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The Effects of English Reading through MPCS Program - Focused on Speed, Comprehension, and Efficiency Index

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The present research was conducted with the aims of developing a web-based Meaningful Phrase Code Switching (MPCS) Program and evaluating its effectiveness through English reading by college students. The specific purposes of this research were (1) to determine the effects of the MPCS program on reading speed, reading comprehension, and the reading efficiency index, (2) to examine the effects of the web-based MPCS program on the affective attitudes of learners, and (3) to find out the correlations between reading speed and reading comprehension. The research was conducted for one semester and the subjects were 52 students who were taking a foreign language course. All data were processed through SPSS (version 15.0). The web-based reading tests and surveys regarding their affective attitudes were conducted before and after the research. The results were as follows; first, the MPCS program made no significant difference in reading comprehension compared to the paper-based meaningful phrase learning. Second, it also made a notable difference in the participants' interest, experienced difficulty, self-confidence, concentration degree, and self-awareness degree of reading speed. Third, regarding the correlations between reading speed and reading comprehension, reading comprehension had no effect on reading speed.

[direct reading by meaningful phrases/reading efficiency index/Web-based meaningful phrase code switching program]

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I. INTRODUCTION

In this recent knowledge and information age, the quantity of information distributed in English appears infinite. The ways to distribute this available information in English are focused on sound (listening) and text (reading). Considering the EFL conditions in our country, the most effective and universal field of language teaching in order to solve a realistic demand is reading (Im, 2007; Jung, 2008; Mikulecky & Jeffries, 1986). To read and understand the majority of English information in a limited time period, what is required is fast reading and meaning grasping skills based on the progressive reading skills in English. Reading through meaningful phrases gives fluency and automaticity in reading comprehension. It not only helps the rapid acquirement of language skills (Newell, 1990) but also is an effective way to improve one's speed in taking tests (Bachman & Palmer, 2005). However, researches on the fast reading skills are limited. A meaningful phrase means a chunk of individual words that become accepted as a single meaning and a way to learn reading comprehension using this is called "reading comprehension by meaningful phrase". The advantage of this learning method is that by reading a text with the goal of comprehension as a whole, learners are able to understand the text better and faster. This kind of learning method is limited on flexibility mostly due to paper-based teaching materials; the computer-based language education is essential for effective English speed-reading activities. Especially, using computers helps to develop skills that are unable to be developed with paper-based speed reading, such as externally controlling the speed of reading, reading by meaningful phrases (chunking), and preventing attention from setting in and regression etc. (Lee, 2006). However, there are almost no computer-based programs that are able to train learners systematically (Sohng, 2011).

Meanwhile, the 21st century is the age of Web 2.0 defined by global participation and sharing, and also the age of Web 3.0, defined by high technology combining the digital base and the analog sensibility so called Digilog (Choi, 2012), is on its way. The era of ubiquitous computing is a new paradigm. The text-based/paper-based learning has become an accessorial learning material. Furthermore, by accelerating the environment of u-learning, the Wi-Fi zone has been expanding; digital-based textbooks have been developed, and the generation of "digital natives" has been proliferating due to the commonality of using laptops, net books, smart phones and so forth. Thus, computer-assisted language learning and teaching has more flexibilities than paper-based education does due to these kinds of environment. Students have the capacity to study without limitations on time and space; the time is right for a trend in web-based meaningful phrase reading and comprehending training programs that can help self-motivated learners develop their capabilities and learning speed. Although these kinds of programs

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are already being developed by education content development firms, there is still a lack of systematical research and verification.

Hence, our research attempts to develop a program called Web-based *Meaningful Phrase Code Switching* (MPCS), based on a website aimed at u-learning, and to analyze the effectiveness by the developed and implemented learning model. The objectives of the research are: first, to go over how the MPCS program has an effect on learners' reading speed, understanding degree and reading efficiency index; second, to observe what effect MPCS has on learners' affective attitude; and third, to investigate if there is meaningful correlation between reading speed and comprehension.

The hypotheses based on the objectives are as follows:

[Hypothesis 1] The MPCS program will be more effective than paper-based direct reading/comprehension by meaningful phrases in improving (1) reading speed, (2) reading comprehension, and (3) reading efficiency index.

[Hypothesis 2] Through MPCS program, the affective attitude, such as (1) interest, (2) experienced difficulty, (3) self-confidence, (4) concentration degree, (5) self-awareness degree of reading speed, (6) habit of progressive reading and comprehending, (7) habitual regression, (8) retention strategies, and (9) habit of reading by meaningful units, will have significant changes.

[Hypothesis 3] There will be a significant correlation between the reading speed and the understanding degree.

II. REVIEW OF LITERATURE

1. Meaningful Units and Chunk Reading

Sense unit, or meaningful unit, is a chunk of words formed when speakers read a text with pauses between phrases (Prator & Robinett, 1985). It is the unit of efficient separating sentences by "sense group" rather than reading word by word and defining meaning, and also reading with pauses between "thought units" or meaningful phrases helps for an easy understanding (Herrick, 1963; Nuttall, 1996; Yorkey, 1970). Besides, reading with pauses between meaningful phrases shortens reading time and quickens reading speed (Smith, 1982).

Direct reading/comprehending is the act in order to read quickly and comprehend

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accurately (Mikulecky & Jeffries, 1986); it is the act to grasp meanings immediately while reading through texts. It is the main problem to identify where to start reading and where to pause; the broad principal of reading by punctuating is not to separate closely related word group, but understand it as a single meaning (Jang, 2003). Because components of sentences are equal to that of the meaning group, it is necessary firstly to make students understand what components of sentences are, and to teach them reading and comprehending by meaningful phrases based on sentence components. Jang (2003) recommended a strategy of reading by meaningful phrases and interpreting phrase by phrase, instead of reading the whole sentence and interpreting it as a whole; this recommended approach will lead to the mental comprehension of the relations between two or more new phrases in a sentence.

2. Web-based Meaningful Unit Code Switching

Code switching is the phenomenon where the linguistic units of two different languages change according to each other (Barrios, 1977); it is the phenomenon to blend grammatical structures of two different languages and use them (Bokamba, 1987). According to Jeoung (2002), code switching means that the code of the mother tongue changes to an object language while emigrants acquire a second language as their object language. According to Hamers and Blanc (1987, 2000), it is the phenomenon where a meaningful chunk of one language rotates to another meaningful chunk of the other language when two different languages appear at a single talk. According to Poplack (1980), the higher the frequency of code switching is, the more an object language can be used. Synthetically, code switching is the act of changing chunk units of an object language to chunk units of a mother tongue. It can also be called language switching, language replacement, and/or language conversion.

