A Comparison of Two Directed Monitoring Conditions for Improving Comprehension

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Abstract: *Purpose*: The purpose of the current study was to test the hypothesis that children, specifically poor comprehenders may demonstrate better comprehension monitoring and comprehension performance under conditions that 1) place emphasis on meaning rather than decoding, 2) do not impose undue demands on working memory and processing capacity, and 3) allow for more processing time.

Method: Fourth grade skilled (n = 20) and unskilled comprehenders (n = 20) listened to passages under two directed monitoring conditions. In one condition, children listened to entire passages (Listen Through; LT) and in the other condition children listened to passages one sentence at a time (Stop, Think and Monitor; STAMP). Participants were asked to listen for anomalous information, to report when and if they identified things in the passages that did not make sense, and to explain why they felt the information was erroneous. All children were asked to recall passages and answer explicit and implicit (inferential) questions about the passages after they listened to them.

Results: Skilled comprehenders performed better on identifying and resolving anomalous information under both directed monitoring conditions. While skilled comprehenders performed better on comprehension outcomes (recall, answering questions) in the LT condition, this was not true in the STAMP condition. Both groups performed comparably on comprehension outcomes, specifically in answering implicit questions in the STAMP condition. Partial correlation coefficients between the number of implicit questions answered correctly and detection and resolution of anomalies was not significant after controlling for the effects of language on the outcome variables.

Conclusions: Further research is needed to identify the most effective methods and procedures for teaching students to comprehend what they are hearing or reading. Underlying factors such as language ability and working memory may mediate the benefit received from an approach or strategy designed to improve comprehension performance. Our study suggests that the measure of comprehension chosen (recall or answering questions) to evaluate comprehension performance may dictate the type of intervention or strategy that is most effective.

Keywords: Comprehension monitoring, comprehension, poor comprehends.

Children who are poor comprehenders represent approximately 5-10% of school age children with reading problems [1-3]. These children demonstrate below-average comprehension despite typical or near-typical word-level reading abilities. Poor comprehenders often exhibit marked difficulty answering questions that require inferences that are critical for understanding spoken and written discourse and for monitoring their comprehension [2, 4, 5].

Comprehension monitoring may be defined as "decisions about one's understanding of what has been read or heard" and are made during the comprehension process. This ability is said to be a component skill of comprehension. Comprehension monitoring begins to develop early and requires conscious effort and attention to meaning [6-8]. Some researchers have suggested that poor comprehension monitoring may contribute to difficulties generating inferences and may interfere with overall comprehension performance [9]. Procedures for teaching children to monitor their comprehension monitoring have been developed in an effort to improve inference generation and ultimately comprehension performance [10-13]. Traditionally, comprehension monitoring is encouraged by asking children questions such as "Is there information that doesn't agree with what I already know? and, "Are there ideas that don't fit together? or "How do I know?" [14-17].

It has been shown that good comprehenders are more likely to engage in comprehension monitoring than poor comprehenders [18, 19]. For example, Oakhill, Hartt and Samols [5] examined the impact of comprehension monitoring skill on comprehension performance for 24 children between the ages of 9 and 10 (12 good and 12 poor comprehenders). Children were asked to read two passages in a spontaneous monitoring condition and two in a directed monitoring condition. All the passages contained anomalous words and sentences. In the spontaneous monitoring condition, children were not given any direction about monitoring their comprehension. The number of

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repetitions, hesitations and self-corrections during oral reading were recorded as an indirect measure of monitoring. In the directed monitoring condition, children were told that passages contained words and sentences that might not make sense and were asked to underline them. Children were also asked to explain why they felt the text they had underlined did not make sense. The number of words and sentences underlined were analyzed as a direct measure of comprehension monitoring. Children were given the option in both conditions of reading aloud or silently. Measures of working memory were obtained to examine correlations between comprehension monitoring and memory skill. All of the passages contained inconsistencies at the word or sentence level.

