TEXTUAL SYNTACTIC COMPLEXITY AND ITS ROLE IN SECOND LANGUAGE READING OUTCOMES IN INDONESIA

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Abstract: This paper examines the role of syntactic complexity in L2 reading outcomes across different EFL proficiency levels in an Indonesian university. Indonesian university students (N=148) at Intermediate and Advanced levels of proficiency read four English passages differing in syntactic complexity. The latter was measured by several widely used text modelling tools. Participants read two low and two high complexity texts and completed a post-test comprehension test. Syntactic complexity had a statistically significant but low magnitude effect size, accounting for 2%-5% of the variance of reading performance between the L2 English proficiency levels. There were also noticeable differences in text analysis measures across the different complexity tools. The usefulness of syntactic complexity as an isolated dimension of text complexity is evaluated. The contribution of this study to the field both in theory and practice is presented.

Keywords: readability; reading outcomes; syntactic complexity.

INTRODUCTION

Reading skill is of central importance in English medium academic study in a second language. Better readers in second language (L2) settings perform better than their less proficient counterparts (Anderson, 1999a, p. 2). Mastering reading competence is one of the most essential goals for students in L2 context (Richards & Renandya, 2002). Factors contributing to L2 reading include lexical knowledge (Kweldju, 1997, 2000; Muldjani, Koda, & Moates, 1998; Nurweni & Read, 1999; Sahiruddin, 2008b), the role of L1 reading (Koda, 1988), topic familiarity (Anderson, 1999b; Goodman, 1967;

Pulido, 2004, 2007), comprehension strategy (Pearson, 2009), and L2 linguistic knowledge (Bernhardt & Kamil, 1995). As typical of many EFL settings, Indonesian students find it a challenge to develop the English reading skills needed to read the English textbooks required in their university study. Kweldju (2002) found that university learners in one of universities in Indonesia had lower vocabulary knowledge. Similarly, Sahiruddin (2008a) reported lower vocabulary size the learners had and it contributed to lower reading performance. The level of knowledge and skills the reader brings to a reading task are crucial predictors of reading outcomes. However, the contribution of reader's knowledge to reading outcomes is only part of the story. Reading outcomes are the result of the interaction between learner-internal factors and the linguistic complexity level within the text. The level of complexity of the text (generally known as text complexity or text readability) is also a crucial aspect. Complexity is widely defined as the range of complexity in terms of the lexical and syntactic features for the written or spoken, which affect how easy it is to understand (Skehan, 2009). The role of text complexity on reading outcomes has been of particular interest in reading education, where evidence shows texts with high complexity given to beginner readers may result in poor reading performance while texts with low complexity given to more advanced readers will also result to less than optimum learning outcomes since the texts may not challenge their current level of reading ability.

The construct of text complexity consists of both lexical and syntactic complexity. Lexical complexity consists of word length and word frequency. Syntactic complexity, on the other hand, involves sentence length as an index of complexity. Readability formulas combine both dimensions to yield an overall text complexity measure. The focus in this paper is on syntactic complexity alone. The few studies on the role of syntactic complexity on L2 reading are inconclusive. Nation and Snowling (2010) found similar pattern that syntactic complexity influences reading performance and differentiate between normal readers and poor comprehenders. This provides

support for syntactic complexity as factor affecting L2 reading. In contrast, other studies showed an opposite result (Barrot, 2013; Karami & Salahshoor, 2014). In addition, syntactic complexity was of interest since text readability formula had much more weight on syntactic complexity (in this case sentence length index) (Hiebert, 2012). Due to inconclusive findings as set out above about the role of syntactic complexity in reading, this paper is interested to scrutinize the role of syntactic complexity on L2 reading in an Indonesian context. This may add more comprehensive information about the role of textual syntactic complexity in second language setting.

LITERATURE REVIEW

Text complexity was historically developed in English native speaker context (L1 setting) resulting that text complexity predicted L1 reading performance. It has been proposed that readability formula or quantitative readability as reliable indicator or a correlate of potential reading difficulty in the L2 (Koda, 2005, p. 109). Looking at text variables in specific such as lexical complexity and syntactic complexity which were believed to affect reading performance, these two variables are discussed here although the focus of the study would be only of syntactic complexity. Generally, syntactic complexity denotes the level of sophistication what language forms at the surface level either in the written or spoken (Ortega, 2003, p. 492), and also languages used to deliver ideas (Carroll, 2008, p. 288). Syntactic complexity involves size of production units (spoken and written forms), range of grammatical patterns, and intricacy of the structures used. All these features lead to the complexity of structures or syntax. For example, complex sentence is associated with one of complex syntactic forms which contain one or more dependent clauses besides its independent clause. In psycholinguistic perspectives, complex sentence is one expressing more than propositions so that beside the fact that such linguistic forms are difficult to process, comprehending the propositions within those linguistic forms is also not easy.

Syntactic complexity is significant to examine since the ability to understand sentence meaning is very essential to generate a coherent mental representation of text meaning. The readers could get propositions of texts as to integrate this information with previous knowledge (Kintsch, 1998). In addition, English teaching practices in Indonesia put much attention of grammar learning for students with a belief that grammar understanding would help students develop their reading ability.

Meanwhile, syntactic complexity where generally assessed by sentence length was found to affect reading. For instance, in the 1980s studies, Berman (1984, p. 153) suggested that syntactic complexity is vital factor to understand the message in the text. In long sentences particularly within complex sentences, for instance, where some sentences are interrelated each other, readers are required to uncover the meaning of every sentence embedded. As a result, if readers had a problem with syntactic patterns and their meaning they would found difficult to get the amount of information and store it to their memory and in turn they could not relate one information with others (missing points). In particular, related to the role of sentence length as an index of syntactic complexity, Coleman (1964, p. 190) pointed out that sentence length can predict readability because it is correlated with syntactic complexity predictors such as nesting, transformation complexity and others. Simply put, the more complex sentences will be more difficult to be processed for comprehension. In psychological terms, Kintsch (1998) and Lennon and Burdick (2014) provide supports to the role of sentence length in comprehension suggesting the long sentence is likely containing multiple discrete ideas (known as prepositions) which in turn requires readers to spend more time for comprehension. Embedded structure in long sentence or complex sentence carries many proposition in the text by which readers should be able to uncover such propositions and their logical relationship of the information in the text. Within the role of syntactic complexity, Nation and Snowling (2010) found similar pattern that syntactic

complexity and semantic ambiguity influence reading performance and differentiate between normal readers and poor comprehenders.

However, syntactic complexity defined within sentence length construct also was found to have a weak contributory effect. For example, syntactic complexity was found not significant at influencing grade 7 readers' reading comprehension since they could comprehend short and long texts equally (Davison, Wilson, & Herman, 1986). Davidson and Green (1988) also posited that syntactic complexity did not lead to the difficulty of text for comprehension. Similarly, Arya et al. (2011) found that syntactic complexity (referring to embedded structure and complex construction or mean number of clauses) did not play a fundamental role in L1 third graders' reading performance over four texts used in their study, arguing certain lengthy sentences sometimes were easier to comprehend when compared to short sentences.

Another syntactic complexity measure which assess sentence complexity is what was suggested by Ellis (2009, p. 495) about the quantity of subordination / the mean number of clauses per T-unit. Simply defined, T-unit is the smallest unit of a text containing one independent clause with its independent clause (Hunt, 1970, p. 189). Assessing the role of syntactic complexity to L2 speaking assessment, Iwashita, Brown, Mcnamara, and O'hagan (2008, p. 32) assessed grammatical or syntactic complexity in spoken assessment employing the number of clauses per T-unit as one of the measures. In addition, Wolfe-Quintero, Inagaki, and Kim (1998) used clauses per T-unit and number of dependent clauses per T-unit to evaluate the levels of syntactic complexity. Recently, Ortega (2003) conducting a meta studies of 25 research for written works produced in EFL and ESL setting scaling the syntactic complexity found that mean length of T-unit became the most frequent criteria employed in those studies.

Barrot (2013, p. 12) comparing the effect of both lexical complexity and syntactic complexity on reading by sixty primary students in Manila also found that syntactic complexity (measured from mean length of T-units, average number of words in T-units, total

number of T-units did not significantly affect reading comprehension, but lexical complexity was the most determining factor for reading comprehension. Different means of T unit in words (MLT-W) and sentences (MLT-M) did not bring any difference of means but similar effect. On the other hand, recently Karami and Salahshoor (2014) investigated to what extent do syntactic complexity (T-unit) and lexical complexity (lexical frequency index) affect academic reading comprehension (IELTS) by 50 Iranian university students enrolled in Teaching English program. It revealed that both lexical complexity and syntactic complexity significantly affect L2 reading outcomes, β=.39 for lexical complexity and β=.37 for syntactic complexity.

