyses validate the CAP as a reliable tool for measuring print awareness skills and tracking changes as a child enters formal schooling.

Justice, Bowles, and Skibbe (2006) developed an assessment tool for print awareness aimed specifically for the emergent literacy skills of children ages 3-5 years: the *Preschool Word and Print Awareness* (PWPA). Unlike Clay's CAP assessment which uses twenty-four points of assessment (Clay, 1985; Goodman, 1982), the PWPA uses fourteen tasks to measure knowledge of print awareness (Justice, Bowles, & Skibbe, 2006). Another point of deviation from the CAP test lies in the scoring. The CAP test assigns scores of 0 for incorrect responses to stimulus items while correct responses receive a score of 1 (Clay, 1985). The PWPA allows some items to be scored as many as 3 points for correct responses. Alternate responses may also be scored for certain stimulus items. An alternate response can earn 1 or 2 points for that particular item (Justice et al., 2006). Justice et al. (2006) divided a sample of 128 children between the ages of 3-5 years into four subgroups based on socioeconomic status and language

skill. The researchers were able to show that the PWPA was able to appropriately separate at-risk children based on environmental and developmental factors from those without (Justice et al., 2006), however, the authors did not examine age as a potential factor. Performance on print awareness tasks varied greatly within each subgroup (Justice et al., 2006). While the PWPA appears to be a promising assessment tool in measuring print awareness, more research needs to be done to establish its validity. The CAP has a more substantial body of literature supporting its validity and recently was updated with the addition of two new stimulus book titles (Clay, 2013) which is why the CAP was chosen as the assessment of print awareness skills for this study.

Overview of Research in Emergent Literacy

Early research suggested that the skill of letter identification played a large role predicting reading abilities of emergent readers (Clay, 1982; Neumann & Neumann, 2014b). Instruction and practice with literacy tasks increases the child's ability to learn letter identification and discrimination skills (Neumann & Neumann, 2014b). Research suggests mastery of letter identification and discrimination does not occur until after the child surpasses kindergarten age (Clay, 1982). Recent theories of emergent literacy suggest that letter identification and sound-letter correspondence may not be as important to literacy development as the historical literature claims. For one, the English language does not have a one-to-one correspondence between letters and sounds. Some letters can represent multiple sounds and the same sound can be represented by multiple spellings, thus learning sound-letter correspondence may be difficult for an early reader (Ehri, 2005). Instead, Ehri argues that word recognition, rather than letter identification, helps the emergent reader become more proficient (Ehri, 2005). Clay's CAP tasks assess the

emergent reader's skills in both letter identification and word recognition. Clay points out that the skills assessed, such as letter identification and word recognition, may facilitate learning literacy skills but are not predictors of future literacy (Clay, 2013).

Levy, Gong, Hessels, Evans, and Jared (2006) studied the ability of 474 children age 48 to 83 months to discriminate correctly printed traditional orthography from scribbles, letter-like characters, pictures, and orthography with errors in linearity or spacing, spelling, or orientation. Grouped into 4-month intervals with at least 50 participants per group, participants were also assessed using the *Wide Range Achievement Test, 3rd Edition* (WRAT-3) (Wilkinson, 1993) to assess reading ability. They found that across all age groups, noticing errors in letter orientation or spelling was a better predictor of performance on the WRAT-3 than noticing errors in form, linearity, or spacing (Levy, et al., 2006). Furthermore, attention to letter orientation and morphological structures emerges in children as young as four years of age (Levy et al., 2006). The findings by Levy are consistent with those of Justice and Ezell (2004). The authors suggest that knowledge of print orientation and the concept of a word as a unit of language serves as a foundation for spelling and reading (Levy et al., 2006).

Failure to master print awareness skills focusing on print orientation during the preschool years can have further implications on the child's reading development in early elementary school. Badian (2005) studied more than 200 children between ages eight and ten years, assessing reading skills via the *Woodcock Reading Mastery Test- Revised* (WRMT-R) (Woodcock, 1987) and the *Wechsler Individual Achievement Test (*WIAT*)* (Wechsler, 1992) and their skills in determining correct orientation of print. The results of this study suggest that students with deficiencies in letter orientation skills performed

more poorly in reading tasks (Badian, 2005), even after several years of formal schooling. These findings contradict Lonigan, Burgess, and Anthony (2000), whose research suggested that print knowledge measured using the CAP did not have a strong predictability on reading skills.

Use of Electronic Books by Consumers and in Research

Changes in computer technology over the past 25 years has made electronic texts an easily accessible and convenient medium of reading. The Enhancing Education Through Technology Act of 2001, a subcomponent of the No Child Left Behind Act (2001), requires schools and teachers to increase access to technology, increase the use of technology, and integrate technology throughout curricula in elementary and secondary school classrooms across the nation. Several states across the United States have already expanded funding to include electronic textbooks in elementary, middle, and high schools (Felvegi & Matthew, 2012). Many school districts now allow students to access educational material in all types of digital media, not just the traditional pre-packaged educational software or CD-ROM programs (Felvegi & Matthew, 2012). As the prevalence of electronic books (e-books) has increased in schools, so has the number of electronic books in the home. In 2013, despite a reduction in sales compared to previous years, electronic books still comprised 11% of all children's book sales (Greenfield, 2014). The rise in popularity of e-books has led researchers to study reader interactions with e-books, posing questions comparing e-books to print books and their effects on emergent literacy skills (Neumann & Neumann, 2014a).

Early research investigating the effects of e-books on early reading used electronic books on CD ROM. DeJong and Bus (2003) conducted an evaluation of the

features contained in 55 Dutch-language electronic CD-ROM picture storybooks for children to determine their effectiveness in facilitating early literacy. Book processing, pictures, multimedia features, gaming options, and interactivity were examined, with overall quality of printed text rated on a 5-point scale. DeJong and Bus (2003) define "book processing" as features related to navigation of the book such as an introductory screen, buttons to simulate page turning, and an overview screen with icon images of the entire book visible on one display screen. Of interest for CAP skills are the book processing features, which provide features analogous to printed book layout or orientation features. The researchers found that of the 55 CD-ROM books included in the study, 85.5% contained an introductory screen, 83.6% contained a forward navigation button, 74.5% contained a backward navigation button, and 47.3% contained an overview screen (DeJong & Bus, 2003). Researchers also found variability in how text was displayed on the screen. Some of the books chose to display a small portion of text, highlighting words as the user read while other books would show longer passages and highlight entire lines of text at a time (DeJong & Bus, 2003). These findings suggest that CD-ROM books available in the early 2000s did not consistently provide features to simulate CAP skills of book orientation, page turning used when reading a traditional print text, and text display.

Korat and Shamir (2004) replicated the study by DeJong & Bus (2003) using Hebrew CD-ROM storybooks. Of the 43 CD-ROM books included in the study, 72.0% contained an introductory screen, 93.0% contained a forward navigation button, 95.3% contained a backward navigation button, and 25.6% contained an overview screen (Korat & Shamir, 2004). The Hebrew and Dutch CD-ROM books had many similarities with

regard to features and design, but neither research team felt the CD-ROM books strongly facilitated emergent literacy skills. Korat and Shamir (2004) found that many of the interactive features in the CD-ROM storybooks focused on entertainment value instead of enhancing the reader's understanding of the storyline. Additionally, the CD-ROM stories were weak in the incorporation of print outside of the storyline text. The researchers suggested that the creators of CD-ROM storybooks consistently include a title screen and incorporate written language into illustrations when appropriate to help develop print awareness (Korat & Shamir, 2004).

Korat, Shamir, and colleagues further studied the features of electronic books on phonological awareness and Concept About Print skills using a CD-ROM storybook created specifically for the study and a separate adapted CAP test for Hebrew (Shamir, Korat, & Fellah, 2012; Shamir & Shlafer, 2011). One study by Shamir et al. (2012), compared phonological and CAP skills between interventions using printed texts and e-books. Participating children ages 5-7 years received one of two different interventions: independently interacting with the e-book across six sessions or guided reading of the same title in a print book with an adult across six sessions. A control group received traditional kindergarten literacy instruction non-specific to the title. With regard to CAP skills, all groups showed improvement between pre-test and post-test scores. However, researchers found no significant difference between the print or electronic methods of intervention (Shamir et al., 2012).

