

EXPLORING THE RELATIONSHIP BETWEEN KINDERGARTENERS' BUDDY READING AND INDIVIDUAL COMPREHENSION OF MULTIMODAL DIGITAL TEXTS*

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ABSTRACT

To understand young children's experience with multimodal digital texts, we investigated how 53 kindergarteners' (ages 5-6) buddy reading behaviors (reading mode selection, sequential/non-sequential reading, hotspot use, use of modalities, use of monitoring) were related to their individual comprehension outcomes (prompted retelling, inference/critical- thinking, depth of target vocabulary knowledge) while reading app books. Multivariate mixed response analysis yielded these findings: (1) Buddy monitoring behaviors (e.g., ask questions, draw attention to book content, debate, or negotiate) were associated with higher vocabulary scores as well as higher inferences/critical thinking scores; (2) Triads had lower prompted retelling scores than dyads especially when reading longer app books. The findings highlight the importance to promote these positive buddy reading behaviors and pay attention to group size.

KEYWORDS

Literacy, Early Childhood, Reading

1. PURPOSE OF THE STUDY

The purpose of the study is to understand the relationship between kindergarteners' (ages 5-6) buddy reading behaviors and their individual comprehension outcomes while reading multimodal digital texts. The central question is: how are different buddy reading behaviors (reading mode selection, sequential/non-sequential reading, hotspot use, use of modalities, use of monitoring) related to individual reading outcomes (prompted retelling, inference/critical- thinking, depth of target vocabulary knowledge)?

Multimodal digital texts, e.g., app books, are increasingly becoming part of young children's literacy ecosystem (Shuler, 2012; Vandewater, Bickham, & Lee, 2006). Reading app books, which involves the use and interpretation of multiple modes (e.g. images, sounds, animation) to form diverse pathways of reading (Kress, 2010; Wolfe & Flewitt, 2010), is different from reading traditional texts. Unfortunately, we have limited understanding of how young children engage with multimodal digital texts (Authors, under review). In addition, while the issue of how buddy reading processes and behaviors are related to early readers' individual comprehension of traditional texts is well studied; it has rarely been explored with emergent readers (e.g., kindergartners) (Authors, 2012). Thus, our research aims to address these research gaps as well as to offer insights to teachers on how to use buddy reading to promote comprehension.

We explored this issue as part of a broader research project on kindergarteners' app book reading development. The broader study design was modeled on Clay's (1966) seminal concepts about print development research. Likewise, we undertook a school-year-long study to understand and foster kindergarteners' children's development of app book reading processes that supported positive reading comprehension outcomes. Using this classroom-based-instruction design of the broader study allowed us to explore the relations between reader processes and outcomes in an ecologically valid setting.

*Due to page limit, the full references and tables are not included. But they are available to view via this link: <https://docs.google.com/document/d/1uzrFZPM6QIz9ht-zjOXVX0rKwSY6clC7F3CWNYwnLQw/edit?usp=sharing>

2. THEORETICAL FRAMEWORK & RELEVANT LITERATURE

This study is grounded in the sociocultural theories that emphasize the social and cultural nature of learning and development (Cole & Wertsch, 1996). Vygotsky (1978) states: "Every function in the child's cultural development appears twice: first, on the social level, and later, on the individual level; first, between people (interpsychological) and then inside the child (intrapyschological). This applies equally to voluntary attention, to logical memory, and to the formation of concepts. All the higher functions originate as actual relationships between individuals." (p57). In the same vein, we speculate reading in a social context, e.g., app book reading amongst buddies in this case, helps readers extend and transform their knowledge (Cobb, 1996) and externalize their learning, which lead to internalization of these practices (Kozulin, 2003). Two mechanisms may likely contribute to these processes: (1) modelling (showing one another a way to make meaning with the text) and (2) scaffolding (supporting one another to engage in those processes) (Vygotsky, 1978).

Multimodal literacy theories, which deemphasize the centrality of text and language and consider multiple 'modes' of communication, also inform us about the multiple pathways of reading app books that differ from reading traditional print text (e.g., Jewitt & Kress, 2003). The traditional print literacy practices (reading and writing) are privileged in school settings and foreground visual modes (e.g. print) for accessing text (Kress, 1997). In contrast, we hypothesize that reading multimodal text will likely involve both visual and action modes (Wohlwend, 2010), thus resulting in more complex transactions between the reader and text. Our coding of buddy reading behaviors of app books tried to capture such complex transactions.

