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Using digital texts vs. paper texts to read together: Insights into engagement and mediation of literacy practices among linguistically diverse students

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ABSTRACT

As schools around the world increasingly use digital text, research is needed to understand the impact different media may have on opportunities for language and literacy development. Using mixed methods to analyze students' collaborative interactions across different media, this study examined how linguistically diverse students engaged with digital and paper books in a cross-age peer-learning literacy program. Findings revealed that the quality of students' engagement differed across media. Students were more likely to engage in meaningful talk, use text features to support comprehension, and attend to text when using paper books. Findings have implications for how educators may reconsider instruction using digital texts in order to support language and literacy development with students learning an additional language.

1. Introduction

With the global spread of the internet and mobile technologies, digital text is becoming more widely used for literacy and language learning inside and outside schools; and some argue the very notion of literacy is changing from a static, singular skillset based on linear print books to a multifaceted and critical processing of complex texts consisting of symbols and visuals, accessed through technologies that change rapidly (International Reading Association, 2009; Luke, 2003). Despite the proliferation of digital media, we still know relatively little about how the use of digital texts may affect language and literacy development (Felvegi & Matthew, 2012). At the same time, schools are becoming increasingly linguistically and culturally diverse, and educators are searching for ways to best support diverse students' literacy and second/additional language learning. Our study set out to examine linguistically diverse students' collaborative interactions across different media in a cross-age peer-learning literacy program to understand the impact media type may have on engagement with text and learning opportunities.

To support language and literacy development with linguistically diverse students, research has shown that students need to hear and use spoken language in many different contexts and engage in discussions where they use language with peers and teachers for meaningful, communicative purposes (Graves, August, & Mancilla-Martinez, 2012). Similarly,

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research has suggested that linguistically diverse students need opportunities for meaningful, collaborative interaction (Walqui, 2006) and active engagement in academic literacy tasks (Gersten & Baker, 2000) to develop language. Literacy focused research has shown that oral language activities in the classroom are critical for students' reading comprehension, as it helps students make important connections and clarifications around the text (Allington & Johnston, 2002; Zygouris-Coe, 2001). Given the importance of conversation around text and the potential of different media for language development, research is needed to explore how different text formats may afford or constrain students' participation in these literacy activities. There is some indication that digital texts may offer opportunities for high-quality talk about text, which is essential for linguistically diverse learners (Baker et al., 2014); but research also suggests that teachers must play a facilitative role for the benefits of digital text to be realized (see Moody, Justice, & Cabell, 2010 discussed below).

The connections between literacy learning and media type (and digital text, in particular) are far from straightforward (Peercy, Martin-Beltrán, Silverman, and Daniel, 2015). Research has documented students using digital texts on computers and tablets for varied purposes such as practicing beginning literacy skills, accessing engaging content with interactive features and hypertext, researching various topics online, learning vocabulary, and enhancing productivity and creativity (Dunn, Gray, Moffett, & Mitchell, 2016; Felvegi & Matthew, 2012; Meskill, Anthony, Hilliker-Vanstrander, Tseng, & You, 2006). Using digital texts in literacy and language learning has been shown to benefit students in many ways, including helping to engage reluctant readers and readers with diverse learning needs, increasing students' motivation and self-efficacy in reading, and connecting with students' out-of-school multimodal, hybrid literacy practices (Goodwyn, 2014; Li, Pow, Wong, & Fung, 2010; Moody et al., 2010; Ware & Warschauer, 2005). However, it is clear that reading in this new medium places unique demands on the reader, such as the need to stay focused and navigate digital text effectively (Cardullo, Zygouris-Coe, Wilson, Craanen, & Stafford, 2012), and interactive features in many e-books may distract rather than support readers (Schugar, Smith, & Schugar, 2013).

More research is needed to understand students' face-to-face interactions around digital text (Baker, 2001; Davis & Neitzel, 2012). Studies examining the use of digital texts for student collaboration and writing have suggested that digital text on tablets and computers facilitate collaboration by allowing students to share screens and construct documents together in real time (Hutchison, Beschorner, & Schmidt-Crawford, 2012). Research has also found that digital technologies can facilitate collaborative reading by allowing students to assess each other's reading fluency, answer comprehension questions together, and co-construct reading responses (Lan, Sung, & Chang, 2009), as well as by promoting behaviors such as monitoring word recognition and summarizing text together (Davis & Neitzel, 2012). However, few studies have examined the quality of student collaboration and the depth of their engagement with digital text compared to traditional, paper-based text. More research is needed to examine students' face-to-face interaction around digital text (Baker, 2001), how reading comprehension may differ when students read digital versus traditional paper texts (Leu, Mallette, & Karchmer, 2001; Mangen, Walgermo, & Brønnick, 2013), and how students' engagement may differ with digital texts (Burnett, 2010).

Student engagement has been shown to have critical importance for children's reading comprehension (Wigfield et al., 2008). While there is large body of research that has investigated children's engagement behaviors with traditional text, research examining children's engagement with digital text is scant. The work of Moody et al. (2010) is one of the few studies to examine children's reading engagement in varying media, with a focus on understanding the way electronic storybooks affect young children's shared reading experiences. They focused on adult-led e-storybook (digital text) reading, child-led e-storybook reading, and adult-led traditional (paper) storybook reading and found that children exhibited the greatest levels of persistence (indicating engagement) with adult-led e-storybook readings, even though they produced more communicative initiations during the adult-led traditional storybook readings. Understanding how and why engagement with digital text may differ from engagement with traditional paper texts warrants further research.

