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Application of the 3-Step Mind Map Approach in Senior High School English Reading Teaching*

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***Abstract*—In an effort to enhance students' English reading ability and thinking quality, this study proposes a 3-Step Mind Map Approach based on information structure and image schema. A comparative experiment was conducted in a senior high school setting with 78 students to evaluate the effectiveness of this approach. The experimental class, taught through the 3-Step Mind Map Approach, outperformed the control class, instructed with traditional methods, in both reading ability and thinking quality. This study highlights the potential of using mind maps as a useful tool in English reading teaching and promoting students' thinking quality.**

***Index Terms*—mind map, English reading ability, thinking quality, information structure, image schema**

I. Introduction

In the last two decades, English teaching and reform in China have undergone rapid development. With recent progress in the field of English teaching, there is now a greater emphasis on improving students' reading ability and thinking quality. This has renewed interest in developing students' core competencies, including language ability, thinking capacity, learning ability and cultural awareness in English teaching.

However, despite these developments, many English teachers still focus on teaching vocabulary and grammar to help students achieve high reading scores. This strategy ultimately fails to improve students' reading ability and thinking quality. Instead, it adds to their burdens. To address these issues, there is an urgent need to find a better approach that can promote students' reading ability and thinking quality. Extensive research has already shown that using mind maps can enhance memory and productivity. As a result, some researchers have started exploring the applications of mind maps in English teaching, but most of these studies focused on junior high school English teaching. This leaves a gap in the research on how mind maps can be used in senior high school. The present study aims to explore a new approach that applies mind maps to English reading teaching to improve students' reading ability and thinking quality with the guidance of information structure (IS) and image schema, which is of great significance to English teaching nowadays.

II. Literature Review

A. Mind Map

A mind map is a powerful tool for organizing information visually, which was first proposed by Tony Buzan in the 1960s. He defines mind map as an intricate diagram that mimics the structure of a brain cell, branching out from its center and evolving through patterns of association (Buzan, 2018).

Buzan (2018) claims that using graphics could maximize brainpower. With the help of a mind map, information can be transformed and replaced by diagrams. Swamy and Kulkarni (2006) suggest that a mind map reflects all kinds of things, time and reactions in the brain, and Meier (2007) believes that it is a powerful instrument for enhancing memory and productivity.

Mind maps could take various forms, but all mind maps share a common organizational structure that shows associations. Mind mapping has advantages over conventional note-taking (Buzan, 2018). For example, it is multi-faced, corlourful, multidimensional, imaginative and analytical (Table 1).

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TABLE 1
DIFFERENCES BETWEEN CONVENTIONAL NOTE-TAKING AND MIND MAPPING

Conventional Note-taking	Mind Mapping
Linear	Multi-faceted
Monochrome	Colourful
Word-based	Words combined with pictures
Listed logic	Associated logic
Sequential	Multidimensional
Restrictive	Imaginative
Disorganized	Analytical

Mind maps are characterized of three components: a central image that captures the main subject, thick branches radiating out from the central image, and a single key image or word placed on each branch (Buzan, 2018). To apply mind mapping more specifically, Hyerle (2004) has designed eight kinds of thinking maps that include circle map, bubble map, double bubble map, tree map, brace map, flow map, multi-flow map and mountain map, which can facilitate thinking skills.

Each type of mind maps has different characteristics, which can be applied to various reading texts. For example, tree maps are most suitable for classification. Circle map could visually demonstrate the definition of an item. The choice of mind map used for a particular text is dependent on the type of information being presented. For instance, a narrative text can be better constructed using a mountain map to depict the plot than a bubble map, whereas a bubble map would be more advantageous than a flow map for gathering the fundamental elements of the narrative.

B. Previous Studies on Mind Map

An abundance of studies have shown the advantages of mind maps in information processing and knowledge organization. Eppler (2006) found the advantages of mind maps after exploring mapping techniques and three other visualization formats, namely mind map, conceptual diagram, and visual metaphor. Stokhof et al. (2020) demonstrated that using a shared mind map helps students learn and refine their knowledge structures, which can make students question effectively. Ma and Yu (2008) analyzed the advantages of mind maps in grasping the theme of long or difficult English texts. Yan (2016) holds that mind mapping cultivating students' thinking ability and improves teaching efficiency. Sun (2018) further proposed using mind maps to help students describe and analyze text so as to cultivate senior middle-school students' thinking quality in English reading.

Based on the theoretical studies on mind maps, researchers have explored various ways to apply mind maps in teaching. For example, Faramarzi (2017) evaluated the effectiveness of mind maps on the reading performance of male dyslexic students in primary school. Wang (2019) found that mind maps promote students' English learning interest and the efficiency of English grammar teaching. Wang (2019) also suggested that teachers can use mind map to prepare lesson plans. In addition, Li (2021) investigated the use of mind maps in English writing teaching and found that the application of mind maps enhances students' writing ability.

Those studies have provided a wealth of experience regarding the implementation of mind maps in English teaching. However, most of these studies have mainly examined the effect of mind maps on students' English reading ability and make little attempt to evaluate the effect of mind maps on students' thinking quality, which is now considered as a key element in students' core competencies in English learning. Besides, although extensive studies have been carried out on the effect of mind maps in English teaching, little attention has been paid to teaching students how to use mind maps in English learning, which might have hindered the learning outcome. In addition, many of these studies have examined the application of mind maps in English writing teaching, but there remains a paucity of the study on the application of mind map to English teaching reading in senior high school. Given the increasing expectations of students' reading ability and thinking abilities, it is necessary to fully harness the benefits of mind maps and innovate English reading teaching in senior high school.

