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The Effects of Blended Text-Processing and Linguistic Comprehension Interventions Among Struggling Middle-School Readers

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Reading comprehension is an essential academic skill (Nash & Snowling, 2006; National Reading Panel, National Institute of Child Health and Human Development, 2000). Yet, among students in the eighth grade, approximately 64% of all students and 91% of students with disabilities do not read at proficient levels (National Center for Education Statistics [NCES], 2013). This suggests that when reading grade-level texts, a large percentage of middle-grade readers are not able to accurately connect important ideas in text, form inferences that integrate information in text with general knowledge of the topic, and synthesize common ideas across various texts (NCES, 2013). These data highlight the need for intensive reading interventions that explicitly teach middle-grade struggling readers how to comprehend grade-level texts and acquire content knowledge from the texts they read.

Theoretical Explanations for Reading Failure

In the reading comprehension literature, two classes of models have been proposed to explain how readers comprehend text. One class – component skills models – hypothesizes

that a set of reading component skills underlies reading comprehension. For example, the Simple View of Reading (SVR; Gough & Tumner, 1986; Hoover & Gough, 1990) hypothesizes that reading comprehension is the product of word reading and linguistic comprehension. According to the SVR, word reading retrieves semantic information at the word level, and linguistic comprehension then uses this semantic information to derive sentence- and discourse-level interpretations when listening or reading (Hoover & Gough, 1990). Within this model, both word reading and linguistic comprehension are necessary for comprehension to occur. However, by middle school, linguistic comprehension is the largest determinant of reading comprehension (Adlof, Catts, & Little, 2006; Catts, Hogan, & Adlof, 2005).

A second class of models – process models – suggests that reading comprehension is an iterative and dynamic process whereby the reader integrates information within text and between text and general knowledge to form a coherent mental representation of the situation described (Graesser, Singer, & Trabasso, 1994; McKoon & Ratcliff, 1992; McNamara & Magliano, 2009; van den Broek, Young, Tzeng, & Linderholm, 1999; van Dijk & Kintsch, 1983; Zwan & Radvansky, 1998). As such, process models suggest that a coherent representation of text is established by engaging memory-based and constructionist cognitive processes. *Memory-based processes* are fast acting and translate print into a literal representation of text that is easily accessible in working memory. *Constructionist processes* are strategic in nature and are engaged in by the reader to improve comprehension if the literal representation of text is not sufficient or does not meet the reader's goal for reading (van den Broek, 2005). Process models suggest that linguistic comprehension skills (e.g., inference making, comprehension monitoring, and word and world knowledge) are not only essential for constructing a literal representation of text but are particularly important when the reader's goal is to learn from text (Cain & Oakhill, 1999; Graesser, Singer, & Trabasso, 1994; Kintsch, 1998; van den Broek, 1990; 1997).

Linguistic Comprehension as a Mechanism for Improving Reading Comprehension

Although product and process models of reading comprehension represent different levels of explanation and investigation (Barnes, Ahmed, Barth, & Francis, in press), both suggest that linguistic comprehension (i.e., translation of semantic information to derive sentence and discourse interpretations) is essential for reading comprehension. The importance of linguistic comprehension is also supported by latent modeling of the SVR, indicating that listening comprehension and reading comprehension represent a unitary construct among middle-grade readers (Adlof et al., 2006). Further, more complex models of reading comprehension that have blended component- and process-oriented skills suggest that linguistic comprehension processes such as inference making, strategy use, and word and world

knowledge directly as well as indirectly impact comprehension among middle- and high-school students (Ahmed et al., 2014; Cromley & Azevedo, 2007).

