In Person with Paper or Individual Screens? Cultivating Early STEM

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Introduction

Many schools are adapting electronic text or devices into elementary classrooms as early as kindergarten. Thus, one main goal of any classroom is to ensure students are comprehending and understanding the text. According to *Education Week*, "A 2012 study by the Joan Ganz Cooney Center at Sesame Workshop, a research organization for children's digital media, found that 3- to 6-year-olds who read interactive e-books with their parents "recalled significantly fewer narrative details than children who read the print version of the same story" (Heitin, 2019). This study highlights the significance of our digital evolution, specifically regarding student retention of key concepts gleaned through digital texts. Our research responds by exploring the learning impact of using paper and digital formats of the same text teaching students about composting. This research adds to Heitin's (2019) findings by examining the critical role of the teacher in reading, facilitating, or granting students complete independence in navigating the paper and digital texts to increase student comprehension of STEM content. This study is particularly beneficial as teachers select materials to plan their own lessons to teach STEM content.

Theoretical Framework

Neumann, M. M., Finger, G., & Neumann, D. L. (2017). A conceptual framework for emergent digital literacy. *Early Childhood Education Journal, 45*(4), 471-479. doi:http://dx.doi.org.proxy.ulib.uits.iu.edu/10.1007/s10643-016-0792-z
- Discuss progress how 21st century and how children learn to read digital and non-digital text
- Emergent literacy through sociocultural interaction
- Framework for emergent digital literacy
- Similarities and differences between digital and non-digital text

SEZGİN, E. Y., & ULUS, L. (2017). The early literacy at preschool education: The book or the E-book? *TOJET : The Turkish Online Journal of Educational Technology, 16*(4) Retrieved from http://ulib.iupui.edu/cgi-bin/proxy.pl?url=http://search-proquest-com.proxy.ulib.uits.iu.edu/docview/1988915859?accountid=7398
- Compares paper books and E-books with Preschool learners
- E-books can benefit students at this age because of the way technology has impacted today's society.
- Explains the difference between paper and E-books as well as the benefits and drawbacks of both.
- The author's seem in favor of E-books for the preschool age group

Yokota, J., & Teale, W. H. (2014). Picture books and the digital world: Educators making informed choices. *The Reading Teacher, 67*(8), 577. Retrieved from http://ulib.iupui.edu/cgi-bin/proxy.pl?url=http://search-proquest-com.proxy.ulib.uits.iu.edu/docview/1523712650?accountid=7398
- Discuss the different features of paper books and e-books
- Discusses which version of the book teachers should incorporate into their classroom,
- When is the best time to use paper books or e-books in the classroom
- The quality of the features paper books and e-books provide.
- Give teachers the guide to choose which version of book is appropriate for their class
- Our research will help approve or disapprove why teachers should have the freedom to pick which version of a book to read.

Methods

This study employed a sequential [QUAN → QUAL] mixed methods approach in first collecting quantitative and then collecting qualitative data (Hanson et al., 2005, p. 227), as part of the data triangulation process in response to the research questions (Creswell, 2014). In addition, this study followed Hanson et al.'s (2005) *basic steps in designing a mixed methods study*, including deciding: (1) if/how to employ a theoretical lens, (2) how to collect data, and (3) when/how the data analysis will occur, particularly if the quantitative [QUAN] and the qualitative [QUAL] implementations of the study are concurrent or sequential, as in the case of this study.

Pedagogical Activities

We invited the class to complete a pre-test on composting, and read the five worksheet questions aloud and students circle the correct picture, in response to each question.
The class was split students into three groups
   Group 1: In-person reading of paper version of the book; the teacher provides students with full guidance throughout the entire book.
   Group 2: Animated digital version of the book (Storyjumper.com) displayed on projector screen in front of class; teacher provides students with minimal guidance, and gives students freedom to tell her how to navigate book.
   Group 3: Digitized author reading of the book (Screencastify) displayed on individual iPads with headphones; teacher provides no guidance and students are free to navigate the story as desired, or even leave the story to view different apps.
All students returned as a whole group to complete a post-reading activity, identical to the worksheet used in step 1. The researchers read the five worksheet questions aloud, and students selected their responses by circling the correct picture. After each student completed the worksheet, the researcher-teacher candidates provided correct answers.

