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THE EFFECTS OF ELECTRONIC MIND MAPPING ON STUDENTS' READING ABILITIES

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ABSTRACT

Reading abilities have been a problematic area among English as a foreign language (EFL) students. The objectives of this study were to investigate the effects of electronic mind mapping on students' reading abilities and students' opinions about learning reading through electronic mind mapping. The participants consisted of 42 students majoring in English at a university in Thailand. To ensure the reliability of the results, participants were selected via purposive sampling from different academic levels and background: 24 third-year students who enrolled in Critical Reading course and 18 fourth-year students who enrolled in American Short Story course. Both groups were taught using the electronic mind mapping. The instruments included a reading test, lesson plans, and a semi-structured interview. The data were assessed using mean, standard deviations, t-test analysis, and the analysis of covariance. The results revealed the potential of electronic mind mapping in enhancing students' reading abilities. The post-test mean scores of both groups were significantly higher than the pre-test mean scores. For the interview results, students reported that this technique assisted their reading abilities and motivated them to read.

KEYWORDS: Reading, Reading abilities; Mind mapping, Electronic mind mapping

INTRODUCTION

Reading is an important ability for learners around the world. Tamrackitkun (2010) stated that reading is one of the most frequently used and needed language abilities in daily life since people have to read a lot such as newspapers, books, banners, text messages, billboards, and so on. Reading abilities are also essential in learning because they are abilities that people need to achieve in order to be successful in education. Moreover, it is undebatable that reading abilities are needed for English learners because they need to explore a number of texts to improve their language.

However, English as a foreign language (EFL) students find difficulty in reading. It is hard to grab the gist of the texts, connections between the texts and the information. Sometimes these problems are overlooked even though they are signs of reading difficulties. Thai EFL students also face these difficulties. In 2018, Thailand was ranked 74 out of 100 nations, in a very low proficiency group by Education First (EF, 2019). The EF English Proficiency Index (EPI) score of Thailand was 47.61 which was ranked 17 out of 25 countries. English proficiency of students in Thailand was ranked at the very low and low proficiency for over ten years (EF, 2019). EF described the person whose

English is in a very low or low level that he/she can only understand simple emails from colleagues and have a simple conversation with foreigners. This score shows that Thai people are unable to fully understand the lyrics or even a newspaper. Another report from Educational Testing Service (ETS) shows the results from the Test of English for International Communication (TOEIC) that the average score of Thai people was only 478 out of 990 and was ranked among the low-level group (TOEIC, 2018). More importantly, this test revealed that Thai students' reading was at the low-level group which the mean score was only 218, and this made Thailand become the last third place in Asia. Although Thai students have learned English reading for more than eleven years, their reading abilities are still at the unsatisfied level (Abdulsata, 2012). Therefore, it is undoubtedly an urgent situation to find a more efficient technique to improve English reading abilities of students.

Teaching English reading can cause boredom for students. Students' attitudes toward reading seems to be an obstruction to the learning process (Arnold & Brown, 1999). The National Statistics Office (2016) shows that only 60 percent of Thai students at the age of 15-24 years old read books. This survey depicts that Thai students lacked interest in reading. Hayikaleng, Nair, and Krishnasamy (2016) also state that Thai students were uninterested in learning reading in English classrooms because of inappropriate teaching methods. That is, they did not enjoy reading class. Therefore, English teachers need to find reading instruction that can develop students' motivation and reading abilities.

Many scholars suggest that mind mapping is one of effective teaching techniques to teach reading. According to Ardini and Lashkarian (2015), mind mapping is a visual tool that can be used to generate ideas, take notes, organize thinking, and develop concepts. Key concepts are linked from the central topic and then connect to more details from sub branches. There are a number of studies investigating using mind mapping as a teaching technique. For example, Stankovic, Besic, Papic, and Aleksic (2011) found that mind mapping was a powerful tool for teaching because it enabled students to see the relations between main ideas and related ideas. Lin, Chen, and Chang (2010) found that using mapping strategy could improve students' text summarizing skills which helped elevate reading abilities and enjoyment while using mind mapping. Similarly, Siriphanich and Laohawiriyanon (2010) discovered that students enjoyed and knew how to connect each information properly. However, employing mind mapping in a traditional form in which students draw manually by using paper and a pen or on the board might not attract students in the 21ST century. Combining mind mapping with technology might motivate students in the period of advanced technology.