The good and poor comprehenders had similar numbers of repetitions, hesitations and self-corrections in the spontaneous monitoring condition. Both groups underlined a similar number of anomalous words and sentences in the directed monitoring condition but the good comprehenders were more accurate in their underlining decisions. There was a positive correlation between working memory and the ability to detect anomalies in the directed monitoring condition. Specifically, the impact of working memory on performance was more pronounced when anomalous sentences were separated by one or more sentences than when they were in adjacent sentences suggesting that children with poorer working memory may perform better when anomalous information is in close proximity in passages.

Although the correlation between detecting anomalous information and comprehension performance was significant in the directed monitoring condition, children's ability to answer comprehension questions was not observed to improve in the directed as compared to the spontaneous monitoring condition. This finding is contrary to studies that highlight the importance of comprehension monitoring for improving comprehension performance (references). That is, while good readers were better at monitoring their comprehension than poor readers, this was not associated with significantly better comprehension performance. One explanation given by Oakhill [5] for their failure to find a relationship between comprehension monitoring and comprehension performance was that children may have been more focused on decoding than constructing meaning. The authors stated that it was possible that the act of reading may have interfered with children's ability to monitor their comprehension and impacted comprehension performance.

Another reason for a failure to find a relationship between comprehension monitoring and comprehension performance may have been related to number of anomalies contained in the passages. In Oakhill [5], children were asked to read passages that contained multiple syntactic, semantic and spelling errors. It is possible that the presence of multiple problems in the passage may have made it too difficult for children to integrate information into a coherent representation for use in generating inferences and in offline comprehension tasks.

One additional explanation for the fact that children did not demonstrate improved comprehension in the directed monitoring condition may have been related to processing time. Discourse research has shown that processing speed is a critical factor in whether information is integrated across sentences and inferences are generated in service of the integration process [20, 21]. It is possible that the children in this study simply needed more processing time to perform the task.

Since the ultimate goal of teaching children to use comprehension monitoring strategies is to improve comprehension performance, it is important to identify contexts that are associated with positive correlations between the two tasks. We hypothesized that children may perform better in a condition that allowed for slightly more processing time and focused their attention on each sentence, rather than the passage as a whole. If children performed better in the sentence-by-sentence condition, it would provide further support for the hypotheses proposed by Oakhill *et al.* [5] that children, specifically those with poor comprehension may experience basic processing limitations that interfere with their ability to monitor and comprehend what they were reading. If this is true, asking them to monitor their comprehension in certain conditions may not be associated with improved comprehension performance.

The purpose of the current study was to extend the findings of Oakhill *et al.* [5] by testing their hypotheses that children, specifically poor comprehenders may perform better under conditions that 1) place the emphasis on meaning rather than decoding, 2) do not impose undue demands on working memory and processing capacity, and 3) allow for more processing time. We asked children to take part in two directed monitoring conditions. In one condition, children listened to passages in their entirety (Listen through (LT) - focus on the whole passage), and in the other

they were asked to process the passage one sentence at a time (Stop, Think and Monitor (STAMP) - focus on each sentence within the whole passage). Our approach in both conditions was to remove the reading requirement, to introduce only one anomaly in each passage and to place anomalous information in close proximity within each passage. We hypothesized that under the latter condition (STAMP), there would be evidence of improved comprehension performance particularly for children with poor comprehension skills.

METHOD

Participants

Two groups of 9-10 year olds participated in this study: 20 skilled comprehenders (12 girls, 8 boys) and 20 less skilled comprehenders (13 girls, 7 boys). Participants were recruited from local schools in the county school district in West Alabama. All children in fourth grade classrooms were given informed consent forms and asked to take them home. Children whose parents agreed for them to participate took part in eligibility testing. The first 20 children who met the criteria for skilled and less skilled comprehenders (described below) participated in the study. The majority of participants were from middle-class families. A total of 11 participants were Caucasian and 29 were African American. All children were monolingual English speakers. None of the participants presented with hearing impairment, visual impairment, gross neurological impairment, oral-structural anomalies, or emotional or social disorders.

