USING ELECTRONIC MIND MAPPING TO ENHANCE EFL HIGH SCHOOL STUDENTS' CRITICAL READING SKILLS

SUP MONLIANG

Graduate School Srinakharinwirot University

2022

การใช้แผนผังความคิดอิเล็กทรอนิกส์เพื่อพัฒนาการอ่านอย่างมีวิจารณญาณของนักเรียนชั้นมัธยมศึกษาตอนปลาย

ศุภร์ มนต์เลี้ยง

ปริญญานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตร
ศิลปศาสตรมหาบัณฑิต สาขาวิชาภาษาอังกฤษ
คณะมนุษยศาสตร์ มหาวิทยาลัยศรีนครินทรวิโรฒ
ปีการศึกษา 2565

USING ELECTRONIC MIND MAPPING TO ENHANCE EFL HIGH SCHOOL STUDENTS' CRITICAL READING SKILLS

SUP MONLIANG

A Thesis Submitted in Partial Fulfillment of the Requirements

for the Degree of MASTER OF ARTS

(English)

Faculty of Humanities, Srinakharinwirot University

2022

THE THESIS TITLED

USING ELECTRONIC MIND MAPPING TO ENHANCE
EFL HIGH SCHOOL STUDENTS' CRITICAL READING SKILLS

BY

SUP MONLIANG

HAS BEEN APPROVED BY THE GRADUATE SCHOOL IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE MASTER OF ARTS
IN ENGLISH AT SRINAKHARINWIROT UNIVERSITY

.....

(Assoc. Prof. Dr. Chatchai Ekpanyaskul, MD.)
Dean of Graduate School

.....

ORAL DEFENSE COMMITTEE

..... Major-advisor	..... Chair
(Dr.Sakulrat Worathumrong)	(Asst. Prof. Dr.Khomduen Phothisuwan)
..... Co-advisor	..... Committee
(Asst. Prof. Dr.Supaporn Yimwilai)	(Dr.Thitima Kamolnate)

Title	USING ELECTRONIC MIND MAPPING TO ENHANCE EFL HIGH SCHOOL STUDENTS' CRITICAL READING SKILLS
Author	SUP MONLIANG
Degree	MASTER OF ARTS
Academic Year	2022
Thesis Advisor	Dr. Sakulrat Worathumrong
Co Advisor	Assistant Professor Dr. Supaporn Yimwilai

The objectives of this study are as follows: (1) to examine the effects of electronic mind mapping on critical reading skills of students majoring in Japanese; (2) to examine the effects of electronic mind mapping on the critical reading skills of students majoring in Mathematics; (3) compare the effects of electronic mind mapping on the critical reading skills of students majoring in Japanese to those of students majoring in Mathematics; and (4) to investigate the opinions of EFL high school students about learning critical reading skills through electronic mind mapping. The participants in this study were 83 eleventh-grade students. They were selected by purposive sampling and divided into two groups: 44 students majoring in Japanese and 39 students majoring in Mathematics. Both groups were taught using electronic mind mapping. The instruments employed in this study consisted of four lesson plans, a critical reading test, a questionnaire, a semi-structure interview, and video recording. The mean score, standard deviation, and a *t*-test analysis, and analysis of Covariance (ANCOVA) were used to analyze the quantitative data, whereas content analysis was used to analyze the qualitative data from the open-ended part of the questionnaire, a semi-structured interview, and a video recording. The results showed the effectiveness of electronic mind mapping. That is, both groups of students significantly improved critical reading skills after learning through electronic mind mapping. When compared the effects of electronic mind mapping on critical reading skills of students majoring in Japanese to those of students majoring in Mathematics, there were statistically differences in the critical reading skills gain of these two groups of students. This means that electronic mind mapping effects on both groups differently. Additionally, the students had positive opinions about learning critical reading skills through electronic mind mapping.

Keyword : Mind mapping, Electronic mind mapping, Critical reading skills

ACKNOWLEDGEMENTS

I would like to express my deepest appreciation to my advisors, Asst. Prof. Dr.Supaporn Yimwilai and Dr.Sakulrat Worathumrong for her warm encouragement and invaluable guidance throughout this study. I also feel very thankful for her valuable comments and suggestions. She always dedicated her time to assist me to go through every procedure of the study. This thesis would not have been accomplished without all the support and advice that I have always received from her.

I also would like to kindly express my gratitude to my oral defense committees, Asst. Prof. Dr.Khomduen Phothisuwan and Dr.Thitima Kamolnate, for their valuable and productive recommendations to help improve my work.

Besides, I acknowledge and extend my appreciation to all the instructors in Master of Arts Program in English at the Faculty of Humanities, Srinakharinwirot University for their great teaching and supports throughout the course. I also express my gratitude to Graduate School of Srinakharinwirot University for my academic success.

Moreover, I also appreciate my colleagues at my workplace who always encourage and support me to keep going when I confronted with the difficulties, as well as my classmates who encouraged me through hard time. All of their support is admirable.

Lastly, I would like to express my special thanks to my family: my parents and my brother for their support and encouragement. I would not have been successful in life without them.

SUP MONLIANG

TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

CHAPTER 1
INTRODUCTION

Rationale

Reading skills are considered significant in today's world. Reading is a mean for students to acquire knowledge. Richards and Renandya (2011) state that reading gains much attention in foreign language learning. Many foreign language students think that reading ability is their goal. That is, they desire to have reading ability in order to acquire information, enjoyment, get good jobs and further study. In addition, Zhang and Koda (2012) state that reading plays an important role in continuing education and self-improvement. Rintaningrum (2019) supports that reading also help students improve their concentrations. This means that reading is an essential skill for students.

In the 21st century where information is easy to access, critical reading is a crucial skill for students. Hudson (2008) states that students who have critical reading skills will be successful in schools. Students with critical reading skills not only are able to analyze any texts but also score better in exams. Varaporn and Sitthitikul (2019) also state that students need to be aware of the acquired information and should have suspicious minds while they approach any information sources. Therefore, students need to acquire critical reading skills and prepare for more challenging reading tasks. For Thailand, critical reading has also been emphasized in the Basic Education Core Curriculum since B.E. 2551 or A.D. 2008. Critical reading is considered one of the learners' key competencies, thinking capacity (Ministry of Education, 2008).

However, many Thai students have experienced the difficulties in learning to read, especially reading critically. This can be seen from the results of various assessments of English and reading. For example, in 2018, Organization for Economic Co-operation and Development or OECD reported the assessment in 2018 that Thailand was ranked 66th for reading out of 79 countries. Thai students scored 393 points in reading which was 16 points lower than the assessment of PISA 2015 (Mala, 2019). In terms of critical reading, many research studies reveal similar results: most of Thai EFL students cannot read critically (Attaprechakul, 2013; Sawangsamutchai & Rattanavich,

2016; Srisirasasipon, 2014). These studies reveal that Thai students have some difficulties in making inferences from the texts they read, cannot identify the tone of the article as well as the attitudes of the writer, and cannot state the author's purpose.

There are two main factors related to difficulties in learning English critical reading among Thai students. The first factor is the teaching method. Most schools in Thailand have used the traditional grammar-translation teaching approach in teaching reading (Sawangsamutchai & Rattanavich, 2016; Srisirasasipon, 2014). Teachers take the role of being the translator of the text and providing the meaning and interpretation whereas students passively receive knowledge. This kind of teaching approach does not provide many opportunities for students to develop higher-order thinking and critical reading. The second factor is related to interest and motivation. Pinter (2017) mentions that motivation is a factor in learning foreign language. However, in foreign language classrooms, teachers and the enjoyable activities in classrooms motivate students. Pinter (2017) also suggests that to involve students' learning, activities can help them think as they read. In order to engage uninterested students, a teacher has to motivate them in reading activities. Hence, it is important to find effective ways to teach reading.

Many scholars suggest mind mapping as an effective way to teach reading. According to Buzan (2004), mind mapping is a thinking tool that has been employed for centuries in order to learn, brainstorm, memorize, think, visualize and solve problems. It is an effective tool that facilitates learners to study, note, and organize information (Tucker, Armstrong, & Massad, 2010). Moreover, it helps low learners succeed in their learning (Holzman, 2004). There are several educators have investigated mind mapping usage in class. For example, Malekzadeh and Bayat (2015) investigated the effects of mind mapping on English reading in English texts. The research was done at an Iranian University. The findings revealed that mind mapping helped develop students' English reading comprehension. Recently, Saori (2020) also studied how mind mapping impacted students' reading comprehension. Mind mapping was employed in the experimental group while conventional learning was used in the control group. The results reveal that mind mapping is a potential technique to teach reading

comprehension. However, Murray and Rabiner (2014) state that technology has become the significant phenomena in daily human life since the beginning of the 21st century. The use of technology has become one of the most effective teaching and learning tools in the classroom. Because the conventional form of mind mapping is created by hand, map size is also limited. Nowadays mind mapping has been combined with technology and electronic mind mapping is starting to appear.

Electronic mind mapping can be an effective tool for teaching reading. Many scholars conducted research studies and found that electronic mind mapping not only affected students' reading comprehension but also provided positive attitudes among students such as the studies of Sabbah (2015) and Mohaidat (2018). Furthermore, electronic mind mapping is an effective tool which promotes active learning and helps enhance critical reading and develop strong reading skills (Ellozy & Mostafa, 2010). Since traditional reading instruction makes Thai students lack motivation in learning critical reading, integrating electronic mind mapping in reading class might be an effective method that can enhance students' critical reading skills.

Statement of the Problem

In traditional reading learning, Thai EFL students were found to have difficulties in learning reading. Students read without interaction with others and lack of interest. These reasons hold students in learning critical reading. In addition, studies about using electronic mind mapping to improve critical reading are still limited. Therefore, this study was to measure the effects of electronic mind mapping on EFL students' critical reading skills and opinions.

Research Objectives

1. To examine the effects of electronic mind mapping on critical reading skills of students majoring in Japanese.

2. To examine the effects of electronic mind mapping on critical reading skills of students majoring in Mathematics.

3. To compare the effects of electronic mind mapping on critical reading skills of students majoring in Japanese to those of students majoring in Mathematics.

4. To investigate EFL high school students' opinions about learning critical reading through electronic mind mapping.

Research Questions

1. What are the effects of electronic mind mapping on the critical reading skills of students majoring in Japanese?

2. What are the effects of electronic mind mapping on the critical reading skills of students majoring in Mathematics?

3. Are there any differences in the effects of electronic mind mapping on the critical reading skills of students majoring in Japanese and those of students majoring in Mathematics?

4. What are EFL high school students' opinions about learning critical reading through electronic mind mapping?

Significance of the Study

This project was conducted to develop students' critical reading skills. Using electronic mind mapping can be helpful for teacher interested in creating lesson which engage students in class activities. This project can help teachers to design activities which promote critical reading. Educators can gain benefit from this project. The results can be their guidelines in improving and revising English curriculum. Lastly, the results of this project can be employed as a guideline for other research.

Scope of the Study

The study focused on using electronic mind mapping to enhance critical reading skills. In this study, the electronic mind mapping software named Coggle was used. The participants in this project included 83 eleventh-grade students at a demonstration school, Bangkok, Thailand. There were two groups of participants: 44 students majoring in Japanese and 39 students majoring in Mathematics.

Definitions of Terms

The terms used in this project are defined as follows:

1. Mind mapping is a graphical image outline that could provide readers better understanding about the ideas or information that creators want to convey. The major concepts are radiated from the central idea while the minors are illustrated as branches of bigger branches.

2. Electronic mind mapping refers to an online tool that allows students to construct mind maps.

3. Critical reading refers to a high-level reading process that the readers need to interpret, analyze, synthesize, and evaluate the reading text. It consists of four skills: making inferences, recognizing the author's purpose, recognizing the author's tone, and drawing conclusion.

