



Learning paragraph structure with online annotations: An interactive approach to enhancing EFL reading comprehension

Jia-Jiunn Lo^a, Shiou-Wen Yeh^{b,*}, Chao-Shien Sung^a

^a Department of Information Management, Chung Hua University, Taiwan

^b Graduate Institute of Teaching English to Speakers of Other Languages, National Chiao Tung University, 1001 Ta-Hsueh Rd., Hsin-chu City 300, Taiwan

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Abstract

An important element of EFL (English as a Foreign Language) reading instruction is helping students to recognize paragraph elements and to comprehend the main idea of a paragraph. This study proposed an interactive approach and constructed an online annotation system, *Paragraph Annotator*, to assist EFL students in learning paragraph structure. It allows readers to analyze paragraphs of text on web pages by noting any paragraph element (topic sentence, controlling idea, or supporting details) in the paragraph. In addition, users can use annotation tools to add their personal ideas to the highlighted element. An experiment was conducted to evaluate the effect of *Paragraph Annotator* on reading comprehension for EFL students. The results reveal that students using *Paragraph Annotator* had significantly better performance in both the Cued Recall Test and the Free Recall Test. Most notably, the effects of the system were more evident when tested with the Free Recall Test, when students were not provided with any cues. Participants using the system responded positively to *Paragraph Annotator*, with respect to *perceived ease of use*, *perceived usefulness*, *attitude to use*, and *intention to use*. Limitations and opportunities for future research are also discussed.

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1. Introduction

Text structure refers to the ways that writers organize information in text. It is used to identify the structural features of texts as an aid to understanding and recall. Pardo (2004) suggested that the structure of the text makes each text unique. By learning text structures, “students will be able to access a schema for a certain genre when they begin to read a new text and can begin to make text-to-text connections for a particular genre, which will help them more easily make meaning” (p. 275). Moss (2004) also noted that, if students are to

* Corresponding author. Tel.: +886 921 706 889; fax: +886 3 571 9033.

E-mail addresses: jlo@chu.edu.tw (J.-J. Lo), shiouwen@mail.nctu.edu.tw (S.-W. Yeh), m09610027@chu.edu.tw (C.-S. Sung).

survive in the Information Age, they must be equipped with the ability and knowledge to read expository text, because most of the text found on Internet websites is expository. Researchers have further highlighted the importance of reading from expository texts in the fields of science and social studies for young learners. They argued, “[comprehension of] such text is critical for academic success” (Meyer et al., 2010, p. 62). In view of the importance of text structure, teachers are encouraged to teach text structure to help students comprehend the different forms of text organization.

A paragraph is a sequence of sentences that supports one main point. It may stand by itself as in academic writing, or be one part of a longer piece of text, such as an essay or a book (Oshima and Hogue, 2006). Paragraphs usually contain elements, such as a topic sentence, a controlling idea, and supporting details. A topic sentence is a complete sentence, which sometimes appears at the beginning of a paragraph, stating or suggesting the main idea of a paragraph. It clearly states the topic and the controlling idea of the paragraph. The part of the topic sentence that announces the specific area to be discussed is called the controlling idea. For example, in the sentence “Diabetes is a disease that prevents your body from properly using the food you eat”, “Diabetes” is the topic, and “prevents your body from properly using the food” serves as the controlling idea of the topic sentence. Supporting sentences then develop, explain, or prove the topic sentence (Gillie et al., 2001).

It has been claimed that learning to identify paragraph elements can assist students in recognizing and understanding the main idea of the paragraph (Duke and Pearson, 2002; Lorch et al., 1993; Meyer et al., 1980) and that an understanding of paragraph structure is essential for EFL (English as a Foreign Language) reading and writing instruction (Gillie et al., 2001; Oshima and Hogue, 2006). If students can comprehend a paragraph, they can better comprehend a text. However, students often are not consciously aware of these elements. Therefore, an important task of reading instruction is helping students to recognize paragraph elements and to comprehend the main idea of a paragraph.

In the context of EFL reading, the nature of reading poses a challenge for learners. According to schema theory, reading is an active and constructive process, whereby learners generate meaning for information by accessing and applying existing knowledge (Carrell and Eisterhold, 1988). The reading process involves “the reader, the text, and the interaction between the two” (Butler-Pascoe and Wiburg, 2003, p. 114). When reading is learned in a second/foreign language, “the complexities increase exponentially because all the subskills required for each operation entail two languages and their interactions” (Koda, 2012, p. 158). When reading English texts, many EFL students lack the knowledge and ability to focus on the structure of the text or on the logical relationships among the ideas (Mohd Din, 1997). In addition, EFL teachers commonly find themselves dealing with a passive class, where students are unresponsive and avoid interaction with the teacher and the reading materials (Hsu, 2006; Snell, 2011). This can be a frustrating experience for both students and teachers. Therefore, it is in urgent need for researchers and teachers to find out ways to help students read successfully in English.

In the Information Age, students need more than exposure to informational texts (Montelongo et al., 2006). They must be equipped with the ability and knowledge to read in the digital world (Schmar-Dobler, 2003). Nonetheless, many EFL learners complain that they cannot understand the meaning of online texts, even when they check hyperlinks and online tools (Fan, 2008). For this reason, it is imperative to offer a supportive online reading environment for EFL learners, to allow them to achieve better reading comprehension. To meet these challenges, the current study developed an online system, *Paragraph Annotator*, and investigated the features and effects of online annotations, with reference to EFL reading strategies and reading comprehension.

