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On the Effect of Text-based Concept Maps vs. Image-based Concept Maps on Developing Iranian Intermediate EFL Learners' Reading Comprehension

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Abstract

The study aims to investigate the influence of image-based and text-based concept maps on the reading comprehension abilities of Iranian Intermediate EFL learners. A total of 90 learners participated in the study, consisting of 55 females and 35 males, all between the ages of 18 and 32. Participants were selected from intact classes at three English language schools in Sabzevar, Iran. This research was organized as a quasi-experimental study, in which the participants were segmented into two experimental groups and one control group. The intervention lasted for five weeks, with two sessions each week, each session running for one hour and thirty minutes. The outcomes from the assessments were analyzed using an independent sample t-test and ANOVA test, revealing that the image-based concept map instructional approach improved learners' reading comprehension. In terms of cognitive understanding and creativity, students who utilized image-based concept mapping outperformed their peers in the text-based mapping group. Additionally, the findings indicated that the image-based concept map teaching strategy could assist students in obtaining a more profound understanding of reading materials. Teachers might consider integrating visual mapping techniques to encourage deeper comprehension and facilitate more meaningful learning experiences, which could ultimately lead to better academic performance in language learning contexts.

Keywords: Concept map, text-based concept mapping, image-based concept mapping, reading comprehension

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1. Introduction

Reading comprehension is essential in both education and language acquisition in today's society (Bitmann, 2024), and there has been extensive research exploring the factors influencing reading comprehension from various viewpoints (Alnedai, et al., 2023; Deng, 2024). Because reading comprehension is a complex process, it demands cognitive involvement from readers as they create meaning based on the text (Smail, Mahmoud, & Adel, 2024). Mouchrif and colleagues (2023) noted that Reading comprehension is a dynamic process that includes an indirect interaction between the reader and the written material.The reader not only interacts with the written material but also grasps its significance. Thus, readers recognize the necessity of comprehension in order to convey the information. We can conclude that no separation can exist between reading and comprehension. In a similar vein, Elida and Oktadela (2022) asserted that reading and comprehension are interwoven and cannot be separated from each other. If readers miss one of content elements, they cannot comprehend the text.

Maulizan and Khatmi (2020) stated that words, sentences, paragraphs, and the entire text meaning comprehension constitute the concept of reading comprehension. Put another way, for students to learn anything from the material, they need to be able to comprehend it. According to Sari and colleagues (2020), reading comprehension serves four purposes: (1) the main ideas of the text identification; (2) rapid skimming; (3) academic or professional setting occurrence; and (4) information integration, writing, texts writing and critiquing. However, in reality, due to challenges with vocabulary and knowledge, students struggle to understand the reading content.

To help readers overcome challenges in reading comprehension, teacherrs have a significant impact on both instruction and learning, particularly in selecting effective teaching strategies and materials. (Dehgan, Kazemi, & Abtahi, 2025). Teachers need to be able to select effective teaching methods for the classroom, like imparting basic knowledge of the material. In order to gather comprehensive information, the method should help students broaden their knowledge. Instructing on learning strategies is an effective method for enhancing students' reading comprehension. Baker and Boonkit (2004) assert that teaching reading strategies is a vital aspect of educating individuals in English as a second or foreign language. A variety of techniques have been created to boost students' reading comprehension, with concept mapping standing out as particularly effective.

The application of the concept map teaching approach enhances meaningful learning (Ausubel, 1968; Novak & Musonda, 1991). During the 1980s, Novak conducted research at Cornell University probing the effectiveness of concept maps as an educational resource designed to minimize rote memorization (Novak & Cannas, 2006). His research focused on Ausubel's cognitive theory, which highlighted the high rank of existing knowledge in the acquisition of new concepts. It was suggested that the primary factor influencing learning is the knowledge that the learner holds prior to the learning experience. The concept map theory is founded on Ausubel's principles (1968; Ausubel, et al., 1978) regarding meaningful learning, which is shaped by the notion of advance organizers. Ausubel contends that significant learning occurs when students are able to efficiently structure information and link new insights to their prior knowledge. Cognitive structure consists of a collection of organized principles, concepts, and previously learned knowledge.

Concept map creation process entails students connecting new concepts to preexisting ones and arranging them in a hierarchical manner to create a cohesive framework for the material that needs to be learned (Chang, et al, 2022; Diaz & Garmendia, 2025). This approach stresses knowledge construction based on students' prior experiences, which is in line with the idea of meaningful learning, where new knowledge consciously connects to preexisting concepts. Concept mapping is the identification and hierarchical arrangement of key information on two-dimensional maps, which can help clarify a text's structure and enhance text comprehension. Concept mapping illustrates the flow of ideas by graphically representing them as multifaceted constructs (Liu, 2014; Liu et al., 2010; Pinandito et al., 2021).

Concept maps, which are typically displayed in a node-link-node format, are essentially graphic organizers or visual representations of knowledge. Key concepts are represented by nodes, which are typically nouns. Directional arrows connecting the nodes are labeled with descriptive words that specify the relationship between the two nodes (Sundra, 2022). According to researchers, concept mapping that is based on guided maps or additional concepts is more successful in improving reading comprehension because these premade concepts and maps serve as external scaffolding, making ideas in the source text easier to understand. Few, if any, studies have contrasted concept mapping with and without outside help (Su & Zu, 2024b). In concept mapping, all educational resources can be broken down into more basic components or concepts through mapping, enhancing the effectiveness of learning or the process of transferring knowledge (Su & Zou, 2024a).