All children were given measures of reading, language, nonverbal reasoning, verbal working memory, and comprehension. The *Woodcock Reading Mastery Test-Revised* (WRMT-R [6] was used to identify participants who were eligible for participation in the study. The *WRMT-R*is a comprehensive, individually administered assessment of reading ability that provides scores for word level reading (decoding) and passage level reading (comprehension). The internal consistency of the subtests is reported to be .91 or greater. No test-retest data are reported for this measure.

Inclusion Criteria

Children who obtained raw scores at grade level for passage and word-level reading and obtained passage comprehension and word identification percentile scores at 40 and above were eligible for participation in the skilled comprehender group [6]. Less skilled comprehenders were identified as children who obtained passage level reading comprehension raw scores that were at least one year below their current

Table 1: Descriptive Statistics for All Participants

	All Children (n = 40)	Skilled Comprehenders (n = 20)	Less Skilled Comprehenders (n = 20)	X^2 or *t*-statistic*	*p*-value	Cohen's *d*
Gender (% male)	37.50% (15)	40.00% (8)	35.00% (7)	0.32	0.75	
Mean age (months)	120.23 (5.05)	119.15 (3.76)	121.30 (5.98)	-1.36	0.18	
TONI-3 standard scores	93.88 (8.09)	95.25 (8.28)	92.50 (7.63)	1.07	0.29	
Passage Comprehension standard scores	98.35 (9.56)	105.95 (6.52)	90.75 (4.84)	8.37	<0.01	2.65
Word Identification raw scores	67.8 (7.93)	72.25 (3.35)	63.35 (8.73)	4.25	.027	1.35
Word Identification standard scores	102.3 (9.05)	107.20 (5.34)	97.4 (9.49)	4.04	<.001	1.27
CELF-4 standard scores	91.50 (17.17)	100.45 (14.17)	81.85 (14.75)	3.99	<0.01	1.28
VWM raw scores	16.25 (3.00)	18.10 (2.44)	14.40 (2.28)	4.86	<0.01	1.57

Note. *Chi-square comparing gender and independent-samples *t*-tests comparing other variables between skilled and less skilled comprehender groups. Values represent M (SD) or % (n).

grade-level. We did not want to exclude children from the less skilled group on the basis of their decoding skill. Therefore, decoding skill as measured on the WRMT word identification and word attack subtests was allowed to vary for the participants in the less skilled group. There were 6 children in the less skilled group whose word identification scores were below the 40th percentile.

Tests Administered

All children were given the *Clinical Evaluation of Language* Fundamentals (*CELF*). The *CELF*is an individually administered assessment of oral language comprehension and production abilities (*CELF-4*; [23]). The*CELF* is used primarily to diagnose children and young adults ages 5-21 with language disorder. Children were given the *Test of Nonverbal Intelligence-3* (*TONI-3*, [24]) to rule out potential reasoning problems. The *TONI* is a nonverbal test of problem solving that requires students to point to the correct responses. Children in both groups were given a measure of verbal working memory to assess their abilities to store and process verbal information that is described below [25]. This task is an experimental task and has been shown to differentiate among children with and without memory limitations.

Descriptive statistics were computed for demographic, language, reasoning and memory variables for the entire sample, skilled comprehenders only, and less skilled comprehenders only (Table **1**). Results of independent-samples *t*-tests showed that age, gender, and nonverbal reasoning (TONI) scores were similar between skilled and less skilled comprehenders, and skilled comprehenders scored significantly higher on language, reading and memory measures. Half of the children (n = 10) in the less skilled group scored below 82 (-1.25 SD from the mean) on the *CELF-4*, which is consistent with a classification of language impairment [26]. All of the children in the less skilled comprehender group were experiencing significant difficulty in the classroom with reading comprehension and were receiving additional instruction from special educators, tutors and reading specialists, although not all of the children were formally classified as language impaired or learning disabled.

Tasks

Verbal Working Memory

The verbal working memory task was designed to measure the ability to store and process verbal information [25]. The task was presented *via* audiotape. Children were told that they were going to play a listening game and to listen carefully. They were instructed to judge the accuracy of each sentence they heard immediately after it was presented. Children listened to 3 lists containing 2 sentences, 3 lists containing 3 sentences, and 3 lists containing 4 sentences. The sentences were an average of 5 words in length. A bell signaled the end of each list. After hearing the bell, children were asked to tell the examiner the last word from each sentence in the list. The verbal working memory score was the total number of words accurately recalled. The maximum score possible for the VWM task was 27.