CHAPTER 2
LITERATURE REVIEW

This chapter provides the description of reading, critical reading, mind mapping, electronic mind mapping, and research studies related to electronic mind mapping. The literature details are described as follows:

Reading

Reading is one of the four fundamental skills apart from speaking, listening, and writing. Reading has been defined by many scholars. Grabe (2009) describes reading as a process that readers take from what they read and apply it in a classroom. The readers understand the texts by choosing the information, interpreting, synthesizing, and evaluating. According to Sheeba (2018), reading is a collaborative activity between the reader and the text, and Sheeba (2018) also added that is a process of decoding symbols in order to create or derive meaning. Reading requires the readers use knowledge, strategies, and skills to determine what that meaning is.

To enhance students' reading, a teaching method is an important factor. According to, Grabe and Stoller (2019) in teaching reading there are three stages including pre-reading, while-reading, and post-reading. The pre-reading stage offers activities to boost students' background knowledge, provide information that students need to comprehend the text, stimulate students' interest in the topic. In this stage, teachers sometimes supplement their textbooks with pre-reading tasks of their own design. Following the pre-reading stage, the while-reading stage offers students to interact with reading texts in making meaning. This stage helps students shape new knowledge and understand the purpose and structure of the text. In this stage, teachers can ask students to do one or more the following tasks. For example, complete a true or false task about the text or match statements that point out connections in the text including cause – effect, problem – solutions, pros – cons, fact – opinion, or stated – inferred etc. The last stage, post-reading, is used to check readers' text comprehension

and review the information for reading texts. This teaching method was employed as a framework to design the lesson plans in this study.

Critical Reading

The definitions of critical reading are various. According to Hudson (2008), critical reading is a skill that helps readers to be able to analyze, synthesize, and evaluate what they read. For Huijie (2010) critical reading is a high-level reading procedure that requires the capacity to read critically and wisely. Similarly, Abdel halim (2011) states that critical reading is the ability to interpret, analyze, and evaluate the credibility of passages. Varaporn and Sitthitikul (2019) defines critical reading as a thinking process that searches the truth from reading texts. The reader makes a lot of careful evaluation and analysis to reach a new understanding. To conclude, critical reading refers to a high-level reading procedure that the readers require the ability to interpret, analyze, synthesize, and evaluate the reading text.

Scholars and educators provide several reasons why critical reading is important. Firstly, critical reading helps students deeper comprehend the text when they read. Razaghi, Amoopour, Shakibaei, Gilaninia, and Javad (2011) mention that critical reading provides students with skills to read the text at a deeper level and better comprehend and analyze the given text. Supported by Tasnimi (2017), critical reading enables students to go beyond a text and analyze the arguments in the text. Secondly, critical reading helps students in education. Kadir, Subki, Jamal, and Ismail (2014) state that the teachers should help students develop critical reading in order to be successful in school. Students with good critical reading skills could perform well in any courses and score better in any test that they take. As a result, it is crucial to prepare students to have critical reading skills in order to study in any program at university level. Thirdly, critical reading is an essential skill in 21st century. According to Alqatanani (2017), critical reading helps students cope with the expansion of knowledge and information in this era. Due to the advance of technology, students can easier access numerous sources of information. The provided information can exist in varying quality and reliability. It can be facts, opinions, and sometimes the purpose of the text is usually hard to determine. The

study of Gottfried and Shearer (2016) reveals that 38% of major political Facebook information was fake. Therefore, teachers and educators need to prepare students to be critical readers. Finally, critical reading promotes critical thinking. Critical reading is related to critical thinking. Kurland (2000) proposes that critical reading is a skill used to acquire information in a reading text while critical thinking is a method used to judge information. Critical thinking will come after critical reading. In other words, a person can have critical thinking after he or she reads critically. In conclusion, critical reading has several benefits, especially in today's society; therefore, schools need to prepare their students to be critical readers.

Critical reading includes several sub-skills proposed by several researchers. According to Ueai-Chimplee (2007), critical reading sub-skills include (1) distinguishing between fact and opinion, (2) recognizing the author's purpose, (3) recognizing the author's tone, (4) recognizing the author's attitude, (5) recognizing the author's organizational patterns, (6) making inferences or logical conclusion, and (7) identifying a source of information. Jasim (2008) proposes four critical reading sub-skills: distinguishing facts from opinions, detecting bias and prejudice, making inferences and drawing conclusions, and recognizing propaganda. Manarin, Carey, Rathburn, and Ryland (2015) describe that critical reading comprises of: (1) identifying patterns of textual elements, (2) distinguishing between main ideas and supporting details, (3) evaluating credibility, (4) evaluating the arguments made in the text, and (5) making inferences about the text. Although the scholars propose various different critical reading skills, they share some similarities—making inferences, recognizing the author's purpose, recognize the author's tone, and drawing conclusion. Therefore, in this study, critical reading consists of four critical reading sub-skills: making inferences, recognizing the author's purpose, recognizing the author's tone, and drawing conclusion.

1) Making Inferences

According to Chomchuen (2014), making inferences is the skill to identify implied meanings based on what is actually said. The critical readers need to have general background knowledge and experience in order to think in depth.

2) Recognizing the author's purpose

According to Chalaysap (2012), the author's purpose is the reason that encourages an author to present a topic. The author's purpose can be clearly stated, or the readers may have to infer it. There are three purposes in writing: to inform, to entertain, and to persuade. Firstly, to inform means to present information about a subject. The author provides several facts to readers. Secondly, to entertain means to delight and amuse the readers. Thirdly, to persuade means to convince reading with several points of view of an author on a subject.

3) Recognizing the author's tone

According to Chalaysap (2012), recognizing the author's tone involves determining an author's feeling or attitudes toward his or her subjects.

4) Drawing conclusion

According to Jasim (2008), drawing conclusion is the critical reading skill which requires readers to make reasonable judgements by using the given information or facts. To draw an accurate conclusion, it depends upon the readers' ability to read critically.

Mind Mapping

There are various educators who provide the definition of mind mapping. Wycoff (1991) and Buzan and Buzan (1993) mention that mind mapping is a form of an outline with pictures and ideas which are radiated out from a central concept. Buzan (1995) also states that mind mapping is a diagram combining both scheme and writing. Moreover, Strangman, Hall, and Meyer (2003) mention that mind mapping is a graphical tool for creating, organizing, representing, and sharing the knowledge. They also add that mind mapping indicates and visualizes the interrelationships among concepts which enhance deeper understanding of contents. In addition, for Budd (2004) mind mapping is creating

an outline, and the main categories come from the center and minor ones are portrayed as branches. In conclusion, mind mapping is a graphical image outline that could provide readers better understanding about the ideas or information that creators want to convey. The major concepts are radiated from the central idea while the minors are illustrated as branches of bigger branches.

The procedures of mind mapping creation are described by Buzan and Buzan (2006) who are experts on mind mapping. They mention that creating mind mapping includes 10 steps. First, put a topic or an image in the center using at least three colors. Second, use symbols, images, codes, and dimensions all over mind mapping. Third, choose key words and print using lower or upper case letters. Fourth, put each word on its own line. Fifth, join the lines beginning from the middle. The center is thicker than the branches. Sixth, equalize the line length with the word or image. Seventh, use a variety of colors throughout the mind mapping. Eighth, develop personal style of mind mapping. Ninth, use emphasis and display appreciations in the mind mapping. Tenth, arrange the order with number, or outlines to organize the branches.

Sabbah (2015) suggests the procedures of using mind mapping in the classroom. First, the vocabulary is introduced; teachers can ask students read silently or raise some questions. Then, students are asked to skim the reading text for the topic and scan the passages for main ideas, supporting ideas, and samples. After that, students work in groups to create their mind mapping using paper and colored pens. Each group decide on mind mapping shape and organize ideas and sub-ideas in the right places. In the first lessons, the projector can be used to illustrate mind mapping created in the classroom. Then, students can work on their mind mapping on their computers. Finally, Students display their mind mapping in class. Additionally, many scholars suggest the processes of the implementation of mind mapping in the classroom, but they share a similarity that the teaching processes should be divided into three stages (Aljaser, 2017; Phongploenpis & Supangyut, 2018; Siriphanich & Laohawiriyanon, 2010; Wang, 2016). In the first stage, mind mapping is implemented to recall students' background knowledge about vocabulary in the reading and to motivate students. In the second stage, after

reading each section of a reading text, students are required to answer reading questions. In the third stage, mind mapping is created to show the relationship of each piece of information of a reading text in the post-reading stage. These three stages were employed as the framework of this study.

There are several advantages of using mind mapping. First, it helps memorizing information. This is because it is typically simpler to remember a diagram than a description (Buzan, 2018; Pressley, Van Etten, Yokoi, Freebem, & Van Meter, 1998). Second, it helps learning and organizing much information. Mind mapping is an ultimate tool which is the easiest way not only to put information into but also to take information out of the brain. Mind mapping is also an effective medium of note-taking that plans personal thoughts. (Buzan, 2005) Third, it helps promoting creative thinking and encouraging brainstorming. Due to its unconstrained and free-form structure, it means that the ideas and connections are limitless; therefore, it is not necessary to keep an ideal format or structure (Davies, 2011). According to Paykoç et al. (2004), mind mapping is also a good source for collaboration. Students have fun sharing or expressing their opinions. Lastly, mind mapping helps promoting enjoyment. With the use of pictures, colors, and videos, mind mapping engages students in class activity.

There are also some benefits of using mind mapping in reading. Paykoç et al. (2004) states that mind mapping can be employed in various ways and objectives in teaching and learning. Mind mapping can be employed to brainstorm ideas, take notes, outline, and analyze a passage. Kaufman (2021) also expresses that mind mapping is a useful technique to use while reading because mind mapping is in non-linear format. It helps viewing the whole note immediately and easily putting information in an appropriate branch or making connections between ideas.

Nowadays, traditional mind mapping has its downside. Myre (2021) states that creating mind mapping on paper consumes too much time and efforts. The size of the sheet is also limited. If mistakes occur during creating mind mapping, the creator cannot undo or easily make edits. Therefore, some scholars propose electronic mind mapping.

Electronic Mind Mapping

There are many proposed definitions of electronic mind mapping. Nong, Pham, and Tran (2009) define electronic mind mapping as a tool providing students to construct and conceptualize knowledge, brainstorm, and organize ideas, and solve problems. It is a tool that activates and stimulates students' collaboration and creativity. Al-Badwoi (2015) writes that electronic mind mapping is an extendable concept of mind mapping, and the process is done via the digital or electronic atmosphere of technology. Another definition of electronic mind mapping stated by Samonlux (2020) is an online software for constructing mind mappings and organizing information by connecting between the main topics and sub-topics. In sum, electronic mind mapping is an online tool that allows students to construct mind maps.

There are some advantages of using electronic mind mapping. First, electronic mind mapping design tools are always available. The user can use a smart phone supported with a small software to design the mind mapping. Second, it attracts students because nowadays it is trend to use technology such as smart phones and laptops. In addition, the design of electronic mind mapping in terms of quantity, quality, and memory capacity is better compared to the traditional mind mapping (Al-Badwoi, 2015).

There are dozens of electronic mind mapping applications and software being used nowadays. According to Pat-Research (2020) and Aston (2021), , the top mind mapping software which fits the working style, goals, and budget is as follows:

1) Coggle

Coggle is a collaborative tool that allows users to create mind mapping. There are several outstanding features including real-time collaboration, unlimited images upload, connectors and loops for process flows, and multiple starting points.

2) Ayoa

Ayoa is a mind mapping software that offers users can add interesting images and graphics to highlight important topics and branches on the mind mapping.

Users can access the following features: real-time collaboration, various preset styles and colors, images and files adding, and branch voting.

3) Freemind

Freemind is a free mind mapping software that allows users to flexibly organize concepts. This software also provides features including various icons and color formatting options.

4) Xmind

Xmind is a free mind mapping software that offers users to arrange complex information and deliver it in a form of online mind map. Its features consist of brainstorming, presentation mode, task management, useful templates, and brand-new clip art.

5) Edraw Mind Map

Edraw Mind Map is a software that any users can access via a website. Its outstanding features are as follows: smart drawing and mind mapping guide, automatic layout, many templates, various symbols, and importing and exporting capabilities.

6) Milanote

Milanote is an easy and free mind mapping software. It allows users to collaborate and brainstorm ideas in the group. It also offers users to combine text, images, and video. The team members can be invited to edit, comment, or view.

