

**Digital Books, Comprehension, Reading Achievement, and Motivation**

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December, 17<sup>th</sup>, 2014

GREV 611-Statistics III

Duquesne University

## **Introduction**

Children are being exposed to technology at an earlier age than ever before. These children are “Digital Natives”, a term used to define children who are growing up in an environment that surrounds them with digital technologies (Presnky, 2001). In the area of early literacy, “digital immigrants” grew up with paper versions of children’s literature read to them by adults (Presnky, 2001). Children today are now exposed to a wide variety of text that now includes digital versions of the formerly paper books in children’s literature. Studies have been completed on computer-based versions of these digital books, but few have been done with emergent readers or hand held devices such as Kindles, iPads, and Nooks. This study aims to look at newer technologies and how they compare in the area of comprehension in emergent readers against their paper versions as read by an adult reader. It will also explore the effect of book type on reading achievement as well as student motivation. The study will focus on kindergarten-aged students, who typically are in the emergent reading stage.

### **Research Topic: Digital Books and Emergent Reader Comprehension**

#### **Research Questions:**

1. Does book type (e-book vs. paper) have an impact on student motivation?
2. Does book choice (e-book vs. paper) generate different scores on a comprehension quiz?
3. Does book choice (e-book vs. paper) generate different learning gains in reading achievement as measured by scores on reading unit tests?

**Research Hypothesis:**

In studying the comprehension of young children with an e-book, the expected outcome is that the learning gains will be greater with the use of an e-book format as measured by the comprehension quiz. In terms of reading achievement, the expected outcome is higher reading achievement as measured by the scores of students on the curriculum provided reading unit tests. In terms of motivation, the expected outcome is that children who use the e-book format will have higher motivation. The choice of motivation, although not a measure of reading ability, is important because motivation has been shown to impact student achievement. These predictions are based on several ideas presented in previous research that showed increased motivation by the learners when using technology and enhanced vocabulary exposure when using an electronic book with the interactivity component for vocabulary words

**Research Variables:**

The independent variable has two levels of book type (traditional paper book and the iPad e-book version). The dependent variables are comprehension, reading achievement, and motivation to read. These research variables were chosen to be studied due to their nature as possible indicators for reading performance in children.

The comprehension variable was measured by scores on two comprehension quizzes that were administered following the reading of the two texts used in the study. Each quiz had possible scores ranged from 0-15. The two quiz scores were compiled for a composite quiz score that can range from 0-30 points. This composite quiz score was recorded as the Comprehension Quiz Score Variable in the SPSS statistical data analysis.

In terms of the reading achievement score, data was gathered from the classroom teachers. This data was composed of scores on unit tests given by the classroom teachers. These tests are identical district wide, summative at the end of a unit, and administered on the same day and time with the same directions through out the district. The total for the tests given this year was a possible 200 points, 10 tests given at a 20-point value. The scores were totaled to get a possible score between 0-200 points. These composite scores were then added as the reading achievement variable in SPSS statistics software for analysis.

The final variable analyzed was motivation to read. An independent observer was selected to rate the children's motivation on a scale of 0-50, with 50 being highly motivated. The observer included a rating of typical body language, expressions, verbalizations, and other signals that would indicate motivation. The observer would rate each student on two occasions, once for each children's book administered, for a total score ranging from 0-100.

### **Population and Sample:**

The population to be studied was Kindergarten-aged students in the public school system of the United States of America. The sample included approximately 100 kindergarten students from one primary school located in a northern Pittsburgh suburb in Western Pennsylvania. The sample was a convenience sample due to its geographic closeness to the researcher and easy access to the student population of the district used. Randomization was done in order to correct for potential biases in the groups. The students in the sample were placed into book type groups randomly and were not selected based on any factors other than grade level and the school in which they were enrolled.