Electronic mind mapping is a new teaching technique. As young generations are surrounded by new electronic devices, the technology is quite reachable and familiar to them. The electronic mind mapping might be useful for students, as drawing a mind map helps the brain to visualize better than linear notes (Serrat, 2017). Moreover, this is an era of technology, so teaching by using electronic mind mapping can be more attractive to students. Mohaidat (2018) stated that the use of electronic mind mapping stimulates the use of the two sides of the brain; moreover, the ideas are arranged in a

sense that help the brain to read and remember the information rather than the traditional linear thinking. Alomari (2019) also agrees that students can benefit from using electronic mind mapping. Studies on the use of electronic mind mapping in English classroom is still limited in Thailand. Thus, this study attempted to investigate the effects of electronic mind mapping on Thai EFL students.

Research questions

This study aims to answer the following questions:

1. What are the effects of using electronics mind mapping on students' reading abilities?
2. What are the differences in the effects of using electronic mind mapping on students' reading abilities of students in American Short Story course and Critical Reading Course?
3. What are students' opinions about teaching reading through electronic mind mapping?

Reading

Reading is considered as one of the four fundamental skills: speaking, listening, reading, and writing (Cheon & Ma, 2014). According to Barnett (1989), reading associated with an insights of diverse background knowledge from deferent fields. Reading requires background knowledge for interpreting the contents of the text to be able to thoroughly comprehend the text. Moreover, reading is defined as a process that someone looks at the text and understand the written meaning (Williams, 1984). It is a process of gaining information that require prior schema as well.

According to Williams (1984), there are three main phases needed to be followed in teaching reading: pre-reading, while-reading, and post-reading. In the pre-reading phase, the teacher introduces and motivates learners' interest in the topic. The teacher can provide students with a reason to read and questions related to background knowledge or motivate learners' to read the texts. The purpose of while-reading phase is to clarify students to better understand the purpose and structure of the text. Activities include answering comprehension questions, completing diagrams or maps, making list and taking notes. Post-reading phrase is to gather all of the piece of information in reading text together.

Reading Abilities

Reading abilities has been defined in many ways by theorists. Grabe and Stoller (2002) defined reading ability as the ability to understand and interpret the information from printed text properly. It is an ability in the process of gaining information from writers through texts. It still plays an important role in English education as it is a significant input in language learning. In reading a text, there is an active communication between the writer on one side and the reader on the other side. However, the similarity of reading process in the second language and the first language is that they use mental activities in order to construct meaning from the text (Liu 2010). Urquhart and Weir (1998) described reading abilities as an interactive process which is a cognitive ability between a person and texts. According to Goodman (2010), reading abilities are continuous process to gain information in which the reader can confirm, reject or refine as reading progresses.

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There are many experts who proposed essential reading skills for EFL learners. According to Grabe and Stoller (2002), reading abilities include: 1) to search for simple information, 2) to skim quickly, 3) to learn from the texts, 4) to integrate information, 5) to write, 6) to critique texts, and 7) to comprehend the text generally. Moreover, Tarigan (1983) proposes seven skills of reading: 1) reading for details or facts, 2) reading for main ideas, 3) reading for sequence or organization, 4) reading for inference, 5) reading for classifying, 6) reading for evaluating, and 7) reading for comparing or for contrasting. Munby (1981) advocated that reading abilities consist of nineteen skills, such as recognizing the script of a language, deducing the meaning and use of unfamiliar lexical items, understanding conceptual meaning, understanding the communicative value of sentences, recognizing indicators in discourse, basic reference skills, skimming, scanning to locate specifically required information and so forth.

In conclusion, reading is a crucial skill to receive information from the text. It can be described as a complex process which requires the processes of word recognition and comprehension. It is an activity that requires readers to interpret by drawing meaning. reading abilities as the cognitive processes which include abilities to be able to find topics, main ideas, details, guessing meaning from context, references, the author's purpose, the author's attitude and tone, inferences, conclusion, and fact and opinion.

