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Mediating Effects of Inferencing on the Relation Between Component Skills and Reading Comprehension of Struggling Adult Readers: Variations by Assessment Type

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Abstract

This study examined whether inferencing mediated the relations between language-based component skills and reading comprehension (sentence and passage-level comprehension) of struggling adult readers, after controlling for other lower-level skills. Word reading fluency and vocabulary knowledge were predictive of sentence-level comprehension. Inferencing mediated the relation between vocabulary and passage-level comprehension. Component skills varied as a function of comprehension measure administered. These findings suggest a need to administer multiple measures of comprehension to understand the underlying component processes involved in struggling adults' reading comprehension skills

Keywords: inferencing, reading comprehension, struggling adult readers

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Previous studies with struggling adult readers have found that component skills within the Simple View of Reading (SVR) framework, such as word reading (e.g., decoding) and language-based reading skills, (e.g., oral vocabulary knowledge, listening comprehension; Tighe & Schatschneider, 2016) uniquely predict reading comprehension. However, the SVR does not directly specify higher-order processing of text, such as inferencing skills. Empirically tested models, including the Direct and Inferential Mediational Model (DIME: Cromley & Azevedo, 2007) and the Inferential Mediation Model (IMM: Kopatich et al., 2019) have specifically found that inferencing skills mediate the relation between language-related skills (e.g., oral vocabulary) and the reading comprehension of older grade-school students and college-aged young adults. To our knowledge, research examining the relation of inferencing abilities to reading comprehension and to other reading component skills is absent in the literature on struggling adult readers.

Component reading skills may also differentially predict various types of reading comprehension measures. Studies with struggling adult readers have utilized a multitude of reading comprehension assessments that have varied on many dimensions (e.g., passage length, passage type, response format, duration, and number of items; Tighe & Schatschneider, 2016). The relations of lower-order component skills and higher-order text processing abilities to reading comprehension may vary according to the type and depth of knowledge required by differing comprehension assessments (see Keenan, Betjemann, and Olson, 2008 for related with work children). This study addressed two research questions with a sample of struggling adult readers:

1. Does inferencing mediate the relations between langauge-based component skills (morphological awareness, vocabulary, listening comprehension) and reading comprehension controlling for other lower-level skills (decoding, word reading fluency)?
2. Do the shared and unique contributions of component skill predictors (direct and indirect) vary by the type of reading comprehension assessment?

Method

Participants

Participants included 95 students enrolled in adult literacy programs and 30 students enrolled in remedial reading classes at a community college (total $N = 125$). The majority of the participants were female (71.2%) with a mean age of 29 ($SD = 11.38$). The sample was predominantly Hispanic (52%) followed by Caucasian (20.8%), and African American (10.4%).

Measures

Decoding

Decoding skills were assessed utilizing the Word Identification and Word Attack subtests of the Woodcock Reading Mastery Test (WRMT-III).

Silent Word Reading Fluency

Word reading fluency was assessed with computer-adapted versions of the Test of Silent Word Reading Fluency- Second Edition (TOSWRF-2) and the Test of Silent Contextual Reading Fluency-Second Edition (TOSCRF-2).

Listening Comprehension

The Listening Comprehension subtest of the WRMT-III was administered to participants in a one-on-one setting.

Morphological Awareness

Morphological awareness was assessed with computerized versions of the experimental Derivation and Decomposition tasks (Carlisle, 2000).

Vocabulary Knowledge

Vocabulary was assessed with the Word Comprehension subtest of the WRMT-III and Vocabulary subtest of the GMRT-4 (Level 6). The GMRT-4 was administered on a computer.

Oral Reading Fluency

The Oral Reading Fluency subtest of the WRMT-III was administered one-on-one with each participant.

Inference Making

Inference making was assessed with a computerized version of the Component Processes task (Hannon & Daneman, 2001), tapped into text integration, text inferencing, knowledge integration, and knowledge component processes. The current study used the knowledge integration and knowledge access component processes in its analyses.