III. THE 3-STEP MIND MAP APPROACH IN ENGLISH READING TEACHING

In the light of the theoretical foundations of IS and image schema theory, we propose the 3-Step Mind Map Approach to enhance English reading teaching. By constructing the connection between the background knowledge and new information, we can have a better understanding with the help of IS. Image schema is an abstract pattern or mental structure that arises from a person's interaction with the world. By utilizing these concepts, the 3-Step Mind Map Approach aims to help students create and complete the image schema for a text, integrating new information into existing knowledge structures.

The 3-Step Mind Map Approach we proposed involves three steps. In the first step, students need to determine the main subject of the text and draw a central image representing it. Then, they need to draw branches and sub-branches radiating from the central image, using different colors and marks to highlight the key points and details as well as the relationship between different nodes. Finally, they need to review and make corrections if necessary. We assume that the 3-Step Mind Map Approach could help students better understand the text, retain important information, and improve their reading comprehension.

While there have been many previous studies on the application of mind map in teaching, most of them have focused on junior high school English teaching. The present study, which incorporates IS and image schema theory in senior high school English teaching, may provide new insight into the application of mind maps and could benefit students of all levels.

A. Theoretical Basis

The study of information structure originated from the Prague School before World War II and was later disseminated in Europe through the work of Halliday (1994). According to Chafe (1976), information structure refers to the way in which speakers organize information in their utterances to convey their intended meaning. IS pertains to the packaging of information in response to the communicative needs of interlocutors. In practice, IS refers to the integration of new information into pre-existing information in terms of the meaning of a sentence. By analyzing IS, one can gain insight into how information is packaged and the status of information in discourse. Components of IS include given information, new information, focus, topic and comment, and cohesion and coherence (Yuan, 2019).

Image schema was originally proposed by German philosopher and psychologist Kant (1929), who defined it as the generic and abstract knowledge a person has acquired in the course of numerous individual experiences with objects, people, situation, and events. Lakoff (1987) refers to it as a relatively simple structure that recurs in everyday bodily experiences. These abstract patterns or mental structures originate from our interactions and observations of the world around us.

The process of creating a mind map involves constructing and completing an image schema in the mind by integrating new information with pre-existing knowledge. According to image schema theory, reading comprehension involves the interaction between the reader's knowledge structure system and the information provided by the text (Yuan, 2019). Technically, integrating mind maps with English reading teaching should benefit students' reading ability and thinking quality in that it facilitates students' analysis of the information structure of a text by visualizing an image schema.

B. Analysis of Information Structure in Reading Texts With Mind Maps

To illustrate how mind map can be used in English reading teaching, two examples are given below. The two examples represent the two most common text types in English reading: narrative and argumentative texts. The following material (Figure 1) comes from Book 1 of English Textbook by Foreign Language Teaching and Research Press (FLTRP). The text in this unit is a story about the Brownlee brothers.

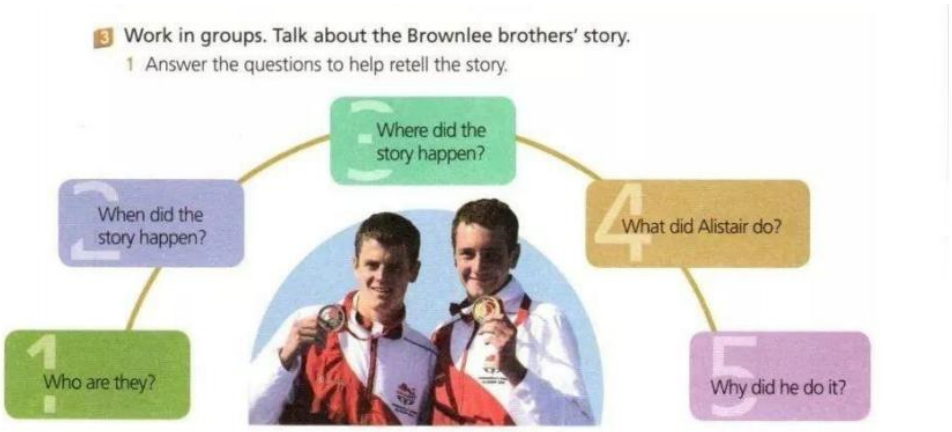

Figure 1. Exercise in Unit 3, Book 1, FLTRP

In the exercise which is based on the reading text, there are five questions to guide students to organize the key information to retell the passage (Figure 1). The six basic elements in a narrative are included in the mind map: what, when, who, where, why and how. In this case, a bubble map could be adopted to arrange these elements. We assume this mind map facilitates students' analysis of the story's information structure, which could enhance students' reading comprehension and could improves students' thinking quality in the long run.