Finally, our research is informed by existing research on buddy reading. Research has demonstrated that buddy reading facilitates beginning reading (e.g., Flint, 2010; MacGillivray, 1997; MacGillivray & Hawes, 1994; Tharp & Gallimore, 1988). For example, Griffin (2002, p. 773) found that first graders shared reading strategies to "pool their expertise" while buddy reading. Likewise, MacGillivray and Hawes (1994) found that first graders helped one another identify unfamiliar words in text. Additionally, Rubinstein-Avila (2003) identified several scaffolding strategies that second graders used with their buddies to support reading processes. Finally, Flint (2010) found that first graders "used strategies and prior knowledge to scaffold each other's learning" and made connections to construct meaning. While buddy reading has been used fairly widely as a method in which older or more experienced readers help younger or less experienced readers process text (e.g., Lowery, Sabis-Burns, & Anderson-Brown, 2008; Shegar, 2009; Theurer & Schmidt, 2008), a limited body of research has focused on same-age young readers processing text together, especially with multimodal digital texts.

3. METHODS

3.1 Participants

Fifty-three kindergarteners between the ages of 5-6 years old participated from across four classrooms in two schools and two U.S. states. Both schools were suburban and served linguistically, culturally, and socio-economically diverse populations of children.

3.2 Data Collection and Coding

Twelve app books were selected for buddy reading, four for individual reading across the units, and two for pre/post intervention individual reading based on their (1) high interactivity, (2) congruent hotspots that supported children's meaning making, (3) user-friendly features, (4) developmental appropriateness, and (5) good narrative/illustration quality; which are related to children's better comprehension outcomes (Morgan, 2013; Zipke, 2014). App books in each unit had similar design features.

Buddy reading sessions took place after each of 12 30-minute group lessons of reading the 12 app books, which are not the focus of the present study, across four units spanning the school-year. During the buddy reading sessions, children had 15 minutes to read the same app book presented in the lesson with a partner. Child's reading behaviors during buddy reading were coded individually, but there was no assessment of

their comprehension outcomes. At the end of each unit, each child was read individually using a novel app book and assessment protocol (15 minutes each; 318 sessions total) and both reading processes and outcomes were coded. All buddy reading and individual test sessions (4 end-of-the-unit sessions plus 2 pre/post sessions) were video-recorded for analysis.

The following four sets of variables were coded. Codes for reading behaviors and outcomes are based on previous work (Authors, under review). Rigorous coder training was undertaken, then two coders separately coded all the data. Differences were discussed to establish consensus, which was used for analyses. Inter-rater reliability was high (see Table 5).

1. Buddy reading behaviors (Table 1, column 2),
2. Individual reading behaviors (Table 1, column 3)
3. Individual reading outcomes (Table 2), and
4. Control variables (these were to avoid uncontrolled variable bias: child demographics, early literacy skills, classroom, time, and basic book attributes – see Table 3).

3.3 Data Analysis

Analyzing the data for this study required addressing outcome and explanatory variable issues (see Table 4). Outcome issues include discrete, infrequent, and multiple types. For discrete outcomes, ordinary least squares regressions can bias the standard errors, so we used a Logit regression to model dichotomous outcomes (Kennedy, 2008). As logistic regression is biased for infrequent events or for small samples, we removed this bias with King and Zeng's (2001) logit correction. Also, multiple types of outcomes can have correlated residuals that underestimate standard errors, which we addressed with a mixed response model (Goldstein, 2011).

Explanatory variable issues include many hypotheses without false positives and robustness procedures. As testing many hypotheses increases the likelihood of a false positive, we controlled for the false discovery rate via the two-stage linear step-up procedure, which outperformed 13 other methods in computer simulations (Benjamini, Krieger & Yekutieli, 2006). To test the robustness of our results, subsets of the data were run separately (Kennedy, 2008).