Data Collection

The worksheets were collected after students completed the pre- and post-reading test to compare results before and after reading the story, and across school sites. These findings served as the quantitative data for this mixed methods study. After the worksheets were gathered and results were promptly evident, the researchers interviewed the teacher at each school with a set of five predetermined questions related to the literacy activities. The interview was recorded and transcribed to prepare for the analysis of the data. This transcription served as the qualitative data for this mixed methods study

Research Site

School 1. School 1 is an elementary school located in South Central, Indiana, with just over 450 students enrolled in 2018-2019, and only four English Language Learners in the entire school. There are 22 teachers in the school, and almost half of the teachers are relatively new teachers, with less than five years of experience. Just under 10% of the student population receives reduced price meals, while 35% of students receive free meals, daily.

School 2. School 2 also is an elementary school located in South Central, Indiana, with just over 350 students enrolled in 2018-2019, and only 18 English Language Learners in the entire school. There are 14 teachers in the school, and around half of the teachers are relatively new teachers with less than five years of experience. Nearly 9% of students receive reduced price meals, while about 19% percent of the student population receive free meals, daily.

School 3. School 3 also is an elementary school located in South Central, Indiana, with just over 500 students enrolled in 2018-2019, and have less than 2 English Language Learners in the entire school. There are 36 teachers in the school, and around half of the teachers are relatively experienced with more than ten years of experience. Nearly 45% of the students receive reduced price meals, while about 45% percent of student population receive free meals, daily.
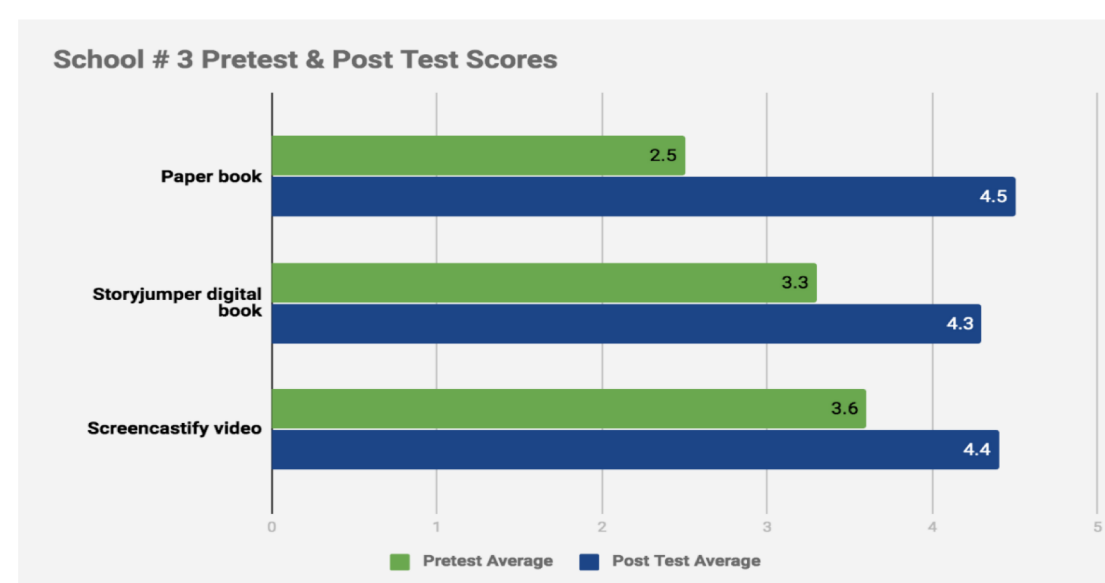
Quantitative Findings

School #1 Findings

Research Group	# of Students in Group	Average Pretest Correct	Average Post Test Correct
Paper book/ full teacher guidance	5	1.8	5
Storyjumper.com/ some teacher guidance	7	2.8	4.6
Screencastify/ no teacher guidance	8	3	3.9