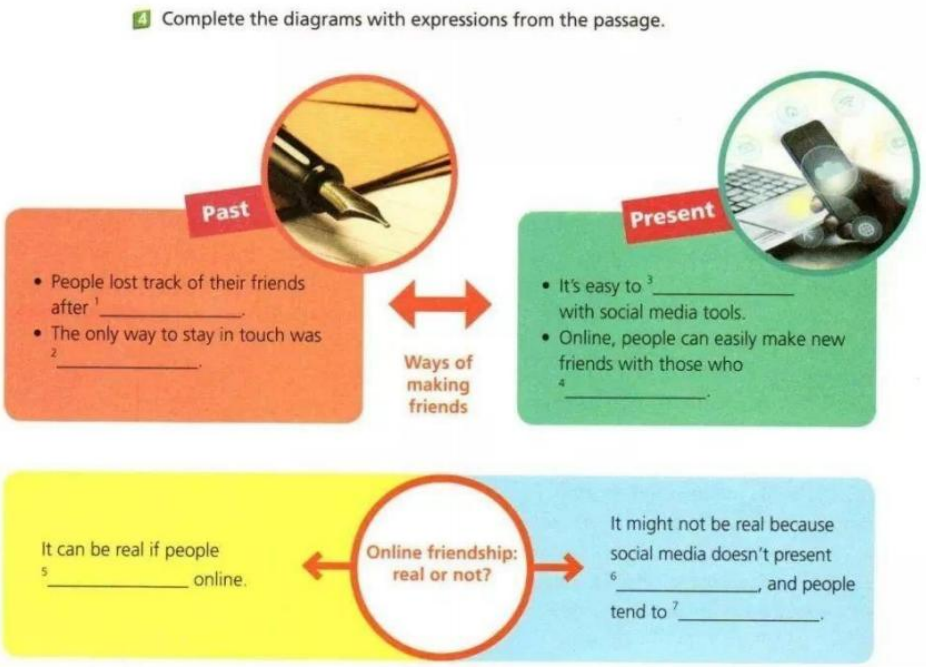

Figure 2 Exercise in Unit 4, Book 1, FLTRP

The second material is an argumentative passage which comes from the exercise in Unit 4 "Friends Forever" (FLTRP). The reading passage is about the changes in making friends in the past and at present. The mind map above (Figure 2) compares and lists different ways of making friends. In addition, a question is also asked in the mind map: is online friendship real or not. This mind map could serve as a guide to help students fully understand the passage and the logical relationship between different ideas in the passage. When students complete the mind map after reading the text, the image schema on this argumentative could also be completed. The information structure could be analyzed and the image schema could be constructed and completed with the help of the mind map.

C. Design of the 3-Step Mind Map Approach

As noted previously, many studies on mind map application fail to provide guidance on teaching students how to create mind maps. This can leave students at a loss when their teachers request them to draw mind maps.

The current study employs the 3-Step Mind Map Approach in English reading instruction which is illustrated in Figure 3. The central image is the most crucial element of a mind map, serving as the foundation for subsequent ideas. Students are instructed to create the central image first and then engage in radiant thinking to analyze the information. During this process, the image schema in the mind is activated, and the IS is illustrated using sub-branches, marks, and colors. The final step involves making any necessary revisions. The 3-Step Mind Map Approach provides students with clear guidance on how to decode information and visualize its structure.

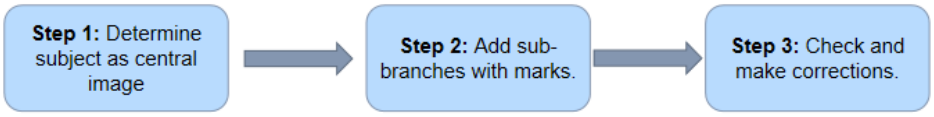

Figure 3. A Flow Chart of the 3-Step Mind Map Approach

Figure 1 demonstrates that using a bubble map is an effective method to gather the fundamental components of a narrative. This is how the 3-Step Mind Map Approach works: to begin, Step 1 highlights the Brownlee brothers as the subject, with their photo as the central image; in Step 2, sub-branches of details are added, that is, who, when, where, what and why. The mind map in Figure 1 features engaging colors and visual elements. Finally, students should complete the mind map and make corrections if necessary.

IV. Research Design

A. Research Questions

As students' core competencies, English reading ability and thinking quality are increasingly recognized as essential components. While researcher have undertaken considerable studies on how to improve students' English reading, few of them attach importance to how to enhance students' thinking quality at the same time. This study aims to develop an effective approach to enhance both English reading ability and thinking quality in students. We propose the 3-Step Mind Map Approach and seek to evaluate its effectiveness in addressing two key questions:

(1) What is the effect of the 3-Step Mind Map Approach on students' English reading ability?

(2) What is the effect of the 3-Step Mind Map Approach on students' thinking quality?

B. Method

In order to evaluate the effect of the 3-Step Mind Map approach on students' English reading ability and thinking quality, the current study adopts a comparative experimental study approach.

A total of 78 students from a senior high school participated in the experiment. They are from two parallel classes: Class 1, Grade 2 and Class 2, Grade 2. Class 1 is the experimental class (EC) which is taught with the 3-Step Mind Map Approach. Class 2 is the control class (CC) with traditional teaching method.

At the start of the study, a pre-test is undertaken to ensure that the students in EC and CC are homogeneous before the experiment in terms of English level and English reading ability. During the process, the two classes are taught with the same English reading content. After the teaching experiment, a post-test is undertaken to evaluate the effect of the 3-Step Mind Map approach on students' reading ability and thinking quality.

C. Materials

(a). Questionnaire on Students' Background Knowledge to Mind Maps

The questionnaire is designed to investigate students' attitude and background knowledge to mind maps. It includes two parts. The first part is the basic explanation of the survey purpose, requirements and introduction to mind maps. The second part is the survey questions, which include the frequency of using mind maps, attitude toward using mind maps, and barriers of English reading.