Reading Comprehension

Reading comprehension was measured with the Passage Comprehension subtest of the WRMT-III and the Comprehension subtest of the GMRT-4 (Level 6). The GMRT-4 was given on a computer.

Results

Research Questions 1 and 2: Predictive Mediation Reading Comprehension Models

Descriptive measures are presented in Table 1. To address our research questions, we specified path mediation models with four latent direct effects predictors and two observed direct

effects predictors separately by reading comprehension measure (WRMT-III Passage Comprehension and GMRT-4 Reading).

Table 1

Descriptive Statistics for all Measures

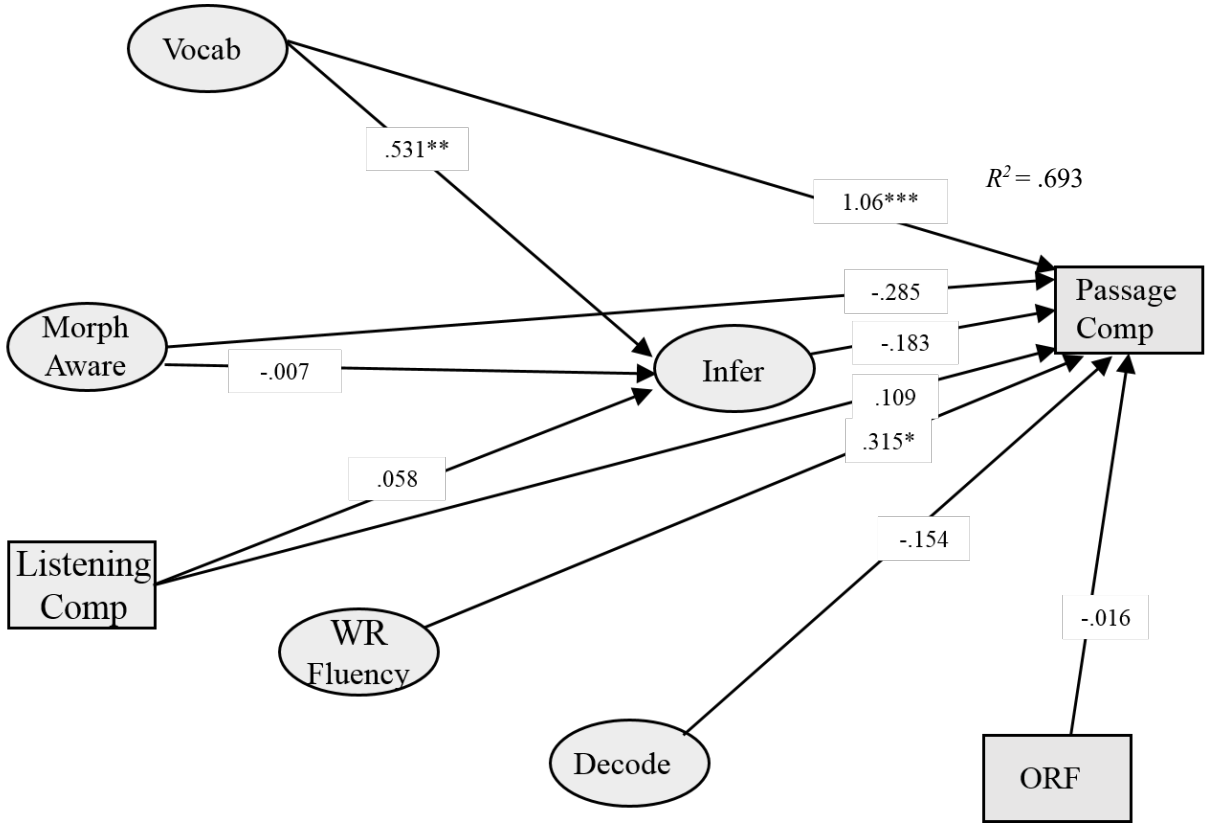
Measure	*N*	M (*SD*)	Min/Max
Decoding			
WRMT Word ID	125	77.09 (13.25)	55-118
WRMT Word Attack	125	81.99 (15.04)	55-123
Silent Word Reading Fluency			
TOSCRF	118	68.81 (13.60)	40-111
TOSWRF	118	71.93 (14.05)	40-107
Oral Reading Fluency			
WRMT ORF	125	86.65 (11.70)	57-119
Morphological Awareness			
Derivation	118	.52 (.25)	0-.93
Decomposition	118	.78 (.20)	0-1
Listening Comprehension			
WRMT LC	125	79.34 (14.23)	55-110
Vocabulary Knowledge			
WRMT Word Comp	125	73.10 (11.65)	55-105
GMRT Vocabulary	117	527.53 (33.17)	433-600
Inferencing			
Knowledge Integration	116	.58 (.08)	.41-.79
Knowledge Access	116	.71 (.13)	.42-.98
Reading Comprehension			
WRMT Passage Comp	125	80.38 (13.06)	55-114
GMRT Reading	115	506.49 (31.26)	420-594