A second study examined the differences between CAP and phonological skills between typically developing kindergarten students and kindergarteners at risk for learning disabilities. A popular Hebrew children's book was adapted to an e-book with

built-in interactive "hotspots" on which children could click for further enhancement features depending on the mode of interaction. When reading in the "read only" mode children also accessed hotspots which included extra music or animations. "Read story with a dictionary" allowed children to access a dictionary with verbal and pictured definition output. "Read and interact" featured interactive games featuring the characters to improve phonological awareness and comprehension. Participating children interacted with the same e-book title for six structured sessions, spending two sessions within each interaction mode. Each session lasted between 20 and 35 minutes. Both typically developing and at-risk students who received the e-book intervention had greater gains from pre-test to post-test CAP scores than students in control groups. The researchers also found an interaction between the children's developmental skills and the intervention received, noting that the greatest improvement was achieved by the at-risk students receiving the e-book intervention (Shamir & Shlafer, 2011). These results suggest that children whose language and motor skills are still developing may be better able to acquire their print awareness knowledge in an electronic format than in traditional print.

A pilot study by Ihmeideh (2014) tested emergent literacy skills of 92 Jordanian kindergarten children (ages 4;7 – 5;2), including using Clay's *Concepts About Print* (1982) to assess print awareness. All participants were tested before intervention to establish a baseline. An experimental group received a trial intervention of exposure to one of three Arabic children's books in electronic format for 15 minutes per day for eight weeks. The e-books used were specifically created for the study and validated by eight experts in early childhood education and technology. A control group received the same

intervention, including the same titles, in print format. After the intervention, participants were once again assessed using Clay's *Concepts About Print* (1982). The results showed that the students in the experimental group scored higher on all test areas including print awareness than the control group. An analysis of covariance revealed statistically significant differences in print awareness between the post-test scores of the two groups: F (1, 87) = 16.459, $p < .000$ (Ihmeideh, 2014). The researchers also found a significant difference between genders, with girls outperforming boys in the area of print awareness: F (1, 87) = 2.615, $p < .110$ (Ihmeideh, 2014).

Ihmeideh (2014) suggested that the novelty of e-books may have been a contributing factor to the higher performance scores in the experimental group. Other studies have found that features of e-books increase entertainment value and reader engagement to text (DeJong & Bus, 2003; Korat & Shamir, 2004). Ihmeideh (2014) also suggests that e-books give children an advantage in teaching print awareness skills over print books due to the interactive features, such as text highlighting, which draw attention directly to print concepts.

Portable electronic readers. As technology has evolved, the portability, storage capacity of multiple books, and cost have made electronic books (e-books) an even more attractive reading option to the general public. However, with the new technology came a different mode of interaction with digital text. CD-ROM electronic books often required a computer with a mouse. This method of interaction required the user to have strong gross motor skills, fine motor skills, and hand-eye coordination to take full advantage of the digital text and its features. A portable reader removed external computer components and allowed users to have reading experience similar to a paper

book, except in electronic format. In November 2007, the online retailer Amazon, introduced its first portable electronic reader, the Kindle (Amazon, 2007). This device revolutionized the electronic book medium.

The development of tablets also changed the economic value of e-books. For the purpose of this study, tablets were defined as portable electronic devices upon which an e-book could be stored. Examples of tablets include the Kindle (Amazon, 2007), iPad (Apple, 2010), and other similar devices. With these devices, users could purchase digital versions of titles from the retailer for a fraction of the cost of the same title in print. For additional costs, readers had the option of subscribing to electronic versions of newspapers and magazines. These devices also allowed readers to store many titles on one device, giving them freedom to change titles without having to change devices or software. As technologically advanced as the first Kindle was at the time of its release, the device limited the user's reading experience. At 6", the screen was small and had a grayscale display. Illustrations were not included in the text and the majority of titles available were targeted for older readers (Amazon, 2007).

Just two years later, a competitor to the Kindle was released by book retailer Barnes & Noble. Their version of the electronic reader, the Nook, debuted in October 2009 (Rich, 2009). At the time, the Nook was comparable to the popular Kindle in price, features, and user-friendliness (Rich, 2009). Since their original releases, both devices have evolved to incorporate new technologies and user features expanding beyond the original electronic book.

Tablet computers are still relatively new on the market. The first generation iPad was introduced in January of 2010 (Apple, 2010). The iPad was one of the first personal

computer devices that used a color touch screen for navigation. In addition to reading electronic books, the iPad had the functionality of a personal computer, complete with a touchscreen keyboard, camera, music player, word processing capabilities, email, and internet access; all on a 9.7 inch display (Apple, 2010). Since the original release, Apple has continued to make upgrades to the iPad, releasing new versions regularly. The newest model, the fifth generation iPad known as the iPad Air, was released in the fall of 2013 (Apple, 2013). Since the release of the iPad in 2010 through the third quarter of the 2014 fiscal year, Apple has sold more than 220 million iPads worldwide (Oremus, 2014).

In the fall of 2013, Amazon released their latest model of the Kindle e-reader: Kindle Fire HDX (Amazon, 2013). This device has features well-beyond the capabilities of its ancestor, the original Kindle. Using a touchscreen instead of control buttons, a user can easily interact with the device. In addition to reading, a user can use this new device to watch television, movies, send email, and capture photo or video images (Amazon, 2013). In just a few years technology had evolved to allow the Kindle Fire HDX to include a larger display screen with full color illustrations allowing thousands of children's book titles available for purchase (Amazon, 2013). The website now features a section of electronic book titles aimed at children under two years of age (Amazon, n.d.).

Willoughby, Evans, and Nowak (2015) examined the effect of electronic alphabet books on emergent literacy and phonological awareness, specifically letter-naming and letter-sound correspondence tasks. The researchers examined 94 students between the ages of three and four years with an equal number males and females in the sample. Baseline data were gathered by having participants complete a letter-naming task, letter-

sound task, *Receptive One-Word Picture Vocabulary Test* (*ROWPVT*) (Gardner, 1985), and the *Test of Phonological Awareness-Kindergarten Version* (*TOPA-K)* (Torgesen & Bryant, 1994). Participants were placed into one of three groups: ABC paperbook, ABC e-book, and a control storybook group. Each group received two intervention sessions per week across eight weeks for 20 minutes per session. During each week of intervention, a research assistant would read a "theme" book at the start of both sessions, giving two presentations of that book. As the book was read, children were given the opportunity to comment and respond to the story, however such interactions were not elicited by the adult. After the presentation of the "theme" book, children were given free time to interact with that week's "theme" book or six other comparable books. Researchers rated types of interactive behavior during the oral presentation of the "theme" book and free exploration periods of each session. After the intervention, participants were reassessed with the same assessment tools used to obtain baseline data.

Results from a split-plot ANOVA revealed that all groups made gains but none showed statistically significant differences between the two experimental conditions and the control in letter-naming, letter-sound correspondence, or phonological awareness (Willoughby, Evans, Nowak, 2015). The amount of time a child spent interacting with the books did have a significant positive effect on post-test scores of all three tasks (Willoughby, Evans, Nowak, 2015).

While the tasks of letter-naming and letter-sound correspondence are not directly assessed in the Clay's *Concept About Print* (1982), similar tasks including visual letter matching and letter orientation are assessed. Providing identical stimulus items in both print and electronic formats is a vital component of the current study. The results of

Willoughby, Evans, and Nowak (2015) suggests that change in mode of presentation alone was not a significant factor in performance across groups.

Research in post-secondary education settings. As portable electronic readers became more popular, researchers across the world began investigating the impact the devices had on education. Some of the first studies involving tablet portable electronic readers and education were conducted at the collegiate level (Marmarelli & Ringle, 2010; Schugar, Schugar, & Penny, 2011).

Recent studies have been conducted by various researchers, examining how readers interact with e-readers at the high school and collegiate levels and any impacts e-readers have on learning. A study commissioned by Amazon, the retailer responsible for the Kindle, examined use at seven institutions of post-secondary education. The researchers found that at one of those sites, Reed College, while students praised the portability and storage capacity of the Kindle DX, the e-readers were less functional for classroom purposes due to inefficient note-taking features, especially the inability to refer to multiple texts on one display. Faculty members surveyed for the study noticed that students who used the e-books exhibited poorer comprehension of academic texts than students who used print textbooks (Marmarelli & Ringle, 2010).

Schugar, Schugar, & Penny (2011) examined the methods first-year undergraduate students used in interacting with electronic academic texts on a Nook as compared to traditional print texts. No statistical differences were found between the control group using print texts and the experimental group using e-readers. None of the students in the experimental group employed traditional note-taking strategies such as highlighting on a daily basis (Schugar, Schugar, & Penny, 2011). The complaints

regarding user friendliness of the e-reader were similar to the complaints of the students in the Reed College study (Schugar, Schugar & Penny, 2011; Marmarelli & Ringle, 2010).

The findings of these two studies suggest that the technological capabilities of e-readers and e-books may not be sufficient for effective use in higher education, the users may not have adequate experience with the medium for effective use, or the medium itself offers a different mode of presentation from traditional print text and alters how the reader processes text. If college students with strong print concept and literacy skills are affected by the medium of electronic text with regard to text interaction and reading comprehension, what effects might be present on a child learning to read using e-books? The increased prevalence of e-books in children's learning environments shows the importance of investigating effects of an e-book on emergent literacy skills, such as print awareness.