Directed Monitoring Conditions

Children participated in two directed monitoring sessions conducted by the first author. The first directed monitoring condition was called the listen-through condition (LT). In the LT condition the examiner read a narrative to the child in its entirety and then asked children to answer comprehension questions and to recall the story. The second directed monitoring condition was called Stop, Think and Monitor (STAMP). In the STAMP condition the examiner read the narrative aloud to the student, one sentence at a time before asking them to answer questions and recall the story. In both conditions, children were asked to listen carefully because there was an error in the passage and they needed to find it and report.

Each passage contained one internal consistency problem in the form of contradictory information for a total of 4 anomalies (maximum possible score = 4). For example, in the passage related to a family trip, children heard the sentence, “The restaurant was closed so Ellen couldn’t order a juicy burger” immediately before hearing the sentence, “After Ellen had eaten the burger for lunch, she felt much better.” Because children with comprehension problems often have poor working memory and this may impact their proficiency in generating inferences [1] all of the inconsistencies (or anomalies) were placed in close proximity to one another (within one or two sentences) as is consistent with research measuring comprehension monitoring ability [5]. The outcome variable related to identifying the anomalies contained in the passages was referred to as *detection*.

Other outcome variables related to comprehension monitoring included resolutions and repetitions. When

children detected an anomaly in a passage (e.g. detection), they were asked to explain why they felt it did not make sense. If children were accurate in detection and in explaining why the anomaly did not make sense, they were given credit for resolving the anomaly. The outcome variable related to this measure was called *resolution.* The total possible outcome score for resolution was 4.

Participants were informed that in both conditions they were free to ask the examiner to stop and repeat a sentence at any time. If children asked the examiner to repeat information, it was documented and coded as a repetition. The number of times children might request a repetition was unlimited. It was possible that children would report the presence of an anomaly in a passage when none existed. When children reported an anomaly to the examiner incorrectly, it was coded as a false detection. The directed monitoring sessions were between 35 to 45 minutes in length and were audio recorded for later transcription and scoring. All responses were recorded and transcribed verbatim. Transcripts were coded for the presence of effective comprehension monitoring behaviors including detection, resolution, and repetition. All false detections were also recorded for later analysis.

Four narrative passages were administered in a counterbalanced order across two conditions (2 LT, 2 STAMP). The conditions (LT, STAMP) were also administered in a counterbalanced order. Each passage was selected and modified from materials published by McGraw-Hill Learning Materials in Spectrum Reading: Grade 4 (1998) and dealt with friendships, academic testing, and family trips. All responses were transcribed according to Systematic Analysis of Language Transcripts (SALT; [27]) conventions. Two independent raters coded for comprehension monitoring behaviors. Inter-rater reliability was 100% for detection of anomaly, 98% for resolution of anomaly, and 100% for requests for repetitions and false detections.

Comprehension

Children were asked to answer 8 comprehension questions after hearing each passage. A total of 4 questions required the use of explicit information from the passage and 4 required an inference from the passage (maximum possible score = 8). For example, in the passage about Mark's Big Test there was an explicit question about the sentence, "The first thing he noticed was the clock on the chair." The question was, "Where was the clock?" An inferential question related to this passage required children to integrate information across the sentences. For example children heard the sentences, "He was exhausted and decided to take a break. When he opened his eyes again the first thing he noticed was the clock on the chair." The inferential question was, "What did Mark do when he decided to take a break?" Any reasonable answer indicating that he fell asleep or dozed off was accepted. The maximum comprehension score across passages was 32. The questions that required the use of factual information were called explicit questions and those that required the generation of a text-based inference were called implicit questions. Two independent raters scored each response. Inter-rater scoring reliability was 100% for explicit questions and 98% for implicit questions.