School # 1 Average Pretest & Post Test Scores
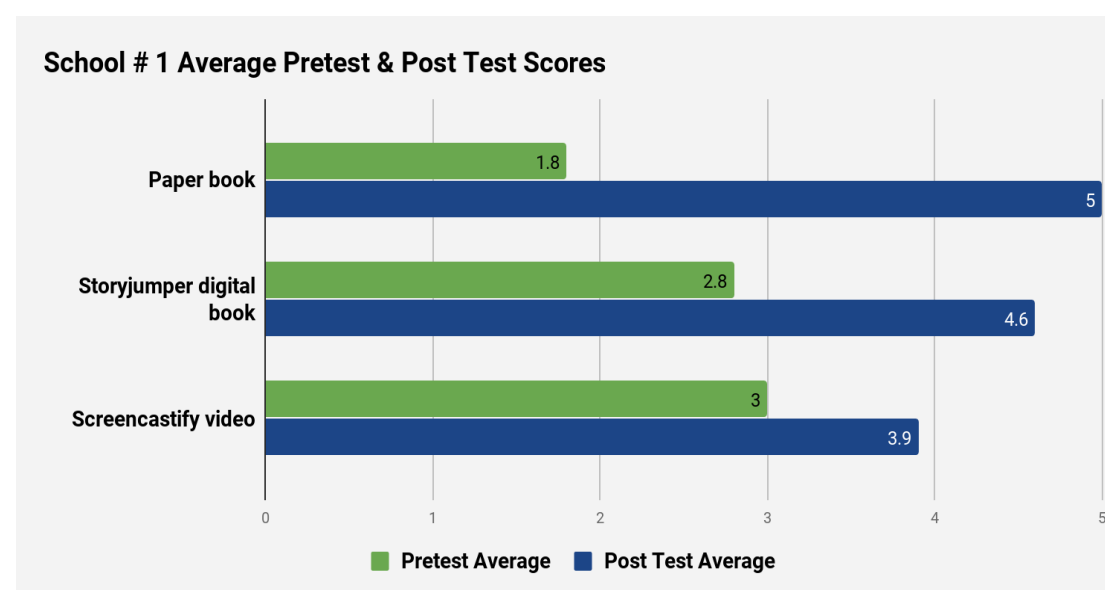
School #2 Findings

Research Group	# of Students in Group	Average Pretest Correct	Average Post Test Correct
Paper book/ full teacher guidance	8	2.4	4.25
Storyjumper.com/ some teacher guidance	9	2.6	4.3
Screencastify/ no teacher guidance	8	4.25	4.75

School # 2 Average Pretest & Post Test Scores
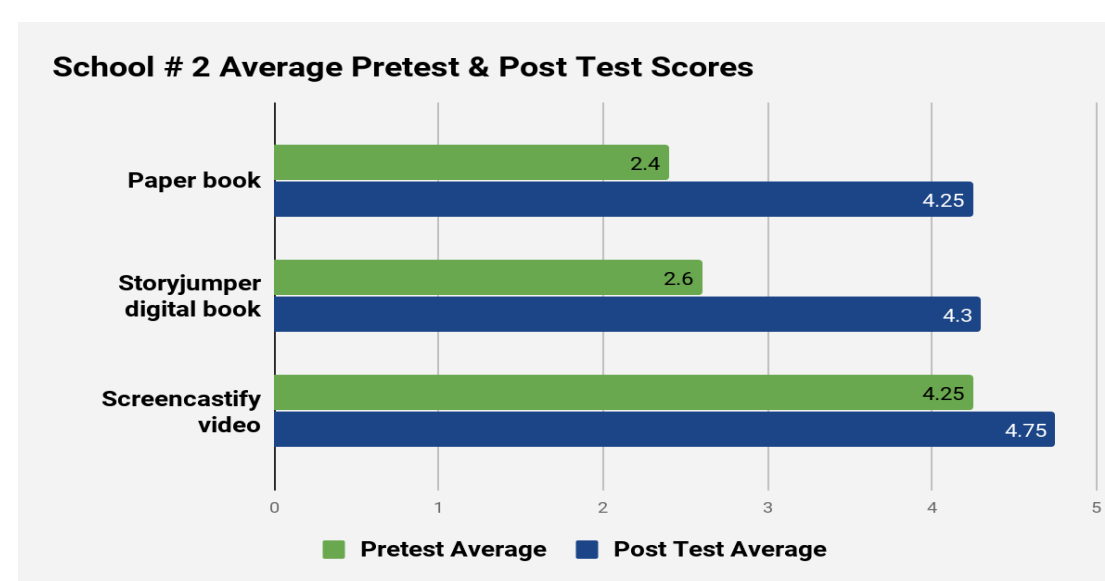
School #3 Findings