7) Miro

Miro is a mind mapping software which can be customized by users. It provides flexible and varied features including an infinite mind mapping canvas, digital workspaces, great library of templates, and practical set of widgets.

8) Mindomo.com

Mindomo.com is available in both free and paid version. Even though the free version limits the number of mind maps and sharing is also disabled, the software output looks terrific.

9) MindMeister

MindMeister is a web-browser software for creating mind mapping. The software offers users to brainstorm with unlimited numbers of users. The software also provides the feature of publishing mind mapping to other websites or blogs.

In summary, there is a lot of available electronic mind mapping software. The software shares some similar features including icons, symbols, colors, and templates. However, Coggle has one unique feature that allows students to collaborate in real-time. This is, it allows students work and learn together, and this can motivate students. Thus, Coggle was used in this study because this software is free and allows students and the teacher to brainstorm, collaborate, and create online mind mapping real time.

Research Studies

Scholars have conducted studies on using electronic mind mapping in various content areas. Zaytoon and Baker (2016) conducted research on using electronic mind mapping to improve the problem-solving skills in Physics. The participants were tenth grade Jordanian students. The experimental group was taught by electronic mind mapping whereas the control group by the conventional mind map. The results revealed that electronic mind mapping is more potential than the conventional mind mapping. Apart from Physics, Mahasneh (2017) investigated the potential of electronic mind mapping on academic performance and attitudes in a psychology class. The participants of this study were 65 students. Electronic mind mapping was employed in the experimental group whereas the control group received teaching in a regular classroom setting. The study revealed that students in the experimental group outperformed the control group. The experimental group students also had good attitudes toward learning through electronic mind mapping. Furthermore, in teaching Biology, Al-Omari and Al-Dhoon (2020) studied the effect of electronic mind mapping on tenth-grade students. Two groups of students were asked to use electronic mind mapping and conventional mind mapping. The analysis revealed that both methods were effective and improved students' achievement in Biology class.

In terms of teaching reading, many researchers have applied electronic mind mapping in classrooms. Sabbah (2015) studied the effects of electronic mind mapping (computerized mind maps) on students' reading comprehension and attitudes toward learning through electronic mind mapping. The participants were ESL students studying in the Community College of Qatar. The results of this study indicated that electronic mind mapping affected students' achievement in reading comprehension. Moreover, students had positive attitudes toward electronic mind mapping. Mohaidat (2018) also investigated the impact of electronic mind mapping on students reading comprehension. The participants of this study were students from two public schools in Irbid. They were divided into the experimental group and the control group. The experimental one studied the text by employing the electronic mind mapping technique (IMindMap), and the control one studied the same text by the traditional method. The results showed that using electronic mind mapping had medium effects on learning reading comprehension. There are several implementations of electronic mind mapping in language classroom, but the studies were conducted on reading comprehension. One research study on critical reading is found. Ellozy and Mostafa (2010) used electronic mind mapping to enhance critical reading skills. The participants of this study were of 70 first year Egyptian students. The students took part in the study, and data were gathered over the course of two semesters. The results showed that electronic mind mapping was a potentially powerful active learning tool which improved analytical reading skills. Electronic mind mapping also gave students the opportunity to express their ideas individually and in groups.

In Thailand, there are also studies about mind mapping. Most of them aimed to improve reading comprehension. Siriphanich and Laohawiriyanon (2010) investigated the effects of mind mapping on students' reading comprehension. The participants of this study were 35 first-year students in a university. The study employed one experimental group with the pretest-posttest design, an interview, and a questionnaire. The results of the study demonstrated that the students' reading comprehension greatly increased on the posttest, and the majority of students were satisfied their satisfaction with their improvement. Apart from using the conventional mind

mapping in teaching reading, Chaichompoo (2017) studied the effects of electronic mind mapping on reading comprehension and summary skills. The participants were 50 second-year English major students chosen by purposive sampling method. The results showed that students comprehended, analyzed, and summarized the reading texts better after learning through electronic mind mapping. Recently, Samonlux (2020) investigated the effects of electronic mind mapping on students' reading abilities. The participants of this study were 24 third-year students and 18 fourth-year students who majored in English at a Thai university. It was shown that electronic mind map benefited students in understanding the reading texts. Moreover, this technique also helped boost the students' reading abilities and motivation.

In Thailand, there are several researchers who applied mind mapping with high school students to develop students' reading comprehension. Laolapa and Bhiasiri (2012) conducted a study about using mind mapping to develop English reading comprehension activities. The participants were 30 eleventh-grade students at Koknangampittayasan School, Kornkaen, Thailand. The research instruments in this study were seven lesson plans, observation forms, and a reading comprehension achievement test. The results showed that the students had developed their reading comprehension. The students also had a very good level of satisfaction. The researchers stated that mind mapping helped students analyze the long and complex reading texts. It also helped students organize the ideas to summarize the main topics and the sub-topics. The researchers also reported that colors, pictures, and symbols helped students memorize and motivate in learning. Moreover, Kamchorn, Pansa, and Srakaew (2022) studied the effect of using mind mapping on English reading comprehension skills. The participants were 26 students studying in eighth grade and ninth grade at Watlinthong School, Angthong, Thailand. The results revealed the positive impacts on not only students' reading comprehension, but also students' motivation. From the results, the researchers suggested that the content used in the lesson should be familiar to students or help students understand the details from the reading text more easily. They also stated a problem in creating mind maps. That was, students might not understand the meanings

of the words. The teachers could first focus on teaching vocabulary to students. In addition, (Sommanut & Pianchana, 2022) studied the development of learning achievement in reading comprehension after using mind mapping. The participants in this study were 16 eighth-grade students selected via Cluster Random Sampling. The research instruments consisted of four lesson plans, a learning achievement test, and a questionnaire. The results showed that students achieved their reading comprehension. The results also showed that students had a high level of satisfaction with learning through mind mapping. In sum, all of the research studies showed positive results on using mind mapping. Mind mapping was an effective tool for teaching reading comprehension to Thai high school students and could motivate students to learn reading comprehension.

According to all of the studies related to electronic mind mapping, the results confirm the effectiveness of this tool. Although there are a number of studies about the use of electronic mind mapping, the studies about using electronic mind mapping on critical reading are limited, especially in Thailand. Therefore, this study proposed to explore the effects of electronic mind mapping on critical reading skills.

CHAPTER 3
RESEARCH METHODOLOGY

This chapter's primary purpose is to present methodology of this research project. Details include research design, participants of the study, research instruments, data collection, data analysis, and ethical considerations.

Research Design

This study employed a mixed-method procedure to examine the effects of electronic mind mapping on EFL high school students' critical reading skills. It combined both quantitative and qualitative approaches. The quantitative data were from the critical reading scores of a pretest and posttest and a questionnaire. The qualitative data were obtained from the open-ended part of the questionnaire, a semi-structured interview, and a video recording. The design of this study is illustrated as the following figure 1.

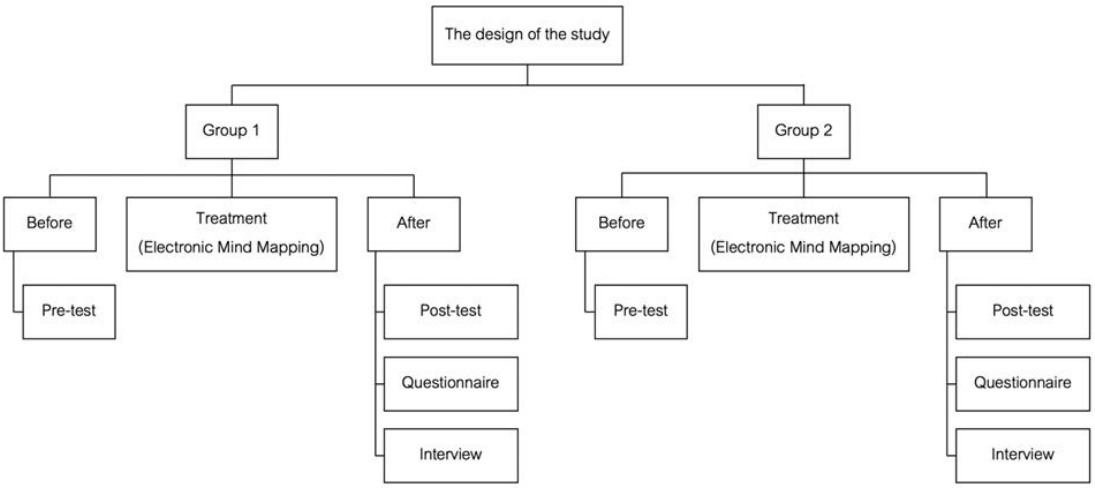

Figure 1 The Design of the Study

Participants of the Study

The population of this study was 477 eleventh-grade students in the 2021 academic year at a demonstration school, Bangkok, Thailand. The reason to choose this school was due to the school's vision and student identity. The vision of the school emphasizes students' English language proficiency and the importance of reading critically. Additionally, the school states that school students are expected to expertise in technology.

The participants were 83 eleventh-grade students studying in the second semester of the 2021 academic year at a demonstration school, in Bangkok, Thailand. They were selected by purposive sampling and divided into two groups: 44 students majoring in Japanese and 39 students majoring in Mathematics. That is, they had different background and interest to ensure the reliability and accuracy of the results. Both groups were taught using the electronic mind mapping, which is Coggle, the web-based mind mapping software. The participants had passed the English Reading I, an English course in the first semester of the 2021 academic year, and they enrolled in English Reading II course in the second semester. The main objective of this course is to develop students' critical reading skills. This study was beneficial to the students because the students were learners of English as a Foreign Language (EFL) and this study helped to prepare them to be critical readers. Therefore, they were qualified to be the participants in this study.

Research Instruments

The instruments included lesson plans, a critical reading test, a questionnaire, an interview, and video recording. The details of the research instruments are described as follows:

1) Lesson Plans

Four lesson plans were designed by the researcher. Each lesson plan was to develop one sub-skill of critical reading skills respectively. There were four lesson plans, namely "Making Inferences," "Recognizing the Author's Purpose," "Recognizing the Author's Tone," and "Drawing Conclusion." Electronic mind mapping was applied in each lesson plan. Each lesson plan was covered two periods, with 45 minutes in each period.

In designing the lesson plans, the teaching method was adapted from a framework of teaching reading based on Grabe and Stoller (2019) and teaching processes of electronic mind mapping of (Aljaser, 2017; Phongploenpis & Supangyut, 2018; Siriphanich & Laohawiriyanon, 2010; Wang, 2016). That is, the teaching process comprised three stages: pre-reading stage, while-reading stage, and post-reading stage, and electronic mind mapping was integrated into each stage. In pre-reading stage, electronic mind mapping was employed in order to activate the students' background knowledge and prepare students for reading texts as well as motivate students to read. In while-reading stage, the teacher introduced one critical reading skill to students. Students were asked to read the assigned text and practice the critical reading skills to check their understanding. Electronic mind mapping was employed in reading activities and exercises in order to help students organize the elements of reading and better understand the texts. In post-reading stage, electronic mind mapping was applied to review the information that students acquired from the text. In addition, students also extended their understanding by commenting and evaluating what they read. The contents and the reading passages were chosen based on the objectives of the course and the book assigned by school. The topics of each lesson plan are presented in the table 1.

Table 1 The Content of Lesson Plans

Week	Content	Duration
1	Making Inferences	90 minutes
2	Recognizing the Author's Purpose	90 minutes
3	Recognizing the Author's Tone	90 minutes
4	Drawing Conclusion	90 minutes

2) A Critical Reading Test

A critical reading test was created and used for pretest and posttest. The critical reading skills included making inferences, recognizing the author's purpose, recognizing the author's tone, and drawing conclusion. The test consisted of 20 items, with 4 multiple choice answers in each item. The tests were evaluated by three specialists in English language using the Item-Objective Congruence (IOC) index. To check the reliability, the test was tried out with students at the same level and did not participate in this project. The reliability of the reading test was 0.85 which is reliable. Therefore, the critical reading test was strong enough to evaluate use in this project.