**A Review of the Literature:*****Tablets in Early Literacy and Early Childhood***

A study by Jong and Bus (2004) looked at emergent readers levels of comprehension of text when presented with a digital CD ROM text versus a traditional paper book read aloud by an adult. The study found that the comprehension for the two groups was similar, and found no significant difference between a computer-based reading and a paper-based reading. This study was completed before the flood of new digital hand held reading devices hit the market. It measured comprehension on exact words or phrases the child used in an emergent retell of the story in a video taped session. Future research may be needed with newer technology with the development of new user interfaces that are more simplified and easy to use.

In another study by Lee (2009), the researcher stated that the children had varying degrees of mouse control abilities. This same barrier to learning was noted again in an article by Shiratuddin and Landoni (2003). It made mention of the fact that children with no computer experiences had to become familiar with a mouse prior to effective use of the technology they were studying. After further review of articles in the area of usability, Couse and Chen (2010) noted a marked increase in the ease of use when studying preschool students and a tablet computer with a stylus. This leads to the belief that current technologies such as iPads, with touch-screen interfaces, may be a solution to this complication in future research. If they use a touch screen interface with no mouse, the study may get more accurate information on achievement.

Motivation of students seemed to be a recurring theme in the review of the literature. The children involved in the Couse and Chen (2010) study stated that they would prefer the use of the

tablet drawing versus more traditional methods of drawing. They gave a variety of reasons why they liked the tablet more than traditional methods of drawing. The explanations involved the technical abilities of the program that were more sophisticated than a paper task. Lankshear and Knobel (2003) discussed the idea that many researchers describe computers as a tool that can increase motivation for learning. The article also stated that the subjects had more enjoyment of their school work and spent more time sustained in learning with more on task behaviors.

Educators are consistently looking for ways to engage children in sustained meaningful learning.

In an article by Wang and Guthrie (2004), motivation was explored in terms of its impact of reading achievement and comprehension. The authors state that certain constructs of reading motivation have been examined closely to determine their relation to text comprehension and have been found to improve reading achievement and text comprehension. In a past study they reported that children who had higher intrinsic motivation or extrinsic motivation increased more in the amount and breadth of reading than students with lower intrinsic motivation or extrinsic motivation (Wang & Guthrie, 2004 p.165). The study described by the authors found that intrinsic motivational factors such as curiosity and involvement increased students' reading comprehension. The results of this study showed that intrinsic motivation was highly correlated with extrinsic motivation. Children appear to be motivated to read for many reasons. Using a different media, such as an iPad, may prove to increase motivation in students.

Motivation to read was also discussed in an article by Ciampa (2012). The author explains the reasoning for the possible increase in motivation is explained. One possible reason for this is an increase in control of the text by students (Ciampa, 2012). This control is exhibited in e-books by allowing the user to activate the reading of word and pages that are equipped with sound and animations that are activated when reading through touch (Ciampa, 2012). The user is

also able to activate a reread of the text with a simple touch or gesture (Ciampa, 2012). The use of the audio activation could reduce the workload for the child by decoding for them, which may allow more processing capacity for comprehension (Ciampa, 2012). A study that involves a qualitative analysis as an extension of this quantitative work may be warranted.

In additional literature about tablet use with young children, there was also mention of the use of technology being directly related to increased work quality and larger academic gains. Haugland (as cited in Lee 2009) stated that computers enhance children's learning and lead to significant developmental gains. Higgins, Hess, and Cox (as cited in Lankshear & Knobel, 2003) studied vocabulary development with the use of CD-ROM stories that used animation clues that produced findings of more effective learning of unfamiliar words. This may indicate that further study on how interactivity can enhance comprehension through an understanding of vocabulary is needed.

### **Design Methodology**

This study was completed in a Western Pennsylvania school district near Pittsburgh, PA. The population studied was Kindergarten-aged students in the United States public school system. The sample included approximately 100 kindergarten students from one primary school in western Pennsylvania. The design of the study was an experimental design that compares two independent samples of students in the area of comprehension, motivation, and reading achievement. The independent variables were defined as the type of book the students were exposed to (iPad or traditional paper). The dependent variables were comprehension as measured by scores on the post-reading comprehension quiz, reading achievement as measured by unit comprehension tests, and motivation as measured by student survey scores.

The students from the sample were randomly assigned to groups. Fifty of the students were presented with the books in a traditional paper read aloud in small groups of 5 students. The other 50 students used the iPad digital book versions in small groups of 5, each with their own individual iPad device. The sample size and group sizes were determined by the availability of subjects to the researcher. They were also determined from the results of a Priori Power Analysis completed in the G-Power program to ensure statistical power in the study (see figure 1 below). The priori was analyzed at statistical power of .95 to ensure statistical power, which indicated a sample size of 74. The choice to use a larger sample was made based on the availability of participants and to ensure higher power in the findings.

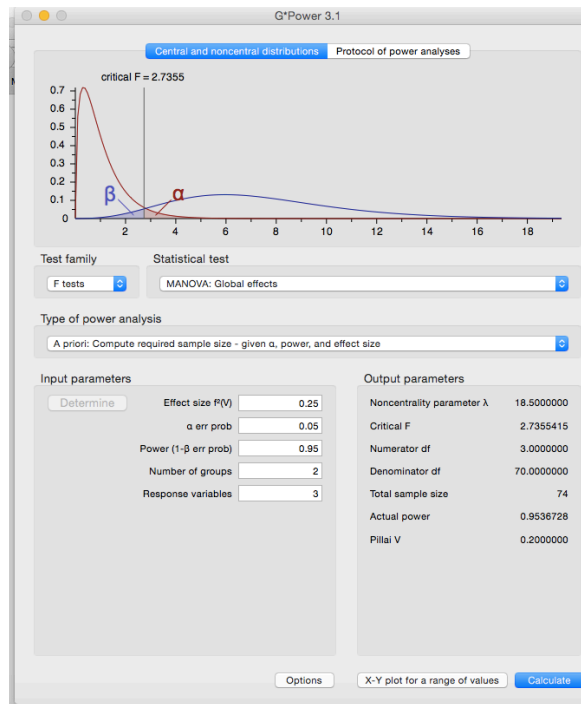


Figure 1-Priori Power Analysis at .95



The first book presented was The Kissing Hand by Audrey Penn. This book is a typical beginning of the school year book used at the kindergarten level and has an interactive iPad version available for use in the iTunes store. The students were read the story aloud or experienced the story via an iPad. The second book presented was Tacky the Penguin. This story is less familiar to students, but is similar in length and level to the first. The books were presented in two different sessions that were two weeks apart.

Following the reading of each text during the sessions, all of the participants were administered the same comprehension quizzes, which were read aloud by the researcher. The students took the quiz within privacy corrals to ensure they answer independently of others. There was no pre or post discussion of the stories or their elements. The quizzes were then collected and scored by the researcher. The possible scores ranged from 0-15. The two quiz scores were compiled for a composite quiz score that could have ranged from 0-30 points. This composite quiz score was recorded as the Comprehension Quiz Score Variable in the SPSS statistical data analysis.

Data was also gathered from the classroom teachers. This data was composed of scores on unit tests given by the classroom teachers. The unit tests are identical district wide and are a part of the reading series Harcourt Story Town. The tests are summative at the end of a unit and administered on the same date throughout the district. The total for the tests given this year was totaled to a possible 200 points, 10 tests given at a value of 20-points each. The scores on each unit test were totaled to get a possible score between 0-200 points.

An independent observer was selected to rate the children's motivation on a scale of 0-50, with 50 being highly motivated. The observer included a rating of typical body language,

expressions, verbalizations, and other signals that would indicate motivation. The observer would rate each student on each book for a total score ranging from 0-100.

As a part of the study design, the researcher presented the significance of the study, as well as the procedures, planned interactions with subjects, and data collection and analysis procedures with the internal review board at Duquesne University. The study was aligned with common instructional activities, instructional materials, educational standards, and interactions with kindergarten students and was not deemed harmful to participants in any way. The IRB at Duquesne University reviewed the proposed study and concluded that there would be no harm to human subjects whom participated in the study and approved the study for completion.

### **Data Screening**

The data was screened prior to its examination through a multivariate analysis of variance (MANOVA) in SPSS statistical software. Using SPSS, the data was examined for missing data, outliers, and for statistical assumptions.

The data was screened for missing data using SPSS software. No data was missing. Due to the fact that the data was complete, the data was next screened for outliers.

The data was screened for outliers using an analysis of the box plots within SPSS statistical software for each dependent variable. The boxplots did not indicate any outliers in the data, therefore no eliminations were needed.

The data was also screened for violations of statistical assumptions. The normality assumption was tested and was not violated in the dependent variables of Reading Achievement [Kolmogorov-Smirnov ( $p=.110$ )] and for the Motivation Variable [Kolmogorov-Smirnov

( $p=.200$ )]. However, the variable Comprehension Quiz Score violated the normality assumption [Kolmogorov-Smirnov ( $p=.000$ )] and required transformation. After examining the skewness and kurtosis values, it was determined that the data had moderate negative skewness. Based on this determination, the variable Comprehension Quiz Score was transformed via a reflection and square root transformation to give the data a more normal distribution. The transformation improved the Shapiro-Wilk statistic to a more acceptable level [Shapiro-Wilk,  $p=.052$ ] but failed to improve the Kolmogorov-Smirnov statistic [Kolmogorov-Smirnov ( $p=.000$ )]. In addition, the Q-Q plots were examined by the researcher to ensure the data was normally distributed. The data points were close to the diagonal line, which indicates a normal or close to normal distribution, on the Q-Q plot. Due to the Shapiro-Wilk being acceptable and a Q-Q plot, in which the data points were close to the diagonal line, the researcher concluded that no further data transformation was needed.

Box's Test of Equality was performed as part of the MANOVA analysis and determined that homogeneity of variance can be assumed,  $F(6, 69583.69)=1.66, p=.125$ . Following the screening of the data, the data analysis was completed and is described below.

### **Data Analysis**

Following the screening of the data, a one-way multivariate analysis of variance (MANOVA) was conducted to investigate the differences between iPad digital texts and traditional paper texts in the areas of comprehension, reading achievement, and motivation. There were two levels of the independent variable, which were the type of book (digital or paper). The dependent variables were the composite score on the post comprehension quizzes (referred to as Comprehension Quiz Score), score totals from reading unit tests (referred to as

Reading Achievement), and scores on a motivation inventory conducted by an independent observer (referred to as Motivation).

## The Results

A one-way multivariate analysis of variance (MANOVA) was conducted to determine comprehension, motivation, and reading achievement differences in two factors of book type. The means and standard deviations for Comprehension Quiz Score, Reading Achievement, and Motivation serve as a function of the two factors are presented in table 1.

The results of the one-way MANOVA are presented in table 2. MANOVA results revealed significant differences among the book types on the dependent variables [Wilks'  $\Lambda=.871$ ,  $F(3, 96)=4.74$ ,  $p=.004$ , multivariate  $\eta^2=.129$ ]. The Analysis of Variance (ANOVA), conducted as a follow up test, revealed significant differences among the book types on the dependent variables of Comprehension Quiz Score [ $F(1, 98)=6.99$ ,  $p=.01$ ] and Reading Achievement [ $F(1, 98)=6.77$ ,  $p=.01$ ] but was not significant for Motivation [ $F(1, 98)=.049$ ,  $p=.83$ ]. For the independent variable, levels of book type, each group/level consisted of 50 participants,  $N=50$ . These results are presented in table 3. No post hoc testing was needed, as there were only two factors/levels of the independent variable.