Research with young children. More recently, researchers have begun to study how children interact with portable tablet electronic reader devices and the implications for the acquisition of emergent literacy skills, including print awareness. Research by the Michael Cohen Group and the US Department of Education (2011) showed that gross motor tablet manipulation skills, such as pressing and dragging across a touchscreen surface, were observed in children as young as two years old. By ages four and five, these skills have been refined to a more adult-like "tap and swipe" movement, with more intent of movement (Neumann & Neumann, 2014; Michael Cohen Group & USDOE, 2011). With an estimated 20 million Kindle devices sold in 2013 (Team, 2014) and as more and more states turn to electronic textbooks in schools (Felvegi & Matthew, 2012),

children are reading with e-books at younger and younger ages. Not only do e-books come with multi-sensory interactive features, but the reduction in motor demand of interacting with e-books as compared to print books may make e-books an even more attractive option for young children as they begin to learn literacy skills.

Purpose

The current body of research studying emergent literacy, Concepts About Print, and electronic books was mostly conducted in the 1990s through 2010, using outdated CD-ROM technology. Little research is currently available examining how young children interact with electronic storybooks using digital tablets. This study will provide insight into how children manipulate contemporary electronic books and whether the CAP test can be adapted to an electronic format as an effective tool for measuring those skills. Current research (Ihmeideh, 2014) suggests that children between the ages of 4;6-5;0 have improved performance on the Concepts About Print (Clay, 1982) assessment after e-book intervention. Levy et al. (2006) suggested that print discrimination skills in children as young as four years of age can be a predictor of future reading performance. The purpose of this study is to validate an electronic version of the Concepts About Print (eCAP) test and determine if there are any differences in children's performance on the two presentations. This study posed the following research questions:

1) Are scores correlated between the paper and electronic modes of presentation for the Concepts About Print assessment?

2) Are there any differences in scores between the paper and electronic modes of presentation of the Concepts About Print assessment?

Methods

Participants

Recruitment. Prospective participants were recruited through fliers placed in the UWM Speech and Language Clinic, distributed to children of the appropriate age at the UWM Children's Center, and through the researchers' personal acquaintances. The original CAP assessment was designed for use with children between the ages of 5;0 and 7;0 (Clay, 1979). Clay (2013) published additional data about the CAP assessment using the two new titles, *Follow Me, Moon* and *No Shoes.* With regard to the eCAP, recent evidence showed that children as young four were able to manipulate a tablet with adult-like movements (Neumann & Neumann, 2014; Michael Cohen Group & USDOE, 2011). For this study, the emphasis was on emergent literacy skills in the preschool age. For that reason, the decision was made to include children between the ages of 4;0 and 5;11, calculated as of the date of evaluation. To be eligible for participation in the study, participants needed to meet the following inclusionary criteria:

- Children between the ages of 4;0 and 5;11.
- Monolingual native English speakers as indicated by parent questionnaire (see Appendix A).
- No history of speech or language delay or disorder as indicated by parent questionnaire.
- Normal hearing as indicated by parent questionnaire.
- Normal vision (with corrective lenses) as indicated by parent questionnaire.
- No developmental delays or disorders in cognition or motor development as indicated by parent questionnaire.

Upon contacting the researcher via email indicating participation interest, a letter with a participant questionnaire (Appendix A) was mailed to the prospective participant's guardian with a self-addressed stamped envelope for return. Upon return of the questionnaire, the researcher screened the questionnaire to ensure the prospective participant met the inclusion criteria. Exact ages were rounded down to the nearest whole month.

The parent or guardian of prospective participants who met all of the inclusion criteria were contacted for acceptance into the study and an appointment was scheduled for data collection. Written consent from the parent or guardian of the child accepted into the study was obtained at the start of each data collection appointment through a consent process and forms approved by the University of Wisconsin-Milwaukee Institutional Review Board (IRB).

Due to the young age of the children, written consent was not obtained from the child participant. Verbal assent was collected from the child participants by following a script (Appendix H) and asking, "Would you like to come read with me?", "Would you like to come look at some books?", or another similarly worded question. The examiner was vigilant to ensure that the children were not placed under significant stress by participating in the study. When working clinically with young children, teachers and speech-language pathologists often have to encourage children to participate in the treatment activities. At times, children expressed that they do not wish to participate in the activity. If a child indicated that he/she did not want to participate in the activity, the researcher redirected him/her to the activity and encouraged participation. All of the participants who started the assessments completed the study without showing a

substantial desire to discontinue the research activities (e.g., uncontrollable crying, hitting, thrashing). A UWM faculty member or staff member of the UWM Children's Center observed each session to ensure the safety of everyone involved. The parent or guardian was also given an option to end their child's participation in the study at any time and remove the child from evaluation. Discontinuation of the study by parent request did not occur.

Participants of the study. Participants consisted of 15 preschool-age children (11 males, 4 females) between the ages of 4 years, 0 months and 5 years, 11 months (M = 5 years and 0.33 months). The sample was comprised mostly of Caucasian males from the greater Milwaukee area suburbs. Two participants of mixed ethnicity were included in the study; one Caucasian-African American and one Caucasian-Latino. Participants were randomly assigned code numbers from a set of predetermined codes to ensure randomization of mode and title presentation. The participants' ages and genders can be viewed in Table 4-1.

Materials

An iPad computer tablet was used as the digital presentation medium during the eCAP administration. The iPad was chosen for its familiarity and popularity with the general public (Apple, 2013). A second generation iPad was chosen due to the researcher and clinician's familiarity with the device and equipment availability.

The stimulus items used for the study included the print books of *Follow Me, Moon* (Clay, 2000a) and *No Shoes* (Clay, 2000b). Both titles were scanned to make digital versions for the eCAP assessment using a Canon MP560 Series Workstation at 150 dpi. Page dimensions were manipulated using Paint.net, a free computer image

editing software, so a two-page spread would fit on the screen display of the tablet computer. Page dimensions for the two-page spread of the print books were 6" tall by 16.5" wide. Dimensions for the display screen on the iPad were 6" tall by 7.75" wide with a 9.75" diagonal display. Images were set at 2048 pixels wide x 1536 pixels tall with 240 pixel per inch resolution to accommodate the two-page spread. Each page of the eCAP stimulus book was half the width of the iPad screen with a black line drawn down the middle to indicate a page break.

Two exceptions to the two-page spread on the iPad were the front cover and the final page of text. Due to the assessment tasks on the final page of each book in which children were asked to isolate letters and words, the decision was made to create an image so that the only the final page of text would be visible on the last screen. The two-page spread in the print version contained the text on the left side with an intentionally blank page on the right.

To improve the resolution of the text, once the two-page image was created from the scanned pages, text was removed from the scanned pages and reinstated using Paint.net. The exact font used in the print books could not be found so a comparable font, Century Gothic, was used at size 40. While both the font used in the books and Century Gothic are sans serif fonts, the fonts in the stimulus texts implemented a serif capital [I] to distinguish it from a lower case [l]. To replicate the serif capital letter [I] in the e-book, horizontal lines were drawn at the top and bottom of each capital letter [I] of the digital texts using Paint.net. Spacing between words and lines in the e-books were adjusted to mimic those in the print book, increase ease of legibility, and to maximize visibility during observation. No other alterations were made to the test items during

scanning or page manipulation. Illustrations were slightly distorted to fit the page dimensions of the iPad. Since attention to the quality of illustrations was not assessed in either the CAP or eCAP, the distorted illustrations did not affect the integrity of the test. Once each two-page spread underwent the digitization process, it was saved as a .jpg image file. The completed images for each book were then compiled and published into its own photo gallery on the iPad to simulate an e-book for assessment purposes.

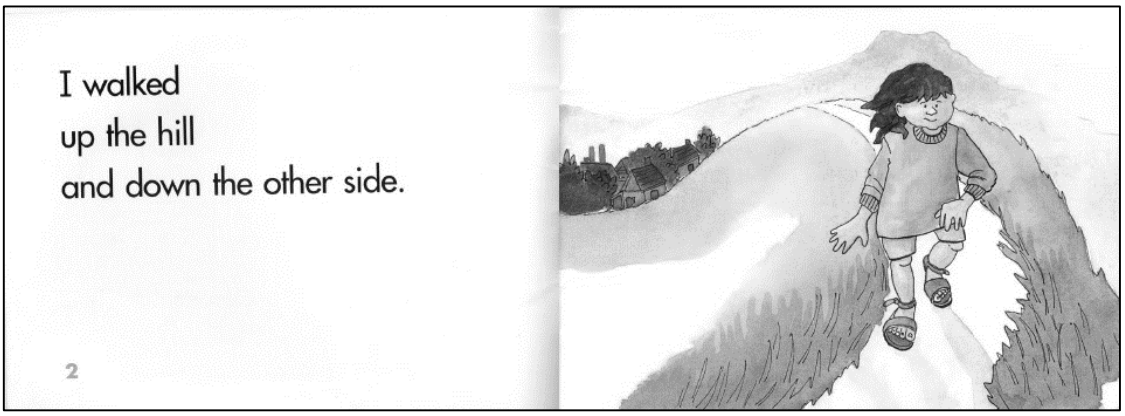

Figure 2-1: Sample page of print book.
Actual dimensions are 6" tall x 16.5" wide.