(b). Reading Ability Pre-Test Paper and Reading Ability Post-Test Paper

Reading ability pre-test is designed to test students' reading ability before the experiment. The post-test is designed to testify whether students' reading ability in EC is significantly better than the CC. Both the reading ability pre-test and the reading ability post-test consist of 4 reading passages and 20 multiple choice questions. The full mark of each test is 100 and each question accounts for 5 points. Students are required to finish each test in 40 minutes. The pre-test paper and the post-test have the same structure and difficulty level.

Benjamin Bloom and his collaborators published a framework for categorizing educational goals: Taxonomy of Educational Objectives (Bloom et al., 1956), familiarly known as Bloom's Taxonomy (Figure 4). The framework consists of six major categories: Knowledge, Comprehension, Application, Analysis, and Evaluation. The categories after Knowledge are presented as "skills and abilities", and each category contains subcategories, all lying along a continuum from simple to complex and concrete to abstract.

The reading ability tests are designed based on Bloom's Taxonomy (Bloom et al., 1956). The framework elaborated by Bloom and his collaborators consisted of six major categories: knowledge, comprehension, application, analysis, synthesis, and evaluation. Questions in the pre-test paper and post-test paper can be divided into 4 types (Figure 4). Questions that require understanding specific information fall under the understanding level of the Bloom's Taxonomy. Questions that involve guessing word meanings and inferring/judging information fall under the applying level, and questions that require analyzing the theme fall under the analyzing level.

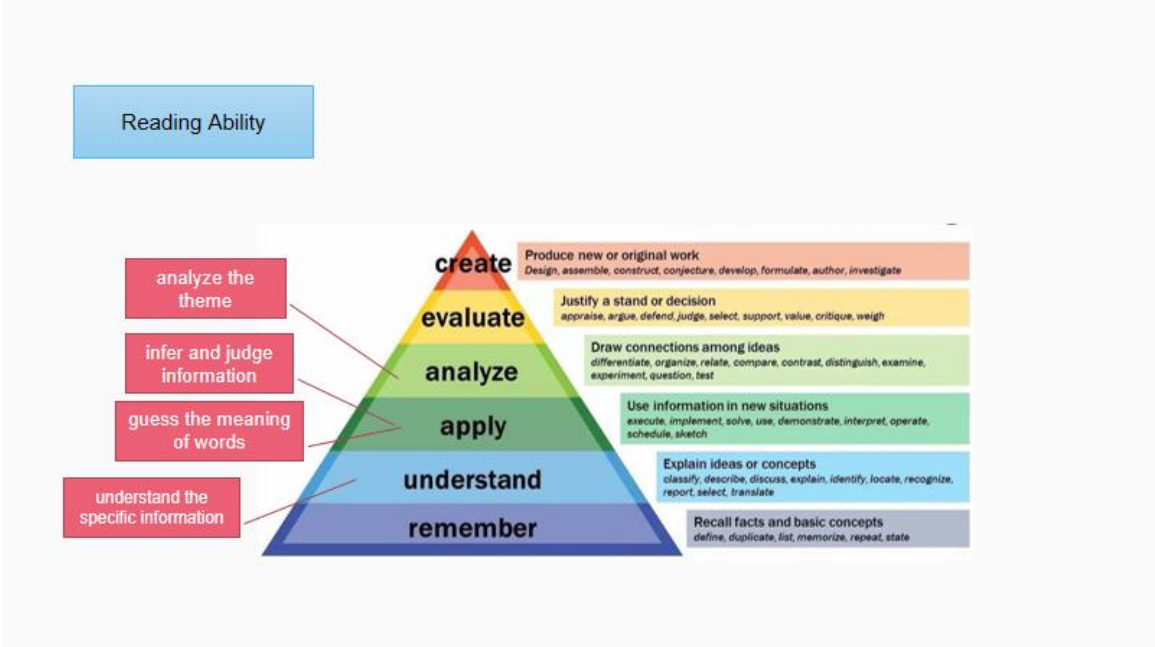

Figure 4. Analysis of Reading Ability in Reading Comprehension

Table 2 provides an example of the reading ability categorization in the reading ability pre-test. As Table 2 shows, testing items concerning information inference and judgment account for 40% of the test, and the difficulty index of this category is two stars. Examples of this question type include questions 3, 4, 7, 10, 12, 17, 18 and 19.

TABLE 2
CATEGORIZATION OF READING ABILITY IN THE PRE-TEST

Question type	Example	Bloom's Taxonomy	Percentage	Difficulty
understand and get the specific information	questions 1, 2, 5, 11, 14, 16	understanding level	30%	*
infer and judge the information	question 3, 4, 7, 10, 12, 17, 18, 19	applying level	40%	**
guess the meaning of words and phrases	question 15	applying level	5%	***
analyze the theme	question 6, 8, 9, 13, 20	analyzing level	25%	****

(c). Thinking Quality Pre-Test Paper and Thinking Quality Post-Test Paper

The ability to think critically, logically, and creatively is an essential component of English language competence, as outlined in the English curriculum standards (Ministry of Education, 2017, p. 5). Improving students' thinking quality can enhance their problem-solving skills in both academic and daily life contexts.

To assess the homogeneity of students' thinking quality, a pre-test is administered to both CC and EC. The post-test then determines if students in the EC demonstrate a significant improvement in their thinking quality compared to the CC. Both tests include a blank-filling task where students must choose the correct sentences from a given set to complete a passage. This task requires students to analyze the logical relations between the sentences and use key elements of information structure, such as topic sentences and cohesion words. Each test is worth a total of 50 points, with each question accounting for 10 points, and students are given 10 minutes to complete the task.