The present researcher developed web-based player that can help learners train direct reading/comprehending and speed reading/comprehending via meaningful phrases. A new technique of this player is that it converts English sentences into word phrases in Korean compatible meaningful phrases; because there is no term for this, we call this Web-based *Meaningful Phrase Code Switching*, and we attempt to define the learning activity with which the player is implemented as MPCS. Also, throughout this player and the learning contents that are embedded in it, we call it the MPCS program.

3. Reading Speed and Understanding Degree

The main elements for improving ability to read are grasping and fast reading; fast reading means to read and understand quickly. This is the fluency of reading, according

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to Anderson (2003), focusing more on fluency than accuracy and understanding about 70% of what is read can be said that the reader can read 200 words per minute (Sohng, 2011). This means that it is meaningless if the reader can read fast but not understand what he or she reads (Jang, 2003; Nation, 2005; Schaffzin, 1997), he or she should understand at least 70% of what they have read (Nation, 2005; Nuttall, 1996). Smith (1982) said, "because our brain works effectively when reading 200 wpm, we can improve our understanding, attention, and strategy through fast reading". Buzan (1997) said that reading at a rate of 200~240wpm is the average for native English speakers. Grabe & Stoller (2002) also said 200~300wpm is the proper rate. Although slower than those, Higgins and Wallace (1989) said, depending on readers' interests, the rate of 180wpm is the ideal reading rate. Nuttall (1996) said reading slowly is rather ineffective in understanding, and also Nation (2009) said reading at less than 100wpm can have a negative effect on understanding. However, on the contrary, Choi and Jun (2006) said that reading too fast makes the understanding degree decrease. Kim (2012) summarized many researchers' opinions and said that higher than 200wpm with an understanding of 50~70% is proper, and the rate between180wpm and 300wpm is the proper rate. Jeong (1988) conducted a research on rates of reading Korean by Korean university students, showing 44.6% of them read slower than 100wpm, and 91.3% read slower than 150wpm; their level of reading was shown to be half comparing to that of American students.

4. Reading Efficiency Index

Im (1988) and Cutler (2002) adopted the reading speed, considering both reading speed and understanding degree, and reading efficiency index as tools for learners' improving their ability to read quickly. The detailed conceptions and definitions are as follows: (1) Reading Speed: Ratio between words per one minute (wpm), (2) Degree of Reading: Ratio of correct answers on comprehension test, and (3) Reading Efficiency Index: The degree of reading comprehension ability calculated by following method such as $\boldsymbol{REI = (wpm \times comprehension) / 100}$.

This research adopted reading efficiency index in order to improve learners' reading speed taking into account their understanding degree. Since there is no meaning of speed if readers are unable to understand what they read, there also is no meaning of only focusing on the reading speed. Furthermore, they also have to consider time in order to deal with the majority of information; it is inefficient to focus only on the understanding degree when considering situations such as the speed-up test. Thus, the reading efficiency index is a proper tool which can measure the learner's direct reading/comprehending ability synthetically.

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III. METHOD

1. Subjects

The subjects of this research were 98 students who took a foreign language class, which was set up as a required subject for the first semester at a two-year college B in city C, province C, in 2012. However, excluding 46 students who were unable to be researched due to absence and/or irregularly attendance, the research subjects were 52 students. They consisted of an Experimental Class (EC; $n = 30$) and a Control Class (CC; $n = 22$). Neither of the two groups majored in English; the organization of each class is outlined in Table 1.

TABLE 1
Organized Research Subjects

Group (Class)	Gender		Percentage %	Total
EC	M	17	56.67	30
	F	13	43.33	
CC	M	18	81.82	22
	F	4	18.18	

2. Research Period and Design

The stages and timeline of this research were as follows: (1) literature review and study of other learning portals (March 2009–August 2010); (2) selection of reading materials (September–December 2010); (3) completion and upload of learning model concept, design, implementation, and content (September 2010–August 2011); (4) pilot experimental treatment of one freshman and one senior class (September 2011–February 2012); and (5) the present experimental treatment (March–June 2012).

The method of this research is as shown in Table 2. Both the EC and the CC had a test on coessentiality through preliminary evaluation, had lessons on partitioning meaningful phrases during the experimental treatment part, and had a web-based reading comprehension test. Then, the EC had a lesson and training on reading comprehension with web-based meaningful phrase code switching program. On the other hand, the CC had direct reading/comprehending lesson with the paper-based meaningful phrase program. After the experimental treatment, they simultaneously started a post evaluation. Every pre-test, post-test and week test was web-based for both classes. This not only enabled consistent evaluations and secured accuracy, ease, and speed for inputting grading results as data, but also enabled recording results per class through the LMS system and plot a graph for reading ease and comparative analysis. Under the LMS

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system control, the learning materials were not allowed to be previewed by either the EC or the CC. Handouts were distributed as a weekly textbook to the CC's. During the research, the difference between EC and the CC was that one studied reading comprehension by meaningful phrases with the web-based training program for self-directed learning, and the other studied with paper-based materials leading by professor.

TABLE 2
Contents of Experimental Treatment

	Pre-test	Experiment Treatment	Post-test
EC	o	1. Meaningful phrase partition lesson using PowerPoint 2. Web-based reading comprehension test 3. Reading comprehension lesson using MPCS	o
CC	o	1. Meaningful phrase partition lesson using PowerPoint 2. Web-based reading comprehension test 3. Paper-based Meaningful phrase direct reading	o

Except for one week of final exams, the experimental treatment for this research was conducted for 14 weeks during the first semester in 2012; the actual lesson was opened for 2 periods for 10 weeks except the period of pre-test, post-test, and a midterm test. Table 3 chronologically shows the research method and design.