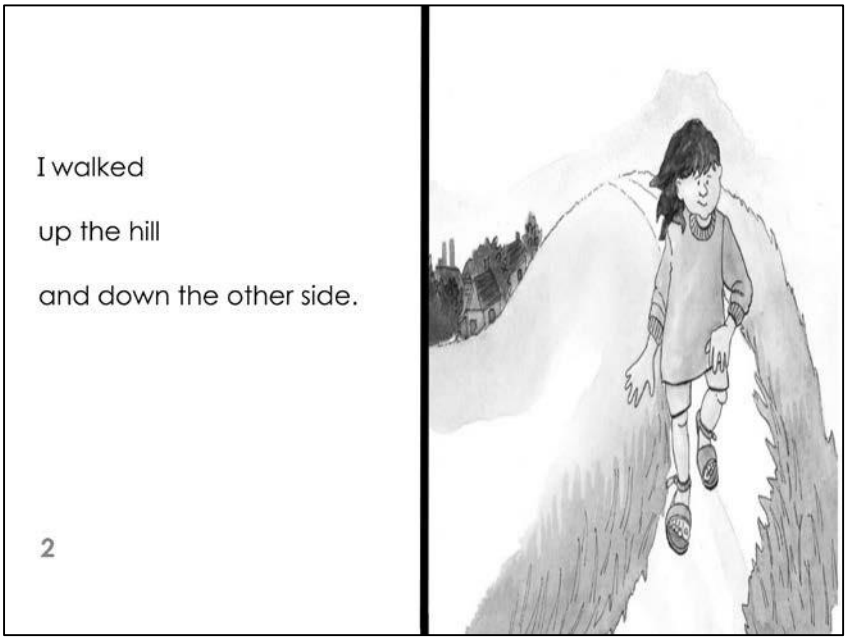

Figure 2-2: Sample page of e-book. Actual dimensions are 6" tall x 7.75" wide.

Procedures

Examiner and Inter-rater Observer Training

To complete this study, all data was collected by two graduate student examiners enrolled in the communication sciences and disorders program at the University of Wisconsin-Milwaukee: the researcher and another student working under the supervising professor for a research project. Both examiners were also trained in clinical skills regarding assessment of young children through clinical practica as part of their graduate program. The two examiners independently and collaboratively studied administration instructions (Appendix E), a scoring guide (Appendix F), and modified scoring sheets (Appendix G) (Clay, 2013) for both the CAP and the eCAP assessments. Mild modifications were made to the standardized protocols to accommodate presentation of the eCAP (Clay, 2013, p. 43-47). Such modifications included standardizing presentation of the book for task one as upside-down with the spine facing the child for both print and electronic texts. The prompt for the first task was changed from "Show me the front of this book" to "Show me how you hold the front of this book." This change was necessary to assess correct orientation of the iPad or print book since the ebook did not have a visual foil of a front and back cover. Thus, simply pointing to the iPad screen to "show me the front of this book" was deemed an unacceptable response.

Other changes to administration instructions were related to the final four tasks in which participants were required to use two 3 x 5 index cards to isolate letter and word boundaries by creating a window between the cards. During training, the researcher discovered that placing an index card directly on the iPad screen and maneuvering the card with a finger directly on top of the card activated the touchscreen of the iPad. To

reduce accidental errors caused by touchscreen sensitivity, participants were given index cards with star-shaped stickers placed on the center of the outer edge of each card (see Figure 3-1). The cards were referred to as "star cards" by both examiners for all assessments to ensure the consistency of terminology.

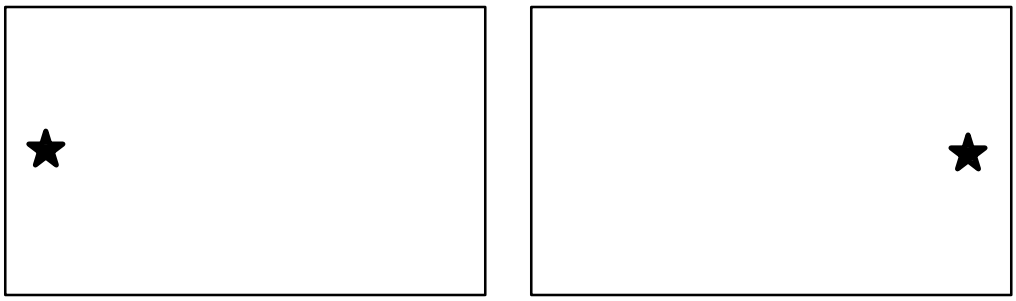

Figure 3-1: Graphic Representation of Star Cards.
Actual dimensions of the cards are 3" x 5".

Participants were instructed to hold the "star cards" with the star between the thumb and forefinger to reduce the amount of contact between the participants' fingers and the iPad. Participants were also instructed to manipulate the cards in a manner so that participant responses were viewed between the two cards. This process did not activate the touchscreen and was used for both the print and electronic books.

Familiarity with the test protocols and scoring was established by having the two examiners practice administering both tests on each other and communication sciences and disorders graduate students until a 95% agreement rating on scoring using point-by-point agreement was achieved. Each examiner also administered both the CAP and eCAP on practice children as part of the training process. The two children selected for the practice training sessions did not meet the inclusion criteria for the study and were chosen for convenience. One was the child of a faculty member and the other was the sibling of a participant to the study. The examiner not actively administering the tests

during each practice session scored the participant's responses from an adjacent observation room. Several seating arrangements were tested to maximize the observer's visibility of participant response through the one-way mirror. The most effective seating arrangement placed the participant at the head of the table adjacent to the mirror while the examiner sat opposite the mirror (See Figure 3-2).

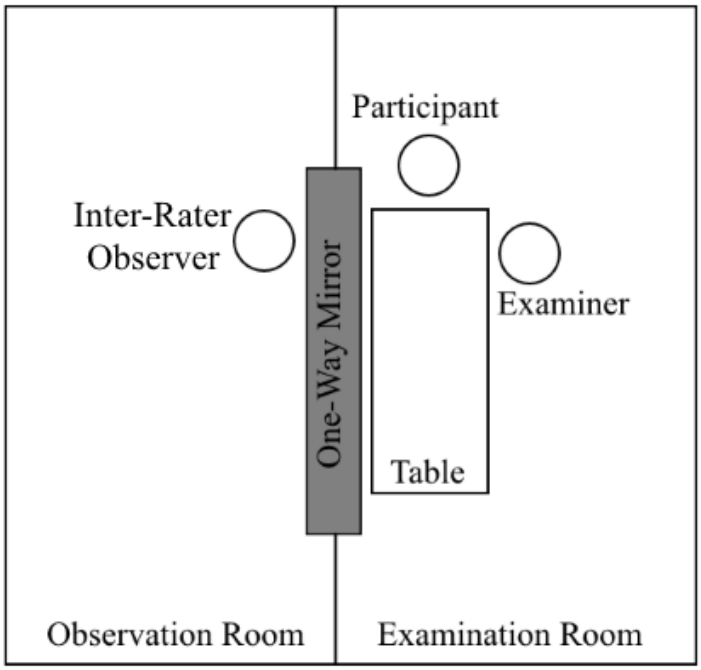

Figure 3-2: Room Layout and Placement of the Examiner and Participant

The two examination rooms had identical dimensions and mirrored floor plans and furniture layouts, with a shared observation room between them. To reduce glare from lights and ensure visibility of the book, both the CAP and eCAP books were placed flat on the table throughout the assessments.

Following the scoring guide for the *Concepts About Print* assessment (Appendix F), the examiner and observer scored participants on each of the 24 test items for both the CAP and eCAP. A correct response earned a score of one point while an incorrect

response earned a score of zero points. This resulted in a maximum score of 24 points for each assessment. Self-corrections were noted in the comments section of the score sheet and were given full credit.

Using point-by-point agreements for each test item, the examiners trained by rating practice subjects until the two examiners' scores differed by less than one point for the same performance on three consecutive trials. Establishing inter-rater agreement provided quantitative analysis that ensured differences in scores between examiners were due to participant performance and not rater bias during scoring (Hallgren, 2012). Scores obtained from clinician training were not included in the data analysis.