3) A Questionnaire

The questionnaire was employed to study the students' opinions about learning critical reading through electronic mind mapping. There were 2 sections. The first one consisted of 10 five-point Likert scale items. The second part of the questionnaire was in the form of open-ended questions.

4) A Semi-structured Interview

A semi-structured interview was done to acquire more information apart from the questionnaire and to assure the accuracy of the questionnaire. To avoid a language barrier in communicating, the interview was conducted in the students' native language (Thai). In the last week of the study, the researcher asked five students from each class to be as volunteers for interviewing.

5) Video Recording

Each lesson, the researcher recorded the video during the teaching. The video provided the data about the participation of students. The data from the video were triangulated with the data from the open-ended part of the questionnaire and the interview.

Data Collection

This study lasted six weeks. In the first week, the participants completed the pretest. The implementation of electronic mind mapping was lasted four weeks. During the experiment, there was video recording. After that, students took the post-test in the last week in order to answer the three research questions.

For the fourth research question, the students responded a 5-point Likert scale questionnaire, and the volunteer students were also asked to be interviewed at the sixth week. The data collection plan schedule is illustrated in the Table 2.

Table 2 Timeline for the Data Collection Process

Time	Procedures	
Week 1	1. Pretest	The participants took the pretest and the researcher will obtain students' critical reading scores.
Week 2	2. Making Inferences	The participants were taught critical reading through electronic mind mapping.
Week 3	3. Recognizing the Author's Purpose	
Week 4	4. Recognizing the Author's Tone	
Week 5	5. Drawing Conclusion	
Week 6	6. Posttest	The participants took the posttest and the researcher will obtain students' critical reading scores.
	7. The Questionnaire	The participants completed the questionnaire to rate their opinions after learning for six weeks.
	8. The Interview	The volunteer students were interviewed.

Data Analysis

The Pretest and the Posttest

The scores from the pretest and the posttest were analyzed by using means, standard deviation, the t-test analysis, and the analysis of covariance. The dependent t-test analysis was applied to find out if there are any significantly differences in students' critical reading skills before and after the experiment whereas the analysis of covariance was applied to judge if there are any significantly differences in students' critical reading skills between two groups of students.

Students' Opinion Questionnaire

The data from the first part were analyzed by mean scores and standard deviations to find out students' opinions about studying critical reading through electronic mind mapping. The data from the questionnaire were scored as illustrated in Table 3.

Table 3 The Rates of the Students' Opinion Questionnaire

Positive Statements		Negative Statements	
Students' Opinion	Score	Students' Opinion	Score
Strongly Agree	5	Strongly Agree	1
Agree	4	Agree	2
Neutral	3	Neutral	3
Disagree	2	Disagree	4
Strongly Disagree	1	Strongly Disagree	5

The value of the students' opinions in learning critical reading through electronic mind mapping was interpreted by using the criteria in Table 4.

Table 4 The Value of Students' Opinions toward Electronic Mind Mapping

Value	Mean Scores
Very positive	4.00 – 4.99
Positive	3.00 – 3.99
Neutral	2.00 – 2.99
Negative	1.00 – 1.99
Very negative	0 – 0.99

The data from the second part, the open-ended questionnaire, were analyzed using content analysis.

A Semi-structured Interview

The interview data were analyzed using content analysis. The data were grouped into categories. Then, the data were analyzed to investigate students' opinions.

Video Recording

The data from the video recording were analyzed using content analysis and were triangulated with the data from the open-ended part of the questionnaire and the interview to investigate students' opinions.

Ethical Considerations

At the beginning of this study, all participants' consent forms were received. Participants were told of the nature and the purposes of this study. They were informed about the procedures of the study and realize that this study did not disadvantage them. They also gained the advantage from this study. They were also provided the assurance that they might withdraw at any time. Due to the secure storage of all data, anonymity and confidentiality were assured.

CHAPTER 4
FINDINGS

This chapter illustrates the findings of the study. The equipment employed to collect the data in the study consisted of the critical reading test, a questionnaire, an interview, and video recording.

This chapter are divided into two parts. The first part presents the results of the data analysis on EFL high school students' critical reading skills, whereas the second part presents students' opinions about using electronic mind mapping to enhance critical reading skills. The findings are presented based on the following research questions:

1. What are the effects of electronic mind mapping on the critical reading skills of students majoring in Japanese?

2. What are the effects of electronic mind mapping on the critical reading skills of students majoring in Mathematics?

3. Are there any differences in the effects of electronic mind mapping on the critical reading skills of students majoring in Japanese and those of students majoring in Mathematics?

4. What are the students' opinions about learning critical reading through electronic mind mapping?

4.1 Students' Critical Reading Skills

4.1.1 The Effects of Electronic Mind Mapping on Critical Reading Skills of Students Majoring in Japanese

Table 5 The Comparison of the Pretest Mean Score to Posttest Mean Score of the Students Majoring in Japanese

Time	*N*	*Mean*	*Max*	*Min*	*S.D.*	*t*-value	*Df*	*p*-value
Pretest	44	10.34	17	2	3.50	8.210	43	.000**
Posttest	44	13.09	18	2	3.38		43	

**$p<.05$

The *t*-test analysis reveals that there were statistically significant differences in the pretest and posttest mean scores of critical reading skills of students majoring in Japanese ($t(43) = 8.210$, $p<.05$). The mean score of the pretest was 10.34 (*S.D.* = 3.50) whereas the mean score of the posttest was 13.09 (*S.D.* = 3.38). The posttest score was significantly higher than the pretest score. Therefore, the result indicates that the students' critical reading skills increased.

Table 6 The Comparison of the Pretest Critical Reading Sub-Skills Mean Scores to the Posttest Critical Reading Sub-Skills Mean Scores of the Students Majoring in Japanese

Skills	Time	*N*	*Mean*	*Max*	*Min*	*S.D.*	*t*-value	*Df*	*p*-value
Making Inferences	Pretest	44	1.95	4	0	0.91	4.378	43	.000**
	Posttest	44	2.48	4	0	0.93		43	
Recognizing the Author's Purpose	Pretest	44	3.16	5	0	1.03	5.868	43	.000**
	Posttest	44	3.84	5	1	1.03		43	
Recognizing the Author's Tone	Pretest	44	2.43	5	1	1.07	7.993	43	.000**
	Posttest	44	3.45	5	1	1.17		43	
Drawing Conclusion	Pretest	44	2.80	4	1	0.93	4.743	43	.000**
	Posttest	44	3.32	4	0	0.96		43	

**$p<.05$

Table 6 points out that students majoring in Japanese significantly improved every sub-skill — making inferences (t (43) = 4.378, $p<.05$), recognizing the author's purpose (t (43) = 5.868, $p<.05$), recognizing the author's tone (t (43) = 7.993, $p<.05$), and drawing conclusion (t (43) = 4.743, $p<.05$) after using treatment. Particularly, the results also show that students majoring in Japanese got the highest gain in recognizing the author's tone sub-skill. In sum, the results indicate that teaching critical reading skills through electronic mind mapping potentially enhanced students' every sub-skill.

4.1.2 The Effects of Electronic Mind Mapping on Critical Reading Skills of Students Majoring in Mathematics

Table 7 The Comparison of the Pretest Mean Score to Posttest Mean Score of the Students Majoring in Mathematics

Time	*N*	*Mean*	*Max*	*Min*	*S.D.*	*t*-value	*Df*	*p*-value
Pretest	39	9.62	15	2	3.74	9.833	38	.000**
Posttest	39	13.79	18	5	3.27		38	

**$p<.05$

Table 7 shows that there were statistically significant differences in the pretest and posttest mean score of critical reading skills of students majoring in Mathematics ($t(38) = 9.833$, $p<.05$). The mean score of the pretest was 9.62 (*S.D.* = 3.74) whereas the mean score of the posttest was 13.79 (*S.D.* = 3.27). The posttest score was significantly higher than the pretest score. Therefore, the result indicates that their critical reading skills improved.

Table 8 The Comparison of the Pretest Critical Reading Sub-Skills Mean Scores to the Posttest Critical Reading Sub-Skills Mean Scores of the Students Majoring in Mathematics

Skills	Time	*N*	*Mean*	*Max*	*Min*	*S.D.*	*t*-value	*Df*	*p*-value
Making Inferences	Pretest	39	1.90	4	0	0.97	6.406	38	.000**
	Posttest	39	2.82	5	1	1.02		38	
Recognizing the Author's Purpose	Pretest	39	2.72	5	0	1.15	6.876	38	.000**
	Posttest	39	3.74	5	1	1.02		38	
Recognizing the Author's Tone	Pretest	39	2.38	5	0	1.35	7.172	38	.000**
	Posttest	39	3.77	5	1	1.13		38	
Drawing Conclusion	Pretest	39	2.59	4	0	1.16	5.900	38	.000**
	Posttest	39	3.46	5	1	0.99		38	

**$p<.05$

When scrutinizing into each sub-skill, Table 6 points out that students majoring in Mathematics significantly improved every sub-skills—making inferences (t (38) = 6.406, $p<.05$), recognizing the author's purpose (t (38) = 6.876, $p<.05$), recognizing the author's tone (t (38) = 7.172, $p<.05$), and drawing conclusion (t (38) = 5.900, $p<.05$) after employing treatment. Similar to the students majoring in Japanese, the results also show that students got the highest gain in recognizing the author's tone sub-skill. Therefore, the results indicate that teaching critical reading skills through electronic mind mapping potentially enhanced students' all sub-skills.

4.1.3 The Comparison of the Effects of Electronic Mind Mapping on Critical Reading Skills of Students Majoring in Japanese to Critical Reading Skills of Students Majoring in Mathematics

Table 9 Unadjusted and Covariance Adjusted Descriptive Statistic

Group	Before Treatment			After Treatment (Unadjusted)		After Treatment (Adjusted)	
	N	*Mean*	*S.D.*	*Mean*	*S.D.*	*Mean*	*S.E.*
Japanese Major Students	44	10.34	3.38	13.09	3.50	12.85	0.34
Mathematics Major Students	39	9.62	3.74	13.79	3.28	14.07	0.36

*Covariates appearing in the model are evaluated at the following values: Pre-test = 10.00

Table 10 The Analysis of Covariance of Japanese Major Students and Mathematics Major Students

Source of Variance	*SS*	*Df*	*MS*	*F*	*Sig*
Before Treatment	532.74	1	532.74	106.22	0.00**
Between Groups	30.85	1	30.85	6.15	0.02**
Error	401.25	80	5.02		

**p<.05

Table 10 shows that before treatment there were statistically differences in the mean scores of students majoring in Japanese and majoring in Mathematics ($F(1) = 106.22$, $p<.05$). To specify, the pretest mean score of students majoring in Japanese was higher than those of students majoring in Mathematics. After the treatment, the analysis reveals that there were statistically differences in the mean scores of students majoring in

Japanese and the mean score of student majoring in Mathematics ($F(1) = 6.15$, $p<0.05$). This means that electronic mind mapping had effects on both groups differently. The electronic mind mapping could better enhance critical reading skills of students majoring in Mathematics than students majoring in Japanese.

4.2 Students' Opinions about Learning Critical Reading Skills through Electronic Mind Mapping

This section was to answer to the fifth question of this research: What are EFL high school students' opinions about learning critical reading through electronic mind mapping. To investigate students' opinions about learning through electronic mind mapping, the data were gathered from the questionnaire, the semi-structured interview, and the video recordings. The results are as follows:

4.2.1 The Questionnaire

At the end of the course, every study was required to complete the questionnaire to study students' opinions about learning critical reading skills through electronic mind mapping. The questionnaire consisted of 10 items. After students completing the questionnaire, mean scores and standard deviations were applied to the data. The results can be seen in Table 11.