Passage Recall

Participants were asked to recall information from passages after hearing them. Recalls were scored by adding the total number of details reported. The authors along with 10 RAs identified important details in each passage independently. A total of 15 details were agreed upon for each passage through discussion and consensus. Each passage contained 15 details for a total possible score of 15 (total possible of 60 across the four passages). Each recall was transcribed using SALT conventions and was scored by two independent raters. Inter-rater reliability for transcription was 97% and inter-rater scoring reliability for the inclusion of specific passage details was 96%.

RESULTS

Table **1** presents descriptive statistics and comparisons for demographic and language processing variables for each comprehension group as well as for the total sample. We first conducted a separate, doubly multivariate MANCOVA for each set of dependent variables (the comprehension and comprehension monitoring measures mentioned previously in this section). The within-subjects factor was Condition (two levels: STAMP, LT). The raw scores from the WRMT-R word identification subtest were used as a covariate for all analyses to control for the potential effects of decoding on performance. When significant, MANCOVAs were followed by separate mixed-design ANCOVAs and independent- or paired-samples *t*-tests to test the simple effects of the interactions using a corrected alpha of .01.Estimates of the effect size for condition or group differences were

computed using partial eta-squared values for mixed-design ANCOVA (< 0.14 large, < 0.06 moderate, < 0.01 small) and Cohen's *d* for *t*-tests (< 0.80 large, < 0.50 moderate, < .20 small).

Comprehension Outcomes

The MANCOVA for comprehension outcomes showed statistical significance for the main effect of comprehension group (Wilk's Λ = 0.69, $F(3,36) = 5.51$, $p = .003$) and the interaction between condition and comprehension group (Wilk's Λ = 0.77, $F(3,36) = 3.55$, $p = .024$). Table **2** presents a summary of the results of the mixed-design ANCOVAs for each of the three comprehension outcomes. In each analysis, there was no significant interaction between the covariate and either factor. There were no significant effects for the mixed-design ANCOVA when the number of passage details recalled was the dependent variable.

For explicit questions, the mixed-design ANCOVA indicated that there was only a significant main effect for group (Table **2**), with skilled comprehenders performing better ($M = 6.78$, $SD = 1.12$) than less skilled comprehenders ($M = 6.03$, $SD = 1.44$), collapsing across conditions. Thus, for explicit questions, there was no significant difference between conditions and the difference between conditions did not differ according to whether one was a skilled or less skilled comprehender (no significant interaction). Table **3** presents descriptive statistics and results of post-hoc comparisons, where justified, for comprehension questions between skilled and less skilled comprehenders, stratified by condition.

For implicit questions, main effects for group and condition, as well as the interaction between condition and comprehension group were statistically significant (Table **2**). An examination of the simple effects of the condition by group interaction resulted in two significant findings (Table **3**): 1) less skilled comprehenders performed significantly better in the STAMP as compared to the LT condition (Cohen's $d = 1.06$, $t = -3.28$, $p = .002$) and 2) within the LT condition only, skilled comprehenders demonstrated superior performance compared to less skilled comprehenders (Cohen's $d = 1.63$, $t = 4.92$, $p < .001$).

Comprehension Monitoring Outcomes

The MANCOVA for comprehension monitoring outcomes showed statistical significance for the main effects of group (Wilk's Λ = 0.76, $F(4,35) = 2.78$, $p = .042$) and condition (Wilk's Λ = 0.45, $F(4,35) = 10.57$, $p < .001$), while the interaction between condition and group approached significance (Wilk's Λ = 0.78, $F(4,35) = 2.42$, $p = .066$). Table **2** presents a summary of the results of the mixed-design ANCOVAs for each of the three comprehension monitoring outcomes. In each analysis, there was no significant interaction between the covariate and either factor. Only the mixed-design ANCOVAs for detections and resolutions showed any significant results, with both demonstrating significant main effects for group, with skilled outperforming less skilled comprehenders. For example, skilled comprehenders detected ($M = 1.75$, $SD = 1.16$) and resolved ($M = 1.65$, $SD = 1.14$) more anomalies than less skilled comprehenders (detections: $M = .85$, $SD = 1.08$; resolutions: $M = .65$, $SD = .99$), collapsing across conditions. Table **4** presents descriptive statistics for comprehension monitoring questions between, stratified by condition and comprehension skill.