This study begins to address the gaps in the research concerning engagement across different media among linguistically diverse students. By observing students' collaborative interactions across different media, our study provides a window into students' dialogic engagement and literacy processes in the moment-to-moment interactions with texts and peers. We examined student interactions as they read together in an elementary school cross-age peer learning (CAPL) program, Reading Buddies, designed for linguistically diverse learners. Our study was guided by the following **research questions**: How do linguistically diverse students use digital text (on tablets) and traditional paper text (in books) to mediate language and literacy learning during cross-age peer interactions? How does student engagement compare across text types? What kinds of opportunities and challenges for language and literacy development do different text formats afford?

2. Conceptual framework

Our conceptual framework is grounded in sociocultural theory and draws upon previous research that examined student interaction and engagement with literacy practices. Our focus on student interactions around text types is oriented by sociocultural theory, which conceptualizes learning as socially situated and mediated by cultural tools (Cole & Wertsch, 1996; Vygotsky, 1978). Our analysis of students' talk around digital and traditional texts draws from sociocultural discourse analysis, which aims to understand "how spoken language is used as a tool for thinking collectively . . . to study how people pursue joint educational activities" (Mercer, 2005, p. 138). Drawing from Mercer (2005) and Mercer and Howe (2012) we conceptualize classroom talk as a social mode of thinking, in which teachers and students use language for "constructing knowledge, creating joint understanding and tackling problems collaboratively" (Mercer, 2005, p. 137).

We examine student interactions around texts together to understand how they used digital and traditional texts to mediate opportunities for language and literacy learning. We operationalize these opportunities as *mediational episodes,* drawing upon the work of second language scholars using sociocultural theory, such as Van Compernolle (2013), who used the term mediation sequence. We conceptualized mediational episodes as moments when students co-constructed meaning of the text together, worked through misunderstandings, and used scaffolding behaviors, such as those described in Klingner and Vaughn (2000). We will explain how we defined mediational episodes in the data analysis section.

Building upon sociocultural perspectives, we operationalize student engagement with text (in this context) as their observable interaction with the text and their peers as they made meaning of the text together. We also drew upon literacy research that has defined reading engagement in terms of children's attention, interest and enjoyment (Roskos, Burstein, & You, 2012; Moody et al., 2010; Wigfield et al., 2008). Fredricks and McColskey (2012) define engagement as consisting of three dimensions: behavioral (i.e., time on task), emotional (i.e., interest and value), and cognitive engagement (i.e., self-regulation and learning strategies). We sought to understand these three dimensions as we examined engagement with the text both qualitatively and quantitatively. More than simply examining engagement as attention to the text (captured with time sampling), we also examined *how* students used the texts differently in ways that related to comprehension of the texts and attention to new vocabulary.

3. Methods

3.1. Description of cross-age peer learning program

Data for this paper came from the third year of our design-based research[1] project that involved teachers and researchers in an iterative, praxis-driven process to develop a CAPL program for kindergarten and fourth grade. The Reading Buddies program consisted of two introductory lessons, 12 teacher-led lessons for the kindergarten and 4th grade, and 12 buddy sessions in which kindergarten "little buddies" (LBs) and 4th grade "big buddies" (BBs) participated in literacy activities together. Teacher-led lessons were designed to prepare students to work together and included multidimensional vocabulary instruction and reading comprehension strategies instruction. In the fourth-grade teacher-led lessons, teachers introduced the focal vocabulary words and text for the week and modeled peer learning strategies. With the big buddies, teachers reviewed the "buddy guide" that included checklists for each session as well as overviews of the strategies and tips for how to be an effective big buddy.[2]

Buddy sessions were similar to class-wide peer-tutoring models (as described in Maheady, Mallette, & Harper, 2006) in that all students in the class participated simultaneously. During each 45-min buddy session, LBs and BBs began the session by sharing drawings they had created using their favorite target word for that lesson; next, the BBs read aloud from books or on tablets[3] with LBs and practiced focus vocabulary in the text; and last, buddy pairs played a question-and-answer game relating to new vocabulary and comprehension of the text.

The students and teachers used three different text types: traditional books, tablet text, and video. In this study, we focus on the interaction of student pairs using the books and the tablets. All formats were narrative informational texts connected to STEM (science, technology, engineering, and math) concepts, and the two texts we focused on for this paper were topically focused on measurement. The traditional texts were printed on paper with color pictures and text and bound like books. Focal words were highlighted in text and their definitions were provided in a text box at the bottom of the page. The digital texts (e-books) had similar color pictures and text; but in addition, the buddies could listen to a narrator read the text and could tap on the highlighted focal words, which would make a definition box appear on the screen above the text. Buddies changed the pages in tablet text by tapping on forwards and backwards arrows, and some pages included animations, such as characters or objects that could be moved on the screen. The buddies read together and stopped periodically to ask comprehension questions about the text, which were part of the buddy guide. (For more background on this program and teacher involvement see Daniel, Martin-Beltrán, Peercy, & Silverman, 2015; Martin-Beltrán, Peercy, Silverman, & Daniel (in press), Peercy, Martin-Beltrán, Silverman, & Nunn, 2015; Silverman et al., in press).

