

## Comprehension Skill Differences between Proficient and Less Proficient Reader in Word-to-Text Integration Processes: Implications for Interventions for Students with Reading Problem

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**Abstract.** The findings of this paper suggest that successful reading of a text especially word-to-text integration is not always contingent upon word identification skills per se, but that skilled reading comprehension is much more complex, requiring both the coordination and the integration of other components of cognitive skills over and above single word identification. Skilled reading as indicated from the findings of this paper in the case of proficient readers compared to less proficient readers is a highly complex capability in which various cognitive and metacognitive processes are likely to be going on simultaneously in parallel during reading which less proficient readers lack. In this respect, to help facilitate learning situations that would optimally enhance students' reading skills at the basic level of education, teachers' understanding of the underlying cognitive processes in text comprehension would be helpful. Consequently, the purpose of this study is to highlight on the cognitive and metacognitive processes that distinguish proficient readers from less proficient readers in word-to-text integration in order to suggest educational intervention for teachers to respond to students with reading problem.

**Keywords:** comprehension; text integration; proficient readers; less proficient readers.

### Introduction

Reading deficiency is one of the major setbacks in Sub-Saharan Africa. Achieving measurable outcome in literacy especially reading and numeracy has become essential for contemporary economy that is gradually becoming knowledge-based. This notwithstanding, monitoring report across the globe, especially those of UNESCO indicates that access and the right to education have overshadowed the attention to quality. It is in this respect that The Dakar Framework for Action in 2000 emphasized quality as basic determinant of

Education for All (EFA) thus committing nations to ensure primary education is of good quality in respect of better cognitive and non- cognitive outcomes (Ghartey, 2010).

Assessment of learning achievement report also show that nations south of the Sahara are among those with less than half of children with minimum literacy achievement. These findings have been corroborated by the 2015 UNESCO Report that none of the countries in the region achieved all the goals set at the beginning of the millennium. In Ghana, for example, as far back as 1994, the Criterion-Referenced Testing (CRT) repeatedly showed that grade 6 pupils' performance in literacy skills was poor. Several studies in Ghana confirm that this failure of Ghanaian pupils to learn English may be attributed to poor quality of pedagogical methods (Kraft, 2003). Dzameshie (1997) sees teaching of English in Ghanaian schools as more analytical and grammar-based.

### **Statement of Problem**

As of July 2011, attempts have been made globally in fifty countries (50) to implement Early Grade Reading Assessment and twenty-three (23) of them are in Africa. The findings show general reading deficits in many primary schools in Africa (Adea, 2012 Report). The 2013 National Education Assessment report in Ghana show that in both English and Ghanaian language, at least 50% or more performed poorly(<http://www.ghanaweb.com/GhanaHomePage/NewsArchive/artikel.php?ID=300691>). The 2006 Chief Examiners Report for the West Africa School Certificate Examination indicated that for English language, out of a total of one hundred and twenty thousand, four hundred and eighty six (120, 486) who sat for the external examination, only eight thousand, seven hundred and thirty eight (8,738) constituting some 7.25% passed English language. Thus, basic literacy skills are yet to reach the levels needed to enhance these literacy skills. Other recent studies report that many children in Ghanaian public basic schools have learning difficulties especially dyslexia in the Greater Accra region of Ghana: seventy-five percent (75%) of teachers and 80 % of head teachers who took part in a survey admitted respectively of their pupils having problems with reading (Special attention Project, December 2011).

### **Research Objectives**

Two fundamental objectives precipitated this study. They are:

- 1) To investigate how text integration as higher cognitive process produces cognitive structures that are the end desired result of reading.
- 2) To find out what constitutes the core cognitive/mental difference between proficient and less proficient readers of expository text among Ghanaian children.

## Research Questions

Based on the above-named objectives, the following two research questions guided this study:

- 1) How does text integration produce cognitive structures that are the desired end of reading?
- 2) What constitutes the core cognitive difference between proficient and less proficient readers of expository text among Ghanaian children?

## Significance of the Study

The development of any nation is largely influenced by the number of citizens who can read and write. It is estimated that in the UK for example, about 99% can read and write. The same cannot be said of many countries in Africa. With consistent reading deficit among many Ghanaian children especially in the less endowed public basic schools compared to the private as backdrop, the findings of this research paper will throw more light on the psychological dynamics of reading comprehension and for that matter be of significance to basic school teachers, as well as the Ghana Education Service. This paper would also be beneficial to all education researchers and contribute to the existing literature in children's reading and comprehension.

## Literature Review/Theoretical Framework

### *Word identification and comprehension processes*

Research in reading comprehension suggests that successful reading of a text is more complex. It begins from bottom-up processes and connected to top-down processes. This implies that basic bottom-up process at the lexical level such as *word identification* is assumed to be understood in conjunction with text representation as: a) an output in the lexical system and b) as an input to the comprehension processes. This link between word recognition and integrating its meaning into a mental model of the text suggest two hypotheses in the literature: 1) skilled readers do this better than less skilled readers (Huang, Y.T., Hopfinger, J., & Gordon, P.C 2014; Perfetti, Yang & Schmalhofer, 2008; Yang, Perfetti & Schmalhofer, 2005, 2007) and 2) the learning of words is contingent on one's information regarding the forms as well as the meanings one has acquired in word-learning. Again in this respect, good readers are better able to do this than less proficient readers (Bolger et al., 2008; Van Daalen-Kapteijns & Elshout-Mohr, 1981).

Perfetti and Stafura (2013) in their proposed Reading Systems Framework place lexical processes especially word identification as key. They postulate three lexical processes that link outcome with comprehension on-line: a) word by word reading, b) eye tracking, and c) event-related potential. All this implies that the skill to comprehend text include the ability to comprehend words (Adlof

& Perfetti, 2011). The role of lexical quality in skilled visual word recognition with respect to individual differences has also been found to be typical with meaning-making in reading with individuals who have such skills (Andrews, 2012). Investigating whether or not individual differences in written language proficiency with university students has any prediction with early stages of lexical retrieval, the findings of Andrews and Lo (2012) corroborated that of the lexical quality hypothesis that suggests that variability among skilled readers is contingent upon the level of specified orthographic representations.

Using the boundary paradigm approach for computational models of eye tracking in reading to assess how individual differences implicate the extraction of lexical information from the parafovea in the reading of sentence, the findings of Veldre and Andrews (2015) suggested that those readers with accurate lexical representations were better able to extract lexical information from any given word prior to its being fixated- and this was more typical with proficient readers. So, lexical quality is in fact related to the processes of bottom-up and top-down, which contributes to both sentence processing, as well as discourse comprehension (Hersch &Andrew, 2012). This inextricable link between text comprehension and words comprehension implicates the need for word-to-text integration.

### **Word-to-text integration**

Van Dijk and Kintch (1983) postulate that word-to-text integration in motivated readers involves mental representation of text situation. Readers' ability to identify textual situations and their interactions with the text promote comprehension. Another key assumption regarding word-to-text integration is that comprehension of texts proceeds along more than one input units. What this in effect means is that humans have mental dictionaries or lexicons acquired during language comprehension from the declarative knowledge (propositional knowledge). Lexical access is in fact the result of decoding one's store of declarative knowledge from multiple sources.

Thus the ability to recall information from more entries or inputs aids word-to-text integration. This is because when one is able to relate a word to the phrase of syntax, meaning of the reference is made to the syntax in the text. This is facilitated more when one can recall many more meanings. Thus single processing of words promotes text integration from multiple inputs necessary to comprehend the situation described in a text. So text comprehension means that readers are able to relate meaning of sentences on the basis of message that is accumulated based on both previous text and previous knowledge in the Long Term Memory (LTM). This memory-based position of comprehension emphasizes the amalgamation of evaluated information from text. Indeed, all the foundational theories of text comprehension from 1988-1999 such as the construction integration model of Kintsch (1988), the landscape model (van den Broek et al., , 1996) and the resonance model (Gerrig &McKoon, 1998) consistently suggest that understanding of text is combination of text information, individuals using prior knowledge in the Long Term Memeory

(LTM) to make meaning relevant to their individual experiences and situations (Verhoeven & Perfetti, 2008).

In a more recent research by Stafura et al (2015) in word-to-text integration, these authors tested the influence of predictive and memory processes. Results indicated the impact of memory processes across sentences. This suggests that memory is crucial in word-to-text integration such that readers who have more memory on what they are reading are more likely to make predictions and meaning-making. Again this skill appears to be proficient with skilled readers than it is with less skilled readers. In a related study by Karimi and Ferreira (2015) in which they reviewed previous studies, they provided evidence for the on-line cognitive 'equilibrium' hypothesis as the basis for good representations in linguistic processing. In other words, when good linguistic representation are made, linguistic comprehension system continues to remain constant confirming the hypothesis that good representation promotes word-to-text integration.

### **Less proficient readers and event related potential (ERP)**

Consistent with the findings of most studies, the root cause of comprehension difficulties can be attributed to three broad areas: a) from the lexical level of identifying words, (Perfetti & Hart, 2001), b) the higher level of inference-making (Long & Golding, 1993) as well as c) the processes of monitoring comprehension (Baker, 1982; Garner, 1980). Within this general framework, there is also the problem of semantic processing at the word level.

In a study by Yang et al (2005) on Event Related Potential (ERP), results showed that text integration was aided by lexico-semantic variable and paraphrasing for skilled readers. This was less so for less skilled readers. These results are in line with the lexical quality hypothesis of Perfetti and Hart (2001) which makes the submission that the key for understanding text has to do with the level of reader's background knowledge. This prior knowledge enhances the recalling of relevant ideas as well as making relevant selection of word meanings. Whereas proficient readers with sufficient quality of knowledge are able to use this event related potential due to quality of knowledge, less proficient readers are likely to show difficulties in integrating the meaning of words with subsequent context (cf. Van Petten & Kutas, 1990; Federmeier & Kutas, 2001; cf, Yang et al 2005). Other studies have also found the N400 to be related to and linked to integration of text (van Berkum et al., , 2003; van Berkum et al., , , 2005). In addition to contemporary computational studies that track the movement of the eye during reading, suggesting that successful identification of words is contingent upon saccade initiation, current research in neuroscience also postulates the superiority of binocular relative to monocular presentation during word identification. Thus, variations made in word fixations rather than monocular presentation of word identification is more likely to facilitate ease of text comprehension (Jainta et al., 2014). Besides, the results of other recent studies using event related potential show that linguistic distinctions could be made between lexical and discourse level processing and that each of this distinct cognitive processes have distinct role to play in word-to-text integration

(Huang et al 2014), concept generation and drawing logical conclusions in language comprehension (Steinhauer et al. (2010).

## **Resume**

The literature review above shows that text comprehension is a multiplicity of various factors that includes the following: a) the ability of the reader to have mental representation of text so that resources of the working memory, especially attention could also be allocated for much higher mental processes, b) comprehension proceeds along more than one input units such that the higher the number of inputs units that one has in terms of knowledge of the subject, the more likely one would be able to comprehend, c) referential meaning of word to semantic representation: the more a reader is able to match meaning of each sentence on the basis of prior knowledge, the more comprehension is facilitated. All the above indicate that word-to-text integration is influenced by various cognitive factors. These theoretical frameworks need to be tested empirically to determine their instructional/pedagogical implications to help teachers to enhance reading comprehension among less skilled readers and to promote the reading skill of proficient readers.

## **Current study**

This current study examined those cognitive factors such as lexical access in which meanings of words are identified based on mental dictionaries or lexicons which humans acquire during language comprehension from the declarative (propositional knowledge). The major hypothesis that this paper investigated is that comprehension in the sense of word-to-text understanding is a function of one's declarative knowledge. This means that the quality of knowledge possessed by a reader including prior knowledge is more likely to allow context-appropriate retrieval as well as making relevant selection of words meanings. Two main research questions guided this study: a) How does text integration produce cognitive structures that are the desired end of reading? ; b) What constitutes the core cognitive difference between skilled and less skilled reader of expository text among Ghanaian children?

## **Research Methodology**

### *Sample*

This study used the experimental research design with a purposive sampling size of two hundred and forty (240) Junior High School pupils between the ages of 14-16 year olds from eight (8) selected Junior High Schools in four (4) administrative districts in Ghana: Kumasi Metropolis, Offinso Municipality, Sunyani Municipality and Brekum Municipality. Two (2) schools were randomly selected from each Municipality. Thirty (30) students were chosen from each school. Out of these thirty students purposively selected from each school to participate in this study half (15) were assumed to be proficient readers and the

other half (15) were considered less proficient readers. Four of the selected schools were private while the other four were public basic schools. In a data not tabled here an estimated 60% of the sample was male and the rest were females. These students came from different socio-economic parental background: children of professionals (doctors, lawyers), children from teachers, children from traders as well as children from farmers.

### *Materials and Design*

In all, three (3) experiments were tested in this study. The first experiment was a pre-test of students on reading achievement specifically administered to test the over-all reading ability between the two groups through a proficiency test. Later an adapted version of Reading Mastery Test of Woodcock (WRMT-R; Woodcock, 1987), the Gray Oral Reading Test–3 (GORT-3; Wiederholt & Bryant, 1992) also tested other high level comprehension other than word identification. In Experiment 2 and 3, the researcher sought answers to the first and second research questions, namely: how does text integration produce cognitive structures that are the desired end of reading and what constitutes the core cognitive difference between proficient and less proficient skilled readers in text comprehension among Ghanaian children?

### **Experiment 1**

This first experiment was pretesting phase to test the ability of these two groups specifically on how proficient they were on reading comprehension. The purpose was to find out whether or not those sampled as 'proficient readers' and 'less proficient readers' from each of these districts in fact have any statistical difference between them in terms of reading comprehension.

### *Methods*

#### *Participants*

Two hundred and forty (240) voluntary third year Junior High School from four selected administrative districts (96 girls and 144 boys) were selected. One hundred and twenty (120) were perceived to be 'proficient readers' and the other 120 considered 'less proficient readers' were purposively selected from eight (8) Junior High Schools (JHS) in Ghana. All participants were between the ages of 11 and 15 and the sample consisted of eighty (80) children from working parents, sixty (60) from professional parents and one hundred children (100) from farming parents.

#### *Materials*

Two tests on reading achievement were administered to test to the over-all reading ability of the two groups- proficient and less proficient readers using Proficiency Test and the subtest of Woodcock Reading mastery Tests-Revised (WRMT-R; Woodcock, 1987), the comprehension component of the Gray Oral Reading Test–3 (GORT-3; Wiederholt & Bryant, 1992). The language

proficiency test comprised some one hundred (100) multiple choice items covering many grammatical points.

## Results

**Table 1: t-test on readers proficiency test in Experiment 1 on reaction time**

	Readers (N=240)	Mean	Standard deviation	t-value	p-value
Score for proficient and less proficient readers on Proficiency Test	Less Proficient Readers	51.60	6.364	-21.271	0.000
	Proficient Readers	86.02	9.410		

Table 1 shows that proficient readers performed better on the proficiency test than the non-proficient. From the table, the proficient readers had a mean score of 86.02 with standard deviation of 9.410, while the less proficient readers had a mean score of 51.60 with standard deviation of 6.364. Their standard deviations however indicate that the scores of the skilled readers were more dispersed than that of the non-skilled readers. To find out if their mean scores were statistically significant, an independent samples t-test was run at an alpha level of 0.05 and the results as in table one show that they were significantly different [ $t=-21.271$ ,  $p=0.00$ ].

## Discussion

The results of this pre-test on proficiency and reaction time, suggest significant differences in performance between the two groups of readers: less proficient  $M=51.60$  ( $SD=6.364$ ) and proficient  $86.02$  ( $SD=9.410$ ). The source of the differences was that proficient readers were found to be more than two times faster at lower order processes than less proficient readers supporting the hypothesis that word decoding, accurate and fast retrieval of lower order processes of phonology is critical in reading comprehension. Lower mental process within the reader's mental representation which may include orthography, phonology appears to implicate readers' processing speed. The faster they are processed, the quicker readers pay attention to higher processes of meaning-making in text comprehension (Stanovich, 2000). Thus, automaticity at lower order level can either facilitate parallel processing or serial processing helping readers to acquire new information either with ease or with some difficulty (National Reading Panel, 2000; Perfetti, 1998; Samuels & Flor, 1997; Spear-Swerling & Sternberg, 1994). As indicated in this pre-test data, proficient readers unlike less proficient readers appear to have acquired highly automatized skills in lower level processes and because of this automaticity, these skilled readers had enough sufficient cognitive resources allocated for higher mental processes such as inference-making and word-to-text integration as indicated in tables 3, 4 and 5 below.



This finding also suggests a probable link between those studies relating working memory capacity and performance load (e.g., Engle & Kane, 2004) thus corroborating Engle (2002) position that High Working Memory Capacity (HWMC) and Low Working Memory Capacity (LWMC) persons do not differ in the amount of attention resources (i.e., WMC) they have per se, but differ in terms of how well they can efficiently allocate these resources, especially in times of interference or when demands on WMC are high. This also supports recent neuropsychological studies on the correlation between Working Memory Capacity (WMC) and attention with specific reference to processing speed of children with Attention-Deficit/Hyperactive Disorder. Children with this disorder typically are slow in a variety of performance (Chhabildas et al, 2001; Hinshaw, 2002; Rucklidge & Tannock, 2002; Willcutt et al , 2005; Wodka, Mahone, et al., 2007; Jacobson et al (2011 ). Again, the data in this first experiment give weight to the findings of Huang (2014) with respect to binocular advantages in reading through parallel processing as opposed to serial processing in reading.

## **Experiment 2**

This second experiment sought to find out how word-to-text integration produce cognitive structures that are the desired end of reading.

### *Methods*

#### *Participants*

The same two hundred and forty (240) participants used in the first experiment were also used for this second experiment.

#### *Materials and procedure*

Ninety multiple choice questions adapted from the Gates-MacGinitie reading test (GMRT) grade level 7-9 was used as the instrument to test how word-to-text integration, specifically the ability of readers to identify textual situations and their interactions with the text to promote comprehension. Questions were categorized along the following variables of different levels of difficulty: *verbatim*, *transform verbatim*, *paraphrase*, *transform paraphrase*. Readers were requested to weigh the degree of overlap between question and target answer and the passage along these four tasks mentioned above. For example in *verbatim*, these were questions directly found in the text; *transformed verbatim*: these were questions similar to what is asked in the text except that different words with the same meaning were used; *paraphrase*: questions in which correct answers were not used but were paraphrased; *transformed paraphrase*: these were questions that required making multiple sentence meanings to be able to answer.

## Results

**Table 2: Different levels of item difficulty**

	Readers	Mean	Std. Deviation	t-value	p-value
Verbatim	Less proficient readers	45.17	4.473	-32.812	0.000
	Proficient readers	73.20	4.877		
Transform verbatim	Less proficient readers	35.53	5.540	-31.764	0.000
	Proficient readers	64.93	4.551		
Paraphrase	Less proficient readers	31.22	6.471	-31.131	0.000
	Proficient readers	59.47	2.746		
transform paraphrase	Less proficient readers	26.65	5.781	-39.028	0.000
	Proficient readers	58.53	2.574		

Readers scores on different levels of difficulty as means to measure word-to-text integration were tested along five variables: verbatim, transform verbatim, paraphrase and transform paraphrase. On all the four tested variables, proficient readers outperformed the less proficient. Independent samples t-tests at 0.05 significant levels also indicated statistically significant differences in the mean scores of the two groups on all the four variables. For example, on the variable *transformed paraphrase*, the non-skilled readers had a mean score of 26.65 with standard deviation of 5.781, while the skilled readers had a mean of 58.53 with standard deviation of 2.574. The standard deviation of the two groups indicates that the scores of proficient readers were more spread than that of the less proficient readers. The comparison of these means with the t-test gave a t-value of -39.028, p-value of 0.000 indicating a significant difference in these mean scores.

## Discussion

The scores of the two groups tested along the four variables suggest consistency with other research findings: speed impairment. Proficient readers appear to have a tendency to recall information on phonology much faster and with a higher level of automaticity more than less proficient readers. This corroborates the findings of other research studies such as Booth et al , (2000) as well as Booth, et al. (1999). This implies that effective reading of word-to-text integration is heavily contingent upon one's ability to decode and to make the needed linguistic input on one hand and on the basis of this, accessing requisite phonological information on the other. This finding suggests among other things individual differences that both proficient readers and less proficient readers bring to reading comprehension such as spillover, executive control as well as phonological rehearsals. For example, the fact that difference between the two groups tended to be wider, the more the level of difficulty, suggests the influence of additional load during reading. Neurological differences such as the brain may not be discounted in this respect. Lower capacity readers seem to have tendency to recruit more cortical resources from right hemisphere areas of the brain. This additional activation is an identified mechanism known to induce additional cortical resources in lower capacity readers unlike skilled readers who tend generally to automatize lower mental processes (Pratt & Just, 2008; Augusto et al 2009). Besides these neurological differences, proficient readers appear to have better higher cognitive comprehension processes because they seem to be able to manipulate information abstractly more than the less proficient readers as indicated in Table 2 corroborating the submission of Hawelka et al (2015), Mason and Just (2006) and Kintsch (1998) that fast readers unlike slow readers are better able to generate forward inferences, as opposed to speed-impaired readers.

## Experiment 3

This third experiment examined what constitutes the core cognitive difference between proficient and less proficient readers in text comprehension.

### *Methods*

#### *Participants*

The same sample used in the first and second experiments was also used for this third experiment.

#### *Materials and procedure*

Ninety questions adapted from the Gates-MacGinitie reading test (GMRT) were used as the instrument to test the following three comprehension variables: text inference, text bridging and text integration.

## Results

**Table 3: t-test on readers' scores on inference**

	Readers	Mean	Standard deviation	t-value	p-value
Score for proficient and less proficient readers on Inference	Less Proficient Readers	34.00	8.030	43.119	0.000
	Proficient Readers	84.00	4.025		

**Table 4: t-test on readers' scores on bridging**

	Readers	Mean	Standard deviation	t-value	p-value
Score for proficient and less proficient readers on bridging	Less Proficient Readers	51.48	5.528	-26.119	0.000
	Proficient Readers	80.92	6.756		

**Table 5: t-test on readers' scores on text integration**

	Readers	Mean	Standard deviation	t-value	p-value
Score for proficient and less proficient readers on Text integration	Less Proficient Readers	51.47	5.420	-18.137	0.000
	Proficient Readers	85.97	13.701		

In all three variables tested in this third experiment in Tables 3, 4 and 5 results show that proficient readers performed significantly better than the less proficient readers. From Table 3 for example on inference-making, proficient readers scored a mean of 84.00 with a standard deviation of 4.025, while less proficient readers had a mean score of 34.00 and a standard deviation of 8.030. These standard deviations indicate that the scores of the proficient readers were more dispersed compared to the less proficient readers. To test the statistical significance in the mean scores of the two groups, an independent samples t-tests were run at an alpha level of 0.05 and as can be seen from the three tables (

Table 3, 4, and 5) the results indicate significant difference [ $t = -43.119, p = 0.00$   $t = -26.119, p = 0.00$  and  $t = -18.137, p = 0.00$ ] respectively. These significant differences in the mean score in all the variables were interpreted to mean that there must be some core cognitive/mental differences between skilled and less skilled readers which are both strategic and neurological.

## Discussion

The above results suggest that skilled comprehenders compared with less skilled readers performed poorly on inference-making, bridging as well as word-to-text integration. These difficulties' appear to result from impairments in higher cognitive skills. Indeed research work on comprehension from the point of view of mental models framework such as Oakhill (1996, 1984), Cain & Oakhill (1999; Cain et al, 2001), make the submission that most poor comprehenders of text have the tendency to construct incomplete representation of text. Precisely because of this, often they may be likely to be able to coordinate information locally, but are unable to do so at coherent integrated level. This finding corroborates this assertion. Less proficient readers on the inference test failed to generate correct inferences because unlike proficient readers, they used different criteria for textual cohesion and either did not pay attention to or were unaware that inference was necessary. This inability to generate such inferences might have resulted in the poor performance as indicated in Table 3 above.

Retrieval error was more typical with less proficient readers. They were four times more to make wrong retrieval than it was with proficient readers. This affected their inference-making ability both on coherent as well as elaborative inference. For a reader to make constructive meaning of text on what is not stated explicitly, he/she needs to combine textual information with background and be able to generate inferences. In this respect, less proficient readers lacked the skill to remember information and made incorrect inferences for most of the time. This confirms the study by Baretta et al (2009) in respect of differential processing of text types by the brain.

Regarding word-to-text integration, again the differences between the two groups are statistically significant: the mean scores of 51.47 (SD=5.420) of less proficient readers compared to 85.97 (SD=13.701) of the proficient indicate vast individual differences between the two groups on this test measure. The high ability performance of the skilled readers reflects their ability to retrieve the meaning of words and interpret the meaning in relation to message context sensitivity. This divergence and the dispersed results of skilled readers suggest implication of individual differences on processes involved in retrieving as well as integrating word meaning to text integration. This corroborates Perfetti and Stafura (2013) and other research evidence that proficient readers more than less-proficient readers tend to apply meaning of words to help them integrate text.

## General Discussion

This research identified two key questions in which comprehension difficulties might arise for most Ghanaian basic school students/pupils, namely, how word-to-text integration can lead to good comprehension and secondly, what constitutes the core cognitive differences between proficient and less proficient readers. Results of the three experiments are consistent with other research work on comprehension especially from the interactive models of reading that provide individual variation framework. In all the three variables tested on the two groups on inference-making, bridging and word-to text integration, scores show huge differences between proficient and less proficient readers in the following three areas: a) differences in requisite general knowledge (without neurological disorder), b) differences in memory recall, c) differences in linguistic ability.

### a) *Differences in requisite general knowledge*

As seen from the results on inference-making in Table 3, with a mean score of 84.00 (SD= 4.025) and 34.00 (SD=8.034), the cause of poor performance on inference was not unrelated to poor readers inability to coordinate and integrate information at both the local level (lexical access) as well as other higher cognitive skills. This finding supports the idea that reading comprehension is much more complex, requiring both the coordination and the integration of other components of cognitive skills over and above single word identification (Ntim (in press), Bruce, Shawn, Glynn, & Jeffrey, (1985). These difficulties in poor inference-making in the case of less proficient readers arise from impairments in higher cognitive skill corroborating the work of Oakhill (1996, 1984), Cain & Oakhill (1999), who make the submission that most poor comprehenders of text have the tendency to construct incomplete representation of text.

### b) *Retrieval error*

Retrieval error was more typical with less proficient readers. They made more error in recall of information and this affected their performance in all three variables giving support for the '*principle of cue-overload*' in which recall fails to make distinctions between competition and in so doing give cause to interference. This is consistent with Van Dyke and McElree (2006), Van Dyke and Lewis (2003) and Gordon et al. (2004) that individual memory system that subserves language comprehension operates in the same way as memory in other domains. In short in language comprehension, human memory structures tend to limit language comprehension processes corroborating the findings of Ntim (in press) and Van Dyke and Johns (2012).

### c) *Vocabulary skills*

Another major finding from this study has to do with the correlation between adequate word reading and vocabulary skills groups. Proficient readers unlike the less proficient demonstrated a high level of adequate vocabulary skills which critically influenced automaticity for efficient

reading. Skilled readers possessed more vocabulary in their mental lexicon and therefore spent less time in lexical access unlike less skilled. This means that attention and mind wandering controls continue to mediate Working Memory's Capacity's (WMC's) relation to reading comprehension. It is important to pay attention to attention-deficit and lexical access. Poor readers due to poor vocabulary tend to spend more time on lexical access, whereas good readers, because they possessed large amount of vocabulary had little problem with automaticity and could concentrate on higher cognitive strategies.

### **Implications for interventions**

Becoming a successful reader is a process that is not fully understood even by many teachers since reading comprehension involves many cognitive and metacognitive psychological processes. Based on the above findings, the following instructional strategies are suggested to improve reading comprehension.

#### *a) The use of incremental rehearsal technique*

Individual differences with respect to students' general knowledge are vital. The findings of this paper corroborate other research work that the more students have requisite knowledge on a subject, the more likely they are able to comprehend what is being read. This means that, children with limited knowledge of any given topic are more likely compared to those with adequate subject matter knowledge to have difficulty. When less proficient readers manifest difficulty understanding text, classroom intervention such as direct instruction on comprehension needs to be given. Indeed, when students are not comprehending the text they read, it is very likely they lack meanings of words or the concept as well as inability of understanding factual information and hence not able to make inferences and coherent relationships of text message. In short, less proficient readers lack the ability of intertextuality. This deficit can be redeemed through pedagogical intervention such as the rehearsal technique (Tucker, 1988). In this technique, students are made to practise the reading of words that are not familiar so that background knowledge of words can be built. They are given enough time to practice this process where they are presented with about 10% unfamiliar words and 90% familiar words simultaneously. Errors are made known to them.

#### *b) Using Semantic Webs*

Using semantic webs to enhance instruction for students with reading difficulty is to explain a concept or a word to students. In a form of a web, the key concept is put at the centre and the main characteristics as well as definition placed around underlined words or concepts. Students are guided by the teacher through the use of the main characteristics of words or

concepts by asking provoking questions from students. These semantic webs could serve the purpose of pre-instructional tool to introduce concepts and words before and/or after the reading of text to assess whether or not students have understood key concepts and words (Zutell, 1998).

*c) Using Questioning and paraphrasing of text.*

This technique has to do with the art of using questions after reading any given text. The use of this pedagogical technique consistently show that students are more likely to have better comprehension of text both on factual as well as on inferential grounds (Beck et al. , 1996). Paraphrasing has to do with helping students to acquire the skill of rephrasing or restating what they have read. These two techniques are found to be effective useful instructional tool to assist students with reading problems (Morrow, 1985; Simmons et al., 1995).

*d) Reducing Memory Load*

Consistent with the findings of recent studies attention is largely implicated by Working Memory (WM) in the sense that the former controls the time a person needs to be able to keep information in WM. When attention is not focused learning is most likely to be undermined. Similarly if student is not focused and is distracted in attention, precisely because information is interfered with, the requisite information needed to be recalled from the Long Term Memory (LTM) is affected adversely. This means that the ability that one has in controlling one's attention is directly correlated to one's academic achievement especially the recall of relevant information from a text. The implication is that precisely because the architecture of the human cognitive system is limited, the teacher needs to reduce memory load through the following strategies: i) breaking learning tasks into smaller units as much as possible without detailed information at a time; ii) reducing the amount of work students are made to complete, iii) keeping new input or information as brief as possible and straight to the point and when needed to frequently repeat in precise form to increase the easiness of depth encoding, iv) to reduce amount of mental processing by giving more learning guidance or "clues" and if need be writing key words on the board. This would help the student from having to hold all of the information concurrently in mind simultaneously, v) the need to provide more examples and non-examples to increase students understanding of material.

## **Conclusion**

Research in reading comprehension suggests that successful reading of a text is not always contingent upon word identification skills. Indeed, it is not always the case that individuals who are good readers are necessarily good passage comprehenders. This supports the idea that reading comprehension is much more complex. It requires the ability to coordinate lower lexical processes as well as and the integration of other higher components of cognitive skills over



and above single word identification. Skilled reading as indicated from the findings of this paper is consistent with other studies that suggest that reading especially word-to-text integration is considered a highly complex capability in which various cognitive processes are likely to be going on in parallel during reading. In this respect, to be able to enhance classroom learning environments that can maximize students learning, especially students with reading problems, teachers' understanding of the underlying psychological/cognitive processes that underlie text comprehension will be helpful. It is within this context that the purpose of this study is to report on the cognitive and metacognitive processes that distinguish proficient readers from less proficient readers and to suggest the needed educational intervention to help students with reading difficulty.

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