Table 2: Results of Mixed-Design ANCOVAs for Each Comprehension and Comprehension Monitoring Outcome

	Group			Condition			Group x Condition		
Dependent Variable	**F**	**p**	**η^2**	**F**	**p**	**η^2**	**F**	**p**	**η^2**
Comprehension									
Passage Details	2.98	0.093	0.07	0.01	0.922	0.01	1.02	0.318	0.03
Explicit Questions	8.85	0.005	0.19	0.07	0.801	0.01	0.33	0.569	0.01
Implicit Questions	17.90	0.001	0.33	5.53	0.024	0.13	17.11	0.001	0.34
Comprehension Monitoring									
Detections	7.03	0.012	0.16	1.18	0.283	0.03	2.78	0.104	0.07
False Detections	1.45	0.236	0.04	0.76	0.389	0.02	0.71	0.405	0.02
Repetitions	0.12	0.729	0.01	3.29	0.078	0.08	0.84	0.366	0.02
Resolutions	9.38	0.004	0.20	0.93	0.341	0.03	1.46	0.235	0.04

Note. Degrees of freedom for all models were 1 (effect) and 37 (error). η^2 = partial eta-squared.

Table 3: Comparison of Comprehension Outcomes between Listen through (LT) and Stop and Think (STAMP) Conditions, Stratified by Comprehension Skill Level

Directed Monitoring Condition	LT *M* (*SD*)	STAMP *M* (*SD*)	Cohen's *d* (*t*-test *p*-value)
Skilled comprehenders			
Passage details (30 items)	19.25 (4.97)	19.40 (4.25)	0.03 (0.919)
Explicit questions (8 items)	6.80 (1.11)	6.75 (1.16)	0.04 (0.899)
Implicit questions (8 items)	***7.35 (.067)***	7.00 (1.03)	0.41 (0.209)
Total (16 items)	***14.15 (1.31)***	13.75 (1.83)	0.25 (0.432)
Less skilled comprehenders			
Passage details (30 items)	15.85 (4.95)	17.40 (5.76)	0.74 (0.367)
Explicit questions (8 items)	5.80 (1.61)	6.25 (1.25)	0.31 (0.330)
Implicit questions (8 items)	***5.70 (1.34)***	**6.85 (0.81)**	**1.06 (0.002)**
	Cohen's d = 1.63 (<0.001)		
Total (16 items)	***11.50 (2.71)***	13.10 (1.59)	0.29 (0.028)
	Cohen's d = 1.32 (<0.003)		

Note. **Bold** = statistical significance favoring the STAMP condition for less skilled comprehenders; **Bold & Italics** = statistical significance favoring the skilled comprehenders within the LT condition only (Cohen's d and p-values appear below those outcomes that were statistically significant).

Table 4: Comparison of Comprehension Monitoring Outcomes between Listen through (LT) and Stop and Think (STAMP) Conditions, Stratified by Comprehension Skill Level

	Directed Monitoring Condition	
Outcome Variables	**LT**	**STAMP**
Skilled comprehenders		
Detection (2 items)	0.55 (0.69)	1.20 (0.70)
False detection	0.30 (0.73)	2.65 (2.28)
Repetitions (2 items)	0.00 (0.00)	0.15 (0.37)
Resolutions (2 items)	0.55 (0.69)	1.15 (0.67)
Less skilled comprehenders		
Detection (2 items)	0.45 (0.76)	0.45 (0.51)
False detection	0.75 (1.12)	4.50 (4.93)
Repetitions (2 items)	0.10 (0.31)	0.25 (0.44)
Resolutions (2 items)	0.35 (0.75)	0.40 (0.50)

Paired t-tests were conducted to determine if there was a difference in the number of false detections by group or by condition. Skilled and less skilled comprehenders were equally likely to falsely detect an anomaly in the LT (p = .140) and the STAMP conditions (p = .136) although there were more false detections in the STAMP (M = 3.57) than in the LT condition (M = .53) for both groups combined (p< .001).

