How Extensive Reading, Reading Span, and Reading Speed Are Interrelated

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This study employed a method of cognitive psychology and aimed to investigate how Extensive Reading, reading span, and reading speed are interrelated. Forty Japanese high school students chose and read English graded readers outside the class freely for about seven months. A reading span test and a reading comprehension test were given to them before and after the reading. The results of the ANOVA and correlations showed the following: Extensive Reading (ER) improved the reading span and reading speed, and the amount of reading, reading span, and reading speed are correlated to each other.

Day and Bamford (1997) explained the role of Extensive Reading in developing fluent second language readers. They emphasized the importance of automatic recognition of words in reading. They stated that insufficient slow lexical access makes it more difficult for working memory to perform its work. However, there are few studies on ER employing methods of cognitive psychology and psycholinguistics.

Working memory (WM) is the system that actively holds information in the mind, and which is needed to perform complex tasks such as reasoning, comprehension, and learning. The capacity of the resources of WM is thought to be limited.

The Reading Span Test (RST) was developed by Daneman and Carpenter (1980). It measures differences in individuals' WMs. The test involves a dual task: reading English sentences aloud, and then memorizing the last word of each sentence. Both of the tasks are believed to use much of the limited available resources of WM.

Studies in L1

Daneman and Carpenter (1980) investigated the RST scores and reading comprehension scores, and showed that they are correlated. They also discovered that the scores of word span tests and those of reading comprehension questions are not correlated. Daneman and Merikle (1996) carried out a meta-analysis of 77 studies that investigated the association between WM capacity and language comprehension ability, and showed that measurements using the combined processing and storage capacity of WM (e.g., reading span, listening span) are better predictors of comprehension than are measurements that use only the storage capacity (e.g., word span, digit span).

Studies in L2

Akamatsu (2000) investigated 105 Japanese college students and showed that the scores of RSTs in English and those of reading comprehension questions are correlated ($R2 = .35$, $p < .05$).

Osaka, Osaka, and Groner (2000) studied the performance on RSTs in Italian on Japanese university students who majored in Italian, and found that the longer they learned Italian, the higher their scores were on RSTs in Italian. She determined that as the period of learning L2 becomes longer, proficiency in the language improves, processing of reading becomes more efficient, the amount of WM resources spent on reading out loud decreases, and more WM resources can be used to memorize words.

The results of these studies in L1 and L2 showed that the scores of RSTs are correlated to those of reading comprehension. Therefore, it can be assumed that as reading comprehension improves in both L1 and L2, the WM resources that are spent on reading comprehension or reading out loud decrease, and the WM resources that can be spent on memorizing words increase.

WM and ER

Many studies on ER found that as the participants read more, their reading comprehension improved. Therefore, following the previous section, it can be assumed that as participants read more in ER and their reading comprehension improves, the WM resources that are spent on reading comprehension or reading out loud decrease, the WM resources that can be spent on memorizing words increase, and the scores of RSTs will get better.

Sasaki and Ueda (2007) conducted a study with 55 Japanese university students as participants. The students chose and read easy English books for about 30 to 40 minutes in class twice a week for 12 weeks. The result was that the average number of words read was about 20,000, and that the average scores of their RSTs after the ER period were better than those before the ER period. They maintained that the effects of ER are cognitive in nature. However, the number of words read and the improvement in the participants' scores on the RSTs were not correlated. They thought that the reason for this was that the difference in the number of words read among the participants was small, and that the differences in WM capacities among the participants were large.

Purpose

Research Question: How are ER, the improvement in reading span, and reading speed interrelated?

Method and Procedure

Participants and Procedure

The participants were 40 Japanese high school students who were 15 to 16 years old. Their English level was false beginner to pre-intermediate, and their TOEIC scores were estimated to be about 310 to 450. The participants chose and read graded readers outside the class freely for about seven months. The teacher instructed the participants to read as many books as possible, and to fill in "the reading marathon sheet" after reading them. An RST and a Reading Test were administered before and after their Extensive Reading.

Reading Span Test (RST)

In this study, the participant read aloud an easy English sentence on the monitor of a personal computer and tried to memorize the final word of the sentence. Right after the participant finished reading out loud, the tester erased the sentence and showed another one by clicking a key. The participant read the sentence out loud and again tried to memorize the final word. The same procedure was repeated until all the sentences of each set had been read out loud, and after that, the participant tried to recall the last words of each sentence.

Reading Test

In order to investigate reading speed (words per minute, or WPM) and reading comprehension, this study used reading comprehension questions taken from STEP (Eiken) Grade 3 and Grade 4 Tests. Through the pilot tests, the texts of the comprehension questions were deemed easy enough for the participants to read fluently. However, the tests were too easy to investigate their reading comprehension, so the scores were used only to check that the participants read the texts while simultaneously understanding it (The STEP Test is one of the major English proficiency tests in Japan; over two million people take it every year).

Data Analysis

After the ER program finished, the participants were divided into two groups according to the amount of words they read: MORE (19 participants who read more) and FEWER (19 participants who read fewer). A two-way 2 × 2 (Group [MORE, FEWER] × Test [pre-test, post-test]) repeated-measures ANOVA was carried out. A subsequent analysis was performed using Bonferroni's post hoc tests.

Next, the number of words read, the scores of the RSTs, and the WPMs were converted to z-scores. The relation between the improvement in the RST scores ([post-RST score] minus [pre-RST score]), the improvement in WPM ([post-reading test WPM] minus [pre-reading test WPM]), and the number of words read was investigated using Spearman's rank correlation. Spearman's rank correlation was used because Pearson's correlation analysis is extremely influenced by outliers.

Results and Discussion

The Results of the Amount of Words Read, RSTs and Reading Tests

Table 1 shows the summary of the descriptive statistics of the number of words read by the Group MORE and Group FEWER, and Table 2 shows the summary of the descriptive statistics of the results of the RSTs, WPM and reading comprehension..

Table 1. Number of Words Read

	MORE	FEWER
	n = 19	n = 19
Mean	45,447	14,279
Standard Deviation	24,458	4,787
Maximum	113,000	21,000
Minimum	23,000	2,400

Table 2. The Results of RSTs, WPM, and Reading. Comprehension

	MORE (N = 19)			FEWER (N = 19)		
	M (SD)	MAX	MIN	M (SD)	MAX	MIN
PRE-RST	26.58 (6.03)	38	19	26.00 (5.26)	34	17
POST-RST	29.47 (6.01)	39	17	26.11 (5.68)	33	14
PRE-WPM	77.60 (15.73)	103.63	37.79	86.74 (29.51)	172.71	56.03
POST-WPM	100.55 (22.62)	150.97	53.80	96.90 (29.48)	164.02	51.54
PRE-RC	22.21 (5.08)	28	5	21.42 (3.91)	28	13
POST-RC	25.89 (3.31)	30	14	24.11 (2.77)	28	19

Note. RC: Reading Comprehension; RST (full marks = 42), RC (full marks = 30)

Results of ANOVA and Correlation

The ANOVA results for the RSTs showed that there was significant interaction between groups and tests ($F(1, 36) = 5.925$, $p = .020$; partial $\eta^2 = .141$; MORE: pre < post). The result of the ANOVA for the WPMs also revealed that there was significant interaction between groups and tests ($F(1, 36) = 4.877$, $p = .034$; partial $\eta^2 = .119$; MORE: pre < post, FEWER: pre < post). Next, the Spearman's rank correlation was calculated. As a result, statistically significant weak correlations were found between the amount of reading and the improvement in the reading span ($\varrho = .327$, $p < .05$), and between the amount of reading and the improvement in reading speed ($\varrho = .321$, $p < .05$). Moreover, a statistically significant correlation was observed between the improvement in reading span and reading speed ($\varrho = .493$, $p < .05$).

Discussion

This study demonstrated that ER improves reading span and reading speed, and that the amount of reading, reading span, and reading speed are correlated to each other. From these, it can be assumed that by reading many books and processing a great many sentences, stories, and passages during the ER period, the WM resources that are spent on reading out loud decrease, the WM resources that can be spent on paying attention to various other things increase, and reading speed increases while comprehending stories and texts.

I would like to focus attention on the fact that ER improves reading span. It is possible that the improvement is related to the following favorable effects that previous studies on ER have found, because the improvement indicates that more WM resources can be used for various activities.

1) Many studies on ER demonstrated that ER improves reading comprehension. 2) Imamura (2007) showed that ER improves the use of global reading strategies, such as predicting what would come next by making use of titles and pictures, as well as inferring the meanings of unfamiliar words from the context. 3) Many studies on ER showed that ER improves the attitudes and motivation toward English and learning English.

As for 1), more WM resources can be used to read more precisely by paying more attention to a greater variety of elements in a given text. Regarding 2), more WM resources can be used to utilize appropriate global strategies more frequently. As for 3), if all WM resources are used only to understand the text, readers will not be able to enjoy reading.

As discussed, studies such as the present one that use a method of cognitive psychology can contribute to an understanding of the results of other studies on ER and the mechanism of the effects of ER. However, in order to discuss this issue with greater accuracy, many, more elaborate studies would have to be carried out.

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