Note: Age-based standard scores are reported for all norm-referenced assessments. Please note the morphological awareness tasks and the inference-based Knowledge Integration and Access tasks are reported as percentages. WRMT = Woodcock Reading Mastery Test – Third Edition. Word ID = Word Identification. TOSCRF = Test of Silent Contextual Reading Fluency – Second Edition. TOSWRF = Test of Silent Word Reading Fluency – Second Edition. ORF = Oral Reading Fluency. LC = Listening Comprehension. Word Comp = Word Comprehension. GMRT = Gates-MacGinitie Reading Test-Fourth Edition

The mediation model with the WRMT-III Passage Comprehension test as an outcome exhibited good model fit ($\chi^2(43) = 50.60$, $p = .199$, CFI = .992, TLI = .986, RMSEA = .038, SRMR = .032, and AIC = 3686; see Fig. 1). Word reading fluency and vocabulary knowledge exhibited significant, unique direct effects (unique R^2 = 5.8 and 4.2%). The predictors jointly accounted for a substantial portion of the passage comprehension variance (R^2 = 69.3%). There were no significant mediation effects.

Figure 1

Predictive Model of WRMT-III Passage Comprehension Subtest

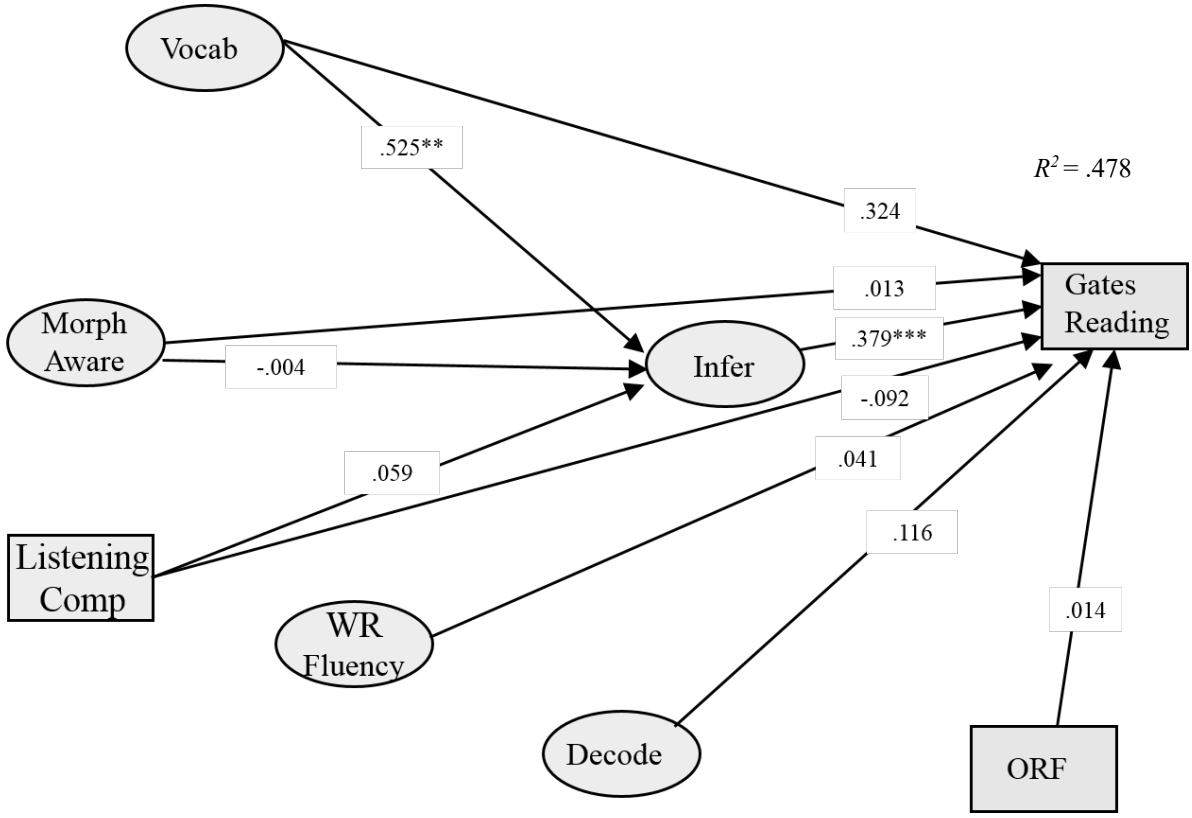


Note: These are standardized parameter estimates. Correlations among latent and observed predictor variables were modeled but are not included in this figure because of space constraints. All correlations were significant, $p < .05$, with the exception of listening comprehension and word reading fluency ($p > .05$). Passage Comp = Passage Comprehension from the Woodcock Reading Mastery Test – Third Edition. Infer = Inference Skills. WR = Word Reading. Morph Aware = Morphological Awareness. Vocab = Vocabulary. Listening Comp = Listening Comprehension. ORF = Oral Reading Fluency.

The second mediation model was identical to the first except the GMRT-4 Reading subtest was the outcome (See Fig. 2). This model exhibited good model fit ($\chi^2(43) = 45.39$, $p = .373$, CFI = .997, TLI = .995, RMSEA = .021, SRMR = .030, and AIC = 3708). The predictors jointly accounted for a large portion of the GMRT-4 Reading subtest variance ($R^2 = 47.8\%$). Vocabulary was indirectly related to reading comprehension via inferencing as a mediator (β = .199, 95% CIs [.040, .358]; unique $R^2 = 7.9\%$).