TABLE 3
LEVELS OF THINKING QUALITY IN ENGLISH READING

Thinking quality level	Requirements	Bloom's Taxonomy
Level 1	observe the cultural phenomenon; compare the similarity and difference of various information; infer the simple logical relations; judge the truthiness of the information	understanding and applying level
Level 2	compare the inherent logical relations; explain the reasons of the difference; construct the new concept; express readers' own opinions	analyzing and evaluating level
Level 3	analyze and solve the problem in practice; express the proper query; make the value judgment; create new ideas	evaluating and creating level

We adopt the blank-filling task in the thinking quality tests because it is a good way to evaluate students' thinking quality. A whole passage is a unit with different logical relations. If some sentences are missing, the logical relations are concealed. If students are to choose the correct sentences, they need to analyze and construct the logical relations of the whole passage. During the process, some key elements of IS are used such as theme, cohesion words and so on. By selecting the appropriate sentences, students demonstrate their understanding of the passage's cohesive structure and the use of key information elements.

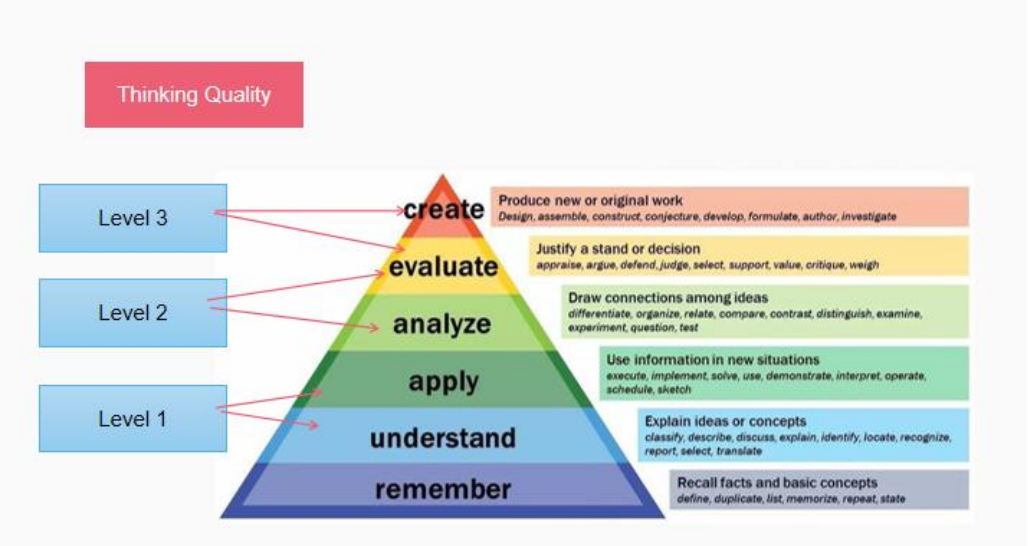

Figure 5. Analysis of Thinking Quality in English Reading

We divide thinking quality into three levels (Table 3) and relate the three levels to Bloom's Taxonomy (Bloom et al., 1956), which reflect different requirements of students' thinking quality development (Ministry of Education, 2017). As presented in Figure 5, in English reading, Level 1 involves understanding and applying abilities; Level 2 involves analyzing and evaluating abilities; Level 3 involves evaluating and creating abilities. For example, when taking the pre-test, which has an argumentative with a whole-part structure, students need to infer the logical relations between paragraphs. This requires the analyzing ability and logical thinking. Meanwhile, students need to compare the choices and choose the most appropriate one for each blank, which belongs to the Level 3 thinking quality.

C. Procedure

Prior to the start of the experiment, a questionnaire survey was administered to assess the students' attitudes towards the use of mind maps in English reading. The invigilator, who is the English teacher of the two classes, comes to the classroom and hands out the questionnaire to each student. Students were requested to complete the questionnaire within 40 minutes. Additionally, pre-tests were conducted to evaluate the students' reading abilities and thinking quality in both the Experimental Group (EC) and Control Group (CC). Students are required to complete each pre-test within 40 minutes.

After the questionnaire and pre-tests, a three-month experiment was then conducted, with the EC utilizing the 3-Step Mind Map approach in English instruction, while the CC employed the traditional bottom-up approach. The lesson plan was designed by the researcher using the 3-Step Mind Map approach.

Following the experiment, post-tests were conducted in both the EC and CC to assess the students' reading abilities and thinking quality. Similarly, students are required to complete each post-test within 40 minutes.

V. Results and Discussion

A. Results of the Questionnaire

Prior to the experiment, a questionnaire was administered to examine the status quo of students' English reading and their attitudes towards mind maps. As Figure 6 and Figure 7 indicate, more than half of the students have a strong interest in mind map and English reading, indicating a favorable environment for the implementation of mind maps in reading instruction.