Mind Mapping

The mind mapping strategy is a technique for presenting thoughts in an organized way. It was established by Buzan (2006) to enable learners to arrange and classify ideas. It is an adaptation of constructivism which involves knowledge construction activity (Buzan & Buzan, 1996). It helps improve reading and decision-making. Buzan thought that the educational systems mainly focused on the employment of the left side of the brain, so he invented this strategy which incorporates two sides of the brain. Mind mapping described as the webs of various information linked around one central concept with connections by using colors and images. The links from the central concept depict a clearer picture of the connection of each concept, so it is accessible to manage the order of them.

The mind mapping allows users to fully use both sides of the brain to construct information. The left side of the brain is responsible for the use of logic, language, arithmetic, sequencing, and details of any topics while the right side of the brain is responsible for creativity, art awareness, imagination, feeling visualization, rhythm and intuition (Murley, 2007). The mind mapping requires cooperation of the brain, creativity from the right brain and logic from the left side. It utilizes both sides of the brain by the use of colors, words, and images (Siriphanich & Laohawiriyanon, 2010).

Moreover, mind mapping requires students to actively engage in their learning, often by connecting their prior knowledge to new schema. During mind mapping constructing, a student interacts with a textbook, teachers, and classmates. Learning is not only passing knowledge from teacher to students,

but also the process of participating in the active construction of knowledge and meaning through interactions with others and with the environment (Salomon & Perkins, 1998).

Lin et al. (2010) pointed out that mind mapping technique is a unique method for exercising many components such as thinking, feeling, attention, coordination, reasoning, hearing, motion sense, implementing skills, visualizing numbers and letters, reading, and analysing are all related to each other in mind mapping.

There are many advantages of mind mapping in teaching reading. Phongploenpis and Supangyut (2018) mentioned that mind mapping benefits students as follows: 1) Keywords and concepts are easily to be focused by the students, 2) It helps students to link the related facts, 3) Students learn the hierarchy of ideas, 4) It helps decision making of complex information, 5) It helps students to find aims for meeting, presentation, or project, 6) Mind mapping supports creative thinking, 7) It can be created by individuals or groups, 8) Mind mapping improves problem solving. In sum, mind mapping is beneficial to use while reading because students can clearly see the whole notes at a glance because OF non-linear graphics.

The implementation of the mind mapping in teaching reading can be divided into three stages (Aljaser, 2017; Phongploenpis & Supangyut, 2018; Siriphanich & Laohawiriyanon, 2010; Wang, 2016). Firstly, the teacher asks students to construct mind maps in the pre-reading stage to recall their background knowledge about related vocabulary in the reading. Students construct mind maps showing the relation of each vocabulary under the reading topic. Secondly, teacher asks the students to answer reading questions after reading each section. Thirdly, students construct the mind mapping to show the connection of each information of a reading text in the post-reading stage.

Electronic Mind Mapping

Recently electronic mind mapping emerged when the technology advanced. According to Dara (2010), electronic mind mapping is designed by using specialized software unlike the traditional form which is drawn by hand. Some studies have shown that electronic mind mapping is more efficient and attractive to students because it has images, colors, and drawings. Al-Badwoi (2015) described electronic mind mapping as an extensive digital version of mind mapping because it can be either software-based mind mapping or web bases mind mapping. Electronic mind mapping is different from mind mapping in terms of creating process and output because the electronic mind mapping is creating in a computer, and the output comes in a software file which can be PDF, jpg, or html. Aljaser (2017) said that electronic mind mapping has more efficiency, and it is more attractive than traditional mind mapping because it created by specialized software for faster outcome which includes photos, colors, illustrations that attract the readers. There are a lot of electronic mind mapping available nowadays which come with free subscription. According to Pat Research (2020), there are 29 free electronic mind mapping. The famous and popular ones are as follow:

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1) FreeMind
FreeMind is an online software that allows users to edit mind mapping. It also has features including color options, hyperlinks, and export files and allows users to copy and paste the document.

2) Edraw Mind Map
Edraw Mind Map is a free software that has different templates, samples, maps, and charts forusers to choose. More importantly, it is compatible with the applications of Microsoft. It also has a smart drawing guide and ready-made symbols.

3) Docear
Docear is a tool for literature management that allows users to take notes. Specially, it has comments and note features. It allows users to draft and write papers on its website; moreover, it provides recommended related papers for downloading from the website. It also focuses on annotations and importing PDF annotation.