Test Administration

Each participant was randomly assigned to receive either the CAP or the eCAP as first mode of assessment. The two book titles, *No Shoes* (Clay, 2000b) and *Follow Me, Moon* (Clay, 2000a), were both used for the CAP and the eCAP. The titles were also alternated in presentation and randomly assigned for the first evaluation as shown in Table 3-1. The participant received the alternate title and in the alternate medium in the same assessment session. This counterbalance of presentation order and title accounted for any learning effect due to repeated testing or familiarity with the test stimulus book.

Table 3-1: Counterbalancing Presentation of Assessment Title and Mode

Participant	**First Assessment**	**Second Assessment**
Participant X-01	Print: *Follow Me, Moon*	Electronic: *No Shoes*
Participant X-02	Electronic: *No Shoes*	Print: *Follow Me, Moon*
Participant X-03	Print: *No Shoes*	Electronic: *Follow Me, Moon*
Participant X-04	Electronic: *Follow Me, Moon*	Print: *No Shoes*

Prior to the start of the evaluation, the examiner administering the test established rapport with the participant by asking the child about his/her day, favorite toys, activities, and other age-appropriate topics. This was a necessary step to gain the child's trust and allow the child to become comfortable with examiner to reduce the influence an unfamiliar adult may have had on performance. Additionally, the examiner read pages from a popular children's picture book to familiarize the child with the examiner's reading voice and reduce any anxiety about the task of looking at a book. After five to ten minutes of informal conversation and reading, the clinician would state, "I have some other books I want to read with you. Would you like to read them with me?" Once the child gave verbal assent, assessment began.

As was previously discussed, the CAP and eCAP assess 24 print awareness skills (Clay, 2013). The tasks assessed are listed in Table 3-2. More detailed descriptions of the tasks can be found in Appendix E.

Table 3-2: List of Tasks on the CAP and eCAP

Item	Task Description
1	Correct orientation of the book
2	Print, not picture, carries the message
3	Directional rules: starts at the top left
4	Directional rules: moves left to right
5	Directional rules: moves down the pages
6	Word-by-word pointing
7	Concept of first and last
8	Inversion of picture
9	Response to inverted print
10	Line sequence
11	Left page is read before a right page
12	Word sequence
13	Letter order
14	Re-ordering of letters within a word
15	Punctuation: meaning of a question mark
16	Punctuation: meaning of a period
17	Punctuation: meaning of a comma
18	Punctuation: meaning of quotation marks
19	Capital and lower case letters
20	Words that contain the same letters in a different order
21	Letter concepts
22	Word concepts
23	First and last letter concepts
24	Capital letter concepts

Each assessment lasted between 10-20 minutes per mode of presentation. Assessment length depended on how quickly a child responded to the questions.

Feedback during assessment was limited to redirecting the participant to the task or comments regarding non-test behavior at the end of each assessment. Feedback to redirect a participant included comments such, "Let's keep reading the story," or "Use your pointer to show me." Comments for non-test behavior included comments such as, "You did such a good job sitting in the chair."

A five to ten minute break occurred after the first mode of presentation during which the participant was offered a snack and read a portion of a popular children's picture book. This process helped reduce the effects of participant fatigue and provided a distractor to reduce learning effect of the test format within the same session. After the break, the participant was assessed using the second mode of presentation. Upon completion of the session, participants were given the picture book read during the session as a token of appreciation for participation.

Establishing Inter-rater Reliability

Examiners observed and scored each other's assessment sessions through a one-way mirror for 40% of the total sessions (12 of 30) for fidelity and consistency of administration and scoring procedures. The examiners each observed and scored equal numbers of CAP sessions and eCAP sessions at random intervals throughout the data collection period.

In some cases, the observer did not score a test item due to an obstructed view of a participant's nonverbal response, poor audio clarity, or not being inside the observation room during presentation of that test item. Unscored test items were omitted from inter-rater reliability calculations.

Scores between raters to confirm consistency of test administration and scoring showed an agreement of 223 / 227 test items. Inter-rater agreement was established at 98.24%.

Table 3-3: Rater A x Rater B Cross Tabulation

		Rater B		
		Score of 0	Score of 1	Total
Rater A	Score of 0	122	3	125
	Score of 1	1	101	102
Total		123	104	227

Table 3-3 reveals that of the 227 test items scored for inter-rater agreement, both examiners agreed that 122 of participants' responses were unacceptable, earning a score of zero points. 101 responses were agreed to be acceptable and earned a score of one point. In three instances, Rater A marked a response as incorrect that Rater B had marked correct. One test item was deemed correct by Rater A and incorrect by Rater B.

Disagreement between raters due to examiner error occurred on only one test item across all CAP and eCAP assessments and all participants. The examiner administering the assessment had initially accepted a response that was deemed unacceptable based on guidelines established in the scoring guide. The error was included as a disagreement for inter-rater agreement analysis but the final score was corrected prior to the analysis comparing the participants' performance between the CAP and eCAP.

Cohen's kappa calculated by SPSS was used to determine the likelihood that the percentage of inter-rater agreement was due to random chance.

Table 3-4: Cohen's Kappa Symmetric Measures

	Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Measure of Agreement Kappa	0.964	0.018	14.533	.000
N of Valid Cases	227			

a. Not assuming the null hypothesis.

Landis and Koch (1977) established a Kappa Statistic scale for reference, rating the strength of inter-rater agreements. A Cohen's Kappa of 0.61 – 0.80 is rated as a substantial agreement (Landis & Koch, 1977). As was previously discussed, participants received a score of 0 for an incorrect response and a score of 1 for a correct response for each test item on both the CAP and eCAP assessments. Since each test item had only two scoring options, the examiners had a 50% chance of agreement on each test item. A Cohen's kappa coefficient was necessary to determine the likelihood that agreement between raters was due to random chance. The Cohen's kappa coefficient for the 227 test items rated for inter-rater agreement (Table 3-4) indicated that the level of agreement between the raters was likely not random ($K = 0.964$) and rated as "Almost Perfect" on the Landis and Koch scale (Landis & Koch, 1977).

Results

Results for this study included raw scores from the CAP and eCAP assessments and statistical data. The raw score indicates the number of points each participant earned on the CAP and eCAP out of a maximum of 24 points.

The raw scores for the participants on each assessment are presented in Table 4-1 and Figure 4-1.

Table 4-1: Raw Scores for Each Participant on the CAP and eCAP

Participant	Gender	Age	CAP Score	eCAP
Participant 40-02	M	4;1	10	6
Participant 40-03	M	4;3	4	5
Participant 40-04	F	4;1	4	5
Participant 40-05	M	4;2	9	11
Participant 46-01	M	4;8	8	10
Participant 46-02	M	4;9	8	6
Participant 46-03	M	4;10	13	12
Participant 46-05	F	4;10	3	6
Participant 46-06	F	4;3	8	9
Participant 51-01	M	5;4	17	16
Participant 51-02	M	5;6	16	15
Participant 51-03	F	5;11	16	15
Participant 51-06	M	5;6	15	14
Participant 51-07	M	5;4	10	10
Participant 51-08	M	5;6	15	14

The raw data from this study shows that participants above the age of 5;0 consistently performed the same as or better on the CAP compared to the eCAP. Three of the five children between 4;0 and 4;6 performed better on the eCAP than the CAP.