These cross-sectional data suggest that listening to language for the purpose of comprehending oral discourse and reading language for the purpose of understanding text are highly inter-related skills. In both instances, semantic information is used to derive sentence- and discourse-level interpretations (Hoover & Gough, 1990). In the case of listening, acoustic-based, semantic information is received through the ear and is used to understand oral discourse; in the case of reading, graphic-based, semantic information is received through the eye and is used to understand written discourse (Hoover & Gough, 1990). Because listening and reading comprehension both require efficient access, retrieval, and integration of semantic information to derive sentence and discourse interpretations, interventions that affect listening comprehension should result in significant gains in reading comprehension and vice versa (Clarke, Snowling, Truelove, & Hulme, 2010; Gilliam, Gilliam, & Reece, 2012; Hulme & Snowling, 2011; Stuart, Stainthorp, & Snowling, 2008). However, little intervention research has explicitly targeted listening comprehension as a mechanism for improving reading comprehension among older struggling readers.

Recent Syntheses of Adolescent Reading Intervention Research

Although listening comprehension among middle-grade struggling readers has not been specifically targeted, several recent syntheses have reported on reading practices for older struggling readers (grades 4-12) (Edmonds et al., 2009; Elleman, Lindo, Morphy, & Compton, 2009; Hall, 2015; Kamil et al., 2008; Scammacca, Roberts, Vaughn, & Stuebing, 2013; Solis et al., 2012; Wanzek et al., 2013). Collectively, these syntheses note small-to-moderate effects of intervention favoring students in the treatment conditions on proximal measures related to the intervention and researcher-developed and standardized measures of reading comprehension. In addition to strategy-based approaches, older struggling readers consistently benefited from instructional practices that explicitly taught readers how to (a) access or build word and world knowledge; (b) formulate main ideas or summaries of text; and (c) actively engage in text-based discourse. Further, a recent synthesis of the effects of explicitly teaching inference making revealed moderate-to-high effects of measures of inference making and standardized measures of reading comprehension (Hall, 2015).

Listening Comprehension as an Intervention Target

A limited body of literature has directly examined the effect of explicitly teaching listening comprehension and oral language discourse on the language and reading comprehension of struggling readers. Among existing studies, Clarke and colleagues (2010) demonstrated that 20 weeks of oral language training was more effective than text-comprehension training or combined text comprehension and oral language training at improving later reading comprehension performance among children age 8-9 years old with specific reading comprehension difficulties. The oral language intervention targeted expressive language and listening comprehension through conversation between children and a tutor. Students were explicitly taught vocabulary, read and discussed narrative texts, and used figurative language.

Fricke, Bowyer-Crane, Haley, Hulme, and Snowling (2013) demonstrated that a 30 week oral language intervention significantly improved the oral language skills and spoken narrative skills of preschool children and led to significant improvements on a standardized assessment of reading comprehension administered six months post treatment. However, a more recent adaptation of this oral language intervention among 6-year old children with dyslexia failed to demonstrate significant effects on oral language and reading comprehension following nine weeks of intervention (Duff et al., 2014).

In summation, listening comprehension interventions targeting preschool children at risk for reading failure or early-elementary-grade children with specific reading comprehension difficulties have been associated with positive gains on measures of language comprehension and reading comprehension following 20-30 weeks of instruction but not for 9 weeks of instruction. However, there are relatively few of these types of studies, and the effects of these interventions on reading comprehension in later elementary or among middle-grade struggling readers remain uninvestigated.

Summary

In summary, an overview of several recent syntheses of effective practices for older struggling readers and the existing literature on the impact of explicitly targeting listening comprehension revealed that struggling readers in the middle grades can benefit from interventions that include the following instructional practices: (a) accessing or building word and world knowledge; (b) generating inferences within text and between text and general knowledge; (c) formulating main ideas or summaries of text; and (d) engaging in text-based discourse. In addition, systematic and explicit use of listening comprehension and oral language discourse may support and increase the efficacy of these practices. While word and

world knowledge, summarizing text, inference making, and text-based discourse have been examined in previous interventions, the research line summarized in the following differs from other studies in the purposeful use of listening comprehension and oral language discourse to scaffold these activities in support of improved reading comprehension among middle-grade struggling readers.