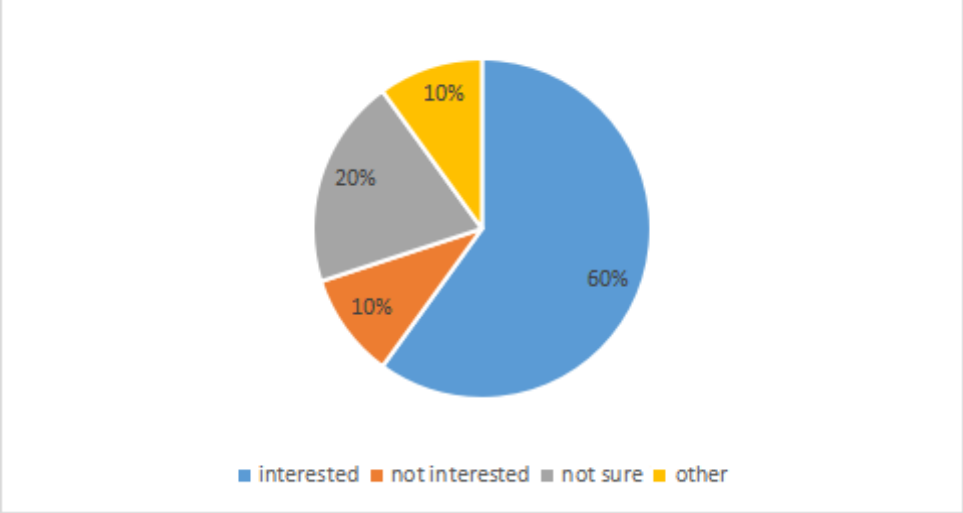

Figure 6. Students' Interest in Mind Map

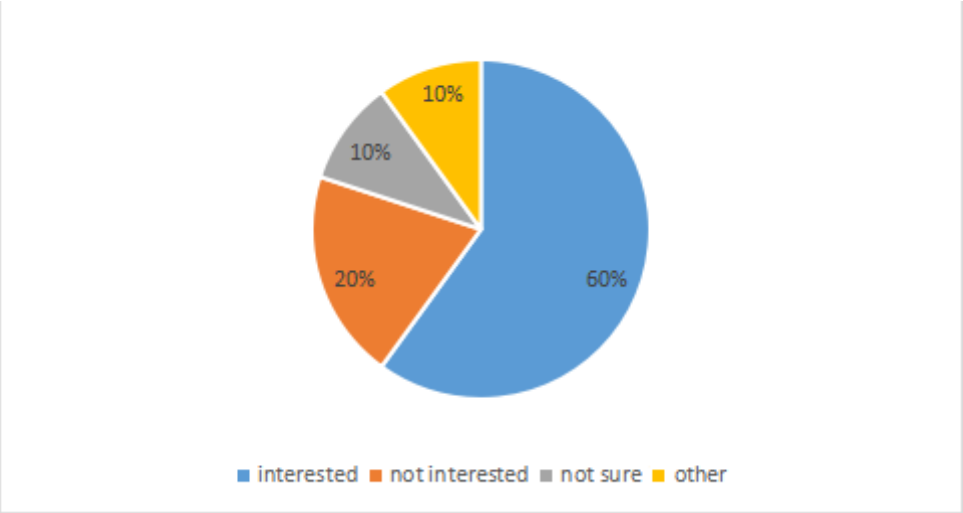

Figure 7. Students' Interest in English Reading

The results in Figure 8 and Figure 9 indicate that teachers utilized mind maps more frequently than the students, suggesting the necessity of guiding and encouraging students to apply mind maps in English learning.