Rojabi (2018) asserts that mapping is a teaching method that is crucial to the teaching of English, particularly in terms of reading comprehension. Because mapping enables students to visualize concepts and details related to the subject,

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it will facilitate the teaching of reading comprehension. The creation of concept maps streamlines written information by removing non-essential details and emphasizing the main ideas. Concept maps aid students in achieving advanced levels of understanding, and assist teachers in clarifying complicated subjects and evaluating students' grasp of the material (Diaz & Garmendia, 2025).

Concept mapping aligns with the cognitive dimensions of reading comprehension. Readers tend to retain general information at the upper levels of a hierarchy for a longer duration than specific details found at the lower levels. The significance of Horner's (1978) cognitive structure for acquiring new knowledge is emphasized through cognitive frameworks. Learning is always influenced by the learner's existing knowledge. It is generally easier to assimilate and remember new information when the cognitive structure is organized and clear (Ausubel, 1968, 1978). In contrast, constructivism focuses on active teaching methods that prioritize student-centered activities and consider learning as an internal, dynamic process where students integrate prior knowledge with new concepts. Constructivists maintain that the most effective teaching strategies begin with what students already comprehend and build from that foundation (Ausubel et al, 1978).

Concept maps have been characterized in a variety of ways by different researchers and experts. Novak and Gowin (1984) demonstrated that concept mapping promotes significant learning, and incorporating images into these maps helps users visualize concrete ideas through examples. When an image conveys information that is difficult to express verbally or in written statements, it remains effective (Wetzel, Radtke, & Stern, 1993). Additionally, incorporating images in concept maps could improve user engagement (Novak, 1990).Furthermore, visual aids can assist in drawing conclusions by utilizing perceptual processing rather than relying on more mentally demanding semantic processing, which reduces the cognitive load needed to keep information in working memory. Consequently, learners can more effectively build a related mental model, enhancing their learning outcomes through the inclusion of appropriate visuals (Larkin & Simon, 1987).

The cognitive theory of multimedia learning (Mayer, 2009) and the integrative model of text and image comprehension highlight the advantages of multimedia effects concerning cognitive processes. Both frameworks suggest that images and text produce distinct representations that are later combined to form a cohesive overall mental model, with support from the learners' existing knowledge. On the other hand, Paivio's (1991) dual coding theory suggests that information recorded in both visual and verbal forms is often recalled more easily. Research conducted by Clark and Mayer (2003) indicates that learners who work with both textual and visual information achieve higher performance on later tasks compared to those who only interact with text. Therefore, it is evident that the integration of image-based elements into concept maps is essential for accurately representing a person's understanding of a subject or for utilizing maps to transmit new information to learners (Yen et al., 2012).

Incorporating images into educational materials requires learners to exert additional effort to combine information from various formats, which promotes better integration of knowledge. Additionally, visuals can communicate important and spatial information rapidly. As a result, students do not need to use considerable cognitive energy to understand these images and keep them in their working memory. Ultimately, the mental images produced by visuals can act as a cognitive structure that aids in forming future representations by combining information obtained from texts and prior knowledge. From a theoretical standpoint, incorporating multimedia elements into a concept mapping activity gives impression being a helpful approach to enhance the development of concept maps and improve learning results (Sanchiz et al., 2019). It can also foster a more engaging user experience (Novak, 1990). Additionally, multiple studies on concept mapping indicate that students who make use of concept maps are likely to achieve better learning results compared to those who work with similar text formats (Yen et al., 2012).

Kalhor and Shakibaei (2012) state that concept maps can be utilized in teaching and learning in several ways, including maps created by learners, maps made by teachers in collaboration with students , and the presentation of these maps to the learners. A common application of concept maps is to serve as an educational tool for conveying content. In this method, key concepts and materials are organized systematically through a concept map. Teachers can apply concept maps at various phases of instruction, including before teaching as a preliminary step, during the teaching process to present new information and elucidate ideas, after teaching to summarize and reflect, and also for assessing students' comprehension.

Concept maps allow teachers to identify the main concepts within the material and their interconnections while providing a concise overview and general understanding of the topic for students. A concept map not only conveys key information visually but also highlights connections, structures, or traits that are not apparent in the text and summarizes them. Paivio's research (1991) showed that people remember information better when it is encoded in various formats. Consequently, dual coding suggests that when learners encounter the same conceptual information

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through a concept map format rather than a traditional text-based one, using concept mapping would result in better retention of that information (Yen et al., 2012). Thus, we hypothesized that concept mapping incorporating images would be more effective than one that relies solely on text. Visual elements could augment text-based concept mapping, thus playing a vital role in improving students' learning.

However, there has been limited research focused specifically on comparing image-based concept mapping with text-based concept mapping. Yen et al. (2012) also note that researchers have rarely made an effort to differentiate the advantages of the presentation method from those of constructing maps. As mentioned earlier, studies show that concept maps positively influence meaningful learning as an effective approach; however, substantial steps have not been taken to incorporate this technique into formal educational environments. This research primarily focuses on investigating how concept maps influence English reading comprehension in intermediate-level EFL learners at language institutes. In addition, it aims to explore an innovative method of utilizing concept maps that emphasizes images instead of conventional text-based formats. Consequently, the study intends to answer the following questions:

1. Does the use of concept mapping influence the reading comprehension of Iranian EFL learners?

2. Is there any difference in the impact of text-based concept maps vs image-based concept maps on the Iranian EFL learners' reading comprehension?