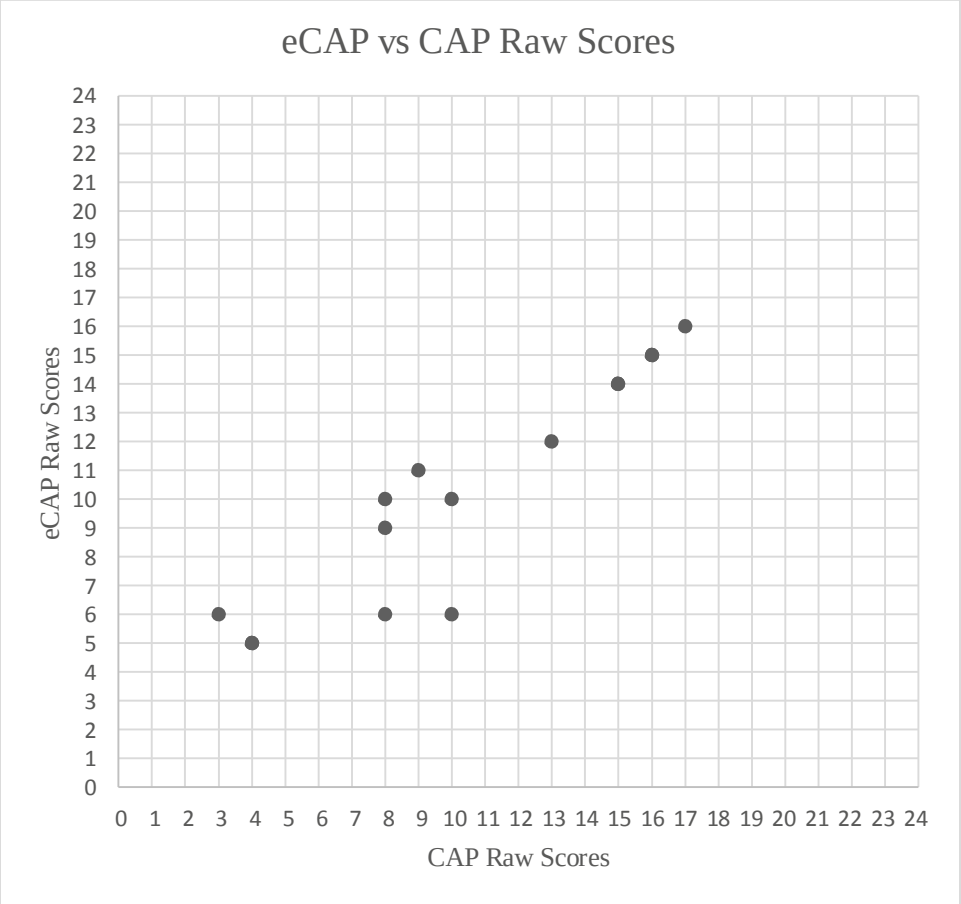

Figure 4-1: CAP and eCAP Raw Score Scatterplot

The scatterplot suggests a positive correlation between the scores of the eCAP and the CAP. Some participants achieved identical scores, thus some data points overlap and are not visible as separate entries on the scatterplot.

Statistical Data

Correlation between the CAP and eCAP. Due to the sample size, nonparametric statistical analyses were used. A one-tailed Spearman's rho correlational analysis was calculated using SPSS. Correlational coefficients can range from -1.0 to 1.0. A negative correlation indicates an inverse relationship whereas a positive 1.0 correlation coefficient indicates a perfect correlation (Schiavetti & Metz, 2006). An extremely strong positive

correlation (r = .919, p = 0.01) was found between the scores of the CAP and the eCAP, confirming the positive correlation suggested on the raw data scatterplot.

Table 4-2: Spearman's Rho Correlation

			Paper	Ebook
Spearman's rho	Paper	Correlation Coefficient	1.000	.919**
		Sig. (1-tailed)	.	.000
		N	15	15
	E-book	Correlation Coefficient	.919**	1.000
		Sig. (1-tailed)	.000	.
		N	15	15

**. Correlation is significant at the p = 0.01 level (1-tailed).

Differences between the scores on the CAP and eCAP. The second research question asked about differences between the scores based on mode of presentation. While the scores were correlated, it did not necessarily show that the scores were equivalent. The differences between scores of the CAP and eCAP were calculated using a paired samples t-test through SPSS.

Mean scores for both the CAP (M= 10.40, SD= 4.72) and eCAP (M= 10.27, SD= 3.97) were calculated as shown in Table 4-3. The mean scores for the CAP and eCAP had a difference of 0.1333. Since the research question did not indicate a preference for one mode of presentation over the other, a two-tailed paired samples t-test was performed using SPSS to compare the means of the CAP and eCAP. The results of the paired

samples t-test (see Table 4-4) determined the degree of statistical equivalence between the two sets of scores.

Table 4-3: Mean Scores of the CAP and eCAP. Standard Deviations and Standard Error of Mean are also calculated.

	M	*N*	*SD*	*SEM*
CAP	10.4000	15	4.71775	1.21812
eCAP	10.2667	15	3.97252	1.02570

Table 4-4: Paired Samples t-Test at $p < 0.05$

Paired Differences					t	df	Sig. (2-tailed)
			95% Confidence Interval of the Difference				
Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
.13333	1.80739	.46667	-.86757	1.13423	.286	14	.779

The results did not show enough evidence to indicate a statistically significant difference between the scores of the CAP and the eCAP ($t(14) = .29$, $p = 0.779$, 95% CIs [-.86757, 1.13423]) and the null hypothesis failed to be rejected. In other words, no difference was found in scores based on mode of presentation.

Discussion

Previous research involving the CAP assessment and e-books utilized technology that has since become outdated. The rapid growth in technological advances, access to technology, and abundance of technology have changed the literacy landscape for today's children. Children now interact with texts in multiple formats during emergent literacy

years. The current study aimed to validate a method of assessing print awareness for e-books by asking two research questions:

1) Are scores correlated between the paper and electronic modes of presentation for the Concepts About Print assessment?

2) Are there any differences in scores between the paper and electronic modes of presentation of the Concepts About Print assessment?

Comparison to Previous Research

Published data from a 1972 study indicated that 50% of European children were expected to achieve a score of 12 points by the age of 5 years, 6 months on the CAP (Clay, 2013). The participants for the current study had a mean age of 5 years, 0.33 months and achieved a mean score of 10.4 points on the CAP. A 2001 study by the New Zealand Ministry of Education of school children assessed with the CAP after six weeks of formal schooling achieved a relative normal distribution of scores with modes at 10 and 11 points (Clay, 2013). A study in 2000 examined 796 New Zealand school children between the ages of 5;0 and 7;0 (Clay, 2013). Mean scores by age group from that study showed that 223 New Zealand children between 5;0 and 5;6 achieved a mean score of 13.5 with a standard error of 0.23 and a standard deviation of 3.5. The participants in the current study between the ages of 5;0 and 5;6 achieved a mean score of 14.6 on the standard CAP and a standard deviation of 2.70. Children in the current study performed similarly to those in previous studies. Different approaches to education and school systems within each country may contribute to minute differences in scores. The current study sample also included a wider age range of students, up to age 5;11, but had fewer students.

While the numerical scores may differ from previous studies of the CAP, the qualitative performance showed that participants of the current study made similar errors when compared to previous studies involving the CAP (Clay, 1982). For example, when asked, "What's wrong on this page" for test items involving errors in spelling or syntax, most of the children's responses reflected content of the story or illustrations as opposed to the orthography. These findings are similar to those Goodman's (1982) review of the CAP assessment. Unfortunately, without altering the prompt or adding clarifying language, thus changing the level of cueing for those test items, the question remains ambiguous to young preschool children. Even the prompt, "What's wrong with the *writing* on this page?" elicited similar responses with regard to story content.

Justice, Bowles, and Skibbe (2006) developed an alternate assessment tool, the Preschool Word and Print Awareness (PWPA), specifically for preschool children. The PWPA assessed 14 skills for a maximum total of 17 points. Results from the PWPA found a significant interaction between children of low socio-economic status, language impairments, and performance on the assessment. The current study was unable to analyze whether the eCAP would result in a similar interaction due to the demographics of the sample population.

Previous studies relied on computer CD-ROM technology for electronic media (Korat and Shamir, 2004; DeJong and Bus, 2003). The e-book created for the current study more accurately simulates today's electronic reading experience than those CD-ROM e-book used in previous studies. E-books on portable tablet devices are now the preferred method of electronic reading. Emergent literacy research using tablet e-readers is still very new in the field (Neumann and Neumann, 2014a, 2014b).

Limitations of the Study

Test sample population. The primary limitation of this study was the sample population. A much larger sample size was preferable, but the researcher was limited by difficulty recruiting participants, time constraints, scheduling, room availability, weather, and illness.

Another limitation to the study involving the test sample population was the lack of normal distribution within test sample population. The sample population lacked the diversity in ethnicity and income to match local population demographics. Greater ethnic and socioeconomic diversity in the sample population is needed in order to draw conclusions that would apply to a larger, more diverse population. Due to a restricted timeline and limited sample size, a normally distributed sample reflecting the ethnic and socioeconomic makeup of the geographic region was not achieved.

Clinical Implications

As more and more children incorporate e-books into their early literacy experiences, a method to assess print awareness skills in this medium will be necessary. While no statistical differences were seen between the two modes of presentation with regard to performance across all age groups, the small sample size may have masked some differences that would be detected in a study with more participants and greater statistical power. Additional research is needed to validate the eCAP, however the results of this study indicate that the eCAP may be an alternative method of assessing print awareness skills of children whose emergent literacy experiences include both the print and e-book modalities.

Directions for Future Research

Additional research is needed to expand the sample size with more diversity within the sample population in order to validate the eCAP assessment. Additionally, expanding the age range to 7;0 would allow for additional validation of the eCAP and comparisons of results to previously published data (Clay, 1979, 2013).

Bilingual and multilingual children were excluded from the current study. Historical research suggests that bilingual and multilingual children experience a longer period of time during which emergent literacy skills are learned and mastered (Reyes, 2006). Whether bilingualism or multilingualism has an effect eCAP performance is yet to be determined. Previous literature has also shown the CAP as an effective assessment tool in languages other than English (Clay, 1985, 1989). Validation of the eCAP assessment in additional languages would allow the tool to be used for non-native English speaking children.