**Table 1**

*Means and Standard Deviations for Comprehension Quiz Scores, Motivation, and Reading Achievement by Book Type*

Factor (Book Type)	Reading Achievement		Comprehension Quiz Score		Motivation	
	M	SD	M	SD	M	SD
Paper Book	178.52	13.62	3.70	0.37	66.72	5.06
IPad Digital Book	172.14	10.73	3.52	0.33	66.92	3.92

**Table 2:** MANOVA Results

	$\Lambda$	<i>Df</i>	Error <i>Df</i>	$\eta^2$	<i>F</i>	<i>P</i>
<b>Factor (Book Type)</b>	<b>.871</b>	<b>3</b>	<b>96</b>	<b>.129</b>	<b>4.74</b>	<b>.004</b>

**Table 3:** Univariate ANOVA results for Motivation, and Reading Achievement by Book Type

Dependent Variable	<i>F</i>	<i>Df</i>	$\eta^2$	<i>P</i>
<b>Reading Achievement</b>	<b>6.77</b>	<b>1</b>	<b>.065</b>	<b>.011</b>
<b>Comprehension Quiz Score</b>	<b>6.99</b>	<b>1</b>	<b>.067</b>	<b>.010</b>
<b>Motivation</b>	<b>.049</b>	<b>1</b>	<b>.000</b>	<b>.826</b>

### ***Conclusions***

In this study, the aim was to determine if digital books on the iPad had a significant impact on comprehension, motivation, and reading achievement in early emergent readers when compared to traditional paper read-a-louds. The data showed that the comprehension of the students who read the digital version of the story was significantly higher than that of those who were read the paper versions. This may be an important insight for all teachers in the early childhood and elementary education fields when planning and designing instruction in their classrooms. Teachers may find that students increase their comprehension skills when using digital literature and may make choices to incorporate this type of media into their practices

more regularly. The data also showed that reading achievement was significantly higher in students who used the iPad digital texts in the study. The study did not see a significant difference in the area of motivation in terms of observed behaviors by the independent rater. This finding was a different result than the one that was predicted by the researcher based on the previous research reviewed prior to the study. Despite the motivation findings, the increase in comprehension and reading achievement may support the idea of further developments in curriculum materials for digital devices in the area of literacy.

### ***Limitations***

One limitation of the study was the availability of the sample. Convenience sampling was used in order to obtain a sample size that would have statistical power. Randomization was done in order to correct for potential biases in the groups. Replicating this study in other demographical areas may result in different results or provide further support to the findings in this study.

The choice of book may have provided some threat to the validity in this study. One of the books chosen is a popular book among early childhood educators. It is possible that some students may have heard this story before and had an advantage going into the comprehension quiz. The second book used, however, was less common and similar in terms of number of words. The choice in terms of the literature used may have had an impact in the study.

Previous exposure to read-a-louds on paper or iPads may also impact the findings of this study. This aspect of external validity is a hard thing to control because parents may have read to their children in differing amounts of time and with a variety of text types. Children are exposed

to other adults who have read to them and may use the same or similar texts and comprehension questioning such as librarians, kindergarten teachers, day care providers, and preschool teachers.

Another limitation may also have been the sample size. Although the sample size was large enough to ensure adequate statistical power, it may have greater influence and different findings in a more large-scale study with kindergarten students. In a larger sample, a significant interaction may have been found.

### ***Future Research Implications***

In the area of future research, researchers may want to consider replication of the study in different geographical regions to improve external validity. Perhaps there may have been a different finding in motivation if a larger sample size had been used. In the same area, motivation, using self reported survey results from a motivation survey might be more accurate in terms of measuring a student's internal motivation. This study could not achieve this with such a young target audience. Replication in a higher grade level could be warranted as well.

Another suggestion I have for future research includes possible creating an original digital story and paper version to use with the students. This would remove the threat to validity that can occur if a child has heard the story before in another setting. This could be done in a variety of ways such as iBooks author, app development, or other creative means like iMovie. It would however ensure that the reader is hearing the story for the first time.

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