2. Literature Review

2.1 Concept Map and Reading Comprehension Background

Novak created concept mapping for the first time at Cornell University in 1972, and it has been used for many years in science education to illustrate the intricate connections between various scientific ideas. Its use grew over time to encompass a wide range of other subject areas, such as language arts, mathematics, and social studies (Ta & Razali, 2023). First language (L1) reading comprehension instruction saw the first application of this method in the field of reading instruction (e.g., Chang, et al., 2002; Liu & Lee, 2013; Oliver, 2009) followed by second language (L2) reading comprehension (e.g., Liu et al., 2010; Tajeddin & Tabatabaei, 2016). However, despite its clear benefits, concept mapping also has its limitations. Challenges such as identifying concepts and their relationships, time limitations, students' reluctance to adapt, and software-related problems can occur during practical implementation (Machado & Carvalho, 2020).

The strategy of Concept Mapping in teaching and learning reading comprehension has been investigated in multiple studies. In an experimental study, Sahin (2013) found that students who received instruction via Concept Mapping demonstrated a more substantial improvement in their reading comprehension skills. Likewise, Phantharakphong and Pothitha (2014) noted that using Concept Mapping improved the English reading comprehension abilities of Thai students, raising their proficiency from 81 percent to 86 percent. Moreover, both Doyle and Kommers (2011) and Berry (2008) suggest that Concept Mapping is a valuable method for teaching and studying reading comprehension.

According to a study that tracked students' eye movements, students who received a concept map along with the text read it faster but still performed slightly better than the group that received just the text (Sunder, 2020). A previous investigation conducted by Liu et al. (2010) regarding the application of concept maps among EFL college students involved two groups of 192 freshmen. The reading content for their study comprised nine articles taken from English-language magazines, and participants were evaluated using a reading test provided by the magazines. The assessment featured twenty-two questions aimed at measuring reading comprehension, with a duration of sixty minutes. Moreover, they utilized an updated version of Yang's (2003) questionnaire. Each class attended two hours of instruction weekly for a duration of ten weeks during the study. Before starting the experiment, both groups participated in a pre-reading evaluation. The results from these assessments were utilized to categorize students as either good or poor readers. The results indicated that concept mapping proved to be a more successful reading strategy than conventional methods for enhancing reading comprehension in readers with lower skills, whereas notable differences in learning outcomes between the experimental and control groups were not consistently seen in skilled readers. The researchers concluded that concept mapping, particularly for beginner readers, aids students in grasping the structure of a text.

There are several ways to apply the concept mapping technique. In some, students were instructed to use a conventional pencil and paper to create a concept map. In contrast, other research mandated that students produce concept maps utilizing software in a technology-enhanced environment, especially when employing Kit-Build concept mapping (Alkhateeb et al., 2015; Alkhateeb et al., 2016a, 2016b; Chiang et al., 2016; Liu et al., 2019). In various studies, both educators and learners took part in exercises focused on creating concept maps. For instance, Soleimani and Nabizadeh (2012) had teachers develop expert-level concept maps for comparison purposes, while the students

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were required to create their own hand-drawn concept maps. Alibabaee et al. (2014) conducted a study that aimed to evaluate the effects of the concept map learning strategy using two distinct approaches (teacher-generated and cooperative concept map strategies) on reading comprehension and student autonomy. The findings revealed that concept mapping positively influenced reading comprehension, especially for the cooperative group. However, it did not significantly impact learner autonomy.

A variety of research studies have shown the immediate benefits of concept mapping on reading comprehension. These investigations revealed that concept maps play a crucial role in enhancing students' reading abilities by engaging their existing language and worldly knowledge (Kalhor & Shakibaei, 2012; Riahi & Pourdana, 2017), linking new information to what they already know, and deepening their grasp of the text (Khajavi & Ketabi, 2012; Lumontad et al., 2020; Tajeddin & Tabatabaei, 2016; Trang, 2017; Yousofi & Seidi, 2015). In addition, concept mapping promotes engagement and aids in fostering meaningful learning experiences (Khajavi & Ketabi, 2012; Lumontad et al., 2020; Nguyen & Pham, 2018; Soleimani & Nabizadeh, 2012; Tabatabaei & Khalili, 2014; Trang, 2017), assists in forming internal links among concepts (Riahi & Pourdana, 2017; Tajeddin & Tabatabaei, 2016), and encourages the application of a variety of reading strategies (Kalhor & Shakibaei, 2012; Rassaei, 2019; Trang, 2017; Usman et al., 2017).

Nonetheless, some studies in the literature report adverse effects related to concept mapping. For example, Lechuga et al. (2015) argued that the concept mapping method was less effective than retrieval practice in an educational assessment. Asri and Andoko (2019) discovered that concept mapping did not fully enhance students' reading abilities. Furthermore, research conducted by Wilson and Kim (2016) on concept mapping found no significant improvement in reading comprehension levels.