Table 11 Students' Opinions about Learning Critical Reading Skills through Electronic Mind Mapping

Questionnaire Item	*Mean*	*S.D.*	The Value of Students' Opinion
1. Activities in class allowed me to practice critical reading skills.	4.35	0.65	Very positive
2. Activities in class were not useful for improving my critical reading skills.*	3.39	1.22	Positive
3. I participated and engaged myself more in learning critical reading skills through electronic mind mapping.	4.13	0.76	Very positive
4. Activities in critical reading class were too difficult.*	3.40	0.97	Positive
5. Learning critical reading skills through electronic mind mapping wastes my time.*	3.71	1.07	Positive
6. Activities in critical reading class encouraged me to have more confidence in learning critically reading skills.	4.07	0.71	Very positive
7. I want to study English subject because I like activities in class.	4.14	0.91	Very positive
8. Activities in critical reading class were boring.*	3.52	0.92	Positive
9. I do not think electronic mind mapping is effective in learning critical reading skills.*	3.52	1.03	Positive
10. I could apply activities I learned in critical reading class to my daily life.	4.23	0.83	Very positive
Total	3.85	0.91	Positive

*Negative Statements

Table 11 reveals that the average mean score was 3.85 (*S.D.* = 0.91), which meant that students had positive opinions about learning critical reading skills through electronic mind mapping. The statement receiving the highest mean score was “Activities in class allowed me to practice critical reading skills” (4.35), followed by the statement “I could apply activities I learned in critical reading class to my daily life” (4.23). The next two following statements were “I want to study English subject because I like activities in class” (4.14) and, “I participated and engaged myself more in learning critical reading skills through Electronic Mind Mapping” (4.13). The statement receiving the lowest mean score was “Activities in critical reading class were too difficult” (3.40). In spite of gaining the lowest attention, the statement was in a positive level.

4.2.2 The Semi-structured Interview

In the last week of the study, five students from each group were volunteers for interviewing. To ensure the students' comprehension, the interview was conducted in Thai and then translated into English. The data were analyzed using content analysis. The results were as follows:

First of all, most of the students reported that electronic mind mapping promoted their enjoyment while learning. Students found that electronic mind mapping was new and interesting to them. One student said, “It was easier to look at the information in the mind map than read the text itself.” One student also expressed that using electronic mind mapping was similar to the game which can be joyfully played with the classmates. However, two students mentioned a few problems about using the electronic mind mapping software. In the first lesson, they commented that they were not familiar with the software tools, and it took more time to do mind mapping; however, when they were familiar with using tools in later classes, they enjoyed creating mind mapping.

Another response was in term of collaboration. All students reported that electronic mind mapping improved their critical reading skills due to the collaboration among their friends. Several students mentioned that during creating electronic mind mapping, they could see their friends’ viewpoints which made them more understand the reading texts and did not miss the important points and keywords. They could brainstorm

with their friends and had opportunities to read and add the branches to the mind map. One student expressed, “I loved the activities and the questions used in the lessons because they helped me improve my reading skills.”

All students agreed that electronic mind mapping was useful to them. Some students found that they could critically read the text faster. Organizing information from the text into the electronic mind mapping helped promote their thinking. They could understand texts easier when they looked at the keywords put in the mind map. They also improved reading skills. One student mentioned, “I could apply using electronic mind mapping to read the articles and various medium.” One student also added, “I could apply electronic mind mapping to my reading in daily life.”

To conclude from the interviews, students had positive opinions about learning critical reading skills through electronic mind mapping. In addition, all students agreed that electronic mind mapping promotes enjoyment and could enhance their critical reading skills.

4.2.3 The Video Recordings

Apart from the data from the questionnaire and the interview, the video recordings were recorded in each lesson to examine the participation of students. The details are presented as follows:

In terms of students’ interaction and behavior, students participated well in creating electronic mind mapping. Furthermore, to compare among two classes, students majoring in Mathematics were more actively participating in class than students majoring in Japanese. However, there were some problems in the classroom in the first few weeks about how to use the electronic mind mapping software. Most students have problems of using various tools, adding branches, and editing branches in the first lessons. Moreover, different electronic devices used in creating mind mapping also caused some problems. For example, the students using iPad and mobile phone found that it was more difficult to click the buttons and edit the mind map. When they found those problems during making a mind map, they both asked their classmates and the teacher for help. Later, it took them less time for to create a mind map. Furthermore, some students

incidentally moved or deleted branches of other friends. During the lessons, students majoring in Mathematics were enthusiastic and active to do the given task. They enjoyed sharing ideas with their group members to put information on Coggle. On the contrary, it found that one group of students majoring in Japanese frequently did not want to share some ideas with their group members. Therefore, the teacher had to spend time encouraging them to brainstorm and to express their opinions with their friends.

Triangulating the results from the questionnaire, the interview, and the video recording, students had positive opinions about learning critical reading skills through electronic mind mapping. Students agreed that using electronic mind mapping could help them enhance their critical reading skills and their understanding while reading texts. They also enjoyed activities while learning through electronic mind mapping.

CHAPTER 5
CONCLUSION AND DISCUSSION

This chapter illustrates a conclusion and discussion of the key findings. It also illustrates limitations of the study, followed by recommendations.

Conclusion

This study attempted to respond the following research questions:

1. What are the effects of electronic mind mapping on the critical reading skills of students majoring in Japanese?

2. What are the effects of electronic mind mapping on the critical reading skills of students majoring in Mathematics?

3. Are there any differences in the effects of electronic mind mapping on the critical reading skills of students majoring in Japanese and those of students majoring in Mathematics?

4. What are the students' opinions about learning critical reading through electronic mind mapping?

The participants involved in this project were 83 eleventh-grade students divided into 2 groups: students majoring in Japanese and students majoring in Mathematics, at a demonstration school, Thailand. They were chosen by purposive sampling. They were taught critical reading by using electronic mind mapping. The instruments included a critical reading test, lesson plans, a questionnaire, a semi-structure interview, and video recording.

The findings were as follows:

First, electronic mind mapping had positive effects on the critical reading skills of EFL students majoring in Japanese. The results revealed that students significantly developed critical reading skills.

Second, electronic mind mapping had positive effects on critical reading skills of EFL students majoring in Mathematics. The results revealed that electronic mind mapping significantly increased critical reading.

Third, there were statistically differences in the critical reading skills gain of these two groups of students. This means that electronic mind mapping had effects on both groups differently. The analysis revealed that students majoring in Mathematics outperformed students majoring in Japanese.

Lastly, students expressed positive opinions about learning critical reading skills through electronic mind mapping. The results of the questionnaire, the semi-structure interview, and the video recording showed that students had positive opinions about learning critical reading skills through electronic mind mapping. The electronic mind mapping promoted students' enjoyment and critical reading skills.

In conclusion, electronic mind mapping had positive effect on critical reading skills and opinions of EFL students.

Discussion

Based on the first and the second research questions, the analysis shows that EFL students enhanced their critical reading skills by learning through electronic mind mapping. In addition, students improved every critical reading sub-skill, namely making inferences, recognizing the author's purpose, recognizing the author's tone, and drawing conclusion. Electronic mind mapping was effective to teach critical reading skills for the several reasons. First of all, electronic mind mapping helped students organize information and ideas of the reading texts. For example, when the students studied the drawing conclusion sub-skill, the teacher asked students to read the passage about helping the blind see. In this activity, students had to take notes in the electronic mind mapping. In addition, they had to use their information written in the electronic mind map to support their conclusion. In this activity, the electronic mind mapping helped students organize the ideas and also remember the information from the reading text better. This discussion is similar to the studies of Chaichompoo (2017) and Mohaidat (2018) which discovered that electronic mind mapping had positive effects on students' understanding and analyzing the reading texts. The information and the ideas were better arranged and organized when students used electronic mind mapping.

Second, electronic mind mapping promotes collaboration among students. In class, electronic mind mapping allowed students to see the whole mind map of the class which students could read their friends' ideas which led them to better understand. In addition, students had opportunities to brainstorm ideas with their classmates. One example was the teaching of making inferences in which the teacher designed the task for students to brainstorm ideas in their groups. The teacher provided the information from the reading text. Then students working in group made inference from the information and wrote their inferences using electronic mind map by adding branches. Students had the opportunity to exchange and share the ideas with their members before completing the electronic mind map. This is in line with the study of Ellozy and Mostafa (2010) which revealed that electronic mind mapping promoted students to have more opportunity to express and exchange their ideas in groups. They learned from their members and increased their understanding.

Regarding the results of each sub-skill, electronic mind mapping potentially enhanced students' sub-skills. The results also show that students in both groups got the highest gain in recognizing the author's tone sub-skill. Recognizing the author's tone involves determining an author's feeling or attitudes toward his or her subjects. The reason to explain this result is that in class students had an opportunity to brainstorm and share idea about words expressing the tone. The electronic mind mapping visualized that information and help them better understand the meanings of the words. Moreover, they had an opportunity to read texts in various media they were interested and identify the author's tone from that media. This discussion is in line with Kamchorn et al. (2022) which reported that the teachers could first focus on teaching vocabulary to students because it helped students learn the meaning of those words before reading the given texts.

The findings also reveal that electronic mind mapping better enhanced critical reading skills of students majoring in Mathematics than those of students majoring in Japanese. This may suggest that electronic mind mapping enhances critical reading skills of lower-proficiency students more than higher-proficiency students. The

explanation is that electronic mind mapping helped low proficiency students see the relation of the passage and improved their critical reading skills. (Prichard, 2014) reported that the reading strategy is influential on learning reading of students. Better readers more often used reading strategies which meant lower-proficiency students require more reading strategies and techniques. In addition, Carrell, Devine, and Eskey (1993) stated that illustrations were particularly appropriate for students with minimal language skills. According to Holzman (2004), mind mapping is an effective tool for low achievers to raise their level of achievement. Hence, electronic mind mapping employed in this study had more benefits students majoring in Mathematics who had lower proficiency. These results confirm the study of Samonlux (2020) which revealed that electronic mind mapping better developed students' achievement. In addition, personality plays significant roles. Mathematics major students were more active than Japanese major students. As seen from the video recording, they were interested in group activities and assignments more than the other group. Moreover, the passages employed in this study were related to science topic which might motivate Mathematics students more than Japanese students. Like the ideas of Kamchorn et al. (2022), the reading content familiar to students could help students easily understand the reading texts.

Regarding the students' opinions about learning critical reading skills through electronic mind mapping, the students expressed positive opinions. This is because electronic mind mapping promoted students' enjoyment. To compare with the traditional mind mapping, electronic mind mapping is more attractive to students. Creating mind mapping on paper consume too much time and efforts. Moreover, the size of the sheets and the tools are limited. When learning through electronic mind mapping, students in this study had an opportunity to use various tools provided by the electronic mind mapping software in order to add branches in mind mapping real time. The statement from the questionnaire, "I want to study English subject because I like activities in class," showed that students enjoyed activities in class, which motivated them to study critical reading skills through electronic mind mapping. This discussion is in line with the study of Sabbah (2015) which investigated the effects of electronic mind mapping on

students' reading comprehension and the results showed that students had positive attitudes toward the electronic mind mapping. Changing colors and attaching pictures in the electronic mind map were also important features that promote students' enjoyment. In the lessons, students enjoyed attaching some pictures into the mind map which were related to the topic of the reading texts. They also liked to change colors of several branches. This discussion is in line with the study of Laolapa and Bhiasiri (2012) which studied about using mind mapping to develop English reading comprehension activities, and demonstrated that colors, pictures, and symbols in electronic mind mapping motivated students to learn their content.

Despite the electronic mind mapping had a positive effect on students' critical reading skills and opinions, the researcher found some challenges. In the first lesson, it took much more time for students to create mind mapping. Most students had problems of using various tools, adding branches, and editing branches in the first lesson and it took time for them to get familiar with Coggle. After the students were familiar with the software, it took them less time to create a mind map. Moreover, some students incidentally moved or deleted branches of other friends which made some students upset. Although there were some problems in class, the electronic mind mapping was effective in increasing EFL students' critical reading.

Limitations of the Study

This study has some limitations. Firstly, this study was limited to only high-school students. The findings may not represent students in other academic levels. Additionally, only four critical reading sub-skills were measured in this study which did not cover all sub-skills of critical reading. Therefore, the results might not be generalized to other critical reading sub-skills and the effect might be different.

Recommendations

The results of the study found that EFL high school students developed their critical reading skills after learning through electronic mind mapping. Therefore, it might

be useful for English teachers to consider electronic mind mapping as an alternative tool to design the activities in reading lessons.