Other demographic factors which may influence performance on the eCAP to examine in future analyses include age, gender, child ethnicity, family income level, parent education level, and the amount of time a child spends with electronic tablets. An optional demographic questionnaire (Appendix D) was completed by several participants' families for future research. Previous research found an interaction between socioeconomic status and performance on the PWPA print awareness assessments in preschool children (Justice, Bowles, & Skibbe, 2006).

While the overall difference in performances across all children between the CAP and eCAP were statistically insignificant, the limited sample size did not allow for age-based statistical analyses. Additional research is needed to determine if any differences

exist in children's performance on the assessment based on age. Children are able to interact with electronic texts at an earlier age than print books due to the reduced fine motor skills required (insert reference). As more and more young children interact with electronic texts, and as schools in this country continue to increase use of instructional technology, including the use of e-books in early childhood and primary level classrooms, research is needed to assess how e-books are influencing print awareness skills in the emergent literacy years.

Finally, the CAP was designed for use as a tool to track student progress as literacy skills are mastered (Clay, 1989). Research is needed to ensure that the eCAP is able to track student growth as effectively as the CAP.

Conclusion

The purpose of this study was to validate an electronic adaptation of the Concepts About Print (CAP) assessment (Clay, 1985, 2000a, 2000b) as a method of assessing print awareness skills in typically developing preschool children. Based on the results of the limited sample size, validation of the electronic Concepts About Print (eCAP) may be possible as determined by correlation between performances on the CAP and eCAP. An extremely strong positive correlation was found between the two modes of assessment. A much larger sample size is needed for true validation of the eCAP. No significant difference was found in scores between the two modes of presentation.

Clinically, the eCAP provides a method to assess knowledge of print awareness skills in preschool children as electronic readers become more prolific at young ages. Additional research with a larger and more diverse sample population is needed to be able to extend the results beyond the scope of the current study and to determine if an

interaction effect exists based on the mode of presentation and age. Research is also needed to explore the effects of gender, socioeconomic status, multiple languages, and amount of exposure to electronic reading material on eCAP performance.

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Appendix A

RESEARCH PARTICIPANTS NEEDED

A research study in the UW-Milwaukee Department of Communication Sciences and Disorders is developing a way to measure how kids interact with electronic books.

Who can participate?

- Children between 4 and 5 ½ years old with no history of speech or language therapy
- Native English speaking
- Children who like to look at iPads

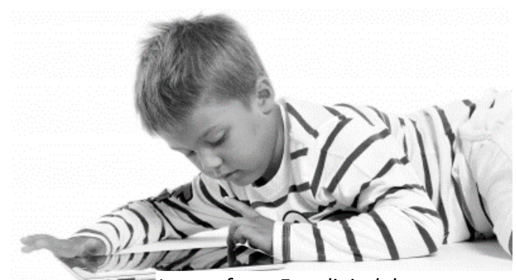

Image from Freedigitalphotos.net

What will my child be asked to do?

- Read books with a UWM graduate student
- Answer questions about the book with a UWM graduate student

Where do I go?

8th Floor of Enderis Hall (2400 E. Hartford Ave.) on the UWM campus.

How long will it take?

The time commitment will be one session lasting 60 minutes. Please arrive 30 minutes before your appointment.

Is parking available?

Parking reimbursement may be available for participants.

UWM Communication Sciences and Disorders Youth Literacy Study Contact: peterkao@uwm.edu	UWM Communication Sciences and Disorders Youth Literacy Study Contact: peterkao@uwm.edu	UWM Communication Sciences and Disorders Youth Literacy Study Contact: peterkao@uwm.edu	UWM Communication Sciences and Disorders Youth Literacy Study Contact: peterkao@uwm.edu	UWM Communication Sciences and Disorders Youth Literacy Study Contact: peterkao@uwm.edu	UWM Communication Sciences and Disorders Youth Literacy Study Contact: peterkao@uwm.edu	UWM Communication Sciences and Disorders Youth Literacy Study Contact: peterkao@uwm.edu	UWM Communication Sciences and Disorders Youth Literacy Study Contact: peterkao@uwm.edu	UWM Communication Sciences and Disorders Youth Literacy Study Contact: peterkao@uwm.edu

Appendix B

RESEARCH PARTICIPANTS NEEDED

A research study in the UW-Milwaukee Department of Communication Sciences and Disorders is developing a way to measure how kids interact with electronic books.

Who can participate?

- Children between 4 and 5 ½ years old with no history of speech or language therapy
- Native English speaking
- Children who like to look at iPads

Image from Freedigitalphotos.net

What will my child be asked to do?

- Read books with a UWM graduate student
- Answer questions about the book with a UWM graduate student

Where do I go?

8th Floor of Enderis Hall (2400 E. Hartford Ave.) on the UWM campus.

How long will it take?

The time commitment will be one session lasting 60 minutes. Please arrive 30 minutes before your appointment.

Is parking available?

Parking reimbursement may be available for participants.

How can I find out more information?

Contact Peter Kao at peterkao@uwm.edu

I would like to participate. How do I get involved?

To participate, send an email to peterkao@uwm.com

A screening questionnaire with a self-addressed, stamped envelope will be mailed to you. If your child is accepted to participate in the study, an appointment will be scheduled for participation.

Appendix C

Participant Questionnaire

Office Use Only
Participant Chronological Age:_____ Participant Code: _____

Child's Date of Birth: _____

Child's Gender: M F

1. Is your child a monolingual (one language), native speaker of English? Y N

2. Does your child have any history of speech or language delay or disorder? Y N

3. Does your child have normal vision (with corrective lenses)? Y N

4. Does your child have normal hearing? Y N

5. Does your child have any history of developmental delay or disorder? Y N

6. How often do you read electronic books with your child, using a tablet computer, Kindle, or Nook? (please circle)

< 15 min/wk 15-30 min/wk 30-60 min/wk 60+ min/wk

7. How often does your child look at or read electronic books independently, using a tablet computer, Kindle, Nook, smartphone, or children's electronic reader? (please circle)

< 15 min/wk 15-30 min/wk 30-60 min/wk 60+ min/wk

8. A snack will be offered to children during a break between assessments. Does your child have any dietary restrictions?

9. Which method of contact would you prefer us to use regarding the status of your child's acceptance into the study?

___ Email: _____

___ Phone: _____

Appendix D

Participant Demographic Survey

Office Use Only
Participant Chronological Age: _____ Participant Code: _____

Child's Ethnicity: _____ Child's Sex: M F

Annual household income: (circle one):

<$20,000 $20,000-$35,000 $35,001-$50,000

$50,001-$75,000 $75,001-$100,000 >$100,001

1. Does your child attend a daycare, preschool, or K4 program? Y N

If yes, approximately how many hours per week? _____

2. Which electronic reading devices are available in the household (check all that apply):

Desktop computer

Laptop computer

Smartphone cellular phone (iPhone, Android, or other similar devices)

Tablet computer (iPad, iPad Mini, Microsoft Surface, Slate, Nexus, or other similar devices)

Electronic reader (Kindle, Kindle Fire, Nook, or other similar devices)

Children's electronic reader (Disney ME Reader, V-Tech Reader, Leap Frog, or other similar devices)

3. How often do you read printed books with your child? (please circle)

< 15 min/wk 15-30 min/wk 30-60 min/wk 60+ min/wk

4. How often does your child look at or read printed books independently? (please circle)

< 15 min/wk 15-30 min/wk 30-60 min/wk 60+ min/wk

5. Do adult members of your household read books electronically? Y N

6. Are electronic devices used for non-reading purposes (games, movies, tv, etc.)?
Y N

If yes, how often does the child participant use electronic devices for non-reading purpose, such as games, movies, tv, etc.? (please circle)

< 15 min/wk 15-30 min/wk 30-60 min/wk 60+ min/wk

Appendix E

Administration instructions for *Follow Me, Moon* and *No Shoes*

Say to the child: *'I'm going to read you this story but I want you to help me.'*

COVER

Item 1

Test: For orientation of the book.

Pass the book to the child, holding it vertically by outside edge, upside down, spine toward the child.

Say: *'Show me how you hold the front of this book.'*

Score: 1 point for the correct cover and orientation.

PAGES 2 / 3

Item 2

Test: Concept that print, not picture, carries the message

Say: *'I'll read this story. You help me. Show me where to start reading. Where do I begin to read?'*

Read the text on page 2.

Score: 1 point for print. 0 for picture.

PAGES 4 / 5

Item 3

Test: For directional rules.

Say: *'Show me where to start.'*

Score: 1 point for top left.

Item 4

Test: Moves left to right on any line.

Say: *'Which way do I go?'*

Score: 1 point for left to right.

Item 5

Test: Return sweep.