3.2 Text-based Concept Map

A concept map offers a visual depiction of various ideas, typically shown in shapes such as ovals or rectangles, with lines illustrating the connections between these ideas. The terms found on these lines, known as linking words or phrases, clarify the type of relationship that exists between the two concepts. The relationships established by these linking phrases yield propositions. Propositions express assertions about an object or an event in the world, whether they happen naturally or are caused by human actions. These propositions consist of two or more concepts linked together by words or phrases to create a coherent statement. They are occasionally called semantic units or units of meaning. As a result, concept maps include both a "graphical structure" and "content" (Canas et al., 2015).

According to Kozminsky (2004), Text Concept Mapping (TCM) involves translating texts into Graphical Organizers (GOs) following a specific layout: Geometric shapes are organized hierarchically, representing content concepts as ellipses and rhetorical structure concepts as rectangles. Connections are made between concepts using directional links and connectives that illustrate the semantic and logical relationships. Concepts are grouped into clusters, each containing a rhetorical structure concept along with its corresponding content concepts. Additionally, concepts from different clusters can be linked using cross lines. Wang et al. (2008) presents the concept map as an educational strategy that connects new information to existing knowledge frameworks and enhances conceptual understanding by effectively displaying related concepts.

The research examines text-based concept maps as graphic organizers created using CMAP tools software, which is a free application developed by Think Buzan known as Imindmap (9th version). This software features knots (concepts and terms) that are interconnected by lines, which help to clarify the relationships among the concepts. Generally, concepts are illustrated within circles or boxes, while the connections between these concepts or propositions are represented by linking lines accompanied by descriptive words. The words on these linking lines provide clarity on the nature of the relationship between the two concepts. While most concepts are designated with words, symbols may also be represented. Propositions are statements that pertain to an object or event in the universe, whether they happen naturally or artificially. These propositions are formed by joining two or more concepts with additional words to create a coherent statement, which we refer to as semantic units. Furthermore, the arrangement of the concepts and the orientation of the linking lines influence the structure of the map, such as hibernacula or non-hierarchical formats.

3.3 Image-based Concept Map and its Underlying Theory

The idea behind this research is that a concept map serves as a visual depiction of essential ideas (extracted from a text) and the relationships that exist between them. Generally, these ideas are arranged in a hierarchical format on a computer screen, with general themes positioned at the top and more detailed concepts below, while the relationships or connections are illustrated spatially with lines (or arrows). Linking phrases (such as, is a type of, leads to, permits, etc.) are placed along these lines to help formulate propositional statements. When created using free software, additional information can be included in a hypertext format, and links can be made to various URLs, encompassing

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other media types like audio files, images, videos, animations, and more. A visual can be powerful when it communicates information that is challenging to express with words or phrases. Additionally, incorporating images into concept maps can improve the overall user experience (Yen et al., 2012).

Gou et al. (2020) showed that effectively created visuals can aid learners in comprehending written material. In addition, Pan (2009) found that the inclusion of images in texts helps low proficiency learners among EFL college students in Taiwan. Responses from students regarding the influence of images on reading comprehension can improve their content grasping. The image-based concept maps I the study are made by CMAP tools software, a free software developed by Think Buzan called *Imindmap* (*9th version) which* provides the closest image related to the knots. The link lines are arrows with suitable symbol or Emoji (e.g. showing the knot "result" with the symbol "»").

The dual coding theory (DCT; Paivio, 1971) has frequently been referenced to justify the use of visuals in conjunction with text (e.g., Hannus & Hyona, 1999; Vekiri, 2002). When learners engage with information through both verbal and visual approaches, they discover it easier to access knowledge from their long-term memory, which supports the formation of strong mental models. In the context of reading comprehension, DCT suggests that when dealing with abstract texts, readers have a limited number of mental images to aid their understanding and are unable to take advantage of nonverbal cognition (Sadoski & Paivio, 1994). Consequently, texts that are abstract require greater cognitive effort.

Incorporating concrete elements, such as graphics, enhances mental imagery by providing more detail. Furthermore, visuals can encourage learners to encode information in both visual and verbal formats, which minimizes cognitive strain and supports memory retention through multiple routes to the same data. For instance, a science text might describe the composition of water as being made up of hydrogen and oxygen, accompanied by a diagram. When tested later, a reader might forget the exact wording but can recall the diagram, thus retrieving key information. When it comes to the differences among learners, both young and adult learners have been assessed through DCT (Sadoski & Paivio, 2013), and individuals in both age groups appear to derive comparable benefits from tangible information while struggling with abstract ideas. In relation to creating graphical displays, the premise of DCT indicates that mental imagery facilitates comprehension, suggesting that more realistic visuals (like photographs) could potentially improve understanding more efficiently.

According to the dual coding theory, learners are likely to enhance their retention of identical conceptual information when it is delivered in a concept map format rather than through traditional, non-graphic methods. Consequently, we anticipated that concept mapping with images would be more advantageous than using text alone. Visual elements may support text-based concept mapping and significantly contribute to enhancing students' learning.

3. Methodology

3.1 Participants and Setting

90 intermediate EFL learners including 35 males and 55 females from three English language institutes in Sabzevar, a city in Khorasan Razavi province in Iran, participated in the study. They consisted of young learners aged 18 to 32. The rationale for selecting participants form English language institutes was their higher-level interest in learning English.