TABLE 3
Research Method and Design

Week	Investigation and Treatment	
	EC	CC
	Web-based Meaningful Phrase Code Switching Class	Paper-based Meaningful Phrase Program Class
1	Lesson Overview and 1st Questionnaire	
2	Pre-test(50minutes), Explanations for Meaningful Phrase and Purpose	
3	Segmentation: Patterns 1~ 2, Sculpture	
4	Segmentation: Patterns 3~ 4, Currency	
5	Segmentation: pattern 5 ~ Review, Communication and War	
6	Segmentation: Passive-Perfect, Idiomatic Auxiliary Verb, An Amazing Machine	
7	Midterm test, Light(Web-based test only)	
8	Segmentation: Impersonal Subject, It, Cave Paintings	
9	Segmentation: Placeholder, Making Money	
10	Segmentation: Noun Phrase, Sign Language	
11	Segmentation: Adjective Phrase, Weight Lifting	
12	Segmentation: Adverbial Phrase, Leonardo da Vinci	
13	Segmentation: Correlative Conjunction, Stocks	
14	Post-test(50minutes), 2nd Questionnaire	

3. Research Tools and Dealing with Results

The tools used for the research were the MPCS program, which was developed by the

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researcher, pre-test and post-test of reading efficiency index evaluation, and survey sheets before and after the experiment treatment. The MPCS program will be described in the following chapter IV.

1) Pre-test and Post-test of Reading Efficiency Index Evaluation

Prior to the beginning of the experimental treatment, all subjects were tested to determine their reading efficiency levels. Following this, the subjects were tested once more to track changes in their reading efficiency index. The text and questions used for this assessment were sourced from Reading for Speed and Fluency 2 (Nation & Malarcher, 2007). Professor Paul Nation's self-assessment was used to take advantage of the expertise that he provides in the field of speed reading; thus, there was no need to further research the validity and reliability of the self-assessment. The passage and questions from the Nation's self-assessment were converted to a web-based reading assessment efficiency index program, and then attached to an online self-assessment. All assessment questions were multiple-choice, and covered: (1) identifying key subjects from reading, (2) keeping track of details within the passage, and (3) understanding the passage based on its English meaning, and not relying on a translational method. Once the subject finished the assessment, instant feedback was available with scores on: (1) reading speed, (2) reading comprehension, and (3) reading efficiency index.

2) Questionnaire

Assessment of the changes in affective attitude during the experiment was tracked using a questionnaire from Sohng (2011). All nine questions were included without any changes, and a five-point Likert scale was used to attain the data. The questionnaire covered: (1) interest, (2) experienced difficulty, (3) self-confidence, (4) concentration degree, (5) self-awareness degree of reading speed, (6) habit of progressive reading and comprehending, (7) habitual regression, (8) retention strategies, (9) habit of reading by meaningful units. This questionnaire yielded a Cronbach's α value of 0.797, which makes the questionnaire reliable.

3) Statistical Analysis and Data Collection

The methods used for the data collection and statistical analysis included: (1) homogeneity testing using t-tests, (2) comparison of pre-test and post-test reading speed, (3) post-experiment test on reading speed between groups, (4) comparison of pre-test and post-test reading comprehension, (5) comparison of reading comprehension between

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groups, (6) comparison of pre-test and post-test reading efficiency index, (7) comparison of reading efficiency index between groups, (8) change in affective attitude, and (9) correlation analysis between reading speed and reading comprehension. All results were analyzed using SPSS v15.0.

IV. DEVELOPING WEB-BASED MPCS PROGRAM

In order to develop the web-based MPCS program, first of all, it is necessary to select appropriate reading materials for high-school and college students who practice fast reading. Next, the learning player that could be realized based on the web was needed to be made, and then it was necessary to embed learning materials into the player.

1. Selecting Reading Materials

We used the original text and questions of Reading for Speed and Fluency 2, written by Nation and Malarcher (2007) and published by Compass Publishing; it suited our purpose of research, which was developing a computer-based English reading comprehension program. In order to observe the appropriateness of each piece of reading material for college students, we measured their readability. Flesh Reading Ease Formula (Flesh RES) and Flesh-Kincaid Grade Level (FK Level), today's universal formulas to measure readability, were used. Both formulae are as follows:

$$\text{(1) Reading Ease Score} = 206.835 - 1.015 \times \frac{words}{sentences} - 84.6 \times \frac{syllables}{words}$$

$$\text{(2) FK Level} = 0.39 \times \left(\frac{words}{sentences}\right) = 11.8 \times \left(\frac{syllables}{words}\right) - 15.59$$

For Flesh RES, it means easier when close to 100%, and harder when close to 0%. In contrast, it means harder when the value is higher for FK Level. In this research, we analyzed the difficulty of the reading materials using MS Word to calculate the RES and the FK Level. The detailed list of reading materials is as in the following Table 4. The average number of words used in the readings was 297.95 words, the average number of sentences was 23.74 sentences, and the average number of words per sentence was 12.63 words. Following that, the value of Flesh RES showed 80.18, and that of FK Level showed 5.16. The lowest level of FK Level was Light, showing a value of 3.7. The highest was The History of Telephones, showing a value of 6.6.

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In sequence, the vocabulary levels in the readings were investigated. The readings that were used in the research were compared to the 2314 basic vocabulary items for the 8th Education Course provided by the national Ministry of Education and Human Resources Development, embodied in *English word learning* written by Jeong (2009). They were also compared to 23 words that are not embodied in the vocabulary list and searched *the Naver English dictionary* (http://endic.naver.com). Those 23 words were judged based on a standard vocabulary list from the Ministry of Education. Table 4 lists the writings' subjects and information that was handled during the experiment treatment.

TABLE 4
Weekly Reading List

Weeks	Subjects	#of Words	# of Sentences	# of Words in Sentence	Flesh RES (%)	FK Grade Level
1 Before Test (20)	Allowances	301	21	14.3	81.8	5.4
	Sending Messages	284	20	14.2	78.3	5.8
	We All Need Exercise	296	30	9.8	81.9	4.2
	Nature for Kids	294	20	14.7	73.9	6.5
Pre-Average		293.75	22.75	13.25	78.97	5.47
2	Sculpture	304	21	13.6	85.3	4.7
3	Currency	311	27	11.5	76.8	5.4
4	Communication and War	307	28	10.6	71.9	5.8
5	An Amazing Machine	301	29	10.3	84.1	4.0
6	Light	303	28	10.8	87.2	3.7
7	Cave Paintings	286	22	12.4	77.4	5.5
8	Making Money	293	23	12.7	81.5	5.0
9	Sign Language	300	20	15.0	86.7	4.8
10	Weight Lifting	303	21	14.4	81.9	5.4
11	Leonardo da Vinci	295	23	12.8	80.5	5.2
12	Stocks	284	23	12.3	82.2	4.8
Interim Average		298.82	24.09	12.40	81.41	4.94
13 After Test (20)	Marketing	298	22	13.5	76.9	5.8
	The History of Telephones	303	24	12.6	70.0	6.6
	The Secrets to a Long Life	299	26	11.5	84.2	4.3
	Jewel of the Earth	299	23	13.0	81.0	5.1
Post Average		299.70	24.02	12.50	78.13	5.41
Whole Average		297.95	23.74	12.63	80.18	5.16

2. Producing Web-based MPCS Player

For the research, it was compulsory to produce the player that can be driven on both this website and the one that was planned to fit the purpose of the research. In order to

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have an idea for a new learning model plan, searching other learning websites and the comparing based on experience proceeded. Also, by analyzing the website valuation basis, we grasped what we needed to produce in the learning model and player, and on the basis of this, the researcher planned and produced the player and the website, named MPCS.