Say: *'Where do I go after that?'*

Score: 1 point for return sweep to left, or for moving down the page.

(Score items 3-5 if all movements are demonstrated in one response.)

Item 6

Test: Word-by-word pointing.

Say: *'Point to it while I read it.'*

Read the text on page 4 slowly but fluently.

Score: 1 point for exact matching.

PAGE 6

Item 7

Test: Concept of first and last.

Read the text on page 6. The child must NOT continue word-by-word pointing.

Say: *'Show me the first part of the story.'* *'Show me the last part.'*

Score: 1 point if BOTH are correct in any sense, that is, applied to the whole text or to a line, or to a word, or to a letter.

PAGE 7

Item 8

Test: Inversion of picture.

Say: (slowly and deliberately) *'Show me the bottom of the picture.'*

(Do NOT mention upside-down.)

Score: 1 point for verbal explanation, OR for pointing to top of page, OR for turning the book around and pointing appropriately.

PAGES 8 / 9

Item 9

Test: Response to inverted print.

Say: *'Where do I begin?'* *'Which way do I go?'* *'Where do I go after that?'*

Read the text on page 8 now.

Score: 1 point for beginning 'I' (*Moon*), or 'Leaves' (*Shoes*), and moving right to left across the lower and then the upper line, OR 1 point for turning the book around and moving left to right in the conventional manner.

PAGES 10 / 11

Item 10

Test: Line sequence.

Say: *'What's wrong with this?'*

IMMEDIATELY read the bottom line first, then the top line. Do NOT point.

Score: 1 point for comment on line order.

PAGES 12 / 13

Item 11

Test: A left page is read before a right page.

Say: *'Where do I start reading?'*

Score: 1 point for indicating the left page.

Item 12

Test: Word Sequence

Say: *'What's wrong on this page?'* (Point to **page number 12**, NOT the text.)

Score: 1 point for comment on either error.

Read the text on page 12 slowly as if it were correctly printed.

Score: 1 point for comment on either error.

Item 13

Test: Letter order. (Changes to first or last letters)

Say: *'What's wrong on this page?'* (Point to **page number 13**, NOT the text.)

Read the text on page 13 slowly as if it were correctly printed.

Score: 1 point for any ONE re-ordering of letters that is noticed and explained.

PAGES 14 / 15

Item 14

Test: Re-ordering of letters within a word.
Say: *'What's wrong with the WRITING on this page?'*

Read the text on page 14 slowly as if it were correctly printed.

Score: 1 point for ONE error noticed.

Item 15

Test: Meaning of a question mark.
Say: *'What's this for?'* (Point to or trace the question mark with a finger or pencil.)
Score: 1 point for explanation of function or name.

PAGES 16 / 17

Test: Punctuation.

Read the text on page 16.

Say: *'What's this for?'*

Item 16

Point to or trace with a pencil, the full stop (period).
Score: 1 point.

Item 17

Point to or trace with a pencil, the comma.
Score: 1 point.

Item 18

Point to or trace with a pencil, the quotation marks.
Score: 1 point.

Item 19

Test: Capital and lower case letters.
Say: *'Find a letter like this.'*
Moon: Point to a capital P and demonstrate by pointing to an upper case P and a lower case p if the child does not succeed.
Shoes: As above for W and w.

Say: *'Find a little letter like this.'*

Moon: Point to capital M, I in turn.
Shoes: Point to capital M, I in turn.

Score: ***Moon:*** 1 point of BOTH m and i are located.
Shoes: 1 point of BOTH m and i are located.

PAGES 18 / 19

Item 20

Test: Words that contain the same letters in a different order.

Read the text on page 18.

Say: *'Show me "was".'*
'Show me "no".'
Score: 1 point for BOTH correct.

PAGES 20

Have two pieces of light card (13 cm x 5 cm) that the child can hold and slide easily over the line of text to block out words and letters. To start, lay the cards on the page but leave all print exposed. Open the cards out between each question asked.

Item 21

Test: Letter concepts.
Say: *'This story says:*

Moon: *"The moon followed me home."*
Shoes: "My shoes were by the river."

I want you to push the cards across the story like this until all you can see is (deliberately with stress) *JUST ONE LETTER.'*

(Demonstrate the movement of the cards but do not do the exercise.)

Speak deliberately. Stress the item.

Say: *'Now show me two letters.'*
Score: 1 point if BOTH are correct.

Item 22

Test: Word concept.
Say: *'Show me just one word.'*
'Now show me two words.'
Score: 1 point for BOTH are correct.

Item 23

Test: First and last letter concepts.
Say: *'Show me the first letter of a word.'*
'Show me the last letter of a word.'
Score: 1 point for BOTH are correct.

Item 24

Test: Capital letter concepts
Say: *'Show me a capital letter.'*
Score: 1 point if correct.

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Pages 44-45

Appendix F

Concepts About Print (CAP) and electronic Concepts About Print (eCAP) Scoring Guide

ITEM	PASS STANDARD
1	Front of book, correct orientation.
2	Print (not picture).
3	Points to top left at 'I said…' *(Moon)* or 'When I…" *(Shoes)*.
4	Moves finger left to right on any line.
5	Moves finger from left ot the right-hand end of a higher line to the left-hand end of the next lower line, or moves down the page.
6	Word-by-word matching
7	Both concepts must be correct, but may be demonstrated on the whole test or on a line, word, or letter.
8	Verbal explanation, or pointing to top of page, or turning the book / iPad around and pointing appropriately.
9	Score for beginning with 'I ran' *(Moon)* or 'Leaves' *(Shoes)* and moving right to left across the lower line and then the upper line, OR turning the book or iPad around and moving left to right in the conventional movement pattern.
10	Any explanation which implies that line order is altered.
11	Says or shows that a left page precedes a right page.
12	Notices at least one change of word order.
13	Notices at least one change in letter order.
14	Notices at least one change in letter order.
15	Says 'Question mark', or 'A question', or 'Asks something'.
16	Says 'Full stop', 'Period', 'It tells you when you've said enough', or 'It's the end.'
17	Says 'A little stop,' or 'A rest', or 'A comma.'
18	Says 'That someone is talking', 'Talking', 'Speech marks'.
19	Locates two capital and lower case pairs.
20	Points correctly to both 'was' and 'no'.
21	Locates one letter and two letters on request.
22	Locates one word and two words on request.
23	Locates both a first and a last letter.
24	Locates one capital letter.

Appendix G

□ ***Print***
□ ***E-book***
□ ***Moon***
□ ***Shoes***

CONCEPTS ABOUT PRINT SCORE SHEET

Date: _____

Name: _____ Age: _____ TEST SCORE: / 24

Examiner: _____ STANINE GROUP:

PAGE	SCORE	ITEM	COMMENT
Cover		1. Front of book	
2/3		2. Print contains message	
4/5		3. Where to start	
4/5		4. Which way to go	
4/5		5. Return sweep to left	
4/5		6. Word-by-word matching	
6		7. First and last concept	
7		8. Bottom of picture	
8/9		9. Begins 'I' (*Moon*) Begins 'Leaves' (*Shoes*) Bottom line, then top, OR turns book	
10/11		10. Line order altered	
12/13		11. Left page before right	
12/13		12. One change in word order	
12/13		13. One change in letter order	
14/15		14. One change in letter order	
14/15		15. Meaning of a question mark	
16/17		16. Meaning of full stop (period)	
16/17		17. Meaning of comma	
16/17		18. Meaning of quotation marks	
16/17		19. Locate: m i (*Moon*); m i (*Shoes*)	
18/19		20. Reversible words 'was', 'no'	
20		21. One letter: two letters	
20		22. One word: two words	
20		23. First and last letter of word	
20		24. Capital letter	

Appendix H

Script for Obtaining Child Assent

Hi, my name is Peter / Kay.

I would like to look at some books with you and ask you some questions about them.

We will look at two books and take a snack break in between.

Your mom / dad / grandma / grandpa has already said it is ok for you to look at some books with me. Would you like to look at some books with me? It is ok if you don't want to.

(If the child says "no", continue making small talk to establish rapport. Possible prompts/topics/questions to be asked in establishing rapport include):

- *"I think these books will be fun to look at. What kind of books do you like to look at?"*
- *"We will look at a picture book and a book on the iPad. What do you like to do on the iPad?"*
- *Other topics could include school activities, favorite play activities, favorite book or television characters, etc. to help establish rapport. All topics will be age-appropriate general questions about the child's interests or hobbies to establish rapport.*

After a few minutes of small talk, the child will be asked again: "Would you like to look at some books with me? It is ok if you don't want to."

(If the child says "no" again, continue making small talk to establish rapport. The examiner will make one final attempt to obtain a verbal response indicating assent from the child by asking): "Would you like to look at some books with me? It is ok if you don't want to."