By definition, annotation is a critical or explanatory note, or body of notes added to a text, especially with regard to literary work (Wolfe, 2002). When students read, they often underline important parts of a document or write notes in the margin. Many researchers have claimed that making reading annotations is a useful strategy for the development of language in learners (e.g., Barger et al., 2001; Kiewra, 1989; Lunsford and Ruskiewicz, 1999; Salvatori, 1996; Wolfe, 2002; Yeh and Lo, 2009). For the purpose of language learning, online annotations increase the opportunities for interactive language practice in a motivating environment. They also facilitate broad access to authentic information and rapid exchange of information (Wolfe, 2002; Wolfe and Neuwirth, 2001).

In this study, an online annotation system, *Paragraph Annotator*, was developed to capitalize on the advantages of the interactive reading approach. This system offers several supportive reading facilities, including Highlight (Topic Sentence, Controlling Idea, and Supporting Detail), Comment, and Dictionary, which help to engage learners in interactive reading. An experimental study was also conducted to investigate the effects of the system on EFL reading

comprehension. It is proposed that online annotations can be used as an interactive tool, to encourage EFL learners to identify paragraph structure and enhance reading comprehension.

2. Literature review

2.1. Paragraph structure and reading comprehension

The ability to read English is important to EFL students, because a great deal of professional and technical literature is written in English. EFL students not only need to read English textbooks, they also obtain knowledge from English journals or magazines (Hsu, 2006). In academic EFL settings, English reading is a foundation skill that facilitates other learning. However, as students progress through university or college, they may experience difficulties in reading. For instance, the texts usually contain unfamiliar structures that make comprehension difficult. As claimed by Mohd Din (1997) and Hsu (2006), without the fundamental ability to read and comprehend paragraphs and texts, students can hardly benefit from university education.

Schema theory suggests that reading is an interactive and constructive process, whereby readers generate meaning for information by applying existing knowledge (see Carrell and Eisterhold, 1988) and by constructing a holistic description of the text (Bransford and Johnson, 1972; Gunnarsson, 1984). Efficient comprehension requires the ability to relate the textual material to one's own knowledge (Carrell and Eisterhold, 1988). According to Jonassen (1985), an instructional model that demonstrates the above principles of interactive reading is the generative hypothesis, which states that meaning for material presented by any medium is generated by activating the existing knowledge structures, in order to interpret what is presented.

Research has also shown that reading comprehension and the recall of information are dependent on a student's ability to recognize organizational structures (Cook and Mayer, 1988; Goldman, & Rakestraw, 2000). Specifically, students' knowledge of the structure of formal discourse assists them in understanding and remembering the text (Butler-Pascoe and Wiburg, 2003; Grabe, 1991). The recognition of an organizational pattern enables the student to form a mental representation of the information and to see the logical relationships advanced by the author. Good readers use text structure to abstract main ideas and to help them remember propositions gained from their reading (Montelongo et al., 2006). In related studies, many researchers have stressed the importance of teaching text structures to students (e.g., Carrell, 1985; Duke and Pearson, 2002; Grabe, 1991; Lannon, 1998; Meyer et al., 2010; Mohd Din, 1997; Moss, 2004; Pardo, 2004).

Being aware of the demands of "living in an era when information is increasing at an alarming rate" and "students who learn to use the organization and structure of informational texts are better able to comprehend and retain the information found in them" (p. 710–711), Moss (2004) suggested that teachers can use various strategies to improve student comprehension of expository text structure. She further proposed a two-phase model to teach text structure — Phase 1: Teacher *modeling* of retellings; and Phase 2: Students *practice* retelling. She explained that, because expository text may be unfamiliar to students, teacher modeling is a critical first step in involving students in the recognition of expository structure. It was stressed that "teachers need to provide extensive scaffolding for students, as they develop understanding of the process" (p. 715). After the modeling phase, students need opportunities to practice the retellings. The interactive learning steps include: (1) encouraging students to think about the organizational pattern of the text; (2) supporting students in the recall of text, with scaffolds and prompts, such as pictures, for the text, or questions; and (3) encouraging students to identify information in the text and to make personal connections between their lives and the text.

In a more recent study, Meyer et al. (2010) created a web-based tutoring system, to help students develop a reading strategy (the structure strategy) for comprehending expository texts. Their study examined the effectiveness of different versions of web-based instruction, which focused on text structure and on students' reading comprehension. In the two-factor experimental design, the factors were the type of feedback provided by the web-based tutor and the motivational factor of the choice of text topics in practice lessons. Their study showed that "non human, pedagogical agents [the ITSS tutor] can teach the structure strategy" (p. 88) by successfully addressing both parts of structure strategy instruction: (1) identifying text structure and (2) enhancing reading comprehension. They also claimed that there is an urgent need for educators and researchers to understand the impact of technology on text structure, in order to facilitate reading comprehension.

2.2. Online annotations and reading comprehension

According to interactive reading theories, reading comprehension is the interaction of many sub processes, including (1) access to background knowledge, (2) identification of the relative importance of ideas within text, (3) prediction of upcoming information, and (4) inferential relation of concepts within and without the text (Eskey, 1986). Duke and Pearson (2002) also suggested that visual representation can help readers understand, organize, and remember what they read. For instance, highlighting information in the text can assist readers to extract important elements and remember what they read before. Highlighting the text is a supportive reading strategy to achieve better comprehension of the text and is regarded as a way to increase interactions between the computer and readers.

It appears that some characteristics of annotations conform to the reading comprehension theories. For instance, online annotation techniques can be developed to highlight texts within web documents and used to provide a visual representation of summaries of key ideas within articles (Du, 2004; Fan, 2008; Lo et al., 2005). Kiewra (1989) indicated that annotations made while reading can aid rereading by offering readers effective and efficient retrieval cues, when they review the text and allow them to identify specific information within the text. Wolfe and Neuwirth (2001) also noted that annotations not only enhance readers' memory and monitor their reading comprehension, but also help to clarify the main idea of the passages that are read.