Overall, support for the direct link between syntactic complexity and reading performance has been inconclusive. Syntactic measures of syntactic complexity do not consistently relate to reading comprehension. This study focused only on the role of syntactic complexity in text comprehension. As part of larger study on the role of readability in L2 setting, investigating the contribution of syntactic complexity alone establishes the extent to which this factor alone affects reading comprehension. The study evaluates the contribution that a range of syntactic complexity measures make to individual differences in L2 reading outcomes. These are word per sentence (Flesch's formula), Clause per T-units, mean clause of T-unit, clauses per sentence (Syntactic analyser), Syntactic complexity (SourceRater formula) and Syntactic simplicity (Coh-Metrix formula) influenced in L2 reading. The hypothesis was that syntactic complexity and 2 reading may be highly correlated and become a strong predictor for L2 reading.

METHOD

The study examines measures of syntactic complexity and the effect they have on L2 reading outcomes. Indonesian university students at Intermediate and Advanced levels of ESL proficiency read English passages of different syntactic complexity (low, high). The questions being examined here are: 1) What is the effect of textual

syntactic complexity measures on L2 reading outcomes? and 2) What is the contribution of syntactic complexity in predicting L2 reading outcomes by different proficiency levels?

It is hypothesised that textual syntactic complexity is closely related to reading performance suggesting that the higher the complexity of a given text (as measured by sentence length and T-units), the more challenging the text will be for comprehension. In more detail, the influence of syntactic complexity is different across group proficiency indicating that the more proficient or skilled readers have better reading performance across different syntactic complexities.

To answer the questions, two studies or experiments were conducted where this study focused on comparing the performance of low proficiency group and high proficiency group based on academic performance (TOEICS).

This compared the performance of L2 Indonesian university adult on a battery of online experimental reading tests comprising of two low and two high syntactic complexity texts (four texts) with various syntactic complexities (two low and two high syntactic complexity).

The participants are Indonesian EFL learners (*N*=148) in an Indonesian university English Study Program, ranging from first- and second-year university level. They were between 18 and 23 years of age. Participants had finished a normal of 6 years learning formal English as a foreign language through formal education. Their mean scores on Test of English for International Communication (TOEIC) were 526 (*SD*=187) with maximum score 990. Those who got score above 500 (M=684, SD=103) were clustered as high proficiency group (n= 77) and those whose score was below 500 (n=71, M= 355, SD= 69) were classified as low proficiency group (n=71).

Four texts of approximately 250-300 words in length were used in the study. Four passages were selected from published samples of as Test of English as a Foreign Language (Davy & Davy, 2002; Duffy & Mahnke, 1998). Of four texts, two were of low syntactic complexity and

two were high syntactic complexity based on Flesch's readability formula (Flesch, 1948, 1951, 1979), SourceRater readability (Sheehan, Kostin, Futagi, & Flor, 2010), CohMetrix formula (Graesser, McNamara, Louwerse, & Cai, 2004; McNamara, Louwerse, McCarthy, & Graesser, 2010), and syntactic complexity analyser (Aihaiyang software, 2013). These readability formulas were chosen because they were the widely employed readability formula in current readability research, in spite of its syntactic complexity descriptions. The levels of syntactic complexity in the texts were assessed in term of sentence length (word per sentence), average clauses per sentence, and mean length of T-units. T-unit analysis was utilized since this syntactic complexity measure has been found to be correlated with academic achievement (Hunt, 1970), L2 reading (Barrot, 2013; Karami & Salahshoor, 2014).

The result of syntactic complexity assessment on four texts use in this study showed the same results about the level of syntactic complexity in the texts being evaluated (see Table 1). Each participant was given online reading tests. Since two low syntactic complexity-texts were not difference in terms of complexity and the same case was also evident to two high syntactic complexity texts, the two low and two high syntactic complexity texts were then combined for each level (see Table 1).

The reading tests included five multiple-choice questions measuring both literal and implicit information in the texts. Text comprehension was evaluated by five multiple-choice items given at the end of each text.

The participants were individually assessed in computer laboratory using online reading tests containing four texts followed by five multiple choice questions for each text allowing 75 minutes to finish the tests. They were required to read the text through the computer screen and followed by multiple-choice questions. They were warned that they cannot go back to texts once they finished reading. The decision of inability to get back to text when answering questions was based on other studies in Berlin German revealing that

without text condition was more sensitive and purer to assess online comprehension as reflected in the quality of the mental representation of the texts (Schroeder, 2011, p. 892). The total score on each passage was 100.

Table 1. Syntactic complexity measures from several readability formulas

Topics		Source-Rater readability (Sheehan, et al. 2010)		Flesch readability (Flesch, 1947, 1976)		Coh-Metrix	Syntactic complexity analyser				
	Ws[1]	SR[2]	TCO[3]	W/S[4]	RE[5]	SS[6]	C/S[7]	MLT[8]	MLC[9]	T/S[10]	CT[11]
Television	205	50	56	18	55	49	1.9	18	10	1	1
Aging	310	58	75	22	43	30	1.5	20	15	1	2
Susan	257	66	56	29	63	2	2.0	25	14	1	5
Literature	311	73	75	39	25	2	2.3	28	19	2	5

Notes: *[1]) Ws: Words, [2]) SR: Syntactic complexity, [3]) TCO: Text complexity overall, [4]) W/S: Word per sentence, [5]) RE: Reading ease, [6]) SS: Syntactic simplicity, [7]) C/S: Clauses per sentence (Norman et al. 1992), [8]) MLT: Mean length of T-unit (MLT) (Iwashita, 2006), [9]) MLC: Mean length of clause (MLC), [10]) T/S: T-unit per sentence (T/S), [11]) CT: Clause per T-Unit (CT) (Iwashita, 2006; Beers & Nagy, 2009).*

FINDINGS

Mean accuracy scores for entire participants can be depicted in Table 2. The data were normally distributed based on the value of skewness (*S*=1.33) and kurtosis (*K*=-.01) representing the values below 1.96 or 2.58 (Field, 2009, p. 139). The reading data was strongly reliable at Cronbach's α=.90. A summary of reading accuracy on four texts with two low syntactic complexity levels and two high syntactic complexity levels is described in Table 2. Further analysis focused on the combined data from both low syntactic complexity scores and high complexity scores.

The first aim of the study was to scrutinize to what degree did syntactic complexity variable influence reading outcomes in general and by group proficiency level in particular.

Table 2. Descriptive statistics for reading accuracy across syntactic complexities

Syntactic complexity	Texts	M	SD
Low	Television	62	22
	Aging	28	22
	Low subtotal	45	22
High	Susan	47	24
	Literature	33	19
	High subtotal	40	21

First, paired t-test was conducted to assess whether reading accuracy for low syntactic complexity scores and high syntactic complexity was different. The result revealed that across group proficiency levels, reading accuracy scores were significantly higher for low syntactic complexity (M=45, SD=22) than for high syntactic complexity (M=40, SD=21), $t(72)=6.27$, $p<.000$, $d=1.48$. Cohen's d effect size was computed using online tool via http://www.uccs.edu/~lbecker/. This revealed a small effect size of the difference (Cohen, 1988) so that syntactic complexity (low and high syntactic complexity) did differentiate reading performance across group proficiency levels but it had small effects. This supported the idea that the reading performance was accounted by other variables such as lexical complexity.

Table 3. Descriptive statistics for reading accuracy across syntactic complexities by proficiency groups

Complexity	High proficiency group		Low proficiency group		Overall	
	M	SD	M	SD	M	SD
Low	55	18	35	14	45	19
High	49	12	29	15	40	17

Looking at more details on the group performance (high proficient group and low proficient group) on both low syntactic complexity-based texts and high syntactic complexity, reading

accuracy means for low syntactic complexity and high syntactic complexity discriminates the two group proficiency levels at p<.000. The mean accuracy for each group is illustrated in Table 3. Overall, low syntactic complexity demonstrated a higher performance compared to high syntactic complexity. This finding supports the hypothesis that reading comprehension decline is due to the increase of syntactic complexity level within texts (figure 1). Regardless of syntactic complexity factors, high proficiency groups outperformed low proficiency group.

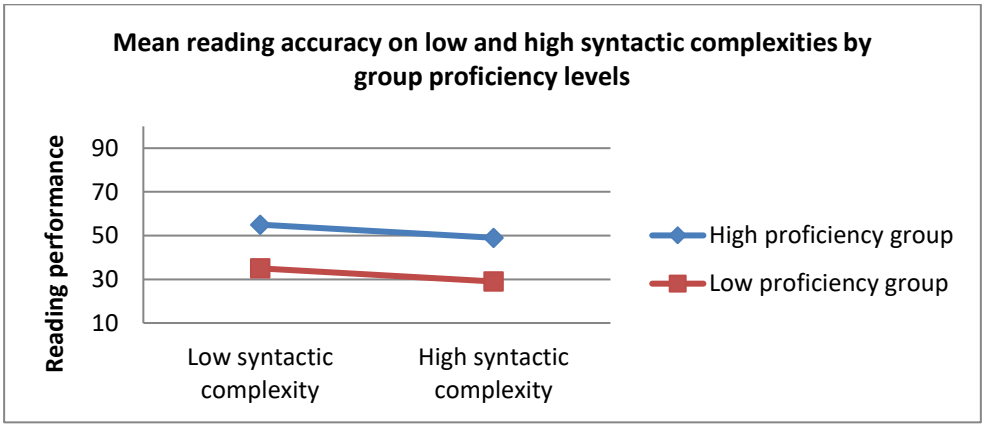

Figure 1. Means accuracy by proficiency levels and syntactic levels

Two-way (Group x Syntactic level) ANOVA was conducted to see the difference of reading performance by two proficiency groups on two syntactic complexity level-based reading. Group was the between subject factor (High proficient group x Low proficient group) and syntactic levels become the within subject factor, repeated measure factors (low syntactic level x high complexity). The results revealed a main effect of group proficiency level on reading performance, F (1,73)=26.92, p=.000 , ηp^2 (partial $\eta 2$)=.269, and syntactic complexity level, F (1,72)=7.77, p=.007 , ηp^2=.098. There was no interaction between group proficiency and syntactic complexity level, F (1,72)=0.795, p=.375 , ηp^2=.011. Pair wise comparison for group and syntactic level showed the mean differences were significant at p<.05, based on a Bonferroni

adjustment made for multiple comparison. The absence of the interaction between group proficiency levels and syntactic complexity demonstrated that group differences in reading performance were not affected by the role of syntactic complexity.

Furthermore, one-way (syntactic level) ANOVA by group was conducted to see in more detail how different proficiency groups performed at every level of syntactic complexity-based texts (see Table 4). Analysis of variance on low level of syntactic complexity text revealed significant main effect of group proficiency levels on reading performance, $F(1, 73)=.26.92$, $p=.000$, $\eta p^2=. 269$. In case of reading performance on high syntactic complexity –based texts, significant main effect of proficiency levels was observed on reading performance, $F(1, 71)=.42.82$, $p=.000$, $\eta p^2 =. 376$. Post hoc analyses using Bonferroni indicated that statistical difference of low syntactic complexity and high syntactic complexity- based reading performance were evident at $p=.000$. These results illustrated that syntactic complexity did discriminate reading performance by group proficiency levels. This finding supports the hypothesis that syntactic complexity level in the texts did consistently predict reading performance between high and low proficiency groups. Simply put, increasing the level of syntactic complexity overall reduce reading comprehension for two proficiency groups.

Table 4 Results of ANOVA by group proficiency levels

Syntactic complexity levels	Reading accuracy		Sig.	Partial η^2
	High proficiency	Low proficiency		
Low	55	35	.000	.269
High	49	29	.000	.376

Key: Significant value at the .05

The second purpose of the paper was to investigate syntactic complexity and its role in predicting L2 reading outcomes across and between group proficiency levels. The influential power of syntactic complexity in reading was assessed by Pearson's correlation and

hierarchical regression analyses. Syntactic complexity levels (high & low) as predictor variable and reading accuracy as the criterion variable. A summary of the results are presented in Table 3. Both syntactic complexity measure and reading measure were less correlated across proficiency levels, Pearson's r (148)=.14, p<.098. In line with this, syntactic complexity accounted for only amount of variance of around 2% in reading measure, indicating that syntactic complexity brought less improvement in reading comprehension (Table 5). This suggested that syntactic complexity was less predictive of reading performance across proficiency levels.

Table 5. Hierarchical regression analyses of the syntactic complexity measure as predictors variable and reading performance as criterion across group proficiency levels

N	**R**	R^2	**AdjustedR^2**	**R^2change**	**B**	**SEB**	β
148	.14	.019	.012	.019	-4.910	2.950	-.136

*F significant at * p < .05, ** p < .01, *** p <.001.*

A further set of correlation and regression was also computed in between group proficiency levels. As indicated in Table 6, syntactic complexity was not significantly correlated with reading performance ranging from r=.17 (high proficient group) to r=.23 (low proficient group). In addition, the Fisher r-to-z transformation was utilized to evaluate whether the two correlation coefficients of two group proficiency levels were significant or not, and it was found that the two coefficient values were not statistically different (p=.711, z=-0.37). In terms of predictive value of syntactic complexity toward reading, syntactic complexity explained only 3% of the variance of reading for high group proficiency and 5% of the variance for low proficiency group. Overall, syntactic complexity was less predictive on reading performance between two group proficiency levels suggesting that many other variables accounted for L2 reading performance.

Table 6. Hierarchical regression analyses of syntactic complexity measure as predictors variable and reading performance as criterion by group proficiency levels

Proficiency levels	**R**	***R²***	**Adjusted*R²***	***R²*change**	**B**	**SEB**	**β**
High proficiency (n=77)	.17	.029	.016	.029 (n.s)	-5.365	3.564	-.171
Low proficiency (n=71)	.23	.054	.041	.054 (n.s)	-6.707	3.367	-.233

DISCUSSION

This paper was intended to examine two questions of (1) whether syntactic complexity exerts great effects on L2 reading performance in Indonesian EFL context, and (2) to what extent syntactic complexity predicts L2 reading. The results of this experiment provided partial support for the link between syntactic complexity and L2 reading. It is partial since the evidence demonstrated that the difference of reading outcomes for low syntactic complexity and high syntactic complexity was small across and between group proficiency levels. On the other words, this partially supports the complexity-accuracy framework (Skehan, 2009) in reading by which the higher complexity in the texts, the lower accuracy performance on reading outcomes. The finding showed a decline in reading comprehension when the texts contain more increasing of syntactic complexity across and between group proficiency levels. Reading performance on texts with low syntactic complexity levels was better than reading accuracy on texts with high syntactic complexity.

Meanwhile, the effect of proficiency levels in L2 reading was more pronounced than the effect of syntactic complexity in which the latter showed a small effect power. It demonstrated that L2 proficiency plays fundamental effect on L2 reading outcomes (Bernhardt & Kamil, 1995). Moreover, it is acknowledged here that these participants were still struggling with reading comprehension since the overall performance was still below 60%.

In addition, low correlation was observed between syntactic complexity and reading comprehension across and between group proficiency levels. The evidence that the two correlation values between the two groups were not significant also indicated that syntactic complexity did not affect much on reading comprehension. Following such pattern, syntactic complexity was also less predictive to reading comprehension accounting for only 3-5% of reading variance. This finding supported previous findings about non-significant effect of syntactic complexity on reading by children (Arya et al., 2011) and L2 adult (Barrot, 2013). Hence, this fact was against the finding that syntactic complexity contributes significantly to L2 reading with β=.37 (Karami & Salahshoor, 2014). Furthermore, looking at the effect of lexical complexity as a function of textual complexity on reading comprehension might be of interest for further studies.

In addition, it may be that the construct of the correlation between syntactic complexity and L2 reading outcome was indirect. It could be argued that syntactic complexity and text comprehension are essentially independent. More complexity in syntactic level does not necessarily equal lower reading comprehension. Since syntactic complexity is only one measure of text readability measures instead of lexical complexity, it is playing a role but other factors might explain other variance in L2 reading. It may be that there are other factors such as lexical which make L2 reading easy and difficult to process since some reading scholars found understanding words was a bottleneck in L2 reading (Anderson, 1999a; Grabe, 2009). In other words, simple sentences with less frequent words used might be more difficult than complex syntactic structures with popular or most frequent words used.

The result of this study partially confirms the hypothesis about the role of textual syntactic complexity as a function of text complexity on reading performance. This might have practical implication particularly in testing purposes. Syntactic complexity was not sufficient to have a high proportion in judging the level of complexity of the texts. In pedagogical purposes, reducing the syntactic

complexity of the texts may not bring group's reading comprehension differences significantly. Another variable in text complexity such as lexical complexity might have a better predictive value on L2 reading.

CONCLUSION

This study reveals that syntactic complexity and accuracy in reading texts are fundamental aspects of L2 reading but since syntactic complexity play a little effect, lexical complexity as another function of text complexity need to be considered in future study so that the two general linguistic factors in text complexity framework (lexical complexity and syntactic complexity) can be closely assessed for future practical testing purposes and pedagogical considerations particularly in L2 context.

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