Figure 2

Predictive Model of GRMT-4 Reading Subtest



Note: These are standardized parameter estimates. Correlations among latent and observed predictor variables were modeled but are not included in this figure because of space constraints. All correlations were significant, $p < .05$, with the exception of listening comprehension and word reading fluency ($p > .05$). Infer = Inference Skills. WR = Word Reading. Morph Aware = Morphological Awareness. Vocab = Vocabulary. Listening Comp = Listening Comprehension. ORF = Oral Reading Fluency.

Discussion

Overall, inferencing had stronger unique effects for the GMRT-4 Reading subtest than for the WRMT-III Passage Comprehension subtest when controlling for other reading-component skills (e.g., fluency, decoding). This is not surprising, given that the Reading subtest of the GMRT-4 taps into inferencing skills (Magliano et al., 2007). When controlling for word reading fluency, decoding, and oral reading fluency, inferencing mediated the relation between the vocabulary and the GMRT-4. This finding supports recent studies that have found a similar mediating relationship between vocabulary and reading comprehension when controlling for other reading-related skills (Ahmed et al., 2016). A mediating relationship was not observed between GMRT-4 and morphological awareness or listening comprehension.

We also observed strong unique effects of vocabulary and word reading fluency to WRMT-III Passage Comprehension. This finding suggests that shorter paragraph and sentence-level comprehension assessments may draw on lower-level reading components skills (Keenan et al., 2008). These results also point toward the importance of word reading fluency and vocabulary knowledge to shorter paragraph/sentence-level reading comprehension.

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