3.2 Research Instruments

3.2.1 Reading Comprehension

A pre-test developed by the teacher, utilizing the reading comprehension materials from Select Readings (2nd Ed.) by Linda Lee and Erik Gundersen, assessed the reading comprehension skills of the students prior to implementing the treatment. This pretest included three passages of approximately equal length (around 600 words on average) and ensured a consistent readability level, along with 30 multiple-choice questions in total. The reliability of these 30 reading items was verified with a Cronbach's Alpha score of 0.764. The readability levels of the three passages in the pretest, calculated using the Flesch Reading Ease Formula, were 55.2, 82.1, and 79.2, respectively.

To measure the impact of the treatment on students, a comparable reading comprehension exam resembling the pretest was used as the posttest. This posttest also contained three passages of comparable length (as long as pretest passages) and maintained the same readability level, featuring a total of 30 multiple-choice questions. The readability scores for the passages in the posttest were 65.9, 50.6, and 74.9, respectively.3.2.2 Materials

The passages utilized for instruction and assessment in this research were chosen from popular reading comprehension books entitled Select Readings (2nd Ed.) written by Linda Lee and Erik Gundersen. The reason for selecting these

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texts is that they are specifically created for intermediate EFL learners and cater to various proficiency levels. A total of ten passages from these texts were randomly selected and taught across all three groups.

3.2.3 Concept mapping Tools

CMAP tools software, a free software developed by Think Buzan called *Imindmap* (*9th version)* was used for making the concept maps. This software provides a design that enables mappers to customize their maps using colors, shadows, images, various line styles and arrowheads for direction indication, different sizes and fonts, along with text alignments. *IBM SPSS statistics 25* was used for the analysis of data received from the experiments. This software helps you consider normality of your data, and also makes you sure of your analysis by performing different tests on your data.

3.3 Procedure

The study employs a quasi-experimental design, including two groups that receive interventions and one control group. The outcome being measured is the reading comprehension abilities of English as a Foreign Language (EFL) learners, while the two factors being tested are text-based concept mapping and image-based concept mapping. Participants were selected from three language schools, utilizing intact classes that were randomly assigned to either the experimental groups or the control group. At the beginning of the term, a pretest was administered, and the intervention spanned five weeks, with two sessions each week, each lasting one hour and thirty minutes. After the intervention period, a posttest was performed to assess the reading comprehension of all three groups. The data from the tests were analyzed using independent sample t-tests and ANOVA.

4. Results and Discussion

After administering the pretest and posttest, the data were first examined for normality to ensure the suitability of the parametric approach. For the pretest, the Kolmogorov-Smirnov test produced a statistic of 0.187 ($df = 90$, $p < 0.001$) and the Shapiro-Wilk test yielded a statistic of 0.902 ($df = 90$, $p < 0.001$), while the skewness (0.139) and kurtosis (–0.776) values were relatively modest. Similarly, for the posttest, the Kolmogorov-Smirnov statistic was 0.141 ($df = 90$, $p < 0.001$) and the Shapiro-Wilk statistic was 0.946 ($df = 90$, $p = 0.001$), with skewness at 0.200 and kurtosis at –0.809. Although the normality tests indicated statistically significant deviations—likely due to the sample size—the modest skewness and kurtosis values suggest that the departures from normality were not substantial.

Based on these findings, a one-way ANOVA was performed to compare the control group with the concept mapping groups regarding both the pretest and posttest measures. The main objective was to assess whether concept mapping impacts the reading comprehension of Iranian EFL learners. The outcomes of the one-way ANOVA for the pretest and posttest data are shown in the tables below.

Table 1. Normality tests

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	0.187	90	0.000	0.902	90	0.000
Posttest	0.141	90	0.000	0.946	90	0.001

Descriptive statistics revealed distinct differences among the three groups. The image-based group ($N = 28$) achieved a mean score of 21.96 ($SD = 1.82$) with a 95% confidence interval ranging from 21.26 to 22.67, indicating strong performance. In contrast, the text-based group ($N = 30$) obtained a mean of 18.47 ($SD = 2.03$) with a 95% confidence interval between 17.71 and 19.22, while the control group ($N = 32$) recorded the lowest mean score of 16.13 ($SD = 1.81$) with a 95% confidence interval from 15.47 to 16.78. The findings indicate that, while initial performance across the groups was quite similar, the intervention seems to have resulted in varying effects on the posttest scores. To statistically validate these variances, a one-way ANOVA was performed to assess whether the mean differences observed among the image-based, text-based, and control groups were significant.

Table 2. Descriptive statistics

N	Mean			95% Confidence Interval for Mean

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			Std. Deviation	Std. Error	Lower Bound	Upper Bound
Image-Based	28	21.9643	1.81521	0.34304	21.2604	22.6681
Text-Based	30	18.4667	2.02967	0.37056	17.7088	19.2246
Control	32	16.1250	1.80947	0.31987	15.4726	16.7774
Total	90	18.7222	3.03917	0.32036	18.0857	19.3588

The one-way ANOVA assessment demonstrated significant variations among the three groups in their posttest scores. According to the ANOVA table, the sum of squares between groups was 512.125 with 2 degrees of freedom, leading to a mean square of 256.062. The sum of squares within groups was 309.931 with 87 degrees of freedom, producing a mean square of 3.562. The calculated F-ratio was 71.879, and this finding reached statistical significance ($p < 0.001$). These outcomes suggest that there are meaningful differences in reading comprehension performance among the groups after the intervention.