4) Vue
Visual Understanding Environment (VUE) is a mind mapping or concept mapping application. It provides simple tools for users to create mind mapping and organize information. It also lets users to export file into different formats.

5) Freeplane
Freeplane is a mind mapping software application for organizing information, and it allows users to connect and share it with others.

6) Coggle
Coggle is a collaborative mind-mapping tool. It helps to simplify complex topics. Users can organise their mind mappings as they like and easily share with other people. Its features include real-time collaboration, unlimited diagrams, unlimited image uploads, and full change history. It is available on internet browsers, so it does not need to be installed. It also has unlimited images and private charts.

Related research
There are a lot of studies about mind mapping. For example, Wang (2016) studied the implementation of mind mapping in college English reading teaching. This study focused on the mind map teaching process which includes the preparation before class, classroom teaching and after class. The results showed that mind mapping stimulated reading motivation, understanding, and memorization of reading texts.

Peng (2011) investigated the effect of combining mind mapping and electronic picture-books on fourth-grade students' reading comprehension ability and reading motivation. The result showed that

electronic mind mapping increased the level of reading comprehension because it uses two sides of the brain: between the logical operation side and creativity side.

In addition, Al-Badwoi (2015) investigated the effect of using mind mapping on comprehending the information in EFL reading texts among Tehran students, at Safir Institute. The participants had a mean age of 25 and divided into an experimental group and a control group. The findings showed that mind mapping strategy enhanced students' reading comprehension.

In Thailand, Siriphanich and Laohawiriyanon (2010) conducted a study on using mind mapping to improve reading comprehension ability of Thai EFL university students. They found that mind mapping was effective in improving students' comprehension skills, and students enjoyed using electronic mind mapping.

There were only a limited number of studies on the implementation of electronic mind mapping in improving reading. These studies found that electronic mind mapping students better understand the reading passages.

Mohaidat (2018) investigated the impact of the electronic mind map (IMindMap) on the development of reading comprehension among ninth-grade students in Jordan. The experimental group was taught using the electronic mind mapping strategy. The result showed that this technique helped students to speed their learning process, and easily to find main and sub ideas.

In Thailand, Chaichompoo (2017) examined the use of electronic mind mapping to improve reading comprehension and summary skills of Thai English major students. He found that this technique enabled Thai students to understand English better. The results showed that this technique allowed students to be able to analyze and summarize the texts.

In conclusion, a number of studies have shown that mind mapping or concept mapping is an effective tool to support students to understand a text (Aljaser, 2017; Alomari, 2019). They pointed out that electronic mind mapping technique had a positive effect on students. Even though there are many studies on the use of mind mapping, the studies on the use of electronic mind mapping on reading abilities are limited, especially in Thailand.

2. MATERIALS AND METHODS

This present study employed a mixed-method design. Creswell and Clark defined mixed-methods as the approach in which greater understanding of the elements of qualitative and quantitative research approaches. Hence, this study combined both qualitative and quantitative approaches. The quantitative data came from the reading test scores of the pre-test and post-test. The qualitative research technique of a semi-structure interview were employed to assure the evaluations from the

quantitative data. The semi-structure interview was used to explore students' opinions about the impact of electronic mind mapping.

The participants consisted of 42 students majoring in English at a university in Thailand. They were selected via purposive sampling. Specially, they were from different academic levels and background to ensure the reliability and accuracy of the results: 24 third-year students who enrolled in Critical Reading course and 18 fourth-year students who enrolled in American Short Story course. Both groups were taught using the electronic mind mapping technique.

The instruments in this study included lesson plans, a reading test, and a semi-structure interview. Six lesson plans were designed by the researcher. Because students were chosen from two courses, the lesson plans were relied on contents and materials of each course. The lesson plans were merged with electronic mind mapping, and they were divided into three stages which were pre-reading, while reading and post-reading.

To measure students' reading abilities, a reading test was employed to compare the scores from pretest and posttest. It was adapted from Yimwilai, Srijongjai, and Puchpan (2009) reading abilities test and consisted of 30 questions, with 4 multiple choice answers in each question. The objectives of the test were to assess students' reading abilities: namely, reading for topics, main ideas, details, guessing meaning from context, references, purposes, the author's attitude and tone, inferences, conclusion, fact and opinion. This test was reviewed in the index item objective congruence by experts and was tried out to check difficulty, discrimination, and reliability.