We modeled kindergarteners' outcomes, *vocabulary knoweldge*, *inference/critical thinking* and *prompted retelling* (**Outcome**), with a *multivariate, mixed response* model (Goldstein, 2011). An alpha level of .05 was used for all analyses.

$$\mathbf{Outcome}_{iy} = \beta_y + \mathbf{e}_{iy} + \beta_{iy}\mathbf{Control}_{iy} + \beta_{zy}\mathbf{Buddy\ Reading\ Behavior}_{iy} + \beta_{zy}\mathbf{Individual\ Reading\ Behavior}_{iy}$$

The **Outcome**_{iy} measure y for each child i has grand mean intercepts β_y with residuals \mathbf{e}_{iy} . First, we entered classroom variables for 4 teachers, children's demographics and book affordances: gender, race, English as second language (vs. first language), triad (vs. dyad), concepts about print score, and listening comprehension with traditional text score, total # automatic animations, total # user-activated congruent hotspots, total # user activated non-congruent hotspots, total # pages in app book, readability level, navigation options (p=page turn only), navigation options (m=page turn & menu), text highlights as it reads aloud, ave # lines of text per page, minimum # hotspots per page, and maximum # hotspots per page (**Control**_{iy}). Next, we entered children's buddy reading behaviors (**Buddy Reading Behavior**_{iy}). Lastly, we added each child's individual reading behaviors (**Individual Reading Behavior**_{iy}).

4. RESULTS

The summary statistics are listed in Table 5 and the results of the multivariate mixed response model of the three reading comprehension outcomes are available in Table 6.

Related to the central question, one particular kind of buddy reading behaviors was found significantly related to reading comprehension outcomes. Buddy monitoring behaviors (e.g., ask questions, draw attention to app book content, debate, or negotiate) were associated with higher scores of depth of vocabulary knowledge for target words. This buddy reading behavior accounted for 7% of the vocabulary variance. Also, children who asked more questions of their buddy or monitored their comprehension more during buddy reading showed stronger inferences/critical thinking, accounting for 7% of their variance. Buddy monitoring

behaviors in our study focused on how buddies interacted regarding the books that they were reading. This finding aligns with existing studies that found young readers “pool their expertise” (Griffin, 2002; p. 773) and scaffold each other’s learning (Flint, 2010; Rubinstein-Avila, 2003). The act of monitoring can serve as ways to model good reading behaviors as well as to scaffold each other’s reading, the two possible social learning mechanisms (Vygotsky, 1978). This highlights the importance to foster productive buddy reading behaviors as a means to improve individual reading outcomes such as vocabulary and inferences/critical thinking.

Our finding also indirectly revealed the effect of group size. Although most of the buddy-reading sessions were done with two students, sometimes there were three students in a group due to absence of some students in the class. Compared to students in dyads, those in students in triads had lower prompted retelling scores, accounting for 2% of its variance. In addition, students in triads rather than dyads reading app books with more pages had even lower prompted retelling scores, accounting for 2% of its variance. In other words, the reading outcome of a larger group was worsened by the length of the books. Dyads seemed to be a more productive group size in our study, which confirmed the findings of early studies on group size (Webb, 1991; Webb & Palincsar, 1996).

It is worth noting the regressions modeling results also revealed some significant relations between factors such as individual reading behaviors, pre-test listening comprehension, book affordances, and reading outcomes, to name a few: (1) children who listened to the entire page before turning the page had higher target vocabulary scores. Furthermore, students who pressed more hotspots that were relevant had higher target vocabulary scores. Individual reading behaviors accounted for 9% of the vocabulary variance; (2) Pre-test listening comprehension was related to prompted retelling, which accounted for 17% of its variance; and (3) Books with fewer pages, more menu options than only page turning or more lines of text per page were associated with better inferences/critical thinking, accounting for 14% of their variance. These interesting findings are beyond the scope of this paper and will be explored in depth in other papers.

5. SIGNIFICANCE

Our study extends the existing research to uncover the relationship between buddy reading behaviors and reading comprehension outcomes in the context of reading digital multimodal texts. Although we did not find multimodal digital text specific buddy reading behaviors (e.g., use of hotspot) that related to reading outcomes, the effect of productive buddy reading behaviors (e.g., ask questions, draw attention to app book content, debate, or negotiate) on reading outcomes such as depth of target vocabulary knowledge, inference/critical thinking was salient. This highlights the needs for teachers to promote these productive buddy reading behaviors. Also the group size is another factor to consider when arranging buddy reading. Our finding indicates that dyads rather than triads are a more appropriate group size for kindergartners.

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