Although the present study revealed the positive effects of electronic mind mapping on EFL high school students, further research can be conducted to strengthen the knowledge in the field. First, this study was only conducted on students in secondary school level. It would be more interesting to conduct research on students at different levels. Moreover, this study was limited to only four sub-skills of critical reading skills including making Inferences, recognizing the author's purpose, recognizing the author's tone, and drawing conclusion. Further research could employ electronic mind mapping to develop other critical reading sub-skills.

REFERENCES

Abdel halim, S. M. (2011). Improving EFL majors' critical reading skills and political awareness: A proposed translation program. *International Journal of Educational Research, 50*(5-6), 336-348.

Al-Badwoi, A. S. (2015). Using e-mind mapping in learning at IBRI College of applied sciences. *Global Journal of Computer Science and Technology, 4*(15), 46-52.

Al-Omari, A. A. H., & Al-Dhoon, B. A. (2020). The impact of e-mind mapping strategy and learning styles on the achievement of the tenth-grade students in biology. *Universal Journal of Educational Research, 8*(12), 6429-6438.

Aljaser, A. M. (2017). The effectiveness of electronic mind maps in developing academic achievement and the attitude towards learning english among primary school students. *International Education Studies, 10*(12), 80-95.

Alqatanani, A. (2017). Do multiple intelligences improve EFL students' critical reading skills? *Arab World English Journal (AWEJ) Volume, 8*(1), 309-321.

Aston, B. (2021). *Compare The 10 Best Mind Mapping Software of 2021*. Retrieved from https://thedigitalprojectmanager.com/mind-mapping-software/

Attaprechakul, D. (2013). Inference strategies to improve reading comprehension of challenging texts. *English Language Teaching, 6*(3), 82-91.

Budd, J. W. (2004). Mind maps as classroom exercises. *The journal of economic education, 35*(1), 35-46. doi:10.3200/jece.35.1.35-46

Buzan, T. (1995). *The mind map book* (2nd ed. ed.). London: BBC Books.

Buzan, T. (2004). *Mind maps for kids: Study skills*. London: Harper Thorsons.

Buzan, T. (2005). *Mind map: The ultimate thinking tool*. London: Thorsons.

Buzan, T. (2018). *Mind map mastery: The complete guide to learning and using the most powerful thinking tool in the universe*. London: Watkins Media Limited.

Buzan, T., & Buzan, B. (1993). *The mind map book: how to use radiant thinking to maximize your brain's untapped potential*. New York: Plume.

Buzan, T., & Buzan, B. (2006). *The mind map book*. Harlow: Pearson Education.

Carrell, P. L., Devine, J., & Eskey, D. E. (1993). *Interactive approaches to second language reading*: Cambridge : Cambridge University Press.

Chaichompoo, C. (2017). Using e-mapping to improve reading comprehension and summary skills of EFL students. *NIDA Journal of Language and Communication, 22*(30), 129-138.

Chalaysap, N. (2012). *Reading theories/models & strategies for EFL learners* (1st ed. ed.). Bangkok, Thailand: National Institute of Development Administration.

Chomchuen, F. (2014). *The effect of the instruction based on reader-response approach on Thai students' critical reading skills.* (Master's thesis). Srinakharinwirot University, Bangkok, Thailand.

Davies, M. (2011). Concept mapping, mind mapping and argument mapping: what are the differences and do they matter? *Higher education, 62*(3), 279-301.

Ellozy, A. R., & Mostafa, H. M. (2010). Making learning visible: Using e-maps to enhance critical reading skills. *MERLOT Journal of Online Learning and Teaching, 6*(3), 634-646.

Gottfried, J., & Shearer, E. (2016). *News Use Across Social Media Platforms*. Retrieved from https://www.pewresearch.org/journalism/2016/05/26/news-use-across-social-media-platforms-2016/

Grabe, W. (2009). 24 Teaching and Testing Reading. In *The handbook of language teaching* (pp. 441). New York: Wiley-Blackwell.

Grabe, W. P., & Stoller, F. L. (2019). *Teaching and researching: Reading* (3rd ed. ed.). New York: Routledge.

Holzman, S. (2004). *Thinking Maps: Strategy- Based Learning for English Language Learners and others.* Paper presented at the 13th Annual Administrator conference: closing the Achievement Gap for education Learner Student, Sonoma county office of Education, California Department of education, California, USA.

Hudson, T. (2008). Teaching second language reading. *ELT Journal, 63*(1), 89-91. doi:https://doi:10.1093/elt/ccn061

Huijie, L. (2010). Developing a hierarchical framework of critical reading proficiency. *Chinese Journal of Applied Linguistics (Foreign Language Teaching & Research Press), 33*(6).

Jasim, B. Y. (2008). The Impact of Instruction in Critical Reading Strategies on Advanced Iraqi EFL learners' comprehension. *College Of Basic Education Researches Journal, 7*(1), 320-363.

Kadir, A. N., Subki, R., Jamal, F., & Ismail, J. (2014). *The importance of teaching critical reading skills in a Malaysian reading classroom.* Paper presented at the International Academic Conference.

Kamchorn, N., Pansa, B., & Srakaew, P. N. (2022). Effectiveness of English reading development using Computer Assisted Instruction on COVID-19 prevention for grade 10 students of Ummaoprachasan school in Nakhon Phanom. *Journal of Management and Local Innovation, 4*(4), 107-119.

Kaufman, J. (2021). *Simple techniques to optimize your reading comprehension and retention. In The Personal MBA*. Retrieved from https://joshkaufman.net/3-simple-techniques-to-optimize-your-reading-comprehension-and-retention/

Kurland, D. J. (2000). Critical Reading vs Critical Thinking. Retrieved from http://www.criticalreading.com/critical_reading_thinking.htm

Laolapa, R., & Bhiasiri, S. (2012). The development of English reading comprehension activities using mind mapping of grade 11 students. *Journal of Education Khon Kaen University, 35*(4), 57-63.

Mahasneh, A. (2017). The effect of using electronic mind mapping on achievement and attitudes in an introduction to educational psychology course. *the new educational review, 47*(1), 295-304.

Mala, D. (2019). *Poor grades for Thai students in PISA tests*. Retrieved from https://www.bangkokpost.com/thailand/general/1808509/poor-grades-for-thai-students-in-pisa-tests

Malekzadeh, B., & Bayat, A. (2015). The effect of mind mapping strategy on comprehending implicit information in EFL reading texts. *International Journal of Educational Investigations, 2*(3), 81-90.

Manarin, K., Carey, M., Rathburn, M., & Ryland, G. (2015). *Critical reading in higher education: Academic goals and social engagement*. Bloomington: Indiana University Press.

Ministry_of_Education. (2008). *Basic education core curriculum since B.E. 2551 (A.D. 2008)*. Bangkok: Kurusapa Ladprao Publishing.

Mohaidat, M. M. T. (2018). The impact of electronic mind maps on students' reading comprehension. *English Language Teaching, 11*(4), 32-42.

Murray, D. W., & Rabiner, D. L. (2014). Teacher use of computer-assisted instruction for young inattentive students: implications for implementation and teacher preparation. *Journal of Education and Training Studies, 2*(2), 58-66.

Myre, M. (2021). The best mind mapping software in 2021. Retrieved from https://zapier.com/blog/best-mind-mapping-software/

Nong, B. K., Pham, T., & Tran, T. (2009). *Integrate the digital mindmapping into teaching and learning psychology.* Paper presented at the Proc., 13th UNESCO-APEID Int. Conf. on Education and World Bank—KERIS High Level Seminar on ICT in Education, Vietnam.

Pat-Research. (2020). *29 free & top mind mapping software*. Retrieved from https://www.predictiveanalyticstoday.com/top-free-premium-mind-mapping-software/

Paykoç, F., Mengi, B., Kamay, P. O., Önkol, P., Özgür, B., Pilli, O., & Yıldırım, H. (2004). *What are the major curriculum issues? The use of mindmapping as a brainstorming exercise.* Paper presented at the The First International Conference on Concept Mapping, Pamplona, Spain.

Phongploenpis, S., & Supangyut, M. (2018). The effect of mind map technique on students' reading comprehension. *International Journal of Management and Applied Science, 4*(12), 49-53.

Pinter, A. (2017). *Teaching young language learners*. Oxford: Oxford University Press.

Pressley, M., Van Etten, S., Yokoi, L., Freebem, G., & Van Meter, P. (1998). *The metacognition of college studentship: A grounded theory approach*. London: Routledge.

Prichard, C. (2014). Reading strategy use of low-and high-proficiency learners and the effect of reading instruction. ***大学教育研究紀要***, *10*, 115-122.

Razaghi, S. J. R., Amoopour, M., Shakibaei, Z., Gilaninia, S., & Javad, S. M. (2011). Critical reading. *Journal of Basic and Applied Scientific Research, 1*(9), 1173-1176. Retrieved from https://www.textroad.com/pdf/JBASR/J.%20Basic.%20Appl.%20Sci.%20Res.,%201(9)1173-1176,%202011.pdf

Richards, J. C., & Renandya, W. A. (2011). *Methodology in language teaching: An anthology of current practice*: Cambridge university press.

Rintaningrum, R. (2019). Explaining the important contribution of reading literacy to the country's generations: Indonesian's perspectives. *Journal of Turkish Science Education, 11*(1), 3-23.

Sabbah, S. (2015). The effect of college students' self-generated computerized mind mapping on their reading achievement. *International Journal of Education and Development using ICT, 11*(3), 4-36.

Samonlux, P. (2020). *The effects of electronic mind mapping on students' reading abilities.* Srinakharinwirot University, Bangkok, Thailand.

Saori, S. (2020). The use of mind mapping to teach reading comprehension. *Journal of Languages and Language Teaching, 8*(2), 162-169.

Sawangsamutchai, Y., & Rattanavich, S. (2016). A comparison of seventh grade Thai students' reading comprehension and motivation to read english through applied instruction based on the genre-based approach and the teacher's manual. *English Language Teaching, 9*(4), 54-63.

Sheeba, S. (2018). Teaching reading: Goals and techniques. *Emerging Trends in Education*, 1-12. Retrieved from

https://www.researchgate.net/publication/328449849_Teaching_Reading_Goals_and_Techniques

Siriphanich, P., & Laohawiriyanon, C. (2010). Using mind mapping technique to improve reading comprehension ability of Thai EFL university students. *The 2nd International Conference on Humanities and Social Sciences*, 1-13. Retrieved from http://fs.libarts.psu.ac.th/research/conference/proceedings-2/4pdf/001.pdf

Sommanut, K., & Pianchana, T. (2022). The development of learning achievement in reading comprehension of grade eight students using concept mapping. *Journal of Educational Review Faculty of Education in MCU, 9*(1), 220-230.

Srisirasasipon, R. (2014). *The effects of a research-based learning approach integrated with self-monitoring to enhance critical reading skills of the upper secondary school students*. doi:DOI: 10.14456/rjas.2016.5

Strangman, N., Hall, T., & Meyer, A. (2003). Graphic organizers and implications for universal design for learning: Curriculum enhancement report. *National Center on Accessing the General Curriculum*, 1-32. Retrieved from http://aem.cast.org/about/publications/2003/ncac-graphic-organizers-udl.html

Tasnimi, M. (2017). Critical reading; An introduction. *Humanizing Lanugage Teaching Magazine, 19*(6), 1-6. Retrieved from https://www.researchgate.net/publication/351428432_Critical_reading_An_introduction

Tucker, J. M., Armstrong, G. R., & Massad, V. J. (2010). Profiling a mind map user: A descriptive appraisal. *Journal of Instructional Pedagogies, 2*(11), 1-13.

Ueai-Chimplee, A. (2007). *Effects of English reading instruction based on the reader response approach on critical reading ability and critical thinking ability of upper secondary school students*. (Master's thesis). Retrieved from https://portal.edu.chula.ac.th/pub/tefl/images/phocadownload/thesis/2007/arnuphab_ue_2007.pdf

Varaporn, S., & Sitthitikul, P. (2019). Effects of multimodal tasks on students' critical reading ability and perceptions. *Reading in a Foreign Language, 13*(1), 81-108.

Wang, Y. (2016). *Application on Mind Map in College English Reading Teaching.* Paper presented at the 2nd International Conference on Economics, Social Sciences, Arts, Education and Manage Engineering, Jinzhou, China.

Wycoff, J. (1991). *Mindmapping: Your personal guide to exploring creativity and problem-solving*. New York: Berkley.

Zaytoon, A. y., & Baker, H. (2016). The effect of using computerized mind maps strategy on solving physics problems of the Tenth basic grade female students in the light of their learning styles. *Dirasat Journal for Educational Sciences, 43*(3), 1841-1859.

Zhang, D., & Koda, K. (2012). Contribution of morphological awareness and lexical inferencing ability to L2 vocabulary knowledge and reading comprehension among advanced EFL learners: Testing direct and indirect effects. *Reading and Writing, 25*(5), 1195-1216.

APPENDICES

Appendix A
Lesson Plans

Appendix A

Lesson Plan 1

Course: EN32204 English Reading 2

Class: Grade 11

Time: 90 minutes

Learning Objectives: Students are able to make inferences from the given reading text.

Content Outline:

Reading Skill: Making Inferences

Vocabulary:

- global warming (n.)	a gradual increase in world temperature caused by gases such as carbon dioxide that are collecting in the air around the earth and stopping heat escaping into space
- greenhouse gas (n.)	a gas which causes the greenhouse effect, especially carbon dioxide
- consecutive (adj.)	following one after the other in regular order
- alarming (adj.)	causing worry or fear
- consecutive (adj.)	following one after the other in regular order
- ice cap (n.)	a thick layer of ice that permanently covers an area of land
- abandon (v.)	to leave a place
- subcontinent (n.)	a large area of land that is part of a continent, often referring to South Asia: the Indian subcontinent

- delta (n.) an area of low, flat land, sometimes shaped like a triangle, where a river divides into several smaller rivers before flowing into the sea
- submerge (v.) to go or put beneath the surface of water
- retreat (v.) to move away from something

Teaching aids/materials: a video, mind mapping software Coggle, PowerPoint presentation, a reading passage, exercises, a textbook (Moving Up Critical Reading 2)

Teaching Procedures & Learning Activities

Objectives	Timing	Teaching Procedures/Activities	Material
- To warm up the students, activate students background knowledge, and introduce the topic of the reading passage.	15 mins	**Pre-reading** 1. Ask students to participate in Picture Reveal Game and let students guess what this picture is. In this game, students will take turns to reveal each square that is covered the hidden picture. Students can guess one answer after reveal each square. (The picture is about Global Warming.) 2. After revealing the whole picture to students, asks students a question "What are causes of global warming?" Then, let students brainstorm in class and put the answer in Coggle. 3. Ask students to guess what that they are going to read. The teacher will write down their answers on the screen.	- PowerPoint Presentation - Electronic mind mapping

Objectives	Timing	Teaching Procedures/Activities	Material
- To make students learn the concept of making inferences and be able to make inferences from the given passage.	60 mins	**While-reading** 4. Let students read the passage and check whether their guess is correct. 5. Tell the correct answer that the passage is about “How Global Warming Changes Our World”. 6. Tell students that it is important for readers to make inferences when the author does not clearly state information in the reading text. 7. Explain the definition of an inference and how to make inferences by learning through examples. 8. Ask students to read the passage again and make the inference from the given information from the reading text. Then students write their answers on Coggle. 9. Let students discuss their answers within class. Then give and explain the correct inferences of the reading passage. 10. Show the students short paragraphs. Then let students work in groups 7 – 11 and make the inferences from the given choices in each paragraph. The students write the answers in Coggle.	- Electronic mind mapping - PowerPoint Presentation - The reading passage about How Global Warming Changes Our World”. - Short paragraphs

Objectives	Timing	Teaching Procedures/Activities	Material
		11. Give the correct answers of each paragraph and explain the paragraph by using PowerPoint presentation.	
- To extend students' understanding about the reading passage.	15 mins	**Post-reading** 12. Ask students to work in groups of 7 – 11 and let students brainstorm to make predictions about the Effects of Global Warming in the next 50 years. Then, let students write the answer on Coggle. 13. Ask students to present their answer from Coggle to the whole class.	- Electronic mind mapping - PowerPoint Presentation

Lesson Plan 2

Course: EN32204 English Reading 2

Class: Grade 11

Time: 90 minutes

Learning Objectives: Students are able to recognize the correct author's purpose from the given reading passage.

Content Outline:

Reading Skill: Recognizing the author's purpose

Vocabulary:

- magnet (n.)	an object that is able both to attract iron and steel objects and also push them away
- explicitly (adv.)	(explained) in an extremely clear way, so that you cannot doubt what is meant
- intent (n.)	purpose
- swarm with (phrv.)	to be crowded
- trendy (adj.)	fashionable
- skyrocket (v.)	to go up high and quickly
- magnetic field (n.)	an area that the power of a magnet affects
- attract (v.)	to make something move toward another thing
- repel (v.)	to make something go away
- practical (adj.)	realistic
- compass (n.)	a device to determine direction (north, south, east, west, etc.)
- critical (adj.)	important

Teaching aids/materials: a video, mind mapping software Coggle, PowerPoint presentation, a reading passage, a textbook (Moving Up Critical Reading 2)

Teaching Procedures & Learning Activities

Objectives	Timing	Teaching Procedures/Activities	Material
- To warm up the students, activate students background knowledge, and introduce the topic of the reading passage	15 mins	**Pre-reading** 1. Ask students to participate in Picture Reveal Game and let students guess what this picture is. In this game, students will take turns to reveal each square that is covered the hidden picture. Students can guess one answer after reveal each square. 2. After revealing the whole picture to students, asks students a question "What word comes up in their mind when they think about magnets?" Then, let students brainstorm in groups of 4 or 5 and put the answer in Coggle. 3. Ask students to guess what that they are going to read. The teacher will write down their answers on the screen.	- PowerPoint Presentation - Electronic mind mapping
- To make students learn the concept of recognizing the	60 mins	**While-reading** 4. Let students read the passage and check whether their guess is correct.	- Electronic mind mapping - PowerPoint Presentation

Objectives	Timing	Teaching Procedures/Activities	Material
author's purpose and be able to recognize the author's purposes from the given reading passage.		5. Tell the correct answer that the passage is about "Magnets: Their Uses and How They Work". 6. Tell students that it is important for readers to identify the author's purpose when they read the text. 7. Ask students to brainstorm in groups and what the author's purposes can be and write them in Coggle. 8. Let's students watch the video. The students will find out that there are three author's purposes including to inform, to entertain, and to persuade. 9. Ask students to read the passage again and identify what the purpose of passage. Students also need to provide the reason or give some sentences or words that indicate the author's purpose. 10. Give the correct author's purposes of the passage. 11. Show the students various types of reading texts such as recipe book, picture book, newspaper article etc. Then let students work in groups 4 – 5 and write the answers in Coggle what the author's purpose of each text is.	- The reading passage - The video about the author's purposes

Objectives	Timing	Teaching Procedures/Activities	Material
		12. Give the correct author's purposes of each text and explain the passage by using PowerPoint presentation.	
- To extend students' understanding about the reading passage.	15 mins	**Post-reading** 13. Ask students to work in groups of 4 – 5 and let students brainstorm to answer the question "If you could add one more ability to magnets, what would it be? Why? Then, let students write the answer in groups on Coggle. 14. Ask students to present their answer from Coggle to the whole class. 15. Ask students to do exercise about the author's purpose	- Electronic mind mapping - PowerPoint Presentation

Lesson Plan 3

Course: EN32204 English Reading 2

Class: Grade 11

Time: 90 minutes

Learning Objectives: Students are able to recognize the author's tone from the given reading texts.

Content Outline:

Critical Reading Skill: Recognizing the author's tone

Vocabulary:

- bitter (adj.)	expressing a lot of hate and anger
- critical (adj.)	extremely serious or dangerous
- humorous (adj.)	funny, or making you laugh
- nostalgic (adj.)	feeling slightly sad when you think about things that happened in the past
- optimistic (adj.)	hoping or believing that good things will happen in the future
- pessimistic (adj.)	thinking that bad things are more likely to happen or emphasizing the bad part of a situation
- enthusiastic (adj.)	showing enthusiasm
- cheerful (adj.)	happy and positive
- uncertain (adj.)	not knowing what to do or believe, or not able to decide about something
- angry (adj.)	having a strong feeling against someone who has behaved badly, making you want to shout at them or hurt them

- depressing (adj.)	making you feel unhappy and without hope for the future
- lighthearted (adj.)	amusing and not serious
- happy (adj.)	feeling, showing, or causing pleasure or satisfaction
- confused (adj.)	unable to think clearly or to understand something
- plain (adj.)	not decorated in any way; with nothing added
- sarcastic (adj.)	using remarks that clearly mean the opposite of what you say, in order to hurt someone's feelings or to humorously criticize something
- admiring (adj.)	showing admiration
- respectful (adj.)	showing admiration for someone or something
- concerned (adj.)	worried
- anxious (adj.)	worried and nervous
- surprised (adj.)	feeling or showing surprise because something has happened that you did not expect
- encouraging (adj.)	making you feel more confidence or hope
- serious (adj.)	not joking or intended to be funny
- neutral (adj.)	deliberately not expressing any strong feeling

Teaching aids/materials: a video, electronic mind mapping software (Coggle), PowerPoint presentation, reading texts

Teaching Procedures & Learning Activities

Objectives	Timing	Teaching Procedures/Activities	Material
- To warm up the students, activate students background knowledge, and introduce the topic of the reading passage.	15 mins	**Pre-reading** 1. Let students look at the painting Guernica. 2. After looking at the painting, ask students to think about what you can see and how you feel while looking at the painting Guernica. 3. Let students answers on Coggle and then discuss those answers in class. 3. Show students the video about the explanation of the painting Guernica. 4. Discuss in class about the shades of colors in the painting can express the feelings about the subject. Then, the teacher links this idea to the reading. 5. Explain students that authors used word to express the feelings in writing which are called tones. Tell the students that they will recognize the author's tone.	- PowerPoint Presentation - Electronic mind mapping - The video about the explanation of the painting Guernica
- To make students learn the concept of	50 mins	**While-reading** 4. Explain students the definition of tone.	- Electronic mind mapping

Objectives	Timing	Teaching Procedures/Activities	Material
recognizing the author's tone and be able to recognize the author's tone from the given texts.		5. Ask students to brainstorm in groups and answers what words can the author's express the tone. The students write those answers on coggles. 6. Discuss and let students share the definitions of words written on Coggle. 7. Let students learn how to determine the tone of a piece of reading text. 8. Ask students to work in groups of 7 – 11 and give each groups the same short reading texts. 9. Let each group read the texts and recognize the author's tone. Students write their answers on Coggle. Students also need to provide the reason or give some sentences or words that indicate the author's tone. 10. Let the whole class read answers of other groups where they are similar or different to their own answer. If they were different, the teacher can let students discuss and share ideas in class. 11. Give the correct author's tone of each reading texts.	- PowerPoint Presentation - The reading texts

Objectives	Timing	Teaching Procedures/Activities	Material
		12. Show the whole class two more texts and ask students to answer the author's tone of the reading texts together. 13. Give the correct author's tone of each text and explain the texts by using PowerPoint presentation.	
- To extend students' understanding about the reading passage.	25 mins	**Post-reading** 14. Ask students to work in groups of 7 – 11 and let students find any media such as a poster, a short reading text, a song lyric. Students attach the picture of that media on Coggle and also provide the author's tone. 15. Ask students to present their answer from Coggle to the whole class.	- Electronic mind mapping

Lesson Plan 4

Course: EN32204 English Reading 2

Class: Grade 11

Time: 90 minutes

Learning Objectives: Students are able to draw the conclusions from the given reading passage and can provide the evidence to support the conclusions.

Content Outline:

Critical Reading Skill: Drawing conclusions

Vocabulary:

- retina (n.)	the area at the back of the eye that receive light and send pictures of what the eye sees to the brain
- cutting-edge (adj.)	very modern and with all the newest features
- implant (v.)	to put an organ, group of cells, or device into the body in a medical operation
- electrode (n.)	the point at which an electric current enters or leaves something, for example, a battery
- restore (v.)	to bring back into use
- devastating (adj.)	causing a lot of damage or destruction
- radiate (v.)	to produce heat and/or light
- receptor (n.)	a nerve ending that reacts to a change, such as heat or cold, in the body by sending a message to the central nervous system
- transmit (v.)	to pass something from one place to another
- awkward (adj.)	difficult to use, do, or deal with

- clunky (adj.) heavy and solid in an ugly way
- coordinate (v.) to make various different things work effectively as a whole
- crude (adj.) simple and not skillfully done or made

Teaching aids/materials: a video, electronic mind mapping software (Coggle), PowerPoint presentation, a reading passage, exercises, a textbook (Moving Up Critical Reading 2)

Teaching Procedures & Learning Activities

Objectives	Timing	Teaching Procedures/Activities	Material
- To warm up the students, activate students background knowledge, and introduce the topic of the reading passage.	15 mins	**Pre-reading** 1. Ask students to close their eyes for about 30 seconds and then ask if you could not see anything, what your life would be. Let students brainstorm in class and put the answer in Coggle. 2. Discuss and share ideas among class about those answers in Coggle. 3. Let's students watch the video about the technology, artificial retina, which is used to assist blind people. After watching the video, ask students to guess what that they are going to read. The teacher will write down their answers on the screen.	- PowerPoint Presentation - Electronic mind mapping
- To make students learn	50 mins	**While-reading** 4. Let students skim the passage and check whether their guess is correct.	- Electronic mind mapping

Objectives	Timing	Teaching Procedures/Activities	Material
the concept of drawing conclusions and be able to draw the conclusion from the given reading passage.		5. Tell the correct answer that the passage is about “Helping the Blind See”. 6. Let students look at the given information in Coggle and tell students that the branches of the mind map are not complete. The main task of the lesson is to fill the evidence and the conclusion which are related to the given information. 7.Tell students that it is important for readers to draw the conclusion when they read the text. 8. Explain students what a conclusion is and how to draw a conclusion. 9. Ask students to work in groups of 7 – 11 and read the passage again. Let students draw a conclusion from what they have read and put the conclusion on the missing branch in Coggle. Students also need to provide the evidence or words that indicate the conclusion. 10. Give the correct conclusions of the reading passage. 11. Show the students various short paragraphs. Then let students work in groups 7 - 11 and write the answers in	- PowerPoint Presentation - The reading passage about “Helping the Blind See” - The video about the technology (artificial retina)

Objectives	Timing	Teaching Procedures/Activities	Material
		Coggle what the conclusion of each text is. 12. Give the correct conclusion of each paragraph and explain by using PowerPoint presentation.	
- To extend students' understanding about the reading passage.	25 mins	**Post-reading** 13. Ask students to work in groups of 7 – 11 and let students brainstorm to answer the question "How could you improve the design or the property of this artificial retina?" Then, let students write the answer in groups on Coggle. 14. Ask students to present their answer from Coggle to the whole class. 15. Ask students to do exercises about drawing conclusion.	- Electronic mind mapping - PowerPoint Presentation

Appendix B

A Critical Reading Test

A Critical Reading Test

Directions: Read the passages and choose the best alternative for each question.

Passage 1 (Item 1 – 3)

The Thompsons were returning home from the holiday trip at Kakslauttanen Arctic Resort. A large number of people gathered there when they got home. They saw the windows of the house were all broken. Part of the roof was blackened and there were several unevenly chopped holes in it. Wet furniture sat on the lawn. An unusable car was in the garage. The whole house was reduced to ashes. There was a great loss of property, but thank God, there was no loss of life.

1. According to the passage, what happened?

    1. Their children had a party in the house one night.

    2. There had been a blizzard during the time when they were not at home.

    3. There had been a house fire last night.

    4. The Thompsons' neighbors gathered in celebration of their children's birthday.

2. Why did furniture sat on the lawn became wet?

    1. The blizzard, combined with the heavy rain, caused furniture to be wet.

    2. The home's plumbing system was broken due to age.

    3. The sudden flood occurred last night.

    4. Firefighters extinguished the fire and protected victims' property.

3. In last the sentence, what is the author's tone?

    1. hilarious
    2. hopeful
    3. frustrated
    4. powerful

Passage 2 (Items 4 – 7)

Cover your mouth when you sneeze! That's what most children are taught. In fact, most people try to hold back the rush of air when they sneeze. It's the polite thing to do, but it's not the safe thing to do. Sneezing is your body's way of clearing foreign matters. Sneezing also transmits infectious diseases like measles, influenza, and COVID-19. If you have a cold, your body is trying to force germs out through the nose. In a sneeze, air leaves the nose with great speed and force. That's why it's dangerous to hold a sneeze in. The air will be forced out into the sinuses and ears. The germs can infect the eardrums. It's true that sneezing can spread germs to other people. But even covering your nose with a handkerchief can't stop that. Germs are so tiny that they go through the clothes. People have to be aware of holding sneeze as it will affect their body in an unpleasant way.

4. The writer says, "Cover your mouse when you sneeze!" The tone of this sentence is _____.

1. lighthearted
2. respectful
3. nostalgic
4. concerned

5. Why does covering your nose with a handkerchief still lead to spreading germs?

1. Germs are powerful.
2. Germs are very small.
3. The air leaves rapidly.
4. The clothe is very small.

6. What is the author's purpose of the passage?

1. To discuss why the reader should try to hold in a sneeze.
2. To confirm that kids are often taught to hold in a sneeze.
3. To warn the reader of the dangers of holding in a sneeze.
4. To persuade parents to teach their kids to avoid sneezing.

7. From the passage, it can be concluded that _____.

1. people will gradually have difficulties in breathing.

2. it will affect the body in an unpleasant way.

3. nosebleeds occur more frequently.

4. people will be more allergic to various kinds of food.

Passage 3 (Items 8 – 11)

The bright red color of Christmas Island red crabs is well-known throughout Australia and the world, as is their spectacular annual migration to the sea. Every year the roads through Christmas Islands become a "living red carpet" as millions of red crabs emerge from the forest and make their way to the ocean to breed. Residents on the island, 1,500 kilometers off the Western Australian coast, look forward to the yearly spectacle and many take to the streets to protect the crabs from danger. One business owner has designed “crab sweepers” car attachments to allow his staff to drive during the migration period. It helps clearing the crabs out of the way. National parks also close a lot of roads for a couple of mouths. The event has become a tourist attraction, with tour companies offering trips to showcase the biological phenomenon. Along with red crab traffic, visitors must be aware of several other crabby neighbors. The residents on the island usually tell the tourists that they will wake up and speak to themselves like, “Where are my shoes gone?” Sometimes the tourists find them, sometimes they don’t.

8. Where would this passage be likely to appear?

1. An encyclopedia
2. A textbook
3. A magazine
4. A school journal

9. If the residents on the island didn't invent crab sweepers, what would red crabs living on Christmas Island be?

1. Red crabs would become endangered animals in a couple of months.
2. Red crabs would be probably killed by various cars used by the locals.
3. Red crabs would be safe while crossing the roads.
4. Red crabs would take more time to migrate to the ocean.

10. What is the writer's tone of the passage?

1. optimistic
2. plain
3. admiring
4. sarcastic

11. In the last two sentences what does the writer want to convey?

1. To persuade the visitors to bring a sandal while traveling to the island.
2. To warn the visitors to be aware of their stuff.
3. To inform the visitors about the street robbery.
4. To entertain readers with various jokes telling by locals.

Passage 4 (Items 12 – 15)

Singing is fun for everyone. However, someone has said that you are a monotone to that you sing off-key. Now you think that you cannot sing. Do not you believe it. A monotone is a singer who sings everything on one note. If you're a monotone, you have trouble telling the differences between high and low pitches. It does not mean that you cannot sing different pitches. It only means that you have to learn to do it. Try talking for five minutes without letting your voice go up or down. It will naturally try to vary the pitch. If you put your hand on your neck, you can feel your neck muscles work when you talk. You can control the pitch. Your voice can do the same thing when you sing.

12. What is the purpose of the writer?

1. To warn the monotone singer that he can't change it.

2. To report scientific knowledge about singing.

3. To convince monotone singers that they can solve this problem.

4. To identify singer's problems.

13. What should a monotone do first in order to sing well?

1. Try talking in a monotone 2. Avoid singing when he talks

3. Putting his hands on his neck 4. Telling how his neck muscles work

14. What can be concluded from this passage?

1. A large number of singers begin as monotones.

2. To sing well, you must learn to listening to a monotone.

3. You voice is used differently when talking and singing.

4. Most people can learn to control pitch when they sing.

15. What is the writer's tone of the passage?

1. Anxious 2. Surprised

3. Pessimistic 4. Encouraging

Passage 5 (Items 15 – 20)

The Galapagos Islands in the Pacific Ocean are not only a rocky, lonely spot, but they are also one of the most unusual places in the world. The reason is that they are the home of some of the last giant tortoises left on earth.

Weighing hundreds of pounds, these tortoises wander slowly around the rocks and sand of the islands. Each of these islands has its own particular kinds of a tortoise. There are seven different kinds of tortoises on these islands.

Hundreds of years ago, thousands of tortoises wandered around these islands. All that changed when people started landing there. When people first arrived, their ships had no refrigerators. It means that fresh food was always a problem for the sailors on board. The giant tortoises provided a solution to this problem.

Ships would anchor off the islands, and crew would seize as many tortoises as they could. Once the animals were aboard the ship, the crew would roll the tortoises onto their backs and use them for soups and stews.

16. What is the author's purpose of this passage?

1. To inform readers about giant tortoises in the Galapagos Islands.

2. To persuade readers to make a trip to the Galapagos Islands.

3. To illustrate readers about what people do in the Galapagos Islands.

4. To entertain readers with an exciting story about sailors.

17. Which question could best help someone figure out the author's purpose of this passage?

1. Did the writer ask me to tell a story to others?
2. Did this passage make me feel relaxed and calm?
3. Did the writer give me information?
4. Did the writer want me to travel to the Galapagos Islands?

18. From the passage, it can be inferred that _____.

1. there are a wide variety of tropical plants
2. sailors settled down and lived on these islands
3. there are many kinds of animals on these islands
4. the problem for sailors is there is no refrigerator

19. What is the writer's tone of the passage?

1. humorous
2. respectful
3. serious
4. neutral

20. What happened to the Giant Tortoises once they were aboard the ship?

1. They were released back into the ocean.
2. They were used for cooking.
3. This won't happen because the sailors avoid catching these tortoises.
4. They were immediately sold to people on the islands.

Appendix C
A Questionnaire

A Questionnaire

Students' opinions about using Electronic Mind Mapping
to enhance critical reading skills.

Part 1: Please rate how strongly you agree or disagree with each of the following statements by placing a check mark (✓) in the appropriate box.

Items / Statements	Rating Scales				
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. Activities in class allowed me to practice critical reading skills.					
2. Activities in class were not useful for improving my critical reading skills.					
3. I participated and engaged myself more in learning critical reading skills through electronic mind mapping.					
4. Activities in critical reading class were too difficult.					
5. Learning critical reading skills through electronic mind mapping wastes my time.					
6. Activities in critical reading class encouraged me to have more confidence in learning critically reading skills.					
7. I want to study English subject because I like activities in class.					

Items / Statements	Rating Scales				
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
8. Activities in critical reading class were boring.					
9. I do not think electronic mind mapping is effective in learning critical reading skills.					
10. I could apply activities I learned in critical reading class to my daily life.					

Part 2: Please write your response.

Are there any comments or ideas about this class that you would like to say? (It can be in Thai.)

_____

_____

_____

_____

Appendix D
Interview Questions

Interview Questions

Directions: Ask five volunteers from each group about learning critical reading skills through electronic mind mapping.

1. How do you feel about learning critical reading through Electronic Mind Mapping?

_____

_____

_____

2. Does electronic mind mapping help you improve critical reading skills? Why or why not?

_____

_____

_____

3. What are the benefits you gain from learning critical reading through Electronic Mind Mapping?

_____

_____

_____

VITA