To investigate potential relationships between working memory, language proficiency, comprehension monitoring, and comprehension performance, Pearson Product Moment Correlation Coefficients were calculated among these variables. A mediator analysis using partial correlations was also conducted. Pearson Product Moment Correlation Coefficients are shown in Table **5**. In general, results showed that language proficiency was significantly and positively related to performance in the ability to answer inferential questions (p = .002), to recall passage details (p = .002) and to detect (p = .021) and resolve (p = .005) anomalies. Language skill was significantly and negatively correlated with false identification (p = .026) of anomalies. The ability to detect (p = .022) and resolve (p = .020) anomalies was positively and

Table 5: Pearson Product Moment Correlation Coefficients and Partial Correlations Computed for Comprehension Monitoring, Comprehension, Language and Memory Outcomes

	Detection	Resolution	False Detection	Repetitions	Oral Language	Verbal Working Memory
Explicit Questions	.20 (.210)	.24 (.132)	-.198 (.220)	.135 (.406)	.257 (.110)	.194 (.231)
Implicit Questions	.36 (.022)* .23 (.159)	.37 (.020)* .20 (.223)	-.198 (.222)	-.166 (.307)	.475 (.002)**	.276 (.084)
Recall of passage details	.23 (.146)	.28 (.076)	-.187 (.248)	.094 (.566)	.477 (.002)**	.333 (.036)* .407 (.010)*
Detection	-	.954 (.0001)** .949 (<.001)**	-.130 (.425)	0	.364 (.021)*	.218 (.176)
Resolution		-	-.207 (.201)	.022 (.892)	.439 (.005)**	.229 (.156)
False Detection			-	.251 (.119)	-.352 (.026)*	-.234 (.146)
Repetition				-	-.238 (.139)	-.112 (.493)
Oral Language					-	.574 (.0001)**
Verbal Working Memory						-

Note: p < .05*; p < .01 **; Partial correlations are in italics and were conducted only for those variables for which the Pearson values were significant.

significantly correlated with accuracy in answering implicit questions. Verbal working memory was positively and significantly correlated with the ability to recall passage details (p = .036) and to overall language skill (p<.001).

Partial correlation coefficients were computed to test the hypothesis that language skill (e.g. CELF composite score) was a mediator of performance on the outcome variables and are reported in italics in Table **5**. The partial correlation between recall of passage details and working memory was significant and moderately large in magnitude. The partial correlation between detection and resolution of anomalies was significant and large in magnitude. The partial correlations between the number of implicit questions answered correctly and detection and resolution of anomalies was not significant after controlling for the effects of language on the outcome variables. If the identification and resolution of anomalies were the sole determinants of the ability to answer implicit questions, the partial correlations related to these variables would be equal to zero. Our results do not support this hypothesis.

DISCUSSION

The purpose of the current study was to extend the findings of Oakhill *et al.* [5] by testing their hypotheses that children, specifically poor comprehenders may perform better under conditions that 1) place the emphasis on meaning rather than decoding, 2) do not impose undue demands on working memory and processing capacity, and 3) allow for more processing time. We asked children to take part in two directed monitoring conditions. In one condition, children listened to passages in their entirety (focus on the whole passage), and in the other they were asked to process the passage one sentence at a time (focus on each sentence within the whole passage). Our approach was to remove the reading requirement, to introduce only one anomaly in each passage, to place anomalous information in close proximity within each passage and to test whether ensuring that children focused on each sentence resulted in better comprehension performance than when children were focused on the paragraph as a whole.

Comprehension Outcomes

Comprehension Questions

Skilled comprehenders performed the comprehension measures equally well across the two directed monitoring conditions. They answered about the same number of explicit and implicit questions and recalled a similar number of passage details in the STAMP and LT conditions. However, the less skilled comprehenders demonstrated better comprehension

performance in the STAMP condition than the LT condition. Specifically, less skilled comprehenders answered more questions requiring an inference in the STAMP condition. There are a number of factors that may have contributed to this pattern of findings including language ability and working memory skills.