1) Analysis of Website Evaluation Standards

To build the website, we searched for other website evaluation standards (Kim, 2001; Lim, 2002). To synthesize, the evaluation can be divided into several parts: the object of the website, the information about education, and techniques & plans. The online English education evaluation standards proposed by Kim (2001) were adopted.

Table 5 shows the consideration of developing MPCS reflecting these standards. The objective of this website is to help high school and college students improve their reading ability. By way of instructional modes, it gives text and voice support, and there is detailed guidance for learners on learning activities. Feedback is composed of the result of the test and graph, and it will progress by interaction between learners and the player. Immediate modification of the content, if necessary, is capable, and the webpage is convenient to view. Moreover, it is able to quickly load web-pages and send signals to the server using a high-speed network. It can also be accessed by various web browsers.

TABLE 5
Devising Criteria of Web-based MPCS

Upper Standards		Lower Standards	MPCS
Objective	Language Function	What function part would the development be based on: listening, speaking, reading, writing, grammar, vocabulary, cultural knowledge, or combined functions?	Reading Comprehension
	Goal	What is the goal of this website: posting students' work, setting up hyperlinks related to the web, cultural, lingual information, language practice and education?	Language practice and education
	Target Students	Who is the website for: local/international students, school/organizations etc?	High school ~ College Students
Instructional Modes	Perceptual Entry	Does the web offer multimedia requisites effectively?	Text and Voice Support
	Feedback	Is there error correction and/or an activity guide? Does it have an intellectual relation?	Activity Guide, Test Results Feedback
	Interactivity	How much interactivity does each activity have?	Interactivity between Learners and Player

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	Communication patterns	Can users communicate with each other online/offline?	Able to Communicate
	Content	Are suggested words suitable for users? Is the content motivating?	Suitable, Motivating
Design and Structure	Acceptance of the contents	How valuable is the information you offer?	Offering study for improving reading comprehension
	Modification, Supplementary	How often is the web updated for users?	If necessary Able to supplement
	Appearance	Is it excellent visually and does it materialize what the web is aiming for?	Materialized
	Navigation	Is it convenient for users to surf?	Convenient
	Loading Speed	How long does it take to load the webpage?	High speed
	Descriptive Element	Can users access the web with various web browsers?	Able to Access

2) Developing Website and MPCS player

After reviewing and analyzing other websites that offer similar educational services, as well as reviewing their methodologies, we visited several English educational review websites and considered their analyses of the above-mentioned sites. Taking all of these analyses into consideration, we developed a new homepage, the MPCS player, and the Learning Management System (LMS).

3) Main Webpage

The MPCS website address is http://www.mpcsedu.net. The subject first logs in and can then move to the main screen. Here, the subject receives instructions on how to use the website and educational curriculum. Other options on the main screen are as follows: lessons, downloads and control panel for developers.

4) Test Functionality

(1) Passage Reading

Once the subject clicks on the test start button they will see Figure 1. As the passage and test pops up, a timer (shown on the bottom right) is automatically started; this tracks how long the subject has spent reading the passage. On the top-right corner the word count is highlighted in yellow. Once the subject has finished reading they press the check button on the bottom right to move to the reading comprehension test screen.

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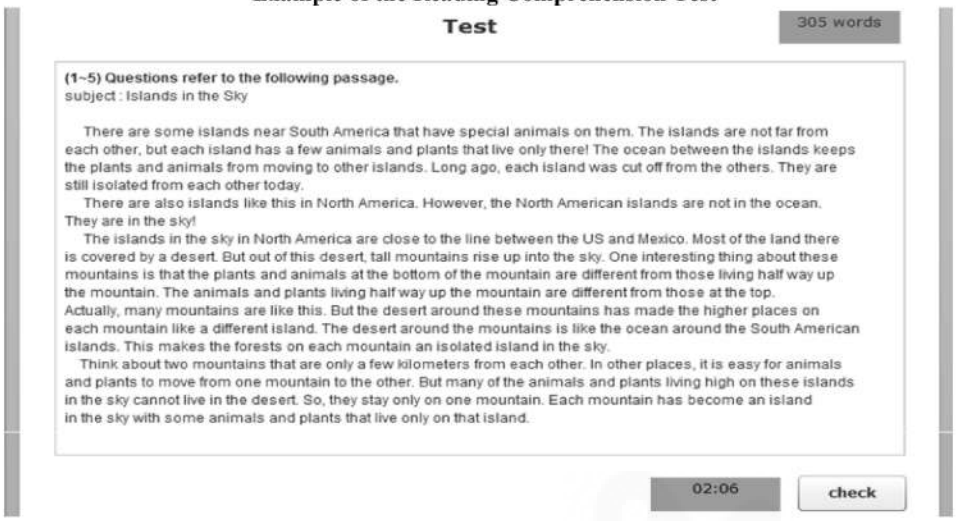
FIGURE 1
Example of the Reading Comprehension Test



(2) Reading Comprehension

A common feature offered by other websites is the possibility to access test questions before, during or after reading a passage. However, our website limits movement between the passage and the reading comprehension test screen. Thus, once the subject reaches the reading comprehension test screen they are not able to go back and look at the passage screen. This is to validate the correlation between reading speed and reading comprehension at the same time, in order to increase the accuracy of the determining the reading speed. In order to differentiate our website from others that use four or five answer choices for reading comprehension tests, we used three answer choices. Once the subject selects their answer choices from the reading comprehension questions, they press the check button to instantly receive the result.

(3) Test Result Screen

From the test screen, the subject can click on test result screen Figure 2. On this screen subject will receive: their reading speed in WPM, their reading comprehension level, and their REI. All scores are automatically tallied and presented as stats with a graph simultaneously. The example below shows a reading speed of 144 WPM, and four out of five questions answered correctly during the reading comprehension test, which resulted in a comprehension score of 80%; thus, the subject received an REI score of 115 for this passage.

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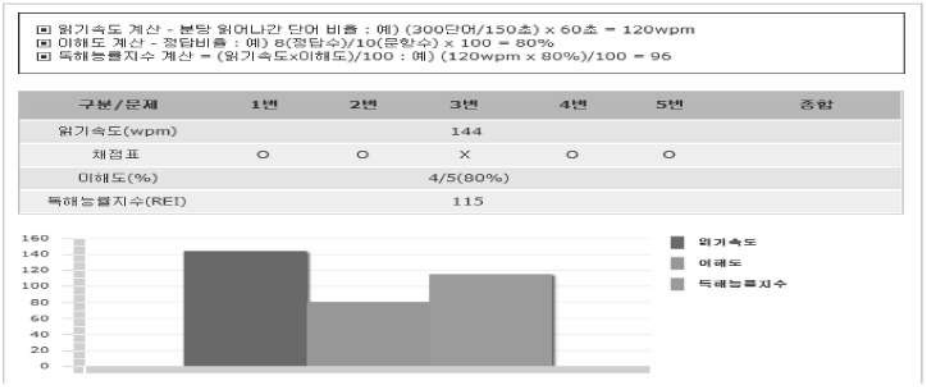
FIGURE 2
Test Result Screen

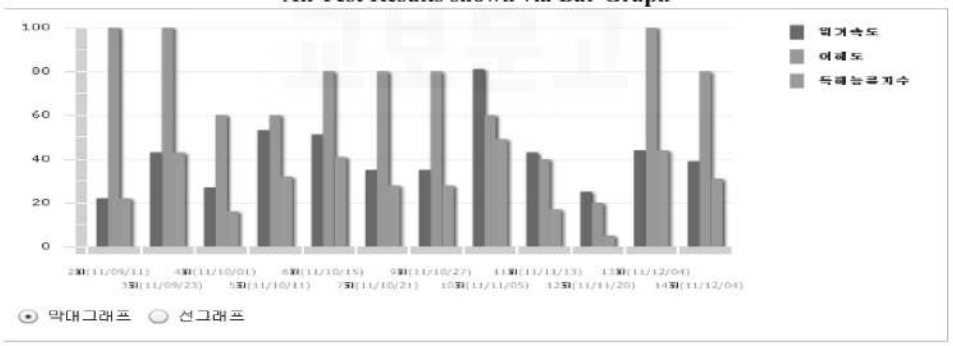


1st bar- Reading speed, 2nd bar-Comprehension, 3rd bar-REI

(4) All Test Results Screen

The subject can review all previous tests that they have taken by clicking on the "all test results" button. The subject can choose to view their results as a bar graph or a line graph on the bottom-left corner. These graphs will display their reading speed, reading comprehension, and REI. An example of the all test results screen is shown in Figure 3.

FIGURE 3
All Test Results shown via Bar Graph



1st bar-Reading speed, 2nd bar-Comprehension, 3rd bar-REI

(5) Pre-test and Post-test of REI Evaluation Results Screen

Pre- and post-test REI evaluation results can also be viewed as a bar graph or line graph with an exception to the number of questions. An added option on this screen is

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for subjects to view their own score relative to their class average. Thus, the subject can review their relative standing compared to other classmates.

5) Functions within MPCS

(1) The MPCS Functions Include Reading Speed Control, Volume Control and Repeat Function following Figure 4.

The reading speed function is shown on the bottom left; this offers ten different reading speed settings. The subject can select the speed at which they feel comfortable in order to improve their reading speed. Subjects should increase their reading speed over time in order to see improvements in their speed. The subject can also control the volume, and there is a mute button that enables the subject to focus on reading only. Around the bottom center or right of the reading speed control buttons is a "repeat function" button. This allows the subject to replay selected areas as many times as needed. The subject can also click on the passage screen to repeat the current section only.

FIGURE 4
MPCS Player Functions



(2) Text Display Option

Figure 5 shows the "text display" option, which can be found on the bottom right. The subject has four choices, from Type A to D, so that they can choose their favorite MPCS

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player option. Type A shows all text, but highlights the part that is being read by the computer at that time. Type B only shows the text that is being read by the computer. Type C builds upon the text that is being read by the computer in a compound manner. Type D does not display any text at all, so that subject can focus on listening only – although the focus of MPCS is to improve reading, Type D function was designed to allow subjects to increase their listening skill. Type B takes into consideration Sohng's (2011) research, which suggests that the paper-based printed text is flawed in the sense that as the subject reads it continues to be present, thus resulting in a loss of focus by the reader, and involuntary regression. Thus, B Type removes the text after reading in order to increase the reader's focus and prevent from going back to passages already read.

FIGURE 5
Type B Text Display



(3) Meaningful Phrase Function

On the passage screen there are the split, erase, reset, submit (long) and submit (short) buttons. Meaningful phrases can be chosen as long or short sections. Many researches (Jang, 1997; Sohng, 2011; Kim et al., 2011) agree that subjects should be able to select between long meaningful phrases and short meaningful phrases. Thus, our MPCS player was designed with this in mind. Figure 6 shows the long meaningful phrases function for the selected passage. The subject can also highlight any given text, and select the long- or short meaningful phrases function, so that only the highlighted text is converted. This allows the subject to check or verify long- or short meaningful phrases section by section.

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FIGURE 6
Meaningful Phrase Function



(4) MPCS Learning Methodology

The MPCS learning methodology was developed with the aim of compensating for the limitations of paper-based meaningful phrase lessons. Thus, our MPCS includes ten reading speeds, an increased field of vision, reading via meaningful phrases, prevention of eye fixation, prevention of eye degeneration, and the ability to distinguish sentence components, which should allow the subject to practice more efficient reading methods.

MPCS allows subjects to choose long or short meaningful phrases based upon their skill levels. Figure 7 displays the short meaningful phrases reading function. Here, a Korean translation of the text being read by the computer is shown for a quick moment (0.5 seconds). The Korean translation is then removed, in case the subject is unable to comprehend the text even after using the short meaningful phrases methodology. Most paper-based materials show the Korean translation at the bottom of the passage, or show the English and Korean on top of each other. However, when a subject who is more comfortable with Korean is exposed to this, the subject tends to read the Korean first. To compensate for this limitation, our MPCS displays the English first and gives the subject enough time to read it before displaying the Korean. In addition, color coding is used to help the reader focus on the desired language, rather than the native language. Figure 7 shows this color coding.