Lannon (1998) suggested that there are three levels of reading, which answer different questions about reading. Firstly, *reading to analyze* identifies the basic principles and how they all fit together by breaking the article down and systematically examining its parts. Secondly, *reading to summarize* identifies the main ideas by retrieving information and understanding facts from the article. Thirdly, in *reading to respond*, readers join a "conversation". They read in order to explore their own thinking and to deduce the special meaning that the article has for them. They then reinvent that material with a force and passion that will make a difference to readers of their own. Because online annotations allow interaction and the rapid storage, manipulation, and retrieval of information, online annotations indeed conform to the *reading to analyze* and *reading to summarize* levels of reading as suggested by Lannon (1998).

In the past ten years, a wide variety of systems that support online annotations in digital documents have been developed for learners and instructors, such as Virtual Notes (Koch and Schneider, 2000), the WATs (Rau et al., 2004), Online Annotator (Yeh and Lo, 2009), and Chang and Hsu's (2011) system. Online annotations may be highlights, comments, notes, explanations, or other types of external remarks that can be attached to a web document, or a selected part of the document. Online annotations have four primary uses: "to remember, to think, to clarify and to share" (Ovsiannikov et al., 1999, p. 336). Online annotations also provide interactive reading opportunities that help students identify the key elements of paragraphs. Of the studies examining the effects of text structure on ESL/EFL reading, only a few have investigated the effects of teaching paragraph structures on reading comprehension. In spite of the advantages mentioned above, the question of how online annotations might facilitate paragraph structure learning in the context of EFL reading has not been addressed.

2.3. Design parameters and research questions of the study

The current study developed an online annotation system, *Paragraph Annotator*, to facilitate paragraph structure learning for EFL students (see Lo et al., 2009 for more details). The design parameters of the experimental system were drawn from the rationale and studies that are reviewed in the Introduction and Literature Review sections of this paper. In summary, reading comprehension can be enhanced by teaching students to use specific cognitive strategies, such as reading to analyze (Lannon, 1998), recognizing text structure (e.g., Goldman and Rakestraw, 2000; Moss, 2004), highlighting texts with different colors to raise awareness (Du, 2004; Fan, 2008; Lo et al., 2005), visualizing text structure (Duke and Pearson, 2002), and generating and manipulating text (Butler-Pascoe and Wiburg, 2003; DeWinstanley and Bjork, 2004; Jonassen, 1985).

An experimental study was also conducted to investigate the following questions: (1) Will EFL students who read the article using *Paragraph Annotator* have higher Cued Recall Test scores than the control group students? (2) Will EFL students who read the article using *Paragraph Annotator* have higher Free Recall Test scores than the control group students? Specifically, the following hypotheses were tested, with regard to students' reading comprehension:

H1. The experimental group has higher Cued Recall Test scores than the control group.

H2. The experimental group has higher Free Recall Test scores than the control group. The third research question concerned students' attitudes toward using *Paragraph Annotator* for reading: (3) What are EFL students' attitudes toward the use of *Paragraph Annotator* for reading purposes?

3. Materials and method

3.1. Instructional program for the experimental group

In *Paragraph Annotator*, the annotation tools include three highlight buttons, in three different colors: yellow for *topic sentence*, blue for *controlling idea*, and green for *supporting detail*. *Paragraph Annotator* allows readers to analyze paragraphs, by marking down any paragraph element (topic sentence, controlling idea, or supporting details) and using the annotation tools to add their personal ideas to the text. Highlighting a paragraph element involved three steps: (1) select the element, (2) apply the corresponding annotation tool, and (3) add comments to the highlighted element. Specifically, while making an annotation, a pop-up window allows additional comments to be input for each annotation (Fig. 1). When identifying paragraphs' key elements, the student first selects the target text and then clicks one of the annotation tools to activate the corresponding function. The topic sentence, controlling idea, and supporting details can then be highlighted with different colors so that students can visualize the paragraph structure and get the key elements of the text more easily (Fig. 2). These comments are shown later, when the user moves the cursor over the annotation mark. *Paragraph Annotator* presents visual representations of text and allows readers to identify relationships and to understand the organization of the text. A *Cancel* button is also available if students want to cancel an annotation mark.

In addition to the three highlight buttons in different colors, which allow students to identify the key elements of each paragraph, the system also includes a supportive reading strategy button, *Dictionary*. As discussed earlier, vocabulary knowledge is important for reading. Vocabulary and reading comprehension are inextricably linked (Duke and Pearson, 2002). Reading ability is strictly constrained by vocabulary knowledge and the use of a dictionary enables readers to comprehend the text. By highlighting unknown words and clicking *Dictionary* button, students can look up these unknown words in the *Yahoo Online Dictionary* (Fig. 3).

3.2. Instructional program for the control group

Although the essay for the control group was the same as that used for the *Paragraph Annotator*, the control group was only provided with the online *Dictionary* (Fig. 4). Since it is important that students are prevented from changing the original content of an online reading mechanism, in this study, both *Paragraph Annotator* and the system for the control group were restricted to a read-only mode. In both systems, the content of the original essay could not be changed.