Listening Comprehension as an Intervention Target Among Middle-Grade Struggling Readers

Through funding from the Institute of Education Sciences, U.S. Department of Education, through Grant R305F100013 to The University of Texas at Austin as part of the Reading for Understanding Research Initiative, two intervention studies have been conducted with the goal of generating empirical evidence about the use of listening comprehension as a mechanism for impacting reading comprehension among middle-grade struggling readers. For both studies, the following research question was addressed: What are the effects of a text-processing reading comprehension intervention that targets listening comprehension through text-based discussions of grade-level informational texts on the vocabulary, inferencing, listening comprehension, and reading comprehension performance of middle-grade struggling readers? Both studies hypothesized that explicit practice in listening comprehension and oral language discourse around text would (a) build up the language processes that restrict middle-grade struggling readers' ability to synthesize semantic information to form the central idea of connected text and (b) lead to improved inference making, listening comprehension, and reading comprehension.

Method and Results

Study 1

Participants and screening procedures. Participants were drawn from one middle school located in the southwestern region of the United States. Students were eligible for the study if they performed at or below one half of a standard error of measurement above the passing score on the Reading State of Texas Assessment of Academic Readiness (STAAR; Texas Education Agency, 2012) in the previous year. Students consenting to participate were randomized in a 1:1 ratio. The final sample included 59 middle-grade students (n = 30 treatment; n = 29 control), with an average age of 14.85 years. Participants were 76% Hispanic, 22% White, and 2% other. Approximately 26% of students were identified as English as a second language (ELLs) and 5% as receiving special education.

Intervention. Students in the treatment condition received approximately 28 hours of intervention delivered in small groups of 3-5 students. Key components of the treatment included (a) accessing and building background knowledge through explicit instruction and repeated exposure to the target words throughout each unit and across multiple units; (b) explicit practice in the formation of inferences that required integration of information within text as well as between text and general knowledge; (c) summarization of text that required students to identify key words and important details in text and then integrate this information into a concise summary that was shared orally and received targeted feedback from the tutor; and (d) practice answering overarching questions on the unit's content that required students to integrate information across the unit's texts.

The intervention explicitly and systematically used oral language discourse and listening comprehension to scaffold reading comprehension. All texts were read orally to students. Tutors then engaged students in discussions about the text and scaffolded the summarization of text. Oral responses made transparent student retrieval and integration of information in text and relevant background knowledge, which provided tutors access to the students' comprehension process. If a student's oral summary was incomplete or in some way incorrect, the tutor directed the student back to the text in order to identify correct information, helped the student to retrieve relevant background knowledge, and assisted the student in reprocessing relevant information in order to derive a concise and correct summary of the text.

Results. Main-effects analyses using pretest as a covariate (ANCOVA) were conducted on measures of vocabulary, reading comprehension, inference making, and language comprehension. These findings are reported fully in McCulley (2015). Results yielded significant effects on the Curriculum-Based Measure-Vocabulary, $F(1, 52) = 8.21$, $p < .01$, $d = .78$.

No statistically significant effects were found on unstandardized or standardized measures of reading comprehension, inference making, or language comprehension, although the adjusted means favored the treatment condition on eight of nine measures: Woodcock-Johnson III-Passage Comprehension subtest (WJ-III, Woodcock, McGrew, & Mather, 2001), $F(1, 52) = .92$, $p > .05$, $d = .26$; STAAR-Reading, $F(1, 52) = 2.64$, $p > .05$, $d = .44$; Curriculum-Based Measure-Summarization of Text, $F(1, 52) = 1.17$, $p > .05$, $d = .29$; Curriculum-Based Measure-Inference, $F(1, 56) = .07$, $p > .05$, $d = .07$; Test of Language Competence-Expanded Edition Listening Comprehension, Making Inferences subtest, (TLC; Wiig & Secord, 1998) ($F(1, 52) = 2.48$, $p > .05$, $d = .43$; Clinical Evaluations of Language Fundamentals-5 Formulating Sentences subtest (CELF-5; Semel, Wiig, & Secord, 2013) , $F(1, 52) = 1.09$, $p > .05$, $d = .28$; Clinical Evaluations of Language Fundamentals-5 Recalling Sentences subtest, $F(1, 52) = .94$, $p > .05$, $d = .26$; Woodcock-Johnson III-Oral Comprehension subtest, $F(1, 52) < .001$, $p > .05$, $d = 0$.