Research Group	# of Students in Group	Average Pretest Correct	Average Post Test Correct
Paper book/ full teacher guidance	5	2.5	4.5
Storyjumper.com/ some teacher guidance	6	3.3	4.3
Screencastify/ no teacher guidance	6	3.6	4.4

School # 3 Pretest & Post Test Scores

Qualitative Findings

Finding One: Teacher Guidance Enhances Student Comprehension and Concept Retention

One evident finding in school one, two, and three is that scores for students who received full teacher guidance improved more than any other group. School one improved by 3.2 points. School 2 improved by 1.85. School 3 improved by 2 points. *For full teacher guidance using the paper book, the three schools saw an average score for improvement of 2.35 between the pre-test and post-test.* In comparison, the digital Storyjumper and Screencastify readings saw an average improvement of *1.5 and 1.1*, respectively.

Finding Two: Paper Texts Enhance Student Comprehension and Concept Retention?

Another key finding concluded from school one, is students who were read the paper book scored higher (all perfect scores) on the post test activity. In school two and three, the majority of the students received a four or five. This was greater than in other groups.

Finding Three: Screen Time Hindered Student Comprehension and Concept Retention

A third finding concluded from school 1 is that *the majority of students who had no teacher guidance missed key pictures and ideas in the story.* Some students would move back and forth to different places of the Screencastify video on their individual iPads without listening to the full story. In school 1 and school 2, some students chose to not watch the story, but only listen on their earphones. This resulted in students missing key images shown on the screen and asked in the post test questions. In school 2, a few of the students also did not watch the story, but only listened, during the digital Storyjumper reading. In school 3, students listened to the Storyjumper while not looking at the screen, but paid full attention to the screen during the Screencastify reading.

Finding Four: Teacher Guided Screen Time Led to Mid-range Student Comprehension and Concept Retention

In school 1, 2, and 3, the teacher guided reading of the paper books allowed teachers to check for prior knowledge before reading, and check for comprehension in the middle and end of the book. This group interaction enhanced students' reading comprehension more than the digital books without teacher guidance. Participants who read the Storyjumper digital audiobook demonstrated some active engagement in viewing the pictures and responding to the questions, but did not evidence the same level of engagement as the participants reading the paper book with the teacher. *Participants in the Screencastify iPad viewing with no personal teacher guidance showed little engagement, including blank staring at the screen while questions and pictures were asked.* Other participants in this group chose to not view the pictures at all while looking around the room, instead.

Validity & Reliability

To enhance the validity of our findings, we implemented this study in three elementary schools across three different SES contexts in Southcentral Indiana, including one low-SES school, one middle-to-low SES school, and one middle-SES school. SES distinctions across the schools intend to strengthen the study's validity and reliability by examining findings across contexts and examining findings across groups within the same context. As all three elementary schools include students of similar ethnic and linguistic background (white, English-speaking), future research might explore similar research questions across contexts that include students of diverse ethnic and linguistic backgrounds. Finally, inter-rater reliability was established in that the researchers individually examined the interview data for emergent themes, and then shared findings with one another to establish shared group findings based around selected key themes.

Discussion

In this study, students who received the greatest in-person teacher guidance in reading a paper book demonstrated the greatest gains in pre- and post-test comprehension scores. In both school 1 and school 3, this paper book group outperformed students who viewed the story using a digital medium, with less or no teacher guidance.

This research demonstrates benefits and drawbacks of using print and digital children's texts to engage early readers in conceptual learning on civic science topics. Many studies demonstrate how digital texts benefit literacy development by engaging reader interest and providing a bridge across cultures and generations, including in the homes of English Language Learners (e.g., Levinson & Barron, 2018). At the same time, other studies highlight challenges presented by digital texts. In particular, Holum and Gahala (2001) conclude that digital texts reduce capacity for reflection, and that "children are better served when adults read aloud to them, thus providing opportunities for spontaneous questions and verbal interaction" (p. 15). Such research does not negate the value of digital texts, but rather, highlights the importance of moderation and purpose in using digital texts without completely replacing paper texts, read by teachers/parents. This conclusion resonates with findings in our study, together offering implications below.