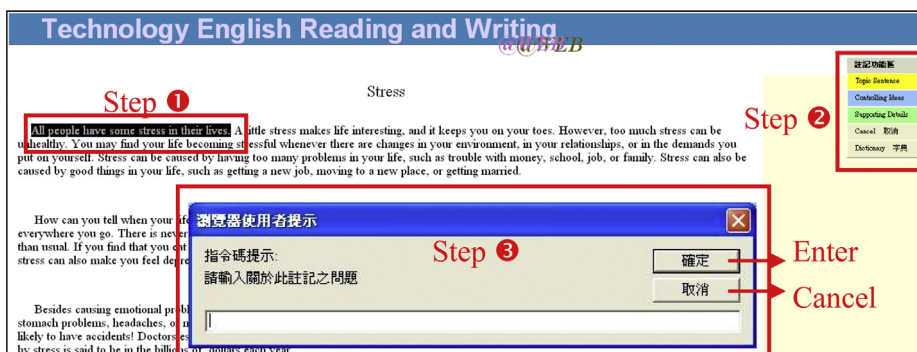


Fig. 1. Screenshot of *Paragraph Annotator*: Three steps to highlight a paragraph element.

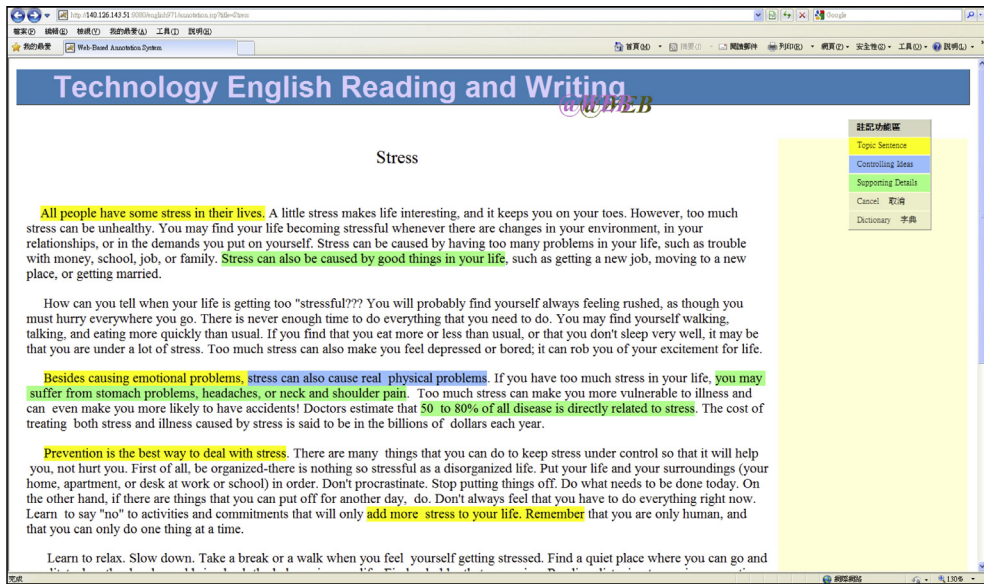


Fig. 2. Screenshot of Paragraph Annotator: Paragraph elements highlighted in three different colors.

3.3. Reading material

The essay used for both the experimental group and the control group (entitled *Stress*) was selected from Gillie, Ingle, & Mumford’s “Read to Write: An Integrated Course for Nonnative Speakers of English” (2001, p. 232)(see Appendix A). The six-paragraph essay follows a clear cause-effect organizational structure with logical relationships among the ideas. Paragraph (A) provides an introduction of the essay. Paragraphs (B) and (C) focus on the effects of stress. The remaining paragraphs discuss solutions to the problem of stress. Each paragraph of the essay contains the elements of a good paragraph, such as a topic sentence, a controlling idea, and the supporting details. This essay is written for intermediate-level nonnative speakers of English, which is appropriate for the English proficiency level of the participants.

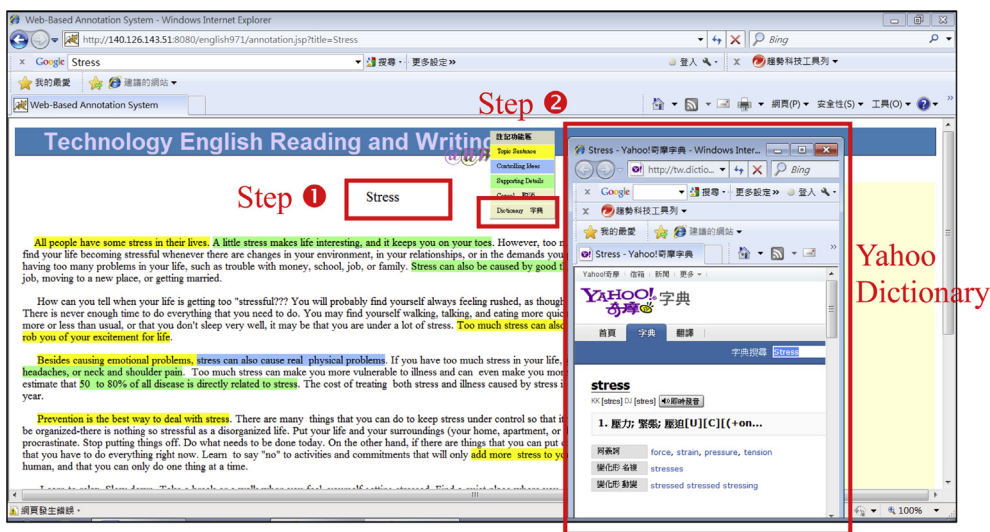


Fig. 3. Screenshot of Paragraph Annotator: Two steps to use Dictionary.