Table 1

Demographics for Study 1

	Control	Treatment
Race/Ethnicity		
African American	0	0
Hispanic	23	19
Caucasian	6	6
Other	0	1
Special Education	3	0
English as a Second Language	6	8
Reduced-Price/Free Lunch Status	NA	NA
Grade		
6	9	9
7	16	10
8	4	7
Male	15	14

Table 2

Treatment Effects on Outcome Measures for Study 1

	Control				Treatment				Cohen's *d*
	Adjusted *M*	*M*	*SD*	*N*	Adjusted *M*	*M*	*SD*	*N*	
Listening Comprehension									
TLC-Inference	7.71	7.34	1.97	29	8.79	9.19	2.97	26	.43*
CELF-5 FS	8.57	8.38	3.35	29	9.32	9.53	2.50	26	.28*
CELF-5 RS	7.76	7.59	1.80	29	8.11	8.31	2.35	26	.26*
WJ-III OC	95.01	95.48	11.96	29	95.03	94.50	8.83	26	0
Reading Comprehension									
WJ III-PC	85.75	84.38	11.86	29	87.40	88.92	7.65	26	.26*
STAAR	1515.20	1511.59	67.96	29	1541.28	1545.31	82.10	26	.44*
Proximal Measures									
CBM-Summary	12.80	12.93	7.11	29	14.76	14.63	8.43	26	.29*
CBM-Inference	3.56	3.55	1.96	29	3.43	3.43	2.10	26	.07*
CBM-Vocabulary	16.69	16.14	3.81	29	19.27	19.88	3.90	26	.78**

Notes. TLC-Inference = Test of Language Competence, Listening Comprehension, Making Inferences; CELF-5 FS = Clinical Evaluation of Language Fundamentals-Formulating Sentences; CELF-5 RS = Clinical Evaluation of Language Fundamentals-5 Recalling Sentences; WJ III-OC = Woodcock Johnson-III Oral Comprehension; WJ III-PC = Woodcock Johnson III-Passage Comprehension; STAAR = State of Texas Assessment of Academic Readiness; CBM-Summary = Curriculum-Based Measure of Summary; CBM-Inference = Curriculum-Based Measure of Inference; CBM-Vocabulary = Curriculum-Based Measure of Vocabulary.

* $p < .05$. ** $p < .01$.

Study 2

Participants and screening procedures. Students were drawn from three middle schools located in the mid-western region of the United States. Students were eligible for the study if they performed at or below Basic on the Missouri Assessment Program – Reading Test (MAP; Missouri Department of Elementary and Secondary Education, 2014). Students consenting to participate were randomized in a 2:1 ratio. The final sample consisted of 134 middle-grade students (n = 83 treatment; n = 51 control), with an average age of 12.90 years. Participants were 84% White, 9% African American, 3% Hispanic, and 5% Other. No students were identified as ELLs; 31% were identified as receiving special education.

Intervention. Students in the treatment condition received approximately 17 hours of intervention delivered in small groups of 4-6 students. Key components of the treatment included (a) identifying key words and main ideas through text-based discourse; (b) synthesizing information within a single text for summarization and making inferences; and (c) integrating information across multiple texts. Texts gradually increased in length (several sentences to several paragraphs). Tutors gradually released targeted corrected feedback to improve the quality of students' main idea statements.