Table 3. ANOVA posttest results

Posttest

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	512.125	2	256.062	71.879	0.000
Within Groups	309.931	87	3.562		
Total	822.056	89			

To identify the particular group differences responsible for the overall effect, post hoc comparisons were performed using both Tukey HSD and Scheffé tests. The results from the post hoc tests consistently indicated that the image-based group surpassed the text-based group, demonstrating a mean difference of roughly 3.50 points, and also exceeded the control group with an even greater mean difference of approximately 5.84 points (all p-values < 0.001). Additionally, the text-based group scored significantly higher than the control group, with a mean difference of roughly 2.34 points ($p < 0.001$). These results were consistent across both the Tukey HSD and Scheffe post hoc procedures, thereby reinforcing the conclusion that the type of concept mapping strategy implemented had a significant effect on posttest reading comprehension performance.

Table 4. Posthoc test results

	(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound
Tukey HSD	Image-Based	Text-Based	3.49762*	0.49596	0.000	2.3150
		Control	5.83929*	0.48842	0.000	4.6747
	Text-Based	Image-Based	-3.49762*	0.49596	0.000	-4.6802
		Control	2.34167*	0.47966	0.000	1.1979
	Control	Image-Based	-5.83929*	0.48842	0.000	-7.0039

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		Text-Based	-2.34167*	0.47966	0.000	-3.4854
Scheffe	Image-Based	Text-Based	3.49762*	0.49596	0.000	2.2624
		Control	5.83929*	0.48842	0.000	4.6229
	Text-Based	Image-Based	-3.49762*	0.49596	0.000	-4.7328
		Control	2.34167*	0.47966	0.000	1.1471
	Control	Image-Based	-5.83929*	0.48842	0.000	-7.0557
		Text-Based	-2.34167*	0.47966	0.000	-3.5363

5. Discussion and Conclusion

The primary research question of this investigation explored the effect of the concept mapping technique on students' understanding of reading material. The findings indicate that the direct instruction of the concept mapping strategy positively influenced the students' reading performance. This aligns with the conclusions drawn by Chang et al. (2002), Liu and Lee (2013), Oliver (2009), Liu et al. (2010), and Tajeddin and Tabatabaei (2016), who have noted that concept mapping effectively enhances students' reading comprehension in both their first and second languages, as well as overall reading skills.

Regarding the enhancement of reading comprehension abilities, the current study corroborates the results from experiments conducted by Sahin (2013), and Phantharakphong and Pothitha (2014). However, the results of this study appear to contradict those of Lechuga et al. (2015), Asri and Andoko (2019), and Wilson and Kim (2016), who found no significant improvement in reading comprehension achievement. As an effective method for promoting meaningful learning, the study's findings support the research conducted by Khajavi and Ketabi (2012), Lumontad et al. (2020), Nguyen and Pham (2018), Tabatabaei and Khalili (2014), Trang (2017), and Soleimani and Nabizadeh (2012).

Before addressing the second question of this study and beginning our discussion on it, we must detail why images are regarded as the most effective medium for teaching reading. According to Esfandi (2021), there are two main reasons highlighting the significance of reading; Initially, reading helps students expand their vocabulary, spell words correctly, identify different grammatical structures, and understand how a well-organized text is constructed. Essentially, reading improves the other three language skills in English. Thus, reading comprehension could be considered the most crucial of the four skills, as it supports greater understanding in listening, speaking, and writing. Furthermore, reading can present difficulties when students face unfamiliar, technical, or intricate content. Even though readers might be able to decode words, they frequently lack the skills needed to understand the deeper meanings of sentences, paragraphs, and the text as a whole. In summary, reading holds significant importance, which is why we should aim to cultivate effective teaching methods that assist students in mastering it.

To improve students' understanding of reading materials, educators must utilize teaching media. In educational settings, media serves as a communication tool that links teachers and students. Furthermore, there are three types of media: audio, visual, and audio-visual. However, the author opts to concentrate on visual media to enhance students' reading comprehension. Visual media includes formats that enable learners to acquire information or knowledge through their visual senses. Therefore, visual media relies solely on sight presented in a visual form. Examples of visual media are image files, flashcards, charts, and more. Based on the arguments made, the writer identifies pictures as the most suitable visual medium for teaching reading. Consequently, the rationale for choosing an image-based concept map is grounded in the previously mentioned advantages of using pictures for reading comprehension.

As previously mentioned, concept maps are visual organizers or representations of knowledge often arranged in a node-link-node format. The nodes, which are usually nouns, indicate significant ideas and are linked by directional arrows that feature terms describing the connection between the two nodes (Sundra, 2022). Researchers (Sou & Zou, 2024; Tajeddin & Tabatabaie, 2016) suggest that concept mapping that utilizes guided maps or supplementary concepts is more effective at enhancing reading comprehension, as these pre-prepared maps and concepts provide external scaffolding that helps clarify ideas in the original text. The existing research on the influence of images on reading comprehension (e.g., Hannus & Hyona, 1999; Pan, 2009; Vekiri, 2002) indicates that most studies highlight the beneficial impact of images on reading comprehension. Nevertheless, limited research has examined the effects of concept maps in both text and image formats (Yen et al., 2012). This research sought to fill this gap by examining the impact of image-based and text-based concept maps on reading comprehension for Iranian intermediate EFL students.