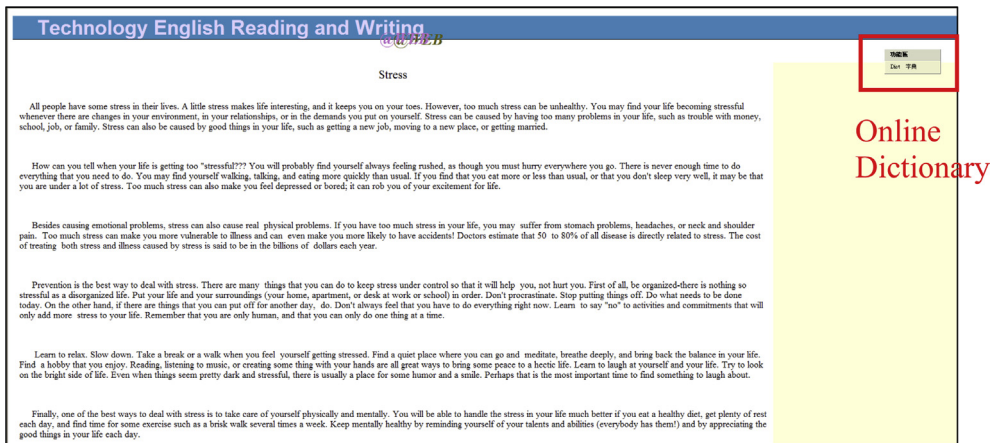


Fig. 4. Screenshot of control group system.

3.4. Experimental design and participants

The experiment was conducted in Chung Hua University in northern Taiwan. When students entered the University, they were required to take an English placement test in order to assess their levels of English language proficiency. Based on the test results, students were assigned to English classes, classified into three different levels, Level A, Level B, and Level C. To ensure that all participants had similar levels of English proficiency, this study used two Level-A classes (each with thirty-two students), taught by the same instructor. During the experiment, Class I comprised the experimental group and Class II the control Group. The control variable was the provision of online annotation tools (with online annotation tools or without the online annotation tools). The online annotation tools included: Topic Sentence Highlight, Controlling Idea Highlight, and Supporting Details Highlight, as supported learning strategies.

The experiment involved a reading phase and a testing phase. In the reading phase, the experimental group of students read the essay, *Stress*, using *Paragraph Annotator* and the control group read the same essay in a web-based environment with only an online dictionary. The experiment took one class hour (50 min) for both groups. Students took 30 min to read the essay. The testing phase immediately followed the reading phase. Both a Cued Recall Test and a Free Recall Test were used to assess students' comprehension. The dependent variables were the recall scores collected after students had read the English essay. An attitude questionnaire was also administered to students in the experimental group to assess their attitudes to the system.

3.5. Instruments and data analysis

In second language research, immediate recall test is a common technique to elicit data immediately after the completion of the task to be recalled (Mackey and Gass, 2005). In this study, immediately after the reading phase of the experimental procedure, students' reading comprehension was assessed, using a Cued-Recall Test and a Free Recall Test. By combining the two methods, the researchers were able to present a more detailed picture of how the *Paragraph Annotator* system affected students' reading comprehension.

The Cued Recall Test was modeled on a measure developed by Carpenter et al. (2006), which investigated what types of learning benefit from a Cued Recall Test. The Cued Recall Test used in the current study consisted of eight multiple-choice items from the passage, *Stress* (Appendix B). The items were scored as correct or incorrect as a measure of general comprehension. The student received one point for each correct item. After the scoring process, descriptive statistics were reported to describe the data collected from the Cued Recall Test, and *t*-test was employed to test if the means of the two groups were significantly different from one another. Cohen's *d* was used as a measure of effect size to represent the difference of cued recall scores between the experimental group and the control group.

The Free Recall Test included open questions, which asked participants to recall the purpose of the essay and elements of each paragraph, such as topic sentences, controlling ideas, and supporting details, without any cues (see

Table 1
Descriptive statistics of cued recall test scores.

Group	Number	Mean	S.D.
Experimental group	32	3.8125	1.7309
Control group	32	3.0625	0.9483

Appendix B). To analyze and score students' free recalls, each paragraph in the essay was firstly divided into paragraph elements, by two independent judges. Any disagreements were settled by a third judge. Each paragraph consisted of a topic sentence, a controlling idea, and supporting details. Once this segregation had been completed, students' free recalls were scored for the presence of each paragraph element of the original text. In scoring, each free recall was blindly judged by two independent graders. Correlation analysis was conducted to test the degree of repeatability of the two graders. The graders achieved a correlation coefficient of $r = 0.864$ for the experimental group and $r = 0.854$ for the control group. The correlation coefficients were found to be significant at the $P < 0.01$ level. After the scoring process, descriptive statistics were reported to describe the data collected from the Free Recall Test, and t -test was employed to test if the means of the two groups were significantly different from one another. Cohen's d was used as a measure of effect size to represent the difference of free recall scores between the experimental group and the control group.

Students in the experimental group also completed an Attitude Questionnaire after they completed the recall tests. The Likert scale questionnaire was used to investigate students' attitudes toward the system they had just used. After reading each of the statements in the questionnaire, the student indicated how much he/she agreed or disagreed by choosing from the following choices: (5) Strongly Agree (4) Agree, (3) Undecided, (2) Disagree, and (1) Strongly Disagree (see **Appendix C**).

The questionnaire included fifteen items, which were divided into four constructs: perceived ease of use, perceived usefulness, attitude to use, and intention to use (Davis, 1989). *Perceived ease of use* (PEU) refers to the extent to which a person believes that using a system would be free of mental effort. *Perceived usefulness* (PU) refers to the extent to which a person believes that the functionality and information provided by a system would be useful. *Attitude to use* (AU) refers to the appraisal and extent of satisfaction with a system. *Intention to use* (IU) is the subjective possibility that users will use the system. In the questionnaire, *perceived ease of use* included three items, *perceived usefulness* included five items, *attitude to use* included two items, and *intention to use* included five items. After students completed the Attitude Questionnaire, the descriptive statistics for the attitude questionnaire were reported and one sample t -test was employed to analyze the data set.

4. Results

4.1. Research question (1): will EFL students who read the article using Paragraph Annotator have higher cued recall test scores than the control group students?

The experimental data were analyzed using SPSS statistical package. **Table 1** summarizes the results for the Cued-Recall Test. It shows that the mean score of the experimental group [Mean = 3.8125] is higher than the mean score of the control group [Mean = 3.0625]. Results of the t -test are presented in **Table 2**. The results show that H_1 was not rejected, which suggests that the experimental group performed significantly better in the Cued Recall Test than the control group [$P = 0.037$](**Table 2**). The Cohen's d for the Cued Recall Test was 0.5374. According to the criteria

Table 2
 t -test of cued recall test scores.

Equality of variance	F-test for variance		t -test for mean		
	F	P	t	d.f.	P
Equal	17.896	0.000***	2.150	62	0.035*
Unequal			2.150	48.071	0.037*

* $P < 0.05$; *** $P < 0.001$.

Table 3
Descriptive statistics of free recall test scores.

Group	Number	Mean	S.D.
Experimental group	32	4.391	2.675
Control group	32	2.688	1.441

recommended by Cohen (1992), effect sizes as 0.20, 0.50, and 0.80 are considered small, medium, and large respectively. Based on Cohen's scale, 0.5374 is considered a medium effect size.

4.2. *Research question (2): will EFL students who read the article using Paragraph Annotator have higher free recall test scores than the control group students?*

The descriptive statistics of the Free Recall Test were computed for further analysis. Tables 3 and 4 illustrate the descriptive statistics and the *t*-test results for the Free Recall Test scores. As can be seen in Table 3, the mean score of the Experimental Group [Mean = 4.391] is higher than the mean score of the Control Group [Mean = 2.688]. Results of the *t*-test suggest that H_2 was not rejected [$P = 0.003$](Table 4). The experimental group performed significantly better in the Free Recall Test. The Cohen's *d* for the Free Recall Test was 0.792. Based on Cohen's scale (Cohen, 1992), high effect of testing was found for the Free Recall Test.

4.3. *Research question (3): what are students' attitudes toward the use of Paragraph Annotator for reading purposes?*

Unlike the Cued and Free Recall Tests, which were used for both groups, the questionnaire was only completed by the experimental group to investigate their attitudes to *Paragraph Annotator*. The descriptive statistics for the Attitude Questionnaire are listed in Table 5. Since the items of the questionnaire required the participants to evaluate *Paragraph Annotator*, one sample *t*-test was used to test whether the mean values of these four variables equaled 3. The results of the *t*-test are listed in Table 6. The results are as expected. Namely, the mean values for all constructs of the attitude questionnaire were significantly greater than 3. That is, the experimental group had a positive attitude to *Paragraph Annotator*, with respect to *perceived ease of use*, *perceived usefulness*, *attitude to use*, and *intention to use*.

5. Discussion

The results of the experiment indicate that students in the experimental group significantly outperformed students in the control group in both the Cued Recall Test and the Free Recall Test. Importantly, the difference in mean scores between the experimental group and the control group is much higher for the Free Recall Test than for the Cued Recall Test [(P value of *t*-test for the Free Recall Test = 0.003) < (P value of *t*-test for the Cued Recall Test = 0.037)](see Tables 2 and 4). The effect sizes (Cohen's *d*) for the Cued Recall Test and the Free Recall Test were 0.5374 and 0.792 respectively. The results show that the effects of the system on reading comprehension are more evident, if measured with a Free Recall Test, when students were not provided with cues (Fig. 5).

These findings suggest that the use of the system, *Paragraph Annotator*, is effective in enhancing EFL students' knowledge of paragraph structure and their reading comprehension. This supports researchers' (Butler-Pascoe and Wiburg, 2003; Grabe, 1991) view that knowledge of paragraph structure assists the learner in understanding and

Table 4
t-test results of Free recall test scores.

Equality of variance	F-test for variance		<i>t</i> -test for mean		
	<i>F</i>	<i>P</i>	<i>t</i>	d.f.	<i>P</i>
Equal	7.341	0.009**	3.171	2	0.002**
Unequal			3.171	47.592	0.003**

** $P < 0.01$.

Table 5
Descriptive statistics of attitude questionnaire.

	No. of subjects	Mean	S.D.
Perceived ease of use	32	3.74	0.5723
Perceived usefulness	32	3.56	0.4212
Attitude to use	32	3.31	0.657
Intention to use	32	3.35	0.6565

remembering the text. These findings are also consistent with previous research (e.g., Carrell, 1985; Duke and Pearson, 2002; Grabe, 1991; Lannon, 1998; Meyer et al., 2010; Mohd Din, 1997; Moss, 2004; Pardo, 2004) that learning to identify text structure and paragraph elements can help students understand the main idea of a text and thus develop reading comprehension.

This study has taken a step in the direction of applying online annotation technology in the design of learning tools to identify text structure and paragraph elements. The *Paragraph Annotator* designed for the experimental group contains many interactive features that were not available to the control group. Three differently colored highlight buttons (Topic Sentence, Controlling Idea, and Supporting Detail) allowed students to identify the key elements of each paragraph. With these annotation tools, readers could highlight the information and graphically display their analysis of paragraph elements in the corresponding colors, in order to get the gist of the text more easily and to achieve better understanding of the essay. Students also could add comments to the highlighted element. In this sense, *Paragraph Annotator* accommodated not only interactive tools to support the identification of text structure, visualization of text representations, and generation of reading strategies as suggested by researchers (Goldman and Rakestraw, 2000; Moss, 2004; Duke and Pearson, 2002; Reutzel, 1985), but also for reading to respond, as suggested by Lannon (1998).

Researchers believe that those learners who use a greater variety of strategies tend to be the most successful (e.g., Oxford, 1990) and that learning strategies can be trained (Brunig, 1983). It is also agreed that “good readers use comprehension strategies to facilitate the construction of meaning” (McLaughlin, 2003, p. 7; McLaughlin and Allen, 2002, p. 9). These strategies include previewing, self-questioning, making connections, visualizing, knowing how words work, monitoring, summarizing, and evaluating. For students in the experimental group, *Paragraph Annotator* became a vehicle for practicing specific reading skills and strategies, such as highlighting and identifying paragraph elements. The *Paragraph Annotator* provided more learning facilities than those available to the control group. If the learner makes use of those learning tools, they may stimulate, or substitute for, the student’s own learning strategies. This leads us to believe that online annotations in a web-based environment are effective in training EFL students who are not so proficient in English reading.

The results are also in agreement with the generative hypothesis. According to generative hypothesis, the generation effect refers to the fact that people typically remember information better when they have taken an active part in producing it, rather than having it provided by an external source (DeWinstanley and Bjork, 2004). In reading comprehension, “when presented with items that must be generated versus read at encoding, individuals typically remember better those items that they generated versus those that they only read” (DeWinstanley and Bjork, 2004, p. 945). In this study, using the reading support to guide students in their analysis of paragraph structure by highlighting elements with different colors, allows “reading to analyze” as suggested by Lannon (1998). Such an approach also supports Spolsky’s (1989) summary of conditions for successful second language acquisition (SLA), which states that a focus on form through manipulation of attention is important for effective task-based instruction.

Table 6
One sample *t*-tests of Attitude questionnaire.

	<i>t</i>	d.f.	<i>P</i> (two-tailed)
Perceived ease of use	7.307	31	0.000***
Perceived usefulness	7.471	31	0.000***
Attitude to use	2.691	31	0.011*
Intention to use	3.016	31	0.005**

P* < 0.05, *P* < 0.01, ****P* < 0.001.

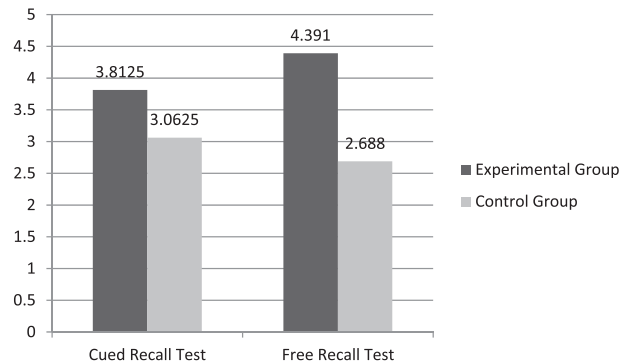


Fig. 5. Difference of mean scores between experimental group and control group in Free recall test and in cued recall test.

As discussed previously, reading in English is a frustrating experience for many EFL students. Grabe (1991) identified six component skills of fluent reading for students who had not attained fluency, but aspired to do so for academic purposes: (1) automatic recognition skills, (2) vocabulary and structural knowledge, (3) formal discourse structural knowledge, (4) content/world knowledge, (5) synthesis and evaluation skills, and (6) metacognitive knowledge and skills (cited in Butler-Pascoe and Wiburg, 2003, p. 118). The *Paragraph Annotator* provide several features (Highlight, Vocabulary, and Comment) which are suitable to assist EFL learners in developing structural knowledge, vocabulary knowledge, and evaluation skills. If the learner is likely to use those learning facilities, the system could help him/her develop reading fluency which is important for EFL students to acquire knowledge from English textbooks or other reading materials.

With respect to students' attitudes to reading English with *Paragraph Annotator*, students in the experimental group showed positive attitudes to the system. The results suggest that even though the highlighting of paragraph elements required extra work, the proposed online annotation system was still user-friendly and did not impede the reading processes of the learners. The use of color can enhance learning and motivation. It is helpful, not only for attracting attention to important information, but also for increasing the information capacity (Alessi and Trollip, 2001). Since people tend to be eye-minded, effective visual aids can emphasize important information to help readers analyze whatever is said in the text.

Due to time constraints, this study administered two immediate recall tests to assess students' reading comprehension (Cued Recall Test and Free Recall Test). It is suggested that future research could administer delayed post-tests (about 4 weeks after the training) to determine the persistence of the effect. It should also be noted that this study is primarily concerned with EFL students. In general, EFL readers have a wide range of learning needs and learning strategies (Oxford, 1990). They also need good user-oriented instruction and interactive language learning experiences (Larsen-Freeman, 2000; Nunan, 1993). The authors recommend that future research could replicate the approach outlined in this study with non-EFL students. In addition, this study obtained permission of 64 EFL students who registered as freshmen in the University. The number of subjects in each group was limited to 32 because of practical reasons. Future research could replicate this study with more subjects to further test the hypothesis of this study. Finally, as stated by Butler-Pascoe and Wiburg (2003, p. 118), "developing reading fluency is a long-term process that results from continuous effort and gradual improvement". For future studies, online annotations could offer many other supportive tools, such as examples and sharing, to scaffold various reading strategy training.