The intervention explicitly and systematically used listening comprehension and oral language discourse around text to scaffold students' comprehension of grade-level expository texts. All texts were read aloud either by the tutor or a student. Tutors then engaged students in discussions about the text in order to check for understanding, identify key words in text, and identify relevant information to include in a brief summary of the text. Oral responses made transparent how accurately students retrieved and integrated information in text and integrated this text-based information with relevant background knowledge on the topic. If a student's oral summary was incomplete or inaccurate, the tutor directed the student back to the text in order to identify relevant information and helped the student to access, retrieve, and integrate relevant background knowledge with this text-based information.

Results. Main-effects analyses using pretest as a covariate (ANCOVA) were conducted on measures of reading comprehension, inference making, language, and recall of vocabulary. Results yielded significant effects in terms of linguistic comprehension. These findings are reported fully in Barth et al. (in press). Specifically, we found significant treatment effects on the Test of Language Competence-Reasoning, $F(1, 119) = 5.34$, $p = 0.023$, $\eta_p^2 = .043$, Hedges g =.33, and Curriculum-Based Measure-Vocabulary, $F(1, 131) = 7.00$, $p = .009$, $\eta_p^2 = .051$, g = .39. We also found significant effects on the Curriculum-Based Measure-Key Word and Main Idea $F(1, 125) = 6.36$, $p = .013$, $\eta_p^2 = .048$, $g = .45$. No statistically significant differences were found on standardized measures of reading comprehension (i.e., Woodcock Johnson III-Passage Comprehension, $F(1, 125) = .062$, $p = .804$, $\eta_p^2 = .002$, g = -.06, and Gates MacGinitie Reading

Test (Gates, 2000), $F(1, 124) = .329$, $p = .567$, $\eta_p^2 = .001$, $g = .00$) or listening comprehension (i.e., Woodcock Johnson III-Listening Comprehension, $F(1, 126) = .084$, $p = .773$, $\eta_p^2 < .001$, $g = .03$). After applying the Benjamini-Hochberg correction to control for Type I error, the Test of Language Competence-Reasoning did not remain significant.

General Discussion

Overall, these two studies provide preliminary support for integrating listening comprehension and oral language discourse around text into text-based reading comprehension interventions for struggling readers in the middle grades. Across both intervention studies, the content of the intervention and learning goals were chosen to reflect our interest in understanding whether improvements in listening comprehension and oral language discourse around grade-level informational texts would lead to improved listening comprehension and reading comprehension. As illustrated, we found small-to-moderate effects of the intervention on skills explicitly modeled and practiced in the intervention such as understanding target vocabulary and synthesizing concise main idea or summaries of text.

We hypothesized that improvements in the linguistic skills targeted in the intervention would generalize to students' general listening and reading comprehension. However, significant effects on proximal measures closely aligned to the intervention did not transfer to more global standardized measures of comprehension. In both studies, the interventions utilized informational science texts to facilitate oral language discourse. Intervention texts and the oral language discourse surrounding these texts did not include the general topics, narrative text structure, or literal question types and formats (i.e., multiple choice or short answer) that are frequently used to probe understanding on standardized assessments of listening or reading comprehension. Although effects were not statistically significant on standardized measures of listening or reading comprehension, the adjusted means generally favored the treatment condition following a small number of intervention hours (i.e., 30 hours in Study 1 and 17 hours in Study 2). Our interpretation of this trend is that there is a practical effect of improved linguistic comprehension on general listening and reading comprehension, but the effect is small. Further, both studies were underpowered to detect small, significant effects.

We consider the findings of Study 1 and 2 to be promising given that the interventions lacked substantial practice (greater than 75 intervention sessions). Substantial practice is likely required to facilitate transfer to global measures of comprehension due to the complex nature of linguistic comprehension. Thus, linguistic comprehension requires the ability to efficiently integrate semantic information into sentence- and discourse-level translations. This semantic information includes knowledge of word forms (i.e., grammatical class, spellings, and

pronunciations) as well as meanings (Perfetti, 2007). Effective practice (i.e., reading) is then required to learn how to accurately and quickly engage this information in order to understand the central message of a text, form inferences, and make generalizations across texts. Because struggling readers read significantly less text than their typically developing peers (Foorman et al., 2006; Kuhn & Schwanenflugel, 2009), their process of accessing, retrieving, and integrating semantic information into larger meaningful units is both less accurate and less efficient, even when struggling readers in the middle grades have the requisite knowledge base to do so (Barnes et al., 2015; Barth, Barnes, Francis, Vaughn, & York, 2015). For this reason, significant effects on proximal measures following only 17-30 hours of intervention are promising.

