Reading Comprehension Across Paper-Based and Electronic Interfaces

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Introduction

• The last decade has seen an exponential increase in the use of technology for educational purposes with a specific focus on the use of electronic interfaces for reading purposes. Yet, there is little research examining how reading comprehension may be affected using electronic vs. paper-based interfaces.

• Computing devices are likely preferred when reading for lower level knowledge and understanding rather than reading to gain deeper levels of information (Kintsch, 1994; Mayes et al., 2001); suggesting that more in-depth comprehension would occur when reading from paper-based interfaces.

• Studies examining differences between electronic and paper-based interfaces yielded mixed results regarding reading comprehension, text presentation, working memory, and reader-interface interactions (Liu, 2006; Mayes, 2001; Srivastava & Gray, 2012).

• An important consideration when comparing reading interfaces is that equivalence between reading tasks is established in terms of the validity of the task, text presentation, and comprehension measurement (Hargreaves et al., 2004; Noyes & Garland, 2008).

• In the current study, **equivalence** was established by selecting a novel reading passage, developing reading comprehension questions, and creating an electronic interface that is equivalent in demands to the paper-based interfaces while still maintaining key features of the electronic-based reading interfaces.

• The purpose of this study is to compare reading comprehension across two equivalent non-linear reading interfaces where the only difference is computer vs. paper text presentation. The following **research questions** were addressed:

1) Do participants who read from a paper-based interface answer more comprehension questions correctly? Are there differences in accuracy by type of question?

2) Do participants who read from a paper-based interface provide longer retells than participants who read from a computer-based interface?

Sample

N = 14	Paper (n = 7)	Computer (n = 7)
Age in Years	18.57 (.79)	18.43 (.53)
Female : Male	5 : 2	5 : 2
Clinical Evaluation of Language Fundamentals Fourth Edition (Semel, Wiig, & Secord, 2001)		
Recalling Sentences	10.29 (1.89)	12.00 (1.41)
Understanding Spoken Paragraphs	9.71 (1.98)	10.29 (2.81)
Peabody Picture Vocabulary Test Fourth Edition (Dunn & Dunn, 2007)		
Standard Score	107.71 (8.75)	114.57 (10.69)
Expressive Vocabulary Test Second Edition (Williams, 2007)		
Standard Score*	109.14 (6.79)	124.14 (12.13)
Reading Task		
Reading Time (minutes)	6.86 (1.31)	6.60 (1.69)
Responding Time (minutes)	3.89 (.83)	3.81 (1.24)
		* p < .05

Procedures

• Freshmen in good standing were recruited to participate in the study and randomly assigned to one of two conditions: Paper-based and Computer-based reading of the same scandal.

• After completing a demographic survey, participants completed standardized assessments in a randomized order.
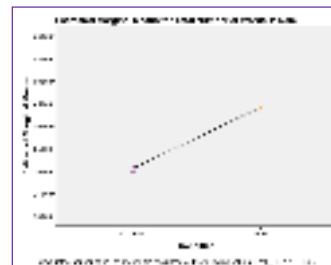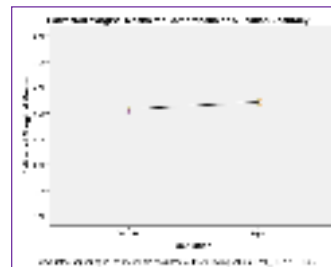
• Participants read a scandal and responded to comprehension questions and produced a retell of the story (counterbalanced across participants).

Figure 1. Sample reading passage in computer-based format, from the book *Scandalous!* (Fryd, 2012)

Results

Wilks's Lambda = .79, F(2,10) = 1.37, p = .30

Condition	Mean # of Correct Responses	Mean # of words in Retell
Computer	5.71 (1.60)	403 (255.80)
Paper	4.86 (1.57)	344.29 (182.44)

Correlation Matrix among Study Variables

		CELF_RS_SS	CELF_USP_SS	EVT_SS	PPVT_SS	READ_time	Q_time	Q_responses	TNW_Retell
CELF_RS_SS	Pearson Correlation	1							
	Sig. (2-tailed)								
	N	14							
CELF_USP_SS	Pearson Correlation	.321	1						
	Sig. (2-tailed)	.263							
	N	14	14						
EVT_SS	Pearson Correlation	.414	.235	1					
	Sig. (2-tailed)	.141	.419						
	N	14	14	14					
PPVT_SS	Pearson Correlation	.258	.374	.689**	1				
	Sig. (2-tailed)	.373	.187	.006					
	N	14	14	14	14				
READ_time	Pearson Correlation	-.233	.001	.286	-.075	1			
	Sig. (2-tailed)	.423	.997	.322	.731				
	N	14	14	14	14	14			
Q_time	Pearson Correlation	-.680**	-.284	-.030	.101	.421	1		
	Sig. (2-tailed)	.007	.325	.919	.799	.133			
	N	14	14	14	14	14	14		
Q_responses	Pearson Correlation	.645*	.228	.524	.074	.021	-.561*	1	
	Sig. (2-tailed)	.013	.437	.055	.801	.943	.037		
	N	14	14	14	14	14	14	14	
TNW_Retell	Pearson Correlation	.408	.044	.527	.291	-.044	.560*	.556*	1
	Sig. (2-tailed)	.148	.881	.053	.313	.880	.037	.039	
	N	14	14	14	14	14	14	14	14

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Discussion

• This preliminary investigation compared reading comprehension between paper-based and computer-based reading platforms with the following key findings:

• By chance, the computer-based group had significantly higher scores on the EVT and a trend toward higher scores across all other standardized measures, so EVT scores were used as a covariate.

• No significant differences were observed between either the comprehension question accuracy or the TNW on retells suggesting reading interface did not affect comprehension.

• This sample size needs to be increased in order to confirm these findings.

• Item analysis did not reveal any significant differences in the distributions of correct answer by group and type of question.

• Correlations suggest a significant relationship between Working Memory and time to respond to question and rate of correct answers.

• Strong positive relationships between the comprehension question and total number of words in retell suggests that the same skill was being assessed, i.e., comprehension.

• Future directions for this research include:
• Increase the sample size to confirm current findings.
• Add a tablet condition to the experiment.
• Investigate generational differences between interfaces, looking at both younger school age children and older generations.
• Investigate group differences by learning disability status.

Acknowledgements

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