Finally, a semi-structure interview was designed for gaining qualitative aspects of the results--students' opinions about experiencing electronic mind mapping in the classroom. It consisted of 4 open-ended questions. Students were asked to respond these questions to allow the researcher to obtain more information apart from the test. The purpose of this instrument was to ensure the reliability of the results from the reading test.

This study was last four weeks. In the second semester in the 2019 academic year, the students from both courses were asked to sign the consent form and complete the pre-test. After the pre-test, they were taught by using electronic mind mapping for three weeks. After teaching by using electronic mind mapping, the students took the post-test. After that, five volunteer students were interviewed. The interview was conducted in Thai to avoid the language barrier that might be the difficulty to express their opinions after participating in this study.

The data from the research instruments were analysed as follows: the data from the pre-test and post-test were analysed by mean scores, standard deviations, a t-test analysis, and an analysis of covariance. The differences between the reading ability of students before and after teaching by using electronic mind mapping were determined by t-test analysis. The analysis of covariance was

used to determine the differences in the effects electronic mind mapping on students in American Short Story course and students in Critical Reading course. The data from the interview were analysed by content analysis

Time	N	Mean	Max	Min	S.D.	*t*-value	Df	*p*-value
Post-test	42	16.81	28	7	6.71	11.71***	41	.00
Pre-test	42	14.07	24	6	6.00			

RESULTS

The Students' English Reading Abilities

This part provides the answers to the first research questions: what are the effects of electronics mind mapping on students' reading abilities? The results are shown in Table 1, 2, 3 and 4.

Tables 1 Descriptive Statistic of Students Reading Mean Scores

Group	Pre-test		Post-test	
	M	*SD*	*M*	*SD*
Critical Reading course	18.29	4.19	21.17	5.07
American Short Story course	8.44	2.12	11.00	3.34
Overall	14.07	6.00	16.81	6.71

Table 1 demonstrates the mean scores and standard deviations from the results of the using electronic mind mapping on students' reading abilities of students in Critical Reading course and American Short Story course. The pre-test mean score of Critical Reading course students was 18.29 (SD=4.19), and the pre-test mean score of American Short Story course students was 8.44 (SD=2.12). The post-test mean score of Critical Reading course students was 21.17 (SD=5.07) and the post-test mean score of American Short Story course students was 11.00 (SD=3.34).

Tables 2 The Comparison of the Pre-test Mean Score to Post-test Mean Score

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Time	N	Mean	Max	Min	S.D.	*t*-value	Df	*p*-value
Post-test	24	21.17	20	13	5.07	9.49***	23	.000
Pre-test	24	18.29	18	11	4.18			

***p<.001

The Table 2 points out that there were statistically significant differences in the pre-test and post-test mean score of students' reading abilities (t (41) = 11.71, p < .001). The mean score of the pre-test was 14.07 (SD = 6.00) whereas the post-test mean score was 16.81 (SD = 6.71). The post-test score was significantly higher than the pre-test score. Hence the results indicate that teaching reading through electronic mind mapping potentially elevated students reading abilities.

Tables 3 The Comparison of the Pre-test Mean Score to Post-test Mean Score of The Students in Critical Reading Course

***p<.001

Table 3 illustrates that there were statistically significant differences in the pre-test and post-test mean scores of students in critical reading course (t=9.49, p<0.001). The pre-test mean score was 18.29 (SD=4.18) whereas the post-test mean score was 21.17 (SD=5.07). Hence, the post-test mean score was significantly higher than the pre-test mean score. The results prove that teaching reading through electronic mind mapping positively affected reading abilities of Critical Reading course.