6. Conclusions

EFL reading instruction must equip students with active and effective reading strategies, which allow them to become fluent readers. Online annotation technology provides a vehicle for learners to practice specific reading skills and strategies. In this study, *Paragraph Annotator* was proposed to help EFL students learn how to read essays, using interactive annotation strategies to enhance students' reading comprehension. *Paragraph Annotator* provides several interactive tools that allow students to recognize and identify the underlying structure of paragraphs. While using the

system, students can learn to identify a paragraph's structure by highlighting the topic sentence, the controlling idea and the supporting details. Such tools can help students focus on the key elements of a paragraph and allow them to manually mark up the elements. The marked text structure visually represents the relationships between paragraph elements and helps students to visualize and monitor their comprehension as they read. The experimental results show that students using *Paragraph Annotator* perform significantly better in both Cued and Free Recall Tests. The results of this study suggest that online annotation technology allows EFL readers the flexibility to interact with the text in ways not possible with books alone.

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Appendix A

The article

Stress

- (A) All people have some stress in their lives. A little stress makes life interesting, and it keeps you on your toes. However, too much stress can be unhealthy. You may find your life becoming stressful whenever there are changes in your environment, in your relationships, or in the demands you put on yourself. Stress can be caused by having too many problems in your life, such as trouble with money, school, job, or family. Stress can also be caused by good things in your life, such as getting a new job, moving to a new place, or getting married.
- (B) How can you tell when your life is getting too "stressful"? You will probably find yourself always feeling rushed, as though you must hurry everywhere you go. There is never enough time to do everything that you need to do. You may find yourself walking, talking, and eating more quickly than usual. If you find that you eat more or less than usual, or that you don't sleep very well, it may be that you are under a lot of stress. Too much stress can also make you feel depressed or bored; it can rob you of your excitement for life.
- (C) Besides causing emotional problems, stress can also cause real physical problems. If you have too much stress in your life, you may suffer from stomach problems, headaches, or neck and shoulder pain. Too much stress can make you more vulnerable to illness and can even make you more likely to have accidents! Doctors estimate that 50–80% of all disease is directly related to stress. The cost of treating both stress and illness caused by stress is said to be in the billions of dollars each year.
- (D) Prevention is the best way to deal with stress. There are many things that you can do to keep stress under control so that it will help you, not hurt you. First of all, be organized—there is nothing so stressful as a disorganized life. Put your life and your surroundings (your home, apartment, or desk at work or school) in order. Don't procrastinate. Stop putting things off. Do what needs to be done today. On the other hand, if there are things that you can put off for another day, do. Don't always feel that you have to do everything right now. Learn to say "no" to activities and commitments that will only add more stress to your life. Remember that you are only human, and that you can only do one thing at a time.

- (E) Learn to relax. Slow down. Take a break or a walk when you feel yourself getting stressed. Find a quiet place where you can go and meditate, breathe deeply, and bring back the balance in your life. Find a hobby that you enjoy. Reading, listening to music, or creating something with your hands are all great ways to bring some peace to a hectic life. Learn to laugh at yourself and your life. Try to look on the bright side of life. Even when things seem pretty dark and stressful, there is usually a place for some humor and a smile. Perhaps that is the most important time to find something to laugh about.
- (F) Finally, one of the best ways to deal with stress is to take care of yourself physically and mentally. You will be able to handle the stress in your life much better if you eat a healthy diet, get plenty of rest each day, and find time for some exercise such as a brisk walk several times a week. Keep mentally healthy by reminding yourself of your talents and abilities (everybody has them!) and by appreciating the good things in your life each day.

Appendix B

The cued recall test and the free recall test

The Cued Recall Test

1. () Stress can be caused by having too many problems in your life, such as
(a) job, relationship (b) families, money (c) school, exam (d) moving, life pressure
2. () Stress can also be caused by good things in your life, such as
(a) job, relationship (b) families, money (c) school, exam (d) moving, marriage
3. () How can you tell when your life is getting too “stressful”? Which of the followings is not mentioned in the article?
(a) You always feel rushed. (b) You don’t sleep well. (c) You feel depressed.
(d) You eat more or less than usual.
4. () Doctors estimate that _____ of all disease is directly related to stress.
(a) 20–50% (b) 30–60% (c) 40–70% (d) 50–80%
5. () How much is the cost of treating both stress and illness caused by stress each year?
(a) one hundred million US dollars (b) ten million US dollars (c) billions of US dollars (d) one million US dollars
6. () What is the best way to deal with stress?
(a) Seeing a doctor (b) Exercise (c) Prevention (d) Complaint
7. () There are many things that you can do to keep stress under control so that it will help you, not hurt you.
(a) Doing mountain climbing and travelling. (b) Stop putting things off. Learn to say “no”. (c) Doing exercises. Learn to relax. (d) Listening to music. Find a hobby that you enjoy.
8. () One of the best ways to deal with stress is to take care of yourself _____.
(a) physically and mentally (b) mentally and spiritually (c) cognitively and mentally (d) logically and psychologically

The Free Recall Test

1. What is the main idea of this article?
2. What are the Topic sentence, Controlling idea, and Supporting details of each paragraph of this article?

Appendix C

The attitude questionnaire

Statements	(5) Strongly Agree	(4) Agree	(3) Undecided	(2) Disagree	(1) Strongly Disagree
1. The functions of the system are easy to use.					
2. This system has a well-designed interface.					
3. This system is helpful to improve my English reading comprehension.					
4. The system makes my English reading become easier.					
5. The system helps me to recognize Topic sentence, Controlling idea, and Supporting details of paragraphs in the article.					
6. I feel using this system is a joyful learning experience.					
7. I am satisfied with the functions provided by the system.					
8. I am willing to use this system as a tool for English reading.					
9. It is a wise decision to use this system to assist learning.					
10. I will continue using this system in the future.					
11. I have a good recall of the content of reading from using this system.					
12. I can understand the procedures to use the system.					
13. The system helps me to recognize the main ideas of the article.					
14. The system raises my motivation to use the online dictionary.					
15. I will recommend this system to others for assisting English reading.					

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