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The findings revealed that incorporating image-based concept maps in reading lessons can improve students' reading comprehension. Future research utilizing a true experimental design is recommended to enable wider generalizations of the results.

References

Alibabaee, A., Mehranfar, Z., & Zarei, G. R. (2014). Role of teacher-constructed vs. cooperative concept map learning strategies in EFL learners' reading comprehension and autonomy. *Journal of Research in Applied Linguistics, 5*(1), 3-23.

Alkhateeb, M., Hayashi, Y., Rajab, T., & Hirashima, T. (2015). Comparison between Kit-Buildand Scratch-Buildconcept mapping methods in supporting EFL reading comprehension. *The Journal of Information and Systems in Education*, *14*(1), 13–27. doi:10.12937/ejsise.14.13

Alkhateeb, M., Hayashi, Y., Rajab, T., & Hirashima, T. (2016a). Experimental evaluation of the KB-mapping method to avoid sentence-by-sentence map-building style in EFL reading with concept mapping. *The Journal of Information and Systems in Education*, *15*(1), 1-14. https://doi.org/10.12937/ejsise.15.1

Alkhateeb, M., Hayashi, Y., Rajab, T., & Hirashima, T. (2016b). Experimental use of kit-build concept map system to support reading comprehension of EFL in comparing with selective underlining strategy. *International Journal of Advanced Computer Science and Applications, 7*(4), 80–87.

Alneyadi, S., Abulibdeh, E., & Wardat, Y. (2023). The impact of digital environment vs. traditional method on literacy skills; Reading and writing of Emirati fourth graders. *Sustainability*, *15*(4), 3418. https://doi.org/10.3390/su15043418

Andoko, B. S., Hayashi, Y., & Hirashima, T. (2019). An analysis of concept mapping style in EFL reading comprehension from the viewpoint of paragraph structure of text. *The Journal of Information and Systems in Education*, *18*(1), 63–68. https://doi.org/10.12937/ejsise.18.63

Asri, A. N., & Andoko, B. S. (2019). The implementation of Kit Builtconcept mapping to help Non-English department students improve their reading skills. *IJET (Indonesian Journal of English Teaching), 8*(2), 15–25.

Ausubel, D. P. (1968). *The psychology of meaningful verbal learning*. New York: Grune and Stratton.

Ausubel, D. A., Novak, J. D., & Hanesian, H. (1978). *Educational psychology. A cognitive view.* New York: Holt, Rinehart and Winston.

Baker, W., & Boonkit, K. (2004). Learning strategies in reading and writing: EAP contexts. *RELC Journal*, *35*(3), 299-328. https://doi.org/10.1177/0033688205052143

Bitmann, F. (2024). Reading begets reading? Disentangling the dynamic interplay between reading competence and reading exposure with a special focus on gender differences. *Reading Research Quarterly*, 1-16.

Cañas, A. J., Novak, J. D., & Reiska, P. (2015). How good is my concept map? Am I a good Cmapper? *Knowledge Management & E-Learning*, *7*(1), 6.

Chang, C. C., Hwang, G. J., & Tu, Y. F. (2022). Roles, applications, and trends of concept map-supported learning: A systematic review and bibliometric analysis of publications from 1992 to 2020 in selected educational technology journals. *Interactive Learning Environments*, *31*(9), 5995–6016. https://doi.org/10.1080/10494820.2022.2027457

Chang K. E., Sung Y. T., & Chen I. D. (2002). The effect of concept mapping to enhance text comprehension and summarization. *The Journal of Experimental Education, 71*(1), 5–23. https://doi.org/10.1080/00220970209602054

Chiang, K. H., Fan, C. Y., Liu, H. H., & Chen, G. D. (2016). Effects of a computer-assisted argument map learning strategy on sixth-grade students' argumentative essay reading comprehension. *Multimedia Tools and Applications, 75,* 9973–9990. https://doi.org/10.1007/s11042-015-2904-y

Clark, R. C., & Mayer, R. E. (2003). E-Learning and the science of instruction: proven guidelines for consumers and designers of multimedia learning. *San Francisco*, CA: Pfeiffer.

Dehqan, M., Kazemi, M., & Abtahi, M. (2025). A comparative study of ZPD-based teacher and peer feedback in comprehending reading and reading strategies. *Language Related Research, 16*(1), 59-8. https://lrr.modares.ac.ir/article-14-57277-en.pdf

Deng, W. (2024). Exploring the effects of working memory on reading comprehension among Chinese EFL learners. *Multidisciplinary Reviews, 5*, 1-10.

Diaz, O., & Garmendia, X. (2025). Bridging reading and mapping: The role of reading annotations in facilitating feedback while concept mapping. *Information Systems, 127*, 1-17. https://doi.org/10.1016/j.is.2024.102458

Elida, Y., & Oktadela, R. (2022). The effect of RAP paraphrasing strategy and semantic map strategy on reading comprehension. *Journal of English Language and Education, 7*(1), 68-74.