3.2. Data sources

Data for this paper came from a larger data set from our study conducted in four culturally and linguistically diverse elementary schools in the mid-Atlantic U.S. The schools had high percentages of ESOL students (up to 55%) and students in the free or reduced-cost lunch program (up to 93%). Prior to the CAPL program, the schools had not used tablets, but had

[1] Design-based research has been described as formative research which involves practitioners and researchers in an iterative, interventionist, and theory-oriented project, and applies qualitative and quantitative methods to examine how a design plays out in classroom practices (Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003 ; Collins, Joseph, & Bielaczyc, 2004; Hoadley, 2005; Reeves, 2006).

[2] Tips included the following: (1) Prepare to work with your little buddy by reviewing your buddy checklist and practicing with a peer; (2) Guide your little buddy by asking questions, prompting their responses, and listening to and building on what they say; and (3) Help your little buddy by pointing to pictures, using gestures, and home-languages (e.g. Spanish) as needed.

[3] Four of the lessons included students watching videos as a whole class. We did not include these lessons in our analysis of this paper because we focus on student pairs reading texts together.

occasionally used e-books on desktop computers. Our research team observed all 12 lessons in the CAPL curriculum across the four schools and we collected 107 h of video data during buddy sessions and teacher-led lessons. We recorded detailed field notes using an observation protocol during buddy sessions. We also collected survey data from 123 kindergarteners and 65 fourth-graders as well as analyzed interview data from 16 students (10 Kindergarteners, six 4th graders) to examine their perceptions of text types.

For the purposes of this paper, we searched for video recorded data that would allow us to observe the same buddy pairs across two comparable buddy lessons using different text types (one digital and one book-based lesson). From our larger data set, we selected the best quality videos from two pairs and one triad of students during two buddy sessions (6 sessions, or 284 min total). These pairs were representative of the larger student sample in that they included students who were reading on, above, and below grade level, and all but one were English learners. Information about focal students' language and literacy levels is included in Table 1 below.

3.3. Data analysis

We analyzed the data in multiple stages in order to examine the ways students used the texts together and how they were engaged in the texts differently. Our analytical approach to the transcript data was guided by sociocultural discourse analysis (Mercer & Howe, 2012; Mercer, 2005), which recommends the complementary use of qualitative and quantitative methods to analyze classroom interactions. In order to understand patterns of student engagement with text across the data, we were guided by previous studies examining reading engagement that have used observations and time sampling data analysis methodology (Ciampa, 2012; Kemp & Carter, 2006; Roskos et al., 2012). We coded the video recorded data (accompanied by transcripts) for student engagement during the buddies' reading of the book or the digital text. Time sampling meant we paused the video every five seconds and coded the salient behaviors present at that moment such as: gaze direction, verbal behavior, body language, or multi-sensory behaviors (see Roskos et al., 2012). We coded these behaviors into four categories: (1) active engagement (2) passive engagement, (3) active disengagement, (4) passive disengagement (informed by Ciampa's, 2012, and Kemp & Carter's, 2006, analysis of on and off-task behaviors). *Active engagement* included intervals when students were interacting with their buddy verbally, by either answering questions, commenting on pictures or animations, or responding to the buddy's comments. Active engagement also included body language such as tapping on the digital animations, sliding to change the page in the digital text, or checking boxes/answering written questions in their buddy guide. Intervals were coded as *passive engagement* when the kindergarteners kept their gaze on the big buddy (as s/he read) or the big buddy fixed their gaze on the text. This passive engagement involved receptive rather than productive language skills. Intervals coded as *active disengagement* included distracting behaviors such as playing with different objects on the table, turning around in the chair to look away, or talking about things unrelated to the reading. Intervals coded as *passive disengagement* consisted of the buddy gazing away from the book and/or his/her buddy (see Table 2 below). While we recognize that observation of student behaviors such as eye gaze and body language has its limitations as a measure of student engagement and may be interpreted differently, this is a commonly used methodology in reading research to begin to shed light on the 'black box' of student engagement (Fredricks & McColskey, 2012; Rosborough, 2014; Roskos et al., 2012). We pushed our analysis further to go beyond simple active/passive engagement to understand the *quality* of students' engagement and the opportunities for verbal interaction, which we conceptualize as especially important for students acquiring an additional language (see Table 3). Working together as a research team to analyze student interactions, we came to a consensus before tallying final time sampling data.

To offer a more nuanced picture of engagement and learning opportunities we analyzed the transcripts of student interactions line-by-line to understand the nature of peer-peer talk as a tool for thinking collectively and working through "joint educational activities" (Mercer, 2005, p. 138). We conducted microgenetic analysis (Parnafes & diSessa, 2013) to closely examine moment-by-moment development of understanding occurring during student discourse. We identified *mediational episodes* in student discourse, when participants asked a question or confronted a misunderstanding across two or more turns of speech (or gesture). Subsequent speech turns were included in the mediational episodes until the initial problem or question was solved or dropped.

To understand discursive patterns across the transcripts we conducted open coding (Corbin & Strauss, 2015) seeking to understand ways that students interact around texts (in both books and digital formats). In our second phase of axial coding,

Table 1
Focal Students.

Name	Grade	Reading level	ESOL level	First language (reported on parent survey)
Vincent	4	Above grade level	N/A	English
Eduardo	4	Above grade level	4.7	Spanish
Kristian	K	On grade level	3	Spanish
Yazmin	4	Above grade level	Exited	Spanish
Abigail	K	Below grade level	1	Spanish
Fiona	4	On grade level	4.1	Spanish
Claudio	K	On grade level	3	Spanish

Table 2
Student engagement.

Active engagement	Passive engagement	Active disengagement	Passive disengagement
Reading text aloud Discussing text with buddy or teacher Tapping on words or animations on tablet	Sitting quietly Listening Gaze on the text, buddy, or teacher	Turning body away Talking off-topic Playing with items on the table	Sitting quietly Gaze elsewhere
Paper Text (out of 815 samplings) 406 (50%)	355 (43%)	9 (1%)	45 (6%)
Digital Text (out of 1085 samplings) 565 (52%)	436 (40%)	18 (2%)	66 (6%)

Table 3
Quality of students' active engagement with text.

Type of active engagement	Little buddies	Big buddies
Engagement involving **verbal interaction**, such as asking and answering questions, writing down answers, and discussing text with buddy	**Paper Text** 79 out of 94 samplings (84%) **Digital Text** 118 of 156 samplings (76%)	308 out of 312 samplings (99%) 192 out of 409 samplings (47%)
Engagement involving mainly **physical actions** such as tapping to change pages or manipulating animations on screen, or checking boxes in the lesson checklist	**Paper Text** 15 out of 94 samplings (16%) **Digital Text** 38 out of 156 samplings (24%)	4 out of 312 samplings (1%) 217 out of 409 samplings (53%)

we looked more closely at the transcripts to examine how students used text features and how they helped each other understand the texts—drawing upon previous studies to further define this coding scheme. For example, we coded scaffolding/helping behaviors as comprehension checks, elaboration, feedback, instruction and prompts (described in Klingner & Vaughn, 2000), which allowed us to understand the richness of mediational episodes. In addition to analysis of transcripts, we read through student interviews and used selective coding to understand the ways that students described benefits and drawbacks of text formats (tablets vs. books).

4. Findings

In this section we discuss both quantitative and qualitative findings to explain how students used digital and traditional texts to mediate literacy learning during their cross-age peer tutoring interactions. Although we begin with quantitative findings to understand patterns across the data in broad strokes, we view the qualitative analysis of student talk as essential to make meaning of these patterns.

4.1. Student engagement

The time sampling included 1900 total observations (every 5 s across 6 transcripts). Table 2 shows the summary of our findings from time sampling. Of the 815 samplings from videos of the students reading the traditional book, we found that students were actively engaged 50% of the time (406 observations) and passively engaged 43% of the time (355 observations). Of the 1085 samplings from videos of the students reading the tablets, we found that students were actively engaged 52% of the time (565 observations) and passively engaged 40% of the time (436 observations).

In sum, this analysis suggests that the students were engaged most of the time using both the tablets and the books. Passive and active disengagement, such as gazing away from the tablet or playing with objects, was rarely observed during these lessons. Despite what appeared to be equal engagement across text types (as measured by time sampling patterns), we found that the *quality* of students' engagement across text types was distinct (Table 3). For example, over 50 percent of the big buddies' and about 24 percent of the little buddies' active engagement (217 out of 409 time samplings for big buddies,

and 38 out of 156 time samplings for little buddies) during the tablet lessons consisted of buddies merely tapping on the tablet to change pages or manipulate animations, without interacting with their buddy.

While the animations may have engaged the students with the text, we found that students were less likely to jointly engage with the text by talking about it with their buddy while reading digital stories. In contrast, students' active engagement with the traditional book included more talk about the story and references to text features compared to the digital stories. For big buddies, almost all of the 312 "active engagement" samplings included some form of verbal interaction when working with paper texts. These included teaching the little buddy new concepts and words, asking questions and giving feedback, discussing the text or its features, and reading the text aloud to the little buddy. Only 4 samplings included primarily physical action such as turning pages or checking boxes in the lesson checklist.

For little buddies, over 80% of the active engagement time during book lessons (79 out of 94 time samplings) was spent verbally interacting with the big buddy by asking and answering questions and commenting on the text, and the rest consisted of helping the big buddy manage the task by checking boxes in a checklist.

We identified 11 instances of technical difficulties that occurred across the three tablet lessons and may have impacted students' engagement with the text (although these instances were not included in the frequency counts of engagement for the time sampling). These included problems with audio, such as skipping, repeating, or no sound; digital pages turning inadvertently; trouble starting or pausing the story; tablets accidentally turning off; headphones not working; and tablets not being charged for the lesson. There were also three instances where the buddies had a brief disagreement over who would get to hold or tap on the tablet.

4.1.1. Learning new vocabulary: touching vs. reading word boxes

We also analyzed the videos of student interactions to identify how students attended to focus vocabulary words and, in particular, how they used embedded definitions. While students tapped on digital definition boxes to activate the audio (automatic narrator would read word definitions), they allowed less time for student explanation or discussion. In contrast, when students used the paper texts, they read the definition, often checked if buddies understood and added further explanation/elaboration.

We found the buddies read the word definition boxes 12 times across the three book lessons. We found two times when buddies used the word boxes specifically to work through mediational episodes when the BBs were checking whether the LBs understood the meaning of the word. If the LB responded that they did not understand, the BB read aloud the word definition in the box as a starting explanation, and then elaborated or paraphrased the definition of the new word. See Excerpt 4 below.

4.2. Students' engagement in mediational episodes

We examined student discourse line-by-line to understand the quality of student engagement and the ways that student interactions around different texts afforded opportunities for literacy and language development. We identified mediational episodes as students made meaning of the text together as they asked questions, encountered misunderstandings, tackled problems collaboratively, or created joint understanding of the text together.

Overall, when students were using the traditional books we found the mediational episodes involved more turns of talk and allowed students to engage more deeply with the text (compared with the mediational episodes involving the tablets.) The mediational episodes involving the digital text were mostly brief vocabulary comprehension checks, which were resolved by the big buddy tapping on the tablet to cause the word definition to pop up and to activate the audio which read the word definition out loud. In the following section we offer examples and discuss the differences we observed in the ways students used the different text types to engage in mediational episodes.

4.2.1. Using traditional vs. digital texts to re-read and build comprehension

Across the transcripts we found that students were more likely to re-read and refer back to the text to answer comprehension questions in the books, in contrast with the tablets, with which the students were less likely to go back to specific pages to re-read. Despite the fact that teachers roved around the classroom encouraging students to re-read and even showed them how to re-play audio in the book, students often skipped this re-reading. The students remarked, "it takes too long" to go back to re-read on the tablet. In an interview, another student explained "At times [the tablets] would get stuck and you would have to go all the way back to the beginning of the story."

In Excerpt 1 below, we observed the buddies referring back to the paper book to engage in a mediational episode in which they were responding to a prompt in the lesson to summarize the story.

Excerpt 1: Mediational episode with a book, re-reading for understanding.

Time		Utterance
	1	Yazmin: ((Writing the summary)) Okay, " . . . to fit Jeffy on the stage."
	2	((Abigail turns pages in the book while Yazmin writes. She looks at a picture of the elephant with birthday balloons.)
00:18:00	3	Yazmin: Okay, are you looking back at the book?
	4	((Abigail nods))
	5	Yazmin: Why?
	6	Abigail: Because . . . ((Still flipping through the pages.))

(*Continued*)

Time		Utterance
00:18:30	7	((Buddies close the book.))
	8	Yazmin: So, do you see this? (4 s) So . . . do you think this . . . do you think this is correct? ((Points to the summary she wrote)) Do you think this is correct?
	9	Abigail: No.
	10	Yazmin: Why? Why don't you think this is correct?
00:19:00	11	Abigail: Yes.
	12	Yazmin: Let me read it to you. ((Reads her summary)) "Jeffy was measured with 10 magic wands to fit Jeffy on the stage." Why isn't that right?
	13	Abigail: Mm?
	14	Yazmin: Why isn't this right? ((Points at the summary.))
	15	Abigail: Because elephant . . . balloons . . . playing balloons from my car.
00:19:30	16	Yazmin: Why was it about balloons?
	17	Abigail: Martha play for elephant balloons.
	18	Yazmin: I didn't hear of the elephant playing with balloons (8 s) So what happened with the balloons? · · · Why are you saying that the balloons were there?
	19	Abigail: Because the boys xx magic show and birthday.
	20	Yazmin: You're saying that there was a magic show and the balloons were there?
	21	Abigail: M-hm.
00:20:30	22	Yazmin: So the balloons stand for a party right, so I should add the party, in there?
	23	Yazmin: I should add the party? To make it correct?
	24	Abigail: ((Nods.)) M-hm.
	25	Yazmin: Okay let me do that. ((Writes)) "The stage for his party."
	26	Abigail: Stage.
	27	Yazmin: "His party." Now is it correct?
	28	Abigail: Yes.
	29	Yazmin: Okay. So, you wanted me to add the party.

While Yazmin was writing, Abigail was "re-reading" the book as she paged through to look at the illustrations (and focused on the party balloons, in particular). Yazmin recognized that Abigail was looking back at the book to re-read, and even asked her why and how this might relate to their summary. Abigail referred to balloons, which were depicted in the illustrations of the book, and Yazmin responded to this idea to co-construct their summary of the book by adding information about the setting, or the party. In this excerpt we observed the students using scaffolding behaviors such as re-reading (lines 1–6, 12–15) and comprehension checks (lines 8, 10, 12, 14, 18, 20, 22–23, 27, 29) to co-construct understanding. We observed both students actively participating by producing language and offering their own understanding of the text.

In the following sections we discuss how students used digital texts for a different kind of re-reading, which was less frequent and allowed for less extended conversations with peers.

4.2.2. Using text features to support comprehension

Previous research has shown the positive effects on reading comprehension and engagement of text features such as illustrations (Levie & Lentz, 1982) and dictionary definitions (Knight, 1994). In digital text, text features included illustrations, vocabulary definitions, audio and manipulable images, which previous research has suggested may increase students' vocabulary learning and reading comprehension (Dalton, Proctor, Uccelli, Mo, & Snow, 2011; Grimshaw, Dungworth, McKnight, & Morris, 2007; Hutchison et al., 2012; Larson, 2010; Verhallen, Bus, & de Jong, 2006).

In contrast to this previous research, we found the buddies were over twice as likely to refer to the pictures while reading a traditional book compared to the tablet. The buddies often used the pictures to support their discussion of comprehension questions in the lessons. While the students also showed engagement with the illustrations and animations on the tablets (based on our observation of their gazing and tapping), their talk about the illustrations/animations was less elaborate as they seemed to jump more quickly to the next screen. Excerpts 2 and 3 show this contrast.

Excerpt 2: Mediational episode with a book, using pictures.

Time		Utterance
13:00	1	Vincent: Okay, now the question. "How could you **estimate** or approximate the elephant's size?"
	2	Kristian: Uh . . . ((yawns)) I don't know.
	3	Vincent: Okay like-
	4	Eduardo: ((Interrupts)) Do you remember what **estimate** means?
	5	Kristian: **Estimate**?
	6	Eduardo: Yes.
	7	Kristian: Like the-
	8	Eduardo: Guess.
	9	Kristian: Like the ((points at something in the classroom))
	10	Eduardo: ((interrupts)) It's a guess.
	11	Kristian: Guess?
	12	Eduardo: Okay see, look. You can **estimate** by getting, if you get two cars stacked on each other, ((gestures with one hand on top of the other)), it might be the size of an elephant, right?

(*Continued*)

Time		Utterance
	13	Kristian: Yeah.
13:30	14	Eduardo: So you get other things and compare it like, like Vincent's pencil is almost the same as my, as my pen. ((BBs hold their pencil & pen next to each other)) Okay?
	15	((Kristian moves finger from the top of the pencil to the top of the pen to compare))
	16	Eduardo: It's comparing. Now do you get it?
	17	Kristian: ((Nods)) Yeah.
	18	Vincent: So, "how do you, how could you **estimate** or approximate the elephant's size?"
	19	Kristian: Um . . . Use the magic wand, right here? ((points at the picture in the book))
	20	Vincent: You could, you could just stack them all up like that ((motions from left to right))
	21	Kristian: Yeah and then you turn it small?
14:00	22	Vincent: No he can **measure** them like one, two three ((counts while moving his fingers along the magic wands in the picture)) and see how long the magic wands are and that's how you can find it, that's another one okay?
	23	Researcher: Like how many magic wands maybe?
	24	Vincent: Yeah.
	25	Researcher: How many magic wands it would take?
	26	Kristian: One hundred?
	27	Vincent: No.
	28	Researcher: I don't know, is that your **estimate**?
	29	((Kristian looks at and touches the picture))
	30	Vincent: Don't count.
	31	Kristian: Mm . . . ten?
	32	Vincent: xx, okay.
14:30	33	Vincent: "Our elephant's length equals **exactly** ten magic wands. Can you use the magic wands to see if we were right?" We were right! See ((points to the picture)). 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 ((counting wands on page with finger))
	34	Kristian: I knew it.
	35	Vincent: Okay.

Excerpt 2 is an example of a lengthy mediational episode among a triad of buddies (2 BBs and 1 LB) that was greatly facilitated by the pictures in the book. The buddies negotiated the meaning of the word *estimate* and how that related to the story by using pictures (lines 19, 22, 29, 33) to come to a joint understanding. In this mediational episode we observed the students using scaffolding behaviors such as comprehension checks (line 4, 16), re-reading (line 18), and using gesture and concrete examples outside of the book (line 9, 12,14) to co-construct understanding. We observed the LB actively participating by producing language and offering his own understanding of the text (lines 7, 11, 13, 15, 17,19, 21, 26, 31, 34).

In Excerpt 3, the same triad was also discussing measurement, this time using the tablet.

Excerpt 3: Mediational episode with a tablet, using pictures.

Time		Utterance
07:00	1	Eduardo: They, they can use, look, they can use tape, tape to **measure** the door ((points to the picture on the tablet))
	2	((Kristian nods))
	3	Eduardo: They're using it to **measure** how long- how tall it is.
	4	((Kristian nods))
	5	Eduardo: That one, that one where they find out the length of things.
07:30	6	((Eduardo tapping on the tablet))
	7	Eduardo: They measure it. They **measure** it with the, with the ruler.

The students in Excerpt 3 used pictures (line 1) and animations (line 6) in the digital text and Eduardo primarily used instruction or explanation (lines 3,5,7) as scaffolding behaviors. Although Kristian shows his engagement with his nodding, he does not produce any language. This pattern across the transcripts of students simply nodding in agreement with the tablet or letting the tablet do the talking suggests that engagement with the tablet did not offer as many opportunities for student-to-student talk.

Excerpt 4: Mediational episode with a book, using word definitions.

Time		Utterance
15:00	1	Vincent: ((Reading from the book)) "Look. The length of the stage is a lot bigger than ten magic wands. That means we can **estimate** that our elephant will fit just fine. Time to decorate for the party." ((Points at the word definition box and reads)) "**Estimate**, when you estimate you make a careful guess." ((Points at the picture)) Like he guessed, like he guessed how many magic wands it would take-
	2	Kristian: ((Interrupts)) Ten!
	3	Vincent: for it to fit the elephant.
	4	Eduardo: It's actually eleven right here.
15:30	5	Eduardo: ((Points to the magic wands)) Three, three, equals six, seven eight nine ten eleven.
	6	Kristian: Very close ten.
	7	Eduardo: It's because they just added one in case it wouldn't fit. (5 s) *Sabes?* [You know?] Okay.

When they used the digital text, we found that the three pairs tapped on words to hear their definitions a total of six times across six sessions. The digital definitions were part of a mediational episode twice. In both episodes, while the pair was listening to the story, the big buddy asked the little buddy whether he knew what a word meant, and when the little buddy indicated that he did not, the big buddy tapped on the digital definition as a way to facilitate understanding of that word. It seemed that the digital reading of definition was the 'last word' or final authority. Because the word box often closed quickly, there was little time for further explanation or discussion among the students (see Excerpt 5 below).

Excerpt 5: Mediational episode with a tablet, using word definitions.

Time		Utterance
03:30	1	Fiona: ((Picks up and examines bag with headphones in it)) Do you know what **measuring** means?
	2	Claudio: No.
	3	((Fiona presses on the tablet definition))
	4	Tablet audio: "**Measure.** When you **measure** things you find the height, weight, or size of something."
		2.5 min cut from the transcript when they continue to listen to the audio narration of the book
05:00	5	Fiona: Next, oh oh! Let's do it again. Do you know what amount means?
	6	Claudio: ((Shakes head))
	7	Fiona: Okay. ((Presses tablet definition))
	8	Claudio: It hold it.
05:30	9	Fiona: ((Nods head)) Okay, **scale** ((Presses tablet definition))

In Excerpt 5, Fiona begins with a comprehension check and seems to think she has resolved any comprehension problems by tapping on the tablet and allowing the automatic narrator read the definitions as it was written word for word. This interaction with the digital texts contrasts with the interactions using paper texts in which the students often paraphrased the definitions written in the text or used their own words to mediate any misunderstandings.

4.3. Noticing text

When reading the books, both big and little buddies gave more attention to the text itself (e.g. decoding, sight words) in contrast to digital text where students usually listened to the audio reading the text without decoding the text itself even though it was equally visible on the screen and paper. Attending more closely to the paper text may be, in part, because they were responsible for reading the text aloud; whereas they mostly listened to the audio reading on the tablets. Even though LBs were not expected to read (but rather listen to the BBs read the paper texts) LBs seemed to employ their emergent literacy skills (such as decoding and sight word recognition) more often with traditional text compared to digital text. For example (as seen in Excerpt 6), little buddies noticed sight words in the text that were part of their kindergarten curriculum.

Excerpt 6: Noticing words in a book.

Time		Utterance
05:30	1	Fiona: ((Reads)) "Planning an Elephant's Party by Ray Lankford. If you're planning a birthday party for your elephant, be sure to do things an elephant will like."
	2	Claudio: That word. This is a sight word today. We've got this sight word <u>like.</u>
	3	((Fiona nods))
		9.5 min cut from the transcript when they were reading the book (due to space limitations)
14:00	4	Fiona: ((Reads)) "Can you use the magic wands to check if we counted right? **Equal.** When you-"
	5	Claudio: ((interrupts)) We! That's a sight word.

Excerpt 6 shows how Claudio was actively engaged in the reading of the book when he interrupted Fiona to comment on the sight words ('like' and 'we' in lines 2 and 5). In another lesson, Claudio was following text in a book closely enough that he was able to point out when the big buddy forgot to read a part of the text. This type of behavior (identifying text/words) was not observed while the buddies were reading digital text. However, we did identify one instance when a little buddy remarked to a big buddy that he heard one of the characters say one of the focal words (during the audio reading on the tablet). This difference between the media types highlights the passive vs. active engagement and disparate opportunities for students to produce language across digital vs. traditional texts.

4.4. Student preferences

Despite the affordances of the traditional texts discussed above, we found that most students preferred tablets over books. In the student survey, 73 out of 123 kindergarteners picked digital stories as their favorite text format. The survey for fourth-graders did not specifically ask students to pick their favorite text format, but 15 out of 65 fourth-graders stated that tablets were their favorite part of the Reading Buddies program. Students preferred digital texts mainly because of the animations and playability. In their interviews students commented:

"Because you can touch the tablet and see what to do." (Kindergartener)

"Because we can play games on the tablet and – – when we touch something it moves." (4th grader)

We found that the word definitions were the most preferred text feature in digital text. For example students commented:

"If I didn't know the word, or if [my little buddy] didn't know the word, I would just press it and we would hear it for he can know." (4th grader)

Students also found the tablet audio helpful:

"Because you'll just listen and you'll hear and understand the words better." (4th grader)

Some students still preferred books: 20 out of 123 kindergarteners picked books as their favorite text format, and 9 out 65 of fourth-graders mentioned reading as their favorite part of Reading Buddies. The reason for this may have been the ease of re-reading and the lack of technical difficulties while reading traditional text. For example, students commented:

"I like them because if you don't understand some words you could flip back to the book." (4th grader)

"At times [the tablets] would get stuck and you would have to go all the way back to the story." (4th grader)

Word definitions were also the most preferred text feature in books. Students commented:

"It was helpful because, if I didn't know the word, it told me right there." (4th grader)

Students also found pictures helpful:

"The pictures show you what's happening." (4th grader)

Our findings suggest that text features are important in both paper books and digital texts, yet it seems that a student preference for digital text might be better leveraged to support language and literacy development. This ambiguous relationship between engagement with texts and students' self-reported preference warrants further research.

5. Conclusions and implications

In sum, we found that students used digital and paper texts in distinct ways during their reading interactions with other students. Although we found that engagement (captured quantitatively by time sampling codes) was relatively equal across the two text types, we found the *quality* of engagement differed considerably. While active engagement around the digital texts consisted mainly of tapping on the screen animations, active engagement with the books involved more student discussion around the text and thus more opportunities for students to practice using language. We found mediational episodes were generally longer and more in-depth when the students were using the paper texts. Our study contributes to research on reading engagement (Ciampa, 2012; Kemp & Carter, 2006; Roskos et al., 2012) by revealing the need to reconsider the analysis of engagement beyond simply "active" and "passive" and to consider the opportunities to use language as a way to understand quality engagement, especially among students acquiring a new language.

Although we recognize the limitations of our findings based on the interactions of seven students across six video-recorded lessons, our complementary methods that allowed for multiple phases of analysis (time sampling, coding observations, line-by-line analysis of student talk) add to the robustness of our findings. As scholars who use microgenetic analysis claim, "close examination of short segments of two or three minutes contain huge amounts of relevant detail to be accounted for, and provide opportunities for important schematizations of learning mechanisms" (Parnafes & di Sessa, 2013, p.15). Examining peer discussions using different text types allowed us to observe students' sense-making processes externalized in their dialogue–as opposed to traditional 'think-alouds' (e.g. Rouet & Passerault, 1999). Our findings shed light on the ways that media type may constrain opportunities for peer conversations around text, building upon Moody et al. (2010) study, which found children produced more communicative initiations during adult led traditional storybooks compared to e-storybooks. Our findings also build upon Segal-Drori, Korat, Shamir, and Klein's (2010) study, which found that reading e-books with another person (in that case an adult) made a significant difference in reading gains when compared with children who read e-books alone. Together, this work points to the importance of human interaction in conjunction with digital text, rather than using digital texts (which provide audio to read books aloud) as a substitute for human interaction.

Our study differs from earlier research that has documented some of the potential benefits of digital text, which can largely be attributed to the multimodality that digital text makes available for students (Felvegi & Matthew, 2012; Hutchison et al., 2012). Our findings revealed that students were more likely to re-read text, use text features to support comprehension, and notice sight words with the paper books, which suggested that traditional texts may better support literacy development. Our findings suggest that well-designed text features are important in both text formats, yet educators need to guide students to understand how they can use these features to support their language and literacy development.

Our finding that students are more likely to notice text (e.g. showing word awareness, using decoding) in traditional books corroborates Mangen et al's (2013) study that found students who read texts in print showed higher comprehension than students who read the texts digitally. Our designed-based research approach revealed the need for teachers to develop new strategies for teaching students how to notice text in digital media. Due to the technological constraints of the schools in this study, without universal access to interactive 'smart boards', educators were limited to more static teaching tools (including PowerPoint presentations) that did not adequately model the multimodality of digital text. Although many of these teachers had experience using digital text and tablets in their personal lives, this study was the first time they were using digital texts on tablets with students; thus the teachers had not modeled how to use and notice text in the same ways

they had done with printed books. In the past, educators have modeled reading strategies using print books such as big books for shared reading; yet in order to model reading digital text teachers should consider using interactive 'smart boards' or large screens that allow students and teachers to simulate reading and interacting with digital texts (in a format that is large enough to share with a group of students).

Our study suggests that educators need to re-think the use of digital text and to consider ways that allow students to engage verbally while taking advantage of text features such as audio explanations and animations. Other studies have found that the audio feature (text-to-speech narration) on e-books, can improve students' engagement with text by enhancing the social aspect of reading (Have & Pedersen, 2013). In contrast, our findings suggest that engagement was of lower quality, student talk was less elaborate and the digital text (and audio features) may constrain the potential social affordances of peers reading together.

If classroom-based conversation is critical for students' reading comprehension because it assists students in making important connections and clarifications around the text (Allington & Johnston, 2002), further research is needed to consider how teachers may create more affordances for student conversations around digital text. Our designed-based research approach suggests that in future iterations of this project, the teachers should offer more guided practice with student pairs interacting with tablets. Our findings revealed that students often relinquished their responsibility to the 'e-book narrator' or gave the tablet the 'final word' for explaining text and new vocabulary. Teachers need to remind the students working together that they are in control of the literacy activity (rather than allowing the narrator/e-book to control their interaction). Students need more explicit practice pausing and discussing the text with their reading partners, going back to re-read, cross-referencing, and finding their place again when reading in the digital format. Because linguistically diverse students need more opportunities to use spoken language, and engage in discussions about text (Graves et al., 2012), educators and e-book designers need to consider ways that students could use new words instead of merely reading their definitions in pop-up windows. Digital text could offer additional supports for students acquiring an additional language; for example, by offering a hyperlink to create a personal dictionary together with a sentence or a picture, or by recording student voices using new vocabulary in a summary of the text. Continued research is needed to discover ways to incorporate new technologies into literacy practices that have shown promise with linguistically diverse learners.

As schools shift to use more digital texts for literacy and language development, this study offers cautionary notes and directions for future research. Together with previous studies, our study suggests the importance of human interaction with digital texts and calls for future research to understand the features of this human interaction that make a difference for literacy development.

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