The most likely explanation is that many of the children in the less skilled comprehender group demonstrated oral language comprehension problems (below average CELF scores). Our statistical analyses revealed that language ability was a significant mediator for performance on comprehension questions. In previous studies, children with language comprehension problems were often as accurate as their typically-achieving peers on a range of tasks when they were given extra processing time [5, 28-30]. Our findings support the hypothesis that allowing students with lower language abilities more time to integrate information across sentences may improve their ability to answer comprehension questions [28-31].

Passage Details

Children who demonstrate poor comprehension often have significant working memory problems that contribute to their difficulties recalling information from texts [5]. Our data showed that the relationship between working memory and the ability to remember passage details remained significant and increased slightly even after controlling for the role of language ability. This pattern of findings suggests that memory explained significant and unique variance in passage recall. While additional processing time may have been helpful for improving performance on comprehension questions, it was not effective in lessening the impact of reduced working memory capacity on the ability to recall passage details.

Comprehension Monitoring

The STAMP condition was not associated with better comprehension monitoring performance for either group. The only major difference in performance between the conditions was in the number of false detections that were made in the STAMP condition as compared to the LT condition. Skilled and less skilled comprehenders were more likely to falsely detect an anomaly in the STAMP than the LT condition, but this did not seem to impact comprehension performance. The ability to detect and resolve anomalies were significantly and positively correlated with the ability to answer inferential questions. The fact that this relationship was no longer significant after controlling for the effects of language ability suggests that language ability, and not comprehension monitoring skill mediated performance on the inferential questions.

Comprehension Monitoring and Memory

We did not find a statistically significant relationship between working memory scores and comprehension monitoring performance even though language and working memory was highly correlated (r = .57). In our study, all anomalies appeared in adjacent sentences. Our directed comprehension monitoring passages were designed specifically to encourage active processing by encouraging focused attention to comprehension, not to place great demands on working memory. We wanted to design a task that would encourage active processing, not overtax an already limited system. Our failure to find a correlation between memory and comprehension monitoring performance may have occurred because our directed monitoring tasks reduced cognitive demands placed on working memory, even in the presence of significant working memory differences among the groups.

Summary/Clinical Implications

The ability to generate inferences is an important part of the comprehension process [32, 33]. Limitations in linguistic proficiency and working memory may interfere with the ability to form inferences that are necessary for cohesion, particularly in the presence of time constraints on cognitive processing [20, 21]. For children with language and/or memory limitations, directed monitoring conditions designed to foster active processing may be more beneficial when they provide children with extended processing time. Given additional processing time, some children may demonstrate better comprehension performance. Our findings suggested that even in the presence of monitoring errors, less skilled comprehenders were more accurate in their offline comprehension performance in the slowed monitoring condition (STAMP), suggesting that they used the extra processing time to integrate information across sentences when answering questions requiring inferences.

These findings may be particularly relevant for a sub-group of poor comprehenders with oral language deficits who have been shown to demonstrate slower response times (RTs) than their typically developing peers on a wide range of linguistic and nonlinguistic tasks [34, 35]. For these children, slowing the rate of

stimulus presentation is associated with better performance in identifying tones, learning novel verbs and syntactic forms [36, 37], and answering questions and recalling information from discourse [38, 39]. Our findings suggest that slowing the rate of presentation of passages in the STAMP condition resulted in improvements in answering comprehension questions requiring an inference for our group of children with poor comprehension abilities.

Perhaps more importantly, this study suggests that it may be beneficial to focus on improving children's language skills in addition to instructing them to monitor their comprehension [40]. Recall that language ability mediated performance on comprehension measures above and beyond the ability to detect and resolve anomalies [41]. It appears that the better one's language skills, the better he or she is able to monitor understanding of what is heard or read.

Further, our study showed that if the comprehension measure used requires children to remember and report details from passages, slowed rate and directed monitoring may not be enough to improve the performance of children with limitations in both language and working memory capacity. For children with reduced working memory, it may be important to provide explicit instruction that targets narrative language and discourse structure [42]. Providing children with a highly specific scaffold, schema or story map for narrative discourse should improve a child's understanding of oral and written discourse for use in recall.

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