Limitations and Future Research

Limitations. Results of Study 1 and 2 are subject to several limitations. First, the comparisons are underpowered by the small sample size. Second, samples differed across the studies. Selection criteria for participation as well as the sample demographics varied considerably, with Study 1 including a significantly larger number of ELLs than Study 1 (26% vs. 0%). Third, although significant effects were found on proximal measures closely aligned to the interventions, those measures differed across studies both in nature and psychometric properties. Finally, the intervention was of short duration, limiting the amount of practice available to students for using listening comprehension and oral language discourse as a method of building general listening and reading comprehension.

Future research. First, although vocabulary was not a major focus of either study, students quickly learned target words through multiple exposures to the words in text and in oral discourse. Future research is needed to understand how implicit instruction may be used to facilitate development of other language targets. Second, Study 1 included a large sample of ELL students. Future research may explore how various subgroups of students such as ELLs or students with learning disabilities respond to interventions that use linguistic comprehension as a scaffold to support comprehension. Third, both studies represent multicomponent interventions; therefore, it is not possible to determine the relative impact of the individual components. Future research should isolate the particular effects of various components in order to gain an understanding of whether components are active or inactive in facilitating comprehension among middle-grade struggling readers. Fourth, the results of the two studies suggest that instruction using oral language discourse and listening comprehension as instructional scaffolds holds promise for improving general listening and reading comprehension. Future research is required to understand whether substantial practice leads to transfer on general comprehension measures. Finally, several recent randomized control trials demonstrate small-to-moderate gains on standardized measures of comprehension (Edmonds et al., 2009; Elleman et al., 2009; Hall, 2015; Kamil et al., 2008; Scammacca et al.,

2013; Solis et al., 2012; Wanzek et al., 2013). Future research is needed to understand whether blending linguistic comprehension into these well-conceptualized text-based approaches facilitates greater transfer to global measures of comprehension.

Table 3

Demographics for Study 2

	Control *N* = 51	Treatment *N* = 83
Race/Ethnicity		
African American	5	7
Hispanic	2	2
Caucasian	45	67
Other	1	6
Special Education	10	32
English as a Second Language	0	0
Reduced-Price/Free Lunch Status	38	63
Grade		
6	19	32
7	20	35
8	12	16
Male	22	49

Table 4

Treatment Effects on Outcome Measures for Study 2

	Control				Treatment				Hedge's *g*
	Adjusted *M*	*M*	*SD*	*N*	Adjusted *M*	*M*	*SD*	*N*	
Listening Comprehension									
WJ III-OC	97.66	97.51	9.06	49	97.83	97.92	10.88	79	.03
TLC-Reasoning	100.09	101.46	13.38	46	104.44	103.62	13.00	76	.33 *
Reading Comprehension									
WJ III-PC	90.72	91.19	8.90	48	90.08	89.80	12.71	79	-.06
GM	481.35	482.87	23.88	47	481.45	480.54	27.67	79	.00
Proximal Measures									
Vocabulary	13.29	13.39	5.28	51	15.64	15.58	6.31	83	.39 **
Key Word and Main Idea	6.74	6.73	2.57	49	7.87	7.86	2.49	81	.45 **

Notes. WJ III-OC = Woodcock Johnson-III Oral Comprehension; TLC = Test of Listening Comprehension Test-Adolescent; GMRT = Gates-MacGinites Reading Test; WJ III-PC = Woodcock Johnson-III Passage Comprehension.

* $p < .05$. ** $p < .01$.

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