Tables 4 The Comparison of the Pre-test Mean Score to Post-test Mean Score of the Students in American Short Story Course

***p<.001

Group	Before Treatment			After Treatment (Unadjusted)		After Treatment (Adjusted)	
	N	M	*SD*	Me	*SD*	Me	*SE*

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		ean	mean	an	mean	an	mean
Critical Reading course	24	18.28	4.19	21.17	5.07	16.03	.38
American Short Story course	18	8.44	2.12	11.00	3.34	17.85	.47

Table 4 shows that there were significantly differences in the pre-test and post-test mean score of the students in American short story course ($t=6.86$, $p<0.001$). The pre-test mean score was 8.44 ($SD=2.12$), and the post-test mean score was 11.00 ($SD=3.34$). The post-test mean score was significantly higher than the pre-test mean score. Consequently, the analysis points out that teaching reading through electronic mind mapping can be beneficial to the students in American Short Story course.

This part provided the answers to the second research questions: What are the differences in the effects of electronic mind mapping on students' reading abilities of students in American Short Story course and Critical Reading course? To compare the effects of electronic mind mapping on students in critical reading course to students in American short story course, the analysis of covariance was used, and the results are shown in the table 5 and table 6.

To compare mean scores between two groups, estimate marginal means was used to get result. The mean scores of two groups were adjusted. The adjusted and unadjusted means for the students in American short story course and critical reading course are presented in Table 5.

Tables 5 Unadjusted and Covariance Adjusted Descriptive Statistic

Time	N	Mean	Max	Min	S.D.	t-value	Df	p-value
Post-test	18	11.00	16	6	3.34	6.86***	1	.000

Pre-test	18	8.44	12	7	2.12		7	

*** p < .05**

Tables 6 The Analysis of Covariance of the Students in American Short Story course and Critical Reading course

Source of Variance	*SS*	*df*	*MS*	*F*	Sig
Before Treatment	711.01	1	711.01	394.33	.000***
Between Groups	11.13	1	11.13	6.17	.017
Error	70.32	39	1.80		

***** p <.001**

The analysis of covariance was conducted to compare the effects of electronic mind mapping on the students in American short story course to critical reading course. The analysis shows that there were no statistically significant differences in the post-test mean score of students in both courses (F =.6.17, p > .001). This indicated that the effectiveness of mind mapping on the students in American short story course were greater than on students in Critical Reading course. This reveals that electronic mind mapping has effects on low proficiency group more than high proficiency group.

Students' opinions about learning reading through electronic mind mapping This section provides the answer to the third research question: What are students' opinions about learning reading through electronic mind mapping? To explore the opinions of students upon the teaching technique, the data were collected from semi-structured interview and analysed by content analysis. The results were as follow:

The results depicted that all of 5 students who volunteered to interview expressed positive opinions about the learning reading through electronic mind mapping. The interviewees expressed that this teaching technique assisted them to improve their information management which important for reading. Four students said that they better understood the passages while reading because they saw the relationship between each information. They thought that this technique helped them to see the organisation of the elements in reading texts. Two students said that they could easily saw the hierarchy of the ideas in reading texts through electronic mind mapping. One student stated that she

could linked the main idea of each paragraph to the sub ideas easily. One student also added that this technique enabled her to easily comprehend the texts because all of the keywords were in the electronic mind mapping.

Furthermore, students reported that they liked to use this technique as another form of note taking. For example, two students reported that they found it easy to remember all of the keywords when using electronic mind mapping. They added that using various colours in electronic mind mapping helped them remember information. All interviewees said that this technique was more accessible for taking note than the traditional form. They said that it helped them a lot in reviewing lessons before the exam because it was easier to remember than linear note taking. One student also added that doing electronic mind mapping in class benefited them when they prepared for the test.

Additionally, all interviewees reported that reading through electronic mind mapping motivated them to read. One student reported that she was motivated by the exercises before reading because the whole class could brainstorm together, and this really helped to see the overview before reading. All said that they enjoyed learning reading because they knew how to find each point in the texts. One student also said that the technique was new, and it encouraged her to read. Two students responded that they enjoyed reading complicated texts more because this technique assisted them while reading. This illustrates that electronic mind mapping provided pleasant environment for learning readings. This is a nice sentence.

Moreover, the students reported that they liked learning reading through electronic mind mapping because it was more attractive for them than the traditional form. For example, one student claimed that electronic mind mapping made the note look clean and organized than traditional mind mapping. Two students said that it was faster to put information in the electronic mind mapping, and it allowed them to share among friends. One student said that electronic mind mapping looked more organised when printed it out than the traditional form. In conclusion, all students liked the electronic mind mapping because of its appearance and characteristics.