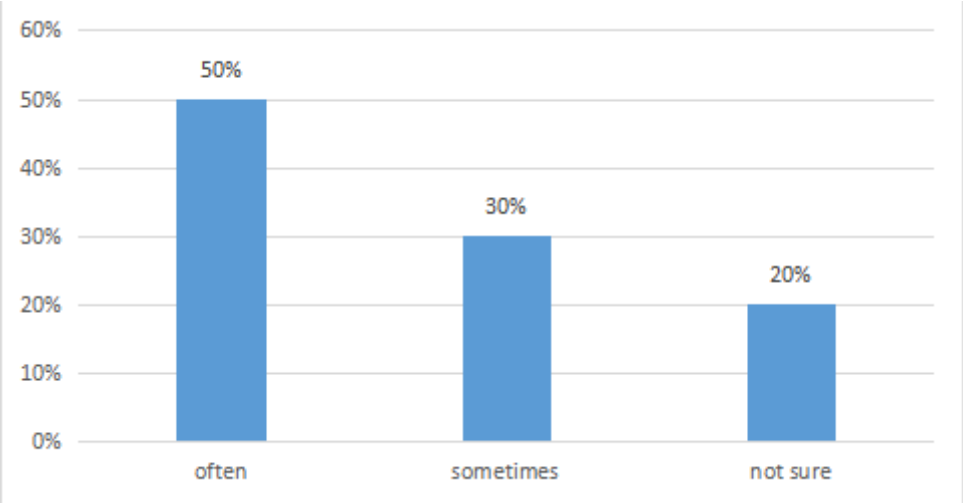

Figure 8. Teacher's Use of Mind Map

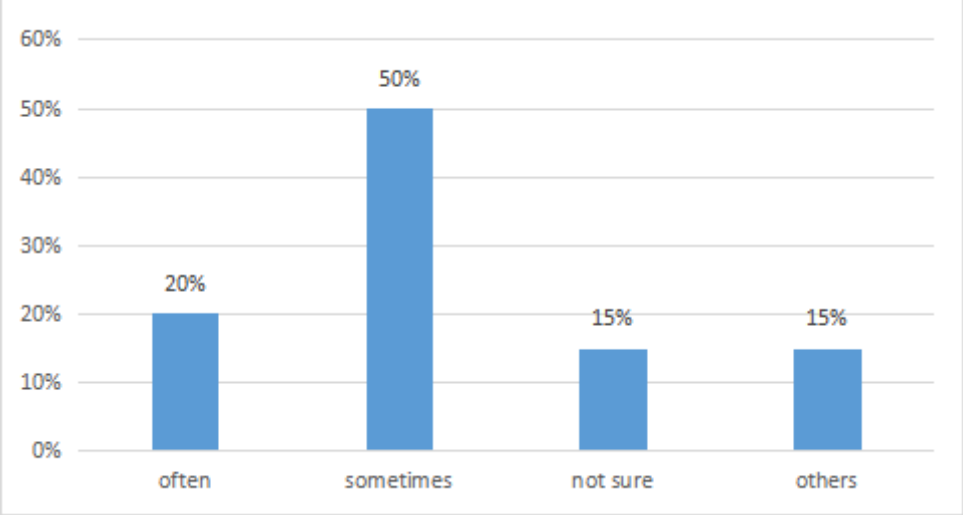

Figure 9. Students' Use of Mind Map

According to Figure 10, 70% of the students perceive words and phrases as most challenging in their English reading. Passage length and grammar are also identified as another two obstacles to students' reading comprehension. Compared with reading skills, vocabulary and grammar are considered as the major obstacles of English reading, which suggests that the students are unaware of their weaknesses in reading skills and thinking quality.

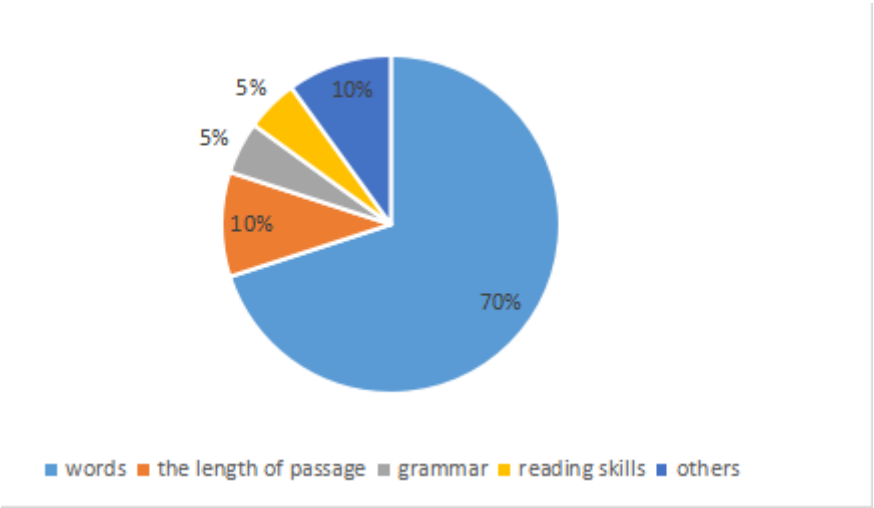

Figure 10. Barriers in English Reading

In summary, the questionnaire results indicate that the majority of students struggle with English reading, primarily due to challenges with vocabulary and reading proficiency. Notably, students demonstrate a keen interest in mind maps, suggesting significant potential for their use in English reading.

B. Results of Reading Ability Tests

The test scores are analyzed with SPSS 28. To answer the first research question, an independent samples T-test was conducted to compare the reading ability between CC and EC in the pre-test with a 95% confidence interval (CI) for the mean difference (Table 4 and Table 5).

TABLE 4
ANALYSIS OF READING ABILITY PRE-TEST SCORE OF EC AND CC

class \ results	N	Mean	Std. Deviation	Std. Error Mean
EC	39	46.79	21.505	3.444
CC	39	48.08	23.272	3.727

TABLE 5
INDEPENDENT SAMPLES T-TEST OF READING ABILITY PRE-TEST

	Levene's Test for Equality of Variances		t-test for Equality of Means						95% Confidence Interval of the Difference	
	F	Sig.	t	df	Significance		Mean Difference	Std. Error Difference	Lower	Higher
					One-Sided p	Two-Sided p				
Equal variances assumed	1.726	.193	-.253	76	.401	.801	-1.282	5.074	-11.388	8.824
Equal variance not assumed			-.253	75.531	.401	.801	-1.282	5.074	-11.388	8.824

Table 5 indicates homogeneity of variance, as confirmed by Levene's Test for Equality of Variances. As demonstrated in Table 4 and Table 5, there is no significant difference in reading ability between the EC (M=46.79, SD=21.505) and CC (M=48.08, SD=23.272), t (76) = -.253, p =.193. These results suggest that the EC and CC exhibit homogeneity in terms of their English reading ability at the outset of the experiment, rendering them appropriate subjects for the study.

Another independent samples T-test was conducted to compare the reading ability of CC and EX in the post-test. Table 7 shows that there was homogeneity of variance as assessed by Levene's Test for Equality of Variances. Table 6 and Table 7 show that there is significant difference in the scores between EC (M=57.18, SD=18.736) and CC (M=48.46, SD=22.306); t (76) = 1.869, p = .045. The reading ability post-test scores of EC are significantly higher than the scores of CC. These results of pre-test and post-test suggest that the 3-Step Mind Map Approach does have an positive effect on students' English reading ability. Specifically, the 3-Step Mind Map Approach improves students' reading ability.