In this study, independent screen time seemed to hinder student comprehension and concept retention. This could be a result of lack of teacher guidance. Without support from a teacher or adult, students became distracted and did not focus on key pictures or story content. Students appeared uninterested and skipped back and forth in both the video author reading and the digital book. This behavior corresponded with students' missing questions on the post-test activity that also used the same key pictures found in the storybook. This finding resonates with research concluding that electronic texts and hypertext may promote among children "a reduced attention span and a general impatience with sustained inquiry" (Birkets 1994, p. 27, as cited in Holum & Gahala 2001, p.15). In contrast, students in our study who experienced the greatest guidance from a teacher reading the paper book, in-person, demonstrated the highest gains in comprehension and retention, from the pre- and post-test scores. This group experienced greater student engagement through teacher questions and group interaction, both of which were minimal or non-existent in the other two groups. These findings encourage greater teacher-student engagement to enhance student comprehension, reflective capacities, and retention (Holum & Gahala, 2001).

Future research might explore if these findings are true across a broader set of cultural, linguistic, and SES school contexts.

References

- Byker, J., Good, A.J., Miller, E., & Kissel, B. (2018, Winter). Multicultural media authorship. *21st Century Learning and Multicultural Education*, 22-25.
- Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). Thousand Oaks, CA: Sage
- Glaser, B.G. (1965). The constant comparative method of qualitative analysis. *Social Problems,12*(4), 436-445.
- Glaser, B.G., & Strauss, A.L. (1967). *The discovery of grounded theory: Strategies for qualitative research.* New York: Aldine.
- Hanson, W.E., Creswell, J.W., Plano Clark, V.L., Petska, K.S., & Creswell, J.D. (2005). Mixed methods research designs in counseling psychology. *Journal of Counseling Psychology, 52*(2), 224-235.
- Heitin, L. (2019, February 20). How Should Reading Be Taught in a Digital Era? Retrieved March 20, 2019, from https://www.edweek.org/ew/articles/2016/11/09/how-should-reading-be-taught-in-digital-era.html
- Hidi, S., & Renninger, K.A. (2006). The four-phase model of interest development. *Educational Psychologist, 41*(2), 111-127.
- Holum, A., & Gahala, J. (2001). Critical issue: Using technology to enhance literacy instruction. Naperville, IL: North Central Regional Education Laboratory.
- Hougham, R.J., Nutter, M., & Graham's, C. (2018). Bridging natural and digital domains: Attitudes, confidence, and interest in using technology to learn outdoors. *Journal of Experiential Education, 41*(2), 154-169.
- IDOE. (n.d.). Retrieved from https://compass.doe.in.gov/dashboard/overview.aspx
- Levinson, A.M., & Barron, B. (2018). Latino immigrant families learning with digital media across settings and generations. *Digital Education Review*, 33, 150-169.
- Neumann, M. M., Finger, G., & Neumann, D. L. (2017). A conceptual framework for emergent digital literacy. *Early Childhood Education Journal, 45*(4), 471-479. doi:http://dx.doi.org.proxy.ulib.uits.iu.edu/10.1007/s10643-016-0792-z
- SEZGİN, E. Y., & ULUS, L. (2017). The early literacy at preschool education: The book or the E-book? *TOJET : The Turkish Online Journal of Educational Technology, 16*(4) Retrieved from http://ulib.iupui.edu/cgi-bin/proxy.pl?url=http://search-proquest-com.proxy.ulib.uits.iu.edu/docview/1988915859?accountid=7398
- Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory.* Thousand Oaks, CA: Sage.
- Yokota, J., & Teale, W. H. (2014). Picture books and the digital world: Educators making informed choices. *The Reading Teacher, 67*(8), 577. Retrieved from http://ulib.iupui.edu/cgi-bin/proxy.pl?url=http://search-proquest-com.proxy.ulib.uits.iu.edu/docview/1523712650?accountid=7398