In conclusion, students favored electronic mind mapping. According to their responses, they all agreed that this technique benefited them to have better understanding of the texts. Moreover, electronic mind mapping boosted the students' reading abilities and motivation toward learning reading as well.

4. DISCUSSION

Research question 1

The present study presents that electronic mind mapping had positive effects on students' reading abilities. This is because the implementation of electronic mind mapping encourages information organizing. Mohaidat (2018) claimed that electronic mind mapping had a positive impact on students' understanding, and analyzing the texts because the information was arranged in a more

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organized way, so the main ideas were noticeable easily. As Bawaheh (2019) proposed, electronic mind mapping maintains an opportunity for students to learn to connect each concept, to form new relationships and to enhance retention. Like the idea of Tungprapa (2015), electronic mind mapping assisted students in this study to perceive contents relation and better understood passages. This is in line with the study of Alomari (2019) which revealed that electronic mind mapping developed students' comprehension skills because it helped students to focus on the basic idea and sub-ideas of the text, make use of their own experiences and come up with their own ideas.

In addition, it transformed the classrooms in this study to be more student-centered and this improved students' learning outcomes. As Mahasneh (2017) proposed, electronic mind mapping involves students' active participation in the learning process. Like the idea of Alomari (2019) electronic mind mapping transformed the classrooms into a more ecstatic and vibrant environment, while supporting the ability to understand reading. Thus, students in this study developed their reading.

Research question 2

According to the findings from the analysis of covariance, there were statistically significant differences in the mean scores of students in American short story course which was a lower proficiency group and students in critical reading course which was a higher proficiency group. Even though the analysis shows that there were no statistically significant differences in the mean score of critical reading course and the mean score of American short story course. It suggests that electronic mind mapping developed reading abilities of the students with lower proficiency greater than the students with higher proficiency. Caleb and Andrew (2019) indicated that effective reading strategy helps elevate students reading abilities but lower proficiency students require more reading technique and prior vocabulary. Furthermore, illustrations are suitable for low proficiency reader because it helps them enable to see the vocabulary and structure of the content (Carrell, Devine, & Eskey, 1988). Therefore, electronic mind mapping had a more positive impact on lower proficiency readers because it's strategy and illustrations.

Research question 3

The results from the interview reveals that the students favored learning reading through electronic mind mapping. The reason to explain is that reading through electronic mind mapping motivated students to read. Similar to the ideas of Sabbah (2015), the process of electronic mind mapping was full of fun and enjoyment when the students exchanged ideas and felt a sense of success when they saw their organized images that they created. The results are in the line with the study of Ellozy and Monstafa (2010) which investigated undergraduate students critical reading skills, and the results showed that electronic mind mapping created three significantly influenced on students' satisfaction and perceived learning which were: insightful visual data, analytical skills, and active discussion among course participants presented in electronic mind mapping environment.

In addition, the students reported that they liked learning reading through electronic mind mapping because it was more attractive to them than the traditional form. First like the ideas of Aljaser (2017), electronic mind mapping composes of various elements of excitement, such as colors, images and shapes, which helps to create the positive attitudes and encourage students to remember well. Secondly, this idea is evident in the interview findings in which students stated that electronic mind mapping turned the note into a clear and concise form but still informative. Thirdly, electronic mind mapping was more convenient for this learning environment. The results are in accordance with the study of Al-Badwoi (2015) which found that thirty-four students were interested in learning English using electronic mind mapping because it was helpful with presentation in front of the class, could develop their creativity, and most importantly could ease their boredom in classroom.

5. CONCLUSION

The present findings evident the positive effects of electronic mind mapping on EFL students' reading comprehension and motivation. Due to the benefits of teaching reading through electronic mind mapping found in this study, this technique can be an alternative for teachers to create a more positive classroom environment, promote learning motivation, and most importantly improve learners' reading performance.

The researcher suggests the following ways in which future research might build upon and strengthen these findings. Other qualitative research methods, such as an observation or diary, could be used to support the qualitative data. This study only conducted on students majoring in English in tertiary level. It might be interesting to conduct a research with other academic levels with a larger sample size, so the results would be more widely generalized.

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