TABLE 6
ANALYSIS OF READING ABILITY POST-TEST SCORE OF EC AND CC

results / class	N	Mean	Std. Deviation	Std. Error Mean
EC	39	57.18	18.736	3.000
CC	39	48.46	22.306	3.572

TABLE 7
INDEPENDENT SAMPLES T-TEST OF READING ABILITY POST-TEST

	Levene's Test for Equality of Variances		t-test for Equality of Means						95% Confidence Interval of the Difference	
	F	Sig.	t	df	Significance		Mean Difference	Std. Error Difference	Lower	Higher
					One-Sided p	Two-Sided p				
Equal variances assumed	4.149	.045	1.869	76	.033	.065	8.718	4.665	-.573	18.008
Equal variance not assumed			1.869	73.800	.033	.065	8.718	4.665	-.577	18.018

C. Results of Thinking Quality Tests

To address the second research question, we analyzed the thinking quality of both the CC and EC in the pre-test. Table 8 presents the results, which reveal that the mean thinking quality score for the EC is 31.03, and the mean score for the CC is 32.31. Although the CC scores slightly higher, the difference is negligible.

TABLE 8
ANALYSIS OF THINKING QUALITY PRE-TEST SCORE IN EC AND CC

	Class	N	Min.	Min. Number	Max.	Max. Number	Mean
Score	1(EC)	39	10.00	3	50.00	4	31.03
	2 (CC)	39	10.00	3	50.00	4	32.31

Table 9 presents a comparison of thinking quality between the EC and the CC in the post-test. The mean score for the EC is 34.10, while the mean score for the CC is 32.56. The difference of over 2 points between the EC and CC indicates that the thinking quality of the EC is different from that in the CC. Specifically, the implementation of the 3-Step Mind Map Approach in English reading teaching has improved the thinking quality of students in the EC.

TABLE 9
ANALYSIS OF THINKING QUALITY POST-TEST SCORE IN EC AND CC

	Class	N	Min.	Min. Number	Max.	Max. Number	Mean
Score	1(EC)	39	20.00	9	50.00	6	34.10
	2 (CC)	39	10.00	3	50.00	4	32.56

The results of the post-test demonstrate that the thinking quality of the EC was significantly improved after the application of the 3-Step Mind Map Approach, while the thinking quality of the CC remained relatively stable. Specifically, while only 4 out of 39 students in the CC obtained full marks in the post-test, 6 out of 39 students in the EC achieved full marks in the thinking quality post-test. Additionally, the lowest score in the CC was 10, while the lowest score in the EC was 20.

D. Summary and Discussion

In the present study, the effectiveness of the 3-Step Mind Map Approach on improving students' reading ability and thinking quality was investigated. The results reveal that the students in the EC outperformed those in the CC in terms of their reading ability and thinking quality post-test scores. These results suggest that the use of mind maps in English reading teaching can enhance students' reading ability and promote their thinking quality.

The effect of the 3-Step Mind Map Approach in English reading teaching is consistent with previous research which has shown the effectiveness of mind maps in English writing teaching. The results of the present study indicate that the application of mind maps can not only facilitate students' English writing skills but also enhance their English reading skills and think quality.

The Image schema theory provides a theoretical explanation for the effectiveness of mind maps in English reading teaching. According to this theory, when students create or complete a mind map, they construct or complete an image schema in their mind, which integrates new information with pre-existing knowledge. Creating a mind map or completing a mind map forces students to analyze the logical relations between different pieces of information in the text, making the information structure more evident and facilitating the identification of main ideas and key points.

Furthermore, in contrast to traditional teaching methods where information is directly provided by the teacher to the students, the 3-Step Mind Map approach encourages students to actively process information themselves. As they become more familiar with this approach, students are better equipped to identify logical connections between pieces of information, thereby enhancing their critical thinking abilities.

Therefore, the present study supports the use of the 3-Step Mind Map Approach in English reading teaching to improve students' reading ability and thinking quality. This approach can promote students' reading ability and thinking quality and has advantages over the traditional English teaching method.

These findings have important implications for English reading instruction in senior high school. Firstly, teachers can introduce the benefits and features of mind mapping to students, emphasizing that it is a process of creative and logical thinking, rather than just drawing diagrams or summarizing ideas. Teachers should also clarify the differences between mind maps and diagrams, as well as linear and divergent thinking, and explain the various components of mind maps. Secondly, teachers should prioritize IS and reading skills over vocabulary and other elements in reading instruction. By understanding the structure of a passage, students can guess the meaning of words and identify the theme of the text. Therefore, teachers should place greater emphasis on IS to improve students' reading ability.

VI. CONCLUSION

The present study proposed the 3-Step Mind Map approach for English reading teaching, and the comparative experimental study shows that this approach not only improves students' reading comprehension, but also enhances their thinking abilities.

The study addresses the gap in the literature by developing a new English teaching approach, which has not been previously explored in the context of English reading teaching. The effectiveness of this approach in improving students' reading ability and thinking quality further expands our understanding on how to enhance teaching outcome in the domain of English reading. It can serve as a valuable resource for teachers seeking to improve their teaching practices. Furthermore, the study provides a practical and evidence-based approach that can be easily implemented in the classroom setting, offering a promising solution to the challenges faced by both students and teachers in the English reading context. Overall, through the innovative approach and empirical findings, the present study fills an important gap in the literature and provides valuable insights for educators and researchers in the field of pedagogy and education.

Of course, the current study also has certain limitations that must be acknowledged. Firstly, the experiment lasted for only 3 months, which is a relatively brief period and may not provide a comprehensive insight into the students' learning over an extended period. Secondly, the sample size of the experiment is not big enough. Additionally, the 3-Step Mind Map Approach could be further customized based on the genre of reading material, the students' learning preferences, and the complexity of the text. Overall, despite these limitations, the results of the study suggest that the 3-Step Mind Map Approach has the potential to be an effective approach for improving students' English reading ability as well as think quality.

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