[Downloaded from mail.ijreeonline.com on 2026-11-19]

Efendi, M. A. (2021). The use of pictures as media to improve students' reading comprehension. *Journal of English Teaching, Literature, and Applied Linguistics*, *2*(2), 84-86.

Guo, D., Zhang, S., Wright, K. L., & McTigue, E. M. (2020). Do you get the picture? A meta- analysis of the effect of graphics on reading comprehension. *AERA Open, 6(1)*, 2332858420901696.

Hannus, M., & Hyona, J. (1999). Utilization of illustrations during learning science textbook passages among low- and highability Children. *Contemporary Educational Psychology*, *24*(2), 95–123. https://doi.org/10.1006/ceps.1998.0987

Horner, D. (1987). Acquisition, learning and the monitor: a critical look at Krashen. *System, 15*(3), 339-349. https://doi.org/10.1016/0346-251X(87)90008-X

Khajavi, Y., & Ketabi, S. (2012). Influencing EFL learners' reading comprehension and self-efficacy beliefs: The effect of concept mapping strategy. *Porta Linguarum,* (17), 9–28.

Kalhor, M., & Shakibaei, G. (2012). Teaching reading comprehension through concept map. *Life Science Journal, 9*(4), 725–731.

Kozminsky, E. (2004). Text concept mapping: The contribution of mapping characteristics to learning from texts. *Concept Maps: Theory, Methodology, Technology Proc. of the First Int. Conference on Concept Mapping Pamplona, Spain.*

Lechuga, M. T., Ortega-Tudela, J. M., & Gómez-Ariza, C. J. (2015). Further evidence that concept mapping is not better than repeated retrieval as a tool for learning from texts. *Learning and Instruction*, *40*, 61–68. https://doi.org/10.1016/j.learninstruc.2015.08.002

Larkin, J. H., & Simon, H. A. (1987). Why a diagram is (sometimes) worth ten thousand words. *Cognitive Science*, *11*(1), 65–99. https://doi.org/10.1111/j.1551-6708.1987.tb00863.x

Lee, Y. (2013). Collaborative concept mapping as a pre-writing strategy for L2 learning: A Korean application. *International Journal of Information and Education Technology*, *3*(2), 254.

Liu, P. L., Chen, C. J., & Chang, Y. J. (2010). Effects of computer-assisted concept mapping learning strategy on EFL college students' English reading comprehension. *Computer & Education, 54*(2), 436–445. https://doi.org/10.1016/j.compedu.2009.08.027

Liu, P. L. (2014). Using eye tracking to understand learners' reading process through the concept-mapping learning strategy. *Computers & Education, 78,* 237–249. https://doi.org/10.1016/j.compedu.2014.05.011

Lumontad, N., S., Argate, R., & Aparece, U. B. (2020). Concept mapping as a reading comprehension tool. *International Journal of English Language Studies, 2*(5), 21–29.

Machado, C. T., & Carvalho, A. A. (2020). Concept mapping: Benefits and challenges in higher education. *The Journal of Continuing Higher Education*, *68*(1), 38–53. https://doi.org/10.1080/07377363.2020.1712579

Maulizan, Z. A., & Khatmi, K. (2020). The effectiveness of SQ4R cooperative learning method on reading learning for EFL students. *Journal of English Teaching and Linguistics*, *1*(2), 126-133.

Mayer, R. E. (2009). Multimedia principle. In R. E. Mayer (Ed.), *Multimedia learning* (2nd ed., pp. 223–241). New York: Cambridge University Press.

Mouchrif, H., Mokhtari, N., & Benzehaf, B. (2023). The impact of semantic mapping on reading comprehension among Moroccan EFL students. *International Journal of Linguistics and Translation Studies*, *4*(3), 1–29.

Novak, J. D. (1990). Concept maps and Vee diagrams: two metacognitive tools to facilitate meaningful learning. *Instructional Science, 19,* 29–52. https://doi.org/10.1007/BF00377984

Novak, J. D., & Gowin, D. B. (1984). *Concept mapping for meaningful learning.* Cambridge: Cambridge University Press.

Novak, J. D., & Canas, A. J. (2006). *The theory underlying concept maps and how to construct them.* Technical report IHMC cMAP tools, 2006-07, Florida.

Novak, J. D., & Musonda, D. (1991). A twelve-year longitudinal study of science concept learning. *American Educational Research Journal, 28*(1), 117–153. https://doi.org/10.2307/1162881

Nguyen, H. B., & Pham, Q. N. (2018). Concept mapping influencing students' ability to summarize reading passages. *European Journal of Education Studies, 4*(4), 306–319.

Oliver, K. (2009). An investigation of concept mapping to improve the reading comprehension of science texts. *Journal of Science Education and Technology*, *18*(5), 402–414. doi:10.1007/s10956-009-9157-3

Paivio, A. (1971). *Imagery and verbal processes*. Holt, Rinehart & Winston.

Paivio, A. (1991). Dual coding theory: retrospect and current status. *Canadian Journal of Psychology*, *45*(3), 255–287. https://doi.org/10.1037/h0084295

[Downloaded from mail.ijreeonline.com on 2026-11-19]

Pan, Y. (2009). The effects of pictures on the reading comprehension of low-proficiency Taiwanese English foreign language college students: An action research study. *VNU Journal of Foreign Studies, 25(3)*, