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READING SPEED AND READING COMPREHENSION: A MISSING LINK?

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Abstract
Reading speed is linked to reading comprehension. While struggling readers read laboriously in their effort to identify words, good readers who read rapidly, accurately and effortlessly are able to utilize their cognitive resources to aid comprehension. This study was carried out to investigate the effectiveness of using repeated reading (RR) strategy on reading accuracy of Malaysian lower secondary school students using the curriculum-based measurement (CBM) procedure (Deno, 1985, 2003). The single subject experimental design (SSED) was used to investigate the effects of the RR strategy on five lower secondary struggling readers' reading speed as measured by the percentage of word decoding (%WCPM). Data was over a period of 12 weeks and their initial and final reading %WCPM was charted on a line graph. The visual results from the line graphs were used to compare the student's individual progress within case as well as across cases. The one-way repeated measures ANOVA procedure was conducted to compare scores of accuracy at Time 1 (baseline prior to intervention), Time 2 (4th week after intervention), Time 3(8th week after intervention) and Time 4 (12th week after intervention).The findings showed that the RR strategy was an effective instrument in enhancing the participants reading rates as measured in %WCPM.

Keywords*: Reading accuracy, repeated reading, curriculum based measurement (CBM), word read correct per minute (WCPM), percentage of WCPM.*

INTRODUCTION

Mastery of the reading skills is central in academic settings (Grabe, 2004) as well as for general purposes (Jodai & Tahriri, 2011). Thus students' ability to read is regarded as one of the most important educational outcomes (Harmer, 2008). In schools comprehension is the fundamental goal of reading (Nation, 2008) for it serves as the core (Shriver, 2006) or essence of any reading program (Jennings, Caldwell & Lerner, 2010).

Researchers have long attested the relationship between reading fluency and reading comprehension (Neddenriep, Fritz & Carrier, 2011; Grabe, 2010; Rasinski, 2005, 2012). Studies spanning over 20 years show the relationship between these two elements (Grabe, 2010; Rasinski, 2012), especially in the L1 context. The correlation between reading fluency and reading comprehension is as high as r = .81 to .90 (Grabe).

LITERATURE REVIEW

Researchers define reading fluency in a number of ways. Fluency is the ability of a competent reader to read non-technical text effortlessly, smoothly, and automatically (Schreiber, 1980), it is the ability of a reader to read text aloud with accuracy, speed, and proper expression (National Reading

Panel (NRP), 2000), it consists of word recognition, accuracy, automaticity and prosodic and syntactic structures (Grabe, 2010) and oral reading fluency (ORF) is the ability to read a text both orally and silently with the correct speed, accuracy, and expression (Rasinski, 2004a).

Although the components of accuracy, automaticity in reading and prosody or reading with expression are closely linked with one another, the role of automatic word recognition or word decoding is viewed as the foundation or the heart of fluent reading (Segalowitz & Hulstijn, 2005). This notion is supported by Spooner, Baddeley and Gathercole (2004) who claim that comprehension ability might be largely dependent on decoding ability and good word recognition is essential for accessing the meaning of written text (International Literacy Association, 2015).

Reading Accuracy and Reading Comprehension

According to Kang*, et al.* (2014), in the L1 context it is accepted that the decoding skills contribute more to reading comprehension for younger or less-skilled readers as compared to older and skilled readers. However, Linan-Thompson (n.d.) claims that accurate reading is crucial to reading comprehension in general. She explains that comprehension will not be affected if we read 'home' instead of 'house'. On the contrary comprehension will be affected if we read 'horse' for 'house'. This explains why it is important for all students to develop adequate decoding skills.

Linan-Thompson (n.d) further explains that exposure to and practicing reading high frequency and decodable words in isolation as well as in text will develop students' automaticity in word decoding. She continues that in addition to decoding words accurately, students need to learn to monitor their understanding of what they read. This monitoring will allow them to self-correct themselves if a word they read incorrectly affects their comprehension of what they are reading.

Accuracy in decoding words or texts is further viewed as an essential component in reading fluency because without accuracy in decoding words and text, comprehension is likely to be reduced (Segalowitz & Hulstijn, 2005). This affirms the notion that the reading process comprises of word identification and comprehension; two differing but highly interrelated areas.

Theoretical Framework

The essential role fluency plays in efficient and successful reading is centred on the Theory of Automatic Information Processing (LaBerge & Samuels, 1974) which theorizes that to become an efficient reader, students should be able to recognize and identify words automatically and then connecting the words as they read to make meaning. The Automatic Information Processing Theory proposes certain assumptions to explain the change from a beginner to an expert.

According to the theory the human mind has a limited capacity to conduct a complex task. Therefore, in order to carry out complex tasks such as recognizing words in a text or understanding their meaning, the mental effort will be spent and this effort utilizes some of the limited capacity of the mind. However, with continued practice over time, the amount of effort needed to perform the task becomes lesser and when this happens a person can carry out two or more tasks at the same time. This simple assumption describes how fluent reading takes place (Samuels, 2004).

When a reader reads, two tasks are carried out simultaneously; decode or recognize the printed words, and the construction of meaning of the words (comprehend) that were decoded (Pikulaki & Chard, 2005; Samuels, 2012; Therrien, 2004). At the beginning stage a reader will find the decoding task to be difficult. When all of the mental capacity is used up in the word recognition process a reader is unable to construct the meaning of a text read. Yet, once the reader is able to decode the words, he can switch his attention to getting meaning. At this stage though, the reading process is one of switching attention back and forth from decoding to meaning making (comprehension). The attention switching process is slow, effortful, and taxing on memory.

When a reader has lots of practice at reading high frequency or common words found in easy reading texts, the decoding or word recognition process becomes easier and eventually it becomes automatic. Automatic entails that the words can be decoded easily with speed and accuracy. Once the decoding task becomes easy and does not utilize all of the processing capacity of the mind, the reader is able to direct the unutilized fraction of the mind toward meaning making. This is the most important trait of a fluent reader; the ability to decode and to comprehend text simultaneously.

Repeated Reading (RR)

According to Samuel (2012) the decoding or word recognition process becomes easier and eventually it becomes automatic with lots of practice at reading high frequency or common words found in easy reading texts. Automatic means that the words can be decoded easily with speed and accuracy.

Reading accuracy thus can be practiced and an analysis of research involving oral reading fluency (ORF) instruction and assessment will show the extensive use of the RR strategy, the by-product of the automaticity theory (Allington, 2009) developed by LaBerge and Samuels in 1974 (Samuels, 2012). This strategy developed by Samuels in 1979 translates the theory into practice (Taguchi, Gorsuch, & Sasamoto, 2006**)**. The strategy denotes an educational strategy for developing reading fluency in which a student rereads a passage until he meets a criterion level. This strategy is an effective tool and research illustrated that it aids improvement in reading fluency and other aspects of reading achievement (Therrien & Kubina, 2007).

The impact of repeated oral reading on fluency was also underlined by Reutzel (2012). A meta-analysis of fluency studies showed that fluency practice is most effective when the reading practice involves RR of a text more than twice. Additionally, its effectiveness is also evident when students are provided with feedback from their teachers, parents, volunteers, and peers.

Therrien and Kubina (2007) affirmed that RR enhances students' reading fluency. They conducted a study to compare reading words in context and reading words out of context to a performance criterion. While investigating if practice with connected text is a critical component of RR for fluency improvement, they found that when students reread words in context, they tended to read faster and made few errors. The researchers reported that students' reading speed increased and the number of word errors decreased as the students reread the connected text passage. All the students who participated in this study reached the rate of 93 words read correct per minute (WCPM) which is the performance criterion with the six readings allocated.

Oral Reading Fluency (ORF) Assessment

A reading assessment should be valid and time efficient. The Curriculum Based Measurement (CBM) (Deno, 1985) which clearly focused on reading fluency assessment is hence a reliable assessment. Since it is used to measure oral reading fluency it is also known as CBM/ORF.

During a reading fluency assessment the CBM/ORF approach requires a reader to read grade-level text orally for one minute. While the reader reads, the teacher or examiner conducting the assessment will mark his uncorrected errors and then calculates the total number of words read correctly. Accuracy is determined by the percentage of words a reader read correctly because it is regarded as a valid measure of reading proficiency (Rasinski, 2004b). If a reader who score within the 97-100% range (independent level) he is capable of reading the assessment text or other text of equivalent difficulty without assistance. If he scores within the 90-96% range (instructional level) he is capable of reading the assessment text or other text of similar difficulty with some assistance customarily provided by a teacher or parent. If he scores below 90% in word accuracy (frustration level) he will find the assessment text or other texts of equal difficulty too difficult to read, though with assistance. The levels of word decoding accuracy are presented in Table 1.

Table 1. Levels of performance for word decoding accuracy.

Reading level	*Percentage range*
Independent Level	97-100
Instructional Level	90-96
Frustration Level	<90

The extensive account on topics related to reading fluency, the RR strategy and its procedure, and the ORF assessment are important topics to consider when planning ORF intervention.

Research Questions

With reference to the previous literature, the study was conducted to answer two research questions using the multiple baseline single-subject design (Creswell, 2008):

1. What is the impact of the RR strategy on the reading rate per minute of lower secondary Malaysian school students as measured by the percentage of word decoding?
2. How effective is the RR strategy in enhancing lower secondary Malaysian school students' reading accuracy development?

METHODOLOGY

The purpose of this study is to investigate the effectiveness of using the RR strategy to enhance lower secondary students' reading accuracy which is one of the components of reading fluency. The CBM, also known as ORF (hence, the CBM/ORF), developed by Deno (1985) was administered to assess students' accuracy in word decoding.

Participants

Participants were five Form 1 students who were struggling readers. They can read but they tend to omit, add, and mispronounce words. In addition, they tend to read at a slow to moderate pace, their reading lacks prosody or expression, and they have difficulty comprehending the text. The five students came from varying socio-economic background. Three of them are Malays and two of them Indians.

Site

The study was conducted in a suburban secondary school in the state of Selangor, Malaysia. The school is about 15 kilometres from Kuala Lumpur, the capital city. It had an enrolment of approximately 1,800 students. The majority of the students were Malays and the rest of the students were Indians and Chinese.

Materials

Materials used in this study consisted of reading texts of between 100 to 250 words at the participants' instructional level. The texts were diversified and consisted of narrative, descriptive ad expository essays. Words used in each text were repetitive in nature. The reading texts contained among other things compound words, suffixes, and mono-syllabic and disyllabic words.

Instrument

The CBM/ORF (Deno, 1985, 2003) procedure was used to investigate the participants' reading accuracy.

Research Design

The single subject experimental design (SSED), which is often used to investigate the effects of an intervention at an individual level, was used in the study. The SSED was utilized since the focus was on individual participants (Byiers, Reichle, & Symons, 2012).

The Repeated Reading (RR) Training

Two teacher researchers conducted the ORF assessment for the researcher. They were trained to identify errors which included mispronunciations, substitutions, reversals, omissions, or words pronounced by the author after a wait of 2-3 seconds without an attempt or response from the participant (Rasinski, 2004b). Apart from being taught to identify the errors they were additionally taught the steps to conduct the ORF/CBM procedure.

Data-Collection Procedures

Data were collected over a period of 12 weeks. In the course of data collection, intervention was conducted twice per week for about 15-20 minutes per session per each participant. Figure 3 illustrates the intervention procedure.

Establishing Baseline for Accuracy in Word Decoding

The percentage of words read correctly per minute for each participant was recorded for 5 days. All five scores were then averaged after the fifth reading. This averaged score formed the baseline for accuracy in word decoding. If a participant read a 150-word passage and made six errors while

reading, he had accuracy in word decoding of 96%. To calculate take the number of words read correctly divided by the number of words in the text multiply by 100.

Twelve-week Repeated Reading (RR) Intervention

The intervention was administered twice a week for 12 weeks. Each intervention lasted approximately 15 to 20 minutes per participant. The CBM/ORF procedure was used to assess the students' reading accuracy or accurate decoding of words in text (Rasinski, 2004b).

Assessing Accuracy in Word Decoding

Each participant's accuracy in word decoding was assessed in the following manner: (1) The participant read a text for 1 minute; (2) the teacher researchers listened to the participants' reading and marked any reading errors made; (3) the teacher researchers determined the participants' accuracy by calculating the number of words read correctly divided by the number of words in the text multiply by 100; (4) the teacher researchers charted the participants' percentage of accuracy in word decoding on a line graph. This first reading was the initial reading of the participant (5) one of the teacher researchers modelled the reading; (6) the participant listened to the teacher researcher and then echoed her reading afterwards; (7) the participant completed four trials of RR; (8) the participant reread the text for 1 minute after his or her fourth trial of RR and; (9) the teachers listened to the participant's reading and repeated Steps 3 and 4. This second reading was the final reading of the participant.

Data Analysis

The initial and final percentages of word decoding accuracy were charted on line graphs for each participant. The use of line graphs was relevant in this study because it was a graphic mode used to present data (Billstein, Libeskind, & Lott, 2004). Each participant's initial and final percentage of word decoding accuracy was compared against the target norms in Table 1.

Analysing Data within Cases

The visual results from the line graphs were used to compare the student's individual progress throughout the 12-week intervention. First, the baselines for each participant's accuracy in word decoding (in percentage of WCPM) were charted on the line graphs. Then the initial and final percentages of his WCPM were charted on two separate lines in the graphs. The effects of the 12-week RR intervention for each participant were observed. The individual progresses of the participants' accuracy in word decoding were examined. This helped to establish whether the 12-week RR intervention impacted each participant's accuracy in word decoding.

Analysing Data across Cases

The participants were of different socioeconomic backgrounds, races, gender, parental academic backgrounds, and exposure to ESL. Hence, apart from establishing each participant's individual progress, the data collected were used to compare the effects of the 12-week RR intervention across all participants.

In addition to the line graphs, the SPSS, Version 11.5, was used to carry out the one-way repeated-measures ANOVA procedure to examine the level of significance between Time 1 (baseline, before the intervention) and Time 2 (4th week intervention), between Time 2 and Time 3 (8th week intervention), and between Time 3 and Time 4 (12th week intervention).

RESULTS

Research Question 1

What is the impact of the RR strategy on the reading rate per minute of lower secondary Malaysian school students as measured by the percentage of word decoding? The CBM/ORF procedure (Deno, 1985, 2003) was used to answer Research Question 1.

Figure 1 shows the results of Participant 1's percentage in accuracy in word decoding. The baseline for her reading rate per minute was 73.6%. Her initial reading rate per minute ranged from 92% to 99% and her final rate per minute ranged from 97% to 100%. This result showed that during the initial reading, she read at the instruction level 22 times and on two occasions she read at the

independent level. In contrast, she read at the independent level 100% throughout the final reading after she had read the reading texts four times repeatedly.

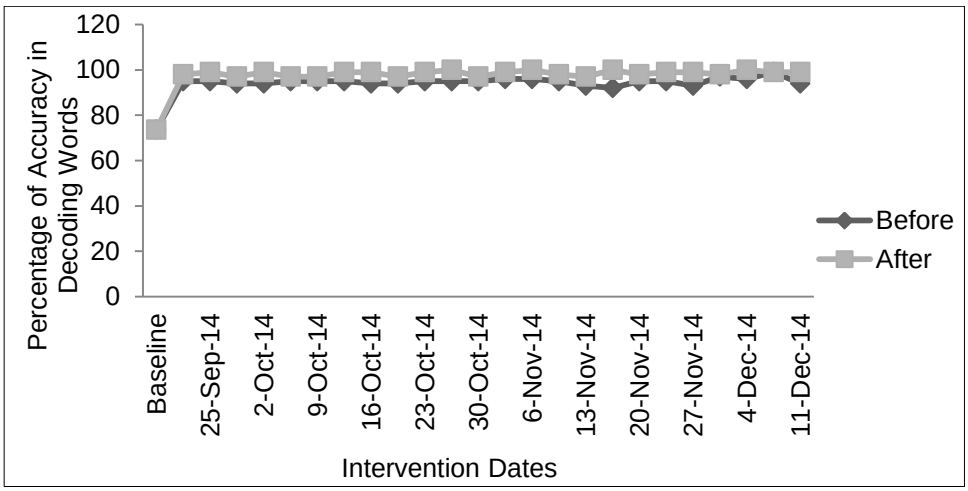

Figure 1. Result of Participant 1's accuracy in word decoding.

Figure 2 shows the results of Participant 2's accuracy in word decoding. The baseline for his reading rate per minute was 88.2%. His initial reading rate per minute ranged from 91% to 97% and his final rate per minute ranged from 97% to 100%. This result showed that during the initial reading, he read 21 times at the instruction level and on three occasions he read at the independent level. In contrast, he read 22 times at the independent level and two times at the instructional level during the final reading after he had read the texts four times repeatedly.

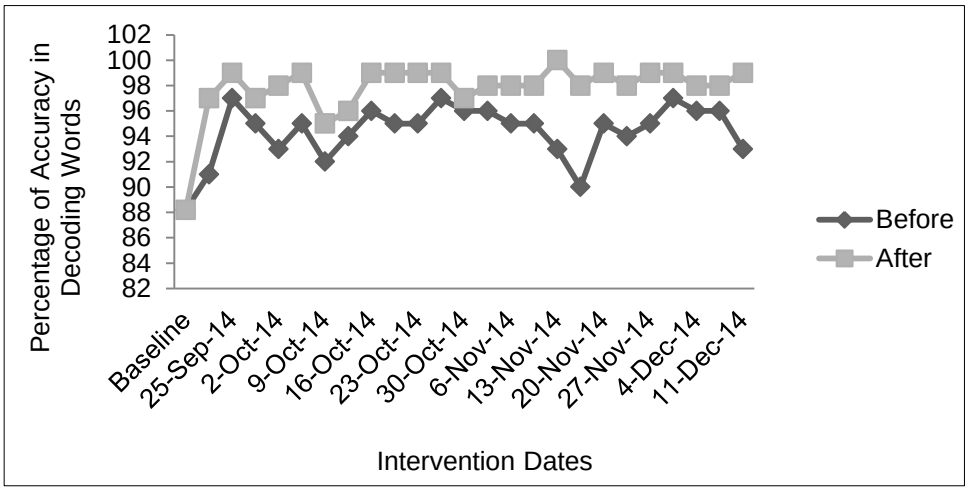

Figure 2. Result of Participant 2's accuracy in word decoding.

Figure 3 shows the results of Participant 3's accuracy in word decoding. The baseline for her reading rate per minute was 85.6%. Her initial reading rate per minute ranged from 88% to 96% and her final rate per minute ranged from 95% to 100%. This result showed that during the initial reading, she read 22 times at the instruction level and on two occasions she read at the frustration level. In contrast she read 20 times at the independent level and four times at the instructional level during the final reading after she had read the reading texts four times repeatedly.

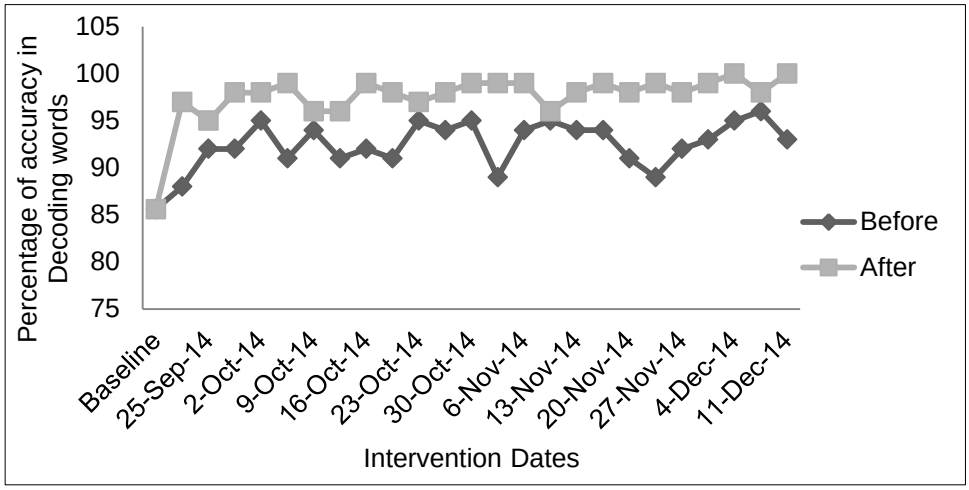

Figure 3. Result of Participant 3's accuracy in word decoding.

Figure 4 shows the results of Participant 4's accuracy in word decoding. The baseline for her reading rate per minute was percentage of 81.8%. Participant 4's initial reading rate per minute ranged from 88% to 98% and her final rate per minute ranged from 96% to 100%. This result showed that during the initial reading, she read 21 times at the instructional level and on two occasions she read at the frustration level and once at the independent level. In contrast, she read 11 times at the instructional level and 13 times at the independent level during the final reading after she had read the reading texts four times repeatedly.

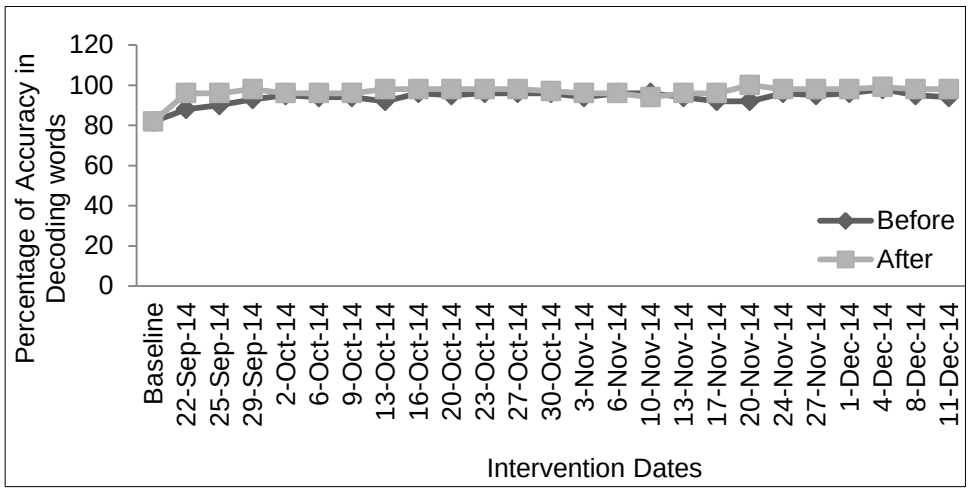

Figure 4. Result of Participant 4's accuracy in word decoding.

Figure 5 shows the results of Participant 5's accuracy in word decoding. The baseline for his reading rate per minute was 88.9%. Participant 5's initial reading rate per minute ranged from 94% to 99% and his final rate per minute ranged from 95% to 100%. This result showed that during the initial reading, he read 16 times at the instructional level and on eight occasions he read at the independent level. In contrast, he read 23 times at the independent level and on one occasion he read at the instructional level during the final reading after he had read the reading texts four times repeatedly.

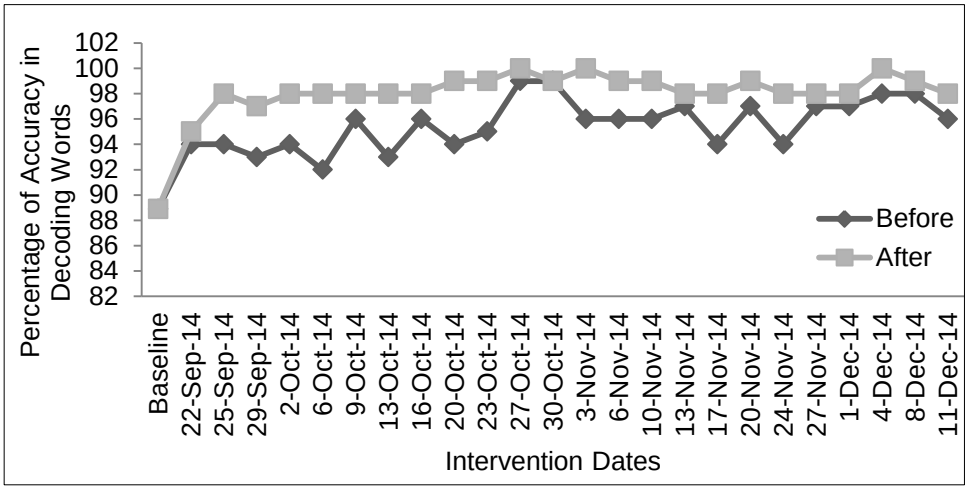

Figure 5. Result of Participant 5's accuracy in word decoding.

Research Question 2

How effective is the RR strategy in enhancing lower secondary Malaysian school students' reading accuracy development?

The one-way repeated measures ANOVA procedure was conducted to compare scores of the accuracy with statistics test at Time 1 (baseline, prior to the intervention), Time 2 (4th week intervention), Time 3 (8th week intervention), and Time 4 (12th week intervention). The mean and standard deviation is presented in Table 2 for Time 1 (baseline, prior to the intervention), Time 2 (4th week intervention), Time 3 (8th week intervention), and Time 4 (12th week intervention)

Standard univariate ANOVA (labelled sphericity assumed) indicated a significant time effect ($F(3, 12) = 335.77$, $p < 0.0005$). For a one-way within-subject ANOVA, all multivariate tests (Pillai'sTrace, Wilks' Lambda, and Hotelling's Trace and Roy's Largest Root) must yield the same result. The multivariate tests indicated a significant time effect (Wilks' Lambda = .005, $F(3, 2) = 142.27$, $p = 0.007$ and multivariate partial eta squared = .99) .

Table 2. Descriptive statistics for accuracy with statistics test at Pretime (Baseline) 1, Time 1, Time 2, and Time 3.

Time	*M*	*SD*	*N*
1 (baseline prior to the intervention)	130.680	4.4466	5
2 (4th week intervention)	154.7250	.80719	5
3 (8th week intervention)	159.5500	1.85531	5
4 (12th week intervention)	185.1250	2.89531	5

Pairwise Comparisons: Accuracy

Six pairwise comparisons were conducted among the mean for pre-Time 1 (baseline, prior to the intervention), Time 2 (4th week intervention), Time 3 (8th week intervention), and Time 4 (12th week intervention). All the six pairwise comparisons were significant controlling for family wise error rate across the six tests at the .05 level, using the Bonferroni procedure.

The smallest *p*-value was for the comparison of Time 1 and Time 4 and Time 2 and Time 4, and its *p*-value of 0.000 was less than $\alpha = .05/5 = .01$ and, therefore, difference between the means for these four times was significant. The next smallest *p*- value was for the comparison of Time 1 and Time 2, Time 1 and Time 3, and Time 3 and 4. Its *p*-value of .001 was less $\alpha = .05/3 = .02$ and, therefore, difference between the means for these six times was significant. The next smallest *p*-value was for the comparison of Time 2 and Time 3, and its *p*-value of 0.034 was less than $\alpha = .05/2 = .025$ and, therefore, difference between the means of these two times was significant.

DISCUSSION

Research Question 1

What is the impact of the RR strategy on the reading rate per minute of lower secondary Malaysian school students as measured by the percentage of word decoding?

The accuracy in word decoding was measured by the reading rate per minute. With reference to Rasinski (2004a), the author converted the total number of words read per minute to percentage (see Figure 4). The percentage of WCPM was then compared against the levels of performance for word decoding accuracy (see Table 3).

The overall results showed Participant 1 read the text independently throughout the final reading sessions, Participant 2 read 21 times at the instruction level and three times at the independent level, Participant 3 read 20 times at the independent level and four times at the instructional level, Participant 4 read 11 times at the instructional level and 13 times at the independent level, and Participant 5 read 23 times at the independent level and on one occasion he read at the instructional level during final reading session.

The results of this study are consistent with Neddenriep et al. (2011) who conducted a study on 5 fourth-grade students within a 15-week period to assess generalized improvements in *comprehension.* The researchers found that at the end of the intervention, the participants made an average of 25% increase from their baseline levels of performance and that represented an average gain of 15 words from baseline to intervention with an effect size of 1.25. They further found that reading fluency of the four students improved and they could read at an instructional or mastery level.

The results of this study that showed that the reading rate per minute of all five participants improved significantly after the RR intervention and this is consistent with Samuels (2012) who found that with each rereading of the same passage, mentally challenged students made fewer errors and their reading rate was enhanced.

Research Question 2

How effective is the RR strategy in enhancing lower secondary Malaysian school students' reading accuracy development?

The results of the one-way repeated measures ANOVA procedure was used to compare accuracy with statistics test at Time 1 (baseline, prior to intervention), Time 2 (4th week intervention), Time 3 (8th week intervention), and Time 4 (12th week intervention). The *p*-value for the comparison of Time 1 and Time 2 and Time 1 and Time 3, was .001, *p*-value for the comparison of Time 1 and Time 4 was 0.000, the *p*-value for the comparison of Time 2 and Time 3 was .034, and the *p*-value for the comparison of Time 3 and Time 4 was .001 The *p*-value of the comparisons of Time 1 and Time 2, Time 1 and Time 3, Time 1 and Time 4, Time 2 and Time 3, Time 2 and Time 4, and Time 3 and Time 4 were all smaller than $\alpha = .05$. The effect size of .99 indicates the means for these four times was moderately significant. Thus, a conclusion can be made that the RR strategy had a positive impact on the lower secondary Malaysian school students reading rate per minute.

CONCLUSION

The objectives of this study was to investigate the impact of the RR strategy on the reading rate per minute of lower secondary Malaysian school students and the effectiveness of the RR strategy in enhancing lower secondary Malaysian school students' reading accuracy development . The results showed that the reading rate per minute of all five participants improved significantly after the RR intervention. In addition to that the results of the one-way repeated measures ANOVA procedure which was used to compare accuracy with statistics test at Time 1 (baseline, prior to intervention), Time 2 (4^{th} week intervention), Time 3 (8th week intervention), and Time 4 (12^{th} week intervention) showed that the RR strategy was effective in enhancing lower secondary Malaysian school students' reading accuracy development.

The Theory of Automatic Information Processing (LaBerge & Samuels, 1974) posits that to become an efficient reader, readers should be able to first recognize and identify words automatically and afterwards connect the words as they read to make meaning of the words they have decoded. The theory in addition informs us that the human mind has a limited capacity to conduct a complex task. Hence, struggling readers could only use the limited capacity of their minds

to decode words. However, with continued practice over time the effort they need to decode words becomes lesser and they can do two things which are word decoding and making meaning of the words they have decoded.

Results of this study have proven the effectiveness of the RR strategy in improving struggling readers' reading rate per minute and enhancing their accuracy development. In addition to that the CBM/ORF procedure (Deno, 1985) is a simple and effective ORF assessment. As such, teachers should utilize the RR strategy and CBM/ORF procedure at school to help their struggling readers to become better readers. The utilization of the RR strategy and CBM/ORF procedure can be very effective in enhancing struggling readers' accuracy in decoding words which is an essential component in reading fluency. For without accuracy in decoding words and text, comprehension is likely to be reduced (Segalowitz & Hulstijn, 2005). Accuracy in word decoding as measured in percentage of WCPM is the missing link which bridges reading fluency and reading comprehension.

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