① First line: Most people ----- Red (keywords), eg. 'Most people, you, some people'
② Second line: use their mouth ---- Blue (verb), eg. 'use, know'
③ Third line: to talk. ----------Black (not keyword or verb), eg. 'to talk, but did, their hands, to speak?'

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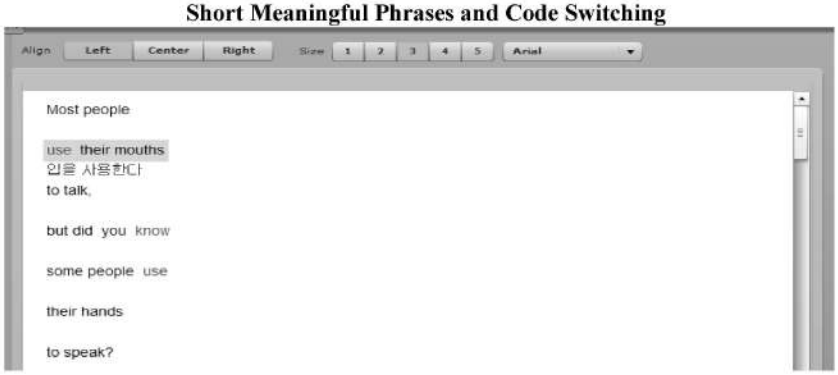
FIGURE 7
Short Meaningful Phrases and Code Switching



Long meaningful phrases allow for faster reading and comprehension of passages compared to short meaningful phrases. Short meaningful phrases are two to three times faster than reading and comprehension compared to the traditional single word at a time. Long meaningful phrases demonstrated five to six times faster reading and comprehension. If subjects find short meaningful phrases easy or show a level of competence, they can challenge themselves via the long meaningful phrase function.

V. RESULTS AND DISCUSSION

1. Homogeneity Testing

A pre-test was performed prior to the experimental treatment, and the results were subjected to independent sample t-test. The experimental and control groups were verified to be homogeneous, and the significant probabilities (p-values) of their test results regarding reading speed, reading comprehension, and reading efficiency index, respectively, were 0.399, 0.532, and 0.970, demonstrating no statistically significant intergroup differences at the 0.05 level, as shown in Table 6.

TABLE 6
Homogeneity Testing for EC&CC

Pre	Group	N	M	MD	SD	df	t	Sig.
Reading Speed	EC	30	91.45	9.400	32.049	50	-0.851	0.399
	CC	22	99.71		37.813			
Comprehension Ability	EC	30	51.83	5.439	13.514	50	0.630	0.532
	CC	22	49.17		17.003			
Reading Efficiency Index	EC	30	48.11	1.583	26.208	50	-0.380	0.970
	CC	22	48.38		24.912			

*p<.05

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2. Validation of Hypotheses

1) Hypothesis 1: Effects of MPCS Program

[Hypothesis 1] *The MPCS program will be more effective than paper-based direct reading/comprehension by meaningful phrases in improving (1) reading speed, (2) reading comprehension, and (3) reading efficiency index.*

Table 7 outlines the results of the pre-post comparison of the reading speed of the EC and CC. The mean reading speed of the EC decreased by 7.83 points from 91.45 to 83.62, but the paired sample t-tests of the pre- and post-tests yielded a significance probability of 0.152, showing no statistically significant difference between baseline and post-experiment scores (α= 0.05). The average scores of CC decreased by 8.68 points from the pre-experiment average of 99.71 to the post-experiment average of 91.03 (p = 0.252), but without achieving statistical significance (p = 0.252).

TABLE 7
Comparison of Pre and Post Reading Speed

Group		N	Mean	s.d.	df	t	Sig.
EC	Pre	30	91.45	32.049	29	1.471	0.152
	Post		83.62	26.997			
CC	Pre	22	99.71	37.813	21	-1.179	0.252
	Post		91.03	40.201			

*p<.05

Table 8 summarizes the results of the independent sample t-test using the post-experiment test data on reading speed, comparing the scores of the EC and the CC. The average scores of the EC and the CC were 83.62 and 91.03, respectively, with the latter scoring 7.41 points higher than the former, but without statistical significance (p = 0.430 at α = 0.05).

TABLE 8
Post-Experiment Test on Reading Speed between Groups

Group	N	Mean	s.d	df	T	Sig.
EC	30	83.62	26.997	50	-0.796	0.430
CC	22	91.03	40.201			

*p<.05

Table 9 gives an overview of the pre-post comparison of the scores obtained by the EC and the CC in reading comprehension. The average score of EC increased by 2.73 from the baseline average of 51.83 to the post-experiment average of 54.56, but without

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showing statistical significance (p = 0.278; α = 0.05). The average score of the CC increased by 2.65 from the baseline value of 49.17 to the post-experiment value of 51.82, but without statistical significance (p = 0.421; α = 0.05).

TABLE 9
Comparison of Pre and Post Reading Comprehension

Group		N	Mean	s.d.	df	t	Sig.
EC	Pre	30	51.83	13.514	29	-1.106	0.278
	Post		54.56	14.784			
CC	Pre	22	49.17	17.003	21	-0.821	0.421
	Post		51.82	17.965			

*p<.05

Table 10 summarizes the results of the experiment for reading comprehension and comparison of the scores of the EC and CC, based on independent sample t-test using the post-experiment test data. The average score of the EC was 54.56 and that of the CC was 51.82, with the EC thus scoring 2.72 points higher than the CC, a result without statistical significance (p = 0.550;α = 0.05).

TABLE 10
Comparison of Reading Comprehension between Groups

Group	N	Mean	s.d	df	t	Sig.
EC	30	54.56	14.784	50	0.602	0.550
CC	22	51.82	17.965			

*p<.05

Table 11 outlines the results of pre-post comparison of the reading efficiency index between the EC and the CC (p = 0.431). The pre-post comparison of the average scores of EC revealed increases of 2.57 (from 48.11 to 45.54), respectively, without showing statistically significant differences (p = 0.431, α= 0.05). The average score of the CC decreased by 1.03 from the pre-test average of 48.38 to the post-experiment average of 47.35.

TABLE 11
Comparison of Pre and Post Reading Efficiency Index

Group		N	Mean	s.d.	df	t	Sig.
EC	Pre	30	48.11	26.208	29	0.798	0.431
	Post		45.54	21.059			
CC	Pre	22	48.38	24.917	21	0.263	0.795
	Post		47.35	29.158			

*p<.05

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Table 12 summarizes the results of the experiment for reading efficiency index and comparison of the scores of the EC and CC, based on independent sample t-tests using post-experiment test data. The average of the EC was 45.54, which was lower by 1.81 than that of the CC, 47.35, a result without statistical significance ($p = 0.795$; $\alpha = 0.05$).

TABLE 12
Comparison of Reading Efficiency Index between Groups

Group	N	Mean	s.d	df	t	Sig.
EC	30	45.54	21.059	50	-0.261	0.795
CC	22	47.35	29.158			

*p<.05

In conclusion, [Hypothesis 1.1)], that reading speed will be improved more effectively by the MPCS program than by direct paper-based reading/comprehension by meaningful phrases was rejected by the results yielded for the EC. Hypothesis 1.2, the same as [Hypothesis 1.1)] except concerning reading comprehension, was rejected for the EC. [Hypothesis 1.3)], concerning the reading efficiency index, was rejected for the EC.

2) [Hypothesis 2]: Affective Effect of MPCS program

The change in the affective attitude of the participants as a result of the MPCS program was investigated by surveying the students in the experimental class using the same questionnaire before and after training in order to determine the influence of training with MPCS on affective attitude.

[Hypothesis 2] *Through MPCS program, the affective attitude, such as (1) interest, (2) experienced difficulty, (3) self-confidence, (4) concentration degree, (5) self-awareness degree of reading speed, (6) habit of progressive reading and comprehending, (7) habitual regression, (8) retention strategies, and (9) habit of reading by meaningful units, will have significant change.*

Table 13 gives an overview of the results of the paired t-tests for the respondents' answers regarding change in affective attitude. Statistically significant, positive pre-post changes were shown for the following five questionnaire items: interest (from 2.20 to 2.76; $p = 0.022$ at $\alpha = 0.05$), experienced difficulty (from 1.53 to 2.56; $p = 0.000$ at $\alpha = 0.001$), self-confidence (from 1.97 to 2.76; $p = 0.001$ at $\alpha = 0.001$), concentration degree (from 2.60 to 3.16; $p = 0.002$ at $\alpha = 0.01$), self-awareness degree of reading speed (from 2.40 to 3.13; $p = 0.002$ at $\alpha = 0.01$). Habit of progressive reading and comprehending, habitual regression, and habit of reading by meaningful units showed no statistical

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significance. The average rating decreased by 0.07 points for retention strategies, again with no statistical significance.

TABLE 13
Change in Affective Attitude

Questions		Mean	s.d.	df	t	Sig.
1. Interest in reading English text	Pre	2.20	.961	29	-2.429	0.022*
	Post	2.76	.935			
2. Experienced difficulty	Pre	1.53	.571	29	-5.869	0.000***
	Post	2.56	.897			
3. Self-confidence	Pre	1.97	.890	29	-3.694	0.001**
	Post	2.76	.897			
4. Concentration degree	Pre	2.60	.894	29	-3.319	0.002**
	Post	3.16	.647			
5. Self-awareness degree of reading speed	Pre	2.40	.932	29	-3.343	0.002**
	Post	3.13	.860			
6. Habit of progressive reading and comprehending	Pre	3.00	.910	29	-1.126	0.269
	Post	3.23	.773			
7. Habitual regression	Pre	3.40	1.192	29	-1.030	0.312
	Post	3.60	1.003			
8. Retention strategies	Pre	2.87	1.106	29	.320	0.752
	Post	2.80	.886			
9. Habit of reading by meaningful units	Pre	2.50	.900	29	-1.439	0.161
	Post	2.90	.922			

*p<.05, **p<.01, ***p<.001

In conclusion, [Hypothesis 2], that through MPCS program, the affective attitude, such as (1) interest, (2) experienced difficulty, (3) self-confidence, (4) concentration degree, (5) self-awareness degree of reading speed, (6) habit of progressive reading and comprehending, (7) habitual regression, (8) retention strategies, and (9) habit of reading by meaningful units, will have significant change, was largely accepted, with the exceptions being 6,7,8 and 9.

1) [Hypothesis 3]: Correlation between reading speed and reading comprehension

[Hypothesis 3] *There will be a significant correlation between the reading speed and the reading comprehension.*

Based on the results regarding the participants' reading speed and reading comprehension, the correlation between reading speed and reading comprehension was investigated. Table 14 shows the results of statistical analysis based on the pre- and post-assessments of the EC and the CC. First, looking at the pre-assessment results, no statistically significant correlation was observed between reading speed and reading

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comprehension at baseline, with a correlation coefficient of 0.015 (p = 0.915 at α = 0.05). Similarly, looking at the post-assessment results, no statistically significant correlation was found between reading speed and reading comprehension, with a correlation coefficient of 0.04 (p = 0.977 at α = 0.05). Nor was there any statistically significant correlation between baseline reading speed and post-experiment reading comprehension, with a correlation coefficient of 0.011 (p = 0.938 at α = 0.05). With regard to the effect of reading comprehension on reading speed, the correlation coefficient between baseline reading comprehension and post-experiment reading speed was 0.204 (p = 0.147 at α = 0.05), and thus statistically not significant.

TABLE 14
Correlation Analysis between Reading Speed and Reading Comprehension

		Pre- reading speed	Pre- comprehension	Post- reading speed	Post- comprehension
Pre-reading speed	Pearson Correlation	1	.015	.574 **	-.011
	Sig. (2-tailed)		.915	.000	.938
	N	52	52	52	52
Pre-comprehension	Pearson Correlation	.015	1	.204	.593 **
	Sig. (2-tailed)	.915		.147	.000
	N	52	52	52	52
Post-reading speed	Pearson Correlation	.574 **	.204	1	-.004
	Sig. (2-tailed)	.000	.147		.977
	N	52	52	52	52
Post-comprehension	Pearson Correlation	-.011	.593**	-.004	1
	Sig. (2-tailed)	.938	.000	.977	
	N	52	52	52	52

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).
A group = EC+CC

In conclusion, with no positive or negative effect of reading speed on reading comprehension verified, [Hypothesis 3], that there will be a significant correlation between the reading speed and the reading comprehension, was rejected. From this it can be inferred that there is no correlation between post-experiment reading speed and reading comprehension.

3. Discussion

1) Discussion of the Effect of Web-based MPCS Program

As the results of the research, the Web-based MPCS program had no significant difference in reading speed, the understanding degree or the reading efficiency index

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compared to a paper-based meaningful phrase program. These kinds of results conflict with several advanced research studies conducted by computer technology (Kim et al., 2011; Sohng, 2004, 2011; Oh & Choi, 2010; Lee, 2003). Sohng (2011) developed a computer-based English reading comprehension program, and it had the significant difference of reading speed and understanding degree in the result of experiment treatment; Oh and Choi (2010) used the multimedia text for fast reading training and gained significant results on the reading speed; Lee (2003) also used PowerPoint and Flash technique to make chunk words, and he had meaningful results on fast reading, understanding degree, and reading efficiency index. In this research, however, comparing among the groups, even though the reading speed before taking the program was slower than it was after using the program, the understanding degree increased. Also, the experimental group, compared to the control group, was not affected by the reading speed, understanding degree or reading efficiency index. Considering the object of the research was to train people to read quickly by using meaningful phrases, the researcher looked for some causes and described them as follows.

Firstly, despite the consciousness of reading quickly during fast reading training, the results show that reading speed decreased while the understanding degree increased. It can be presumed that there were changes in either the reading strategy or the reading formula.

Secondly, the methods of tests were different from each other. The existing learning method had been to compare questions with articles. However, the method of MPCS asked learners to read articles initially, and then to answer the questions; it was impossible to go back to the articles while answering the questions. Thus, since learners focused only on the reading speed in the beginning, they were unable to clearly comprehend the readings and answer the questions accurately. Nevertheless, they eventually adapted to the method, and both the reading speed and the understanding degree were gradually increased.

Thirdly, there was a lack of self-directed learning ability and/or learning performance ability. Most learners participating in the research, not only showed insufficiencies in self-directed learning abilities (90.91%), but also lacked achieving the studying abilities (65.45%). In the research, the EC used a training program that was specialized in web-based and learned self-directed learning; the CC had class using a paper-based program led by a professor. In view of the fact that learning meaningful phrase code switching study by web-based MPCS is related to self-directed learning ability, it could be one reason why the result opposed the previous research.

As a result, although the web-based MPCS program did not show statistical differences, there would be plenty of improvements if taking the experimental treatment for a long period since there was the expectation that by using MCS continuously learner

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standards could be improved.

2) Discussion of Affective Attitude of Web-based MPCS Program

Meaningful phrase learning has a positive effect on interests (Lee, 1995; Yang, 2000; Kim, 2002), motivation (Yang, 2000), confidence (Lee, 1995), learning attitude (Jeong, 2005; Oh, 2006) and so forth for affective components (Choi, 2005; Oh & Choi, 2010; Kim, et al, 2011). However for the result of this research, there are partially meaningful differences for affective attitude. Especially emotional factors such as interests and self-confidence showed significant differences, while the habits, which directly affect learners' reading ability, have not shown any differences. The learners had been educated by using the paper-based class until they matriculated. Hence when they experienced the MPCS, it inspired them to have interests and motivation via the MPCS program. Plus owing to the function of enhancing concentration degree, the result of this research showed significant differences in concentration degree. However the habits appeared difficult to change in a single semester since they had been fossilized for a long time.

While unlike the pre-post assessment results, the majority of the respondents' answers to the affective attitude survey reached the significance level. This may be explained by the positive answers to the questionnaire item on expectations regarding the learning effects of the MPCS Program, that is, whether MPCS-based learning would improve reading efficiency. As 50.91% of respondents answered positively, though 5.45% of them showed negative response, it can be considered that MPCS will henceforward help learners to improve the reading comprehension study upon becoming familiar to the MCPS over time, though the current result is not significant.

3) Discussion on Correlation between Reading Speed and Understanding Degree.

The research on the correlation between the reading speed and the understanding degree differed from preceding researches (Buzan, 1997; Nation, 2009; Nuttal, 1996). In other words, reading speed and understanding degree are not correlative. Therefore, the reading speed and the understanding degree do not affect each other. However according to the progress of the reading speed and the understanding degree investigated in the research, it had shown that the average reading speed fluctuated lower than that of the pre-test during the first 5 weeks; then the speed started to increase in last 5 weeks. In contrast, it is represented that the understanding degree seemed to draw a rising curve which can be noted that learners considered the understanding degree in the early stages. Then both reading speed and understanding degree started to increase after becoming adjusted to the testing method. This shows the different research complexion compared

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to Im (2001) who mentioned the understanding degree initially will decrease while the reading speed increases and then eventually both will increase afterwards. This implies that the understanding degree had an effect on the reading speed. Therefore, for the follow-up research, it will be meaningful to increase the scale of study objects and deeply observe the correlation between the reading speed and the understanding degree.

VI. CONCLUSION

The research was conducted in order to help learners overcome the limitation of the paper-based reading comprehension study for the environment aiming for u-learning, to be free of time and space, to develop the web-based MPCS Program for self-directed study and direct reading/comprehension training, and to verify the implemented learning model.

Concretely, this research was firstly to investigate how the web-based MPCS Program influenced the reading speed, understanding degree and reading efficiency index; secondly, to investigate how the web-based MPCS Program influenced the affective attitude; and thirdly, to investigate the correlation between the reading speed and the understanding degree.

The summaries of concept, objective, subject and result of this research are as follows.

Firstly, for the web-based MPCS Program, there was not a statistically significant difference in reading speed, reading efficiency index, and the understanding degree comparing to EC, who took part in the paper-based meaningful phrase class.

Secondly, through the web-based MPCS Program, there were significant improvements in interest, experienced difficulty, self-confidence, concentration degree, and self-awareness degree of reading speed.

Thirdly, the research of the correlation between the reading speed and the understanding degree showed a result which is different from the preceding research (Buzan, 1997; Nation, 2009; Nuttall, 1996). That is, the reading speed and the understanding degree did not influence each other.

Fourthly, although the web-based MPCS Program was unable to prove the effect in the statistics, there is expectation that using this learning program will support learner improvements in reading comprehension.

To conclude, it is true that the research rarely shows the web-based MPCS Program to be more effective on reading speed, understanding degree and reading efficiency index than the professor-led meaningful phrase class with paper-based materials; however, there is anticipation that learners can improve their standards through continuous studies with the MPCS player. There was also an influence on affective attitudes except for the

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habit of progressive reading and comprehension, reading by meaningful units, habitual regression and retention strategies. Therefore, there will be a significant form of contribution by the self-directed web-based MPCS learning player in comparison to the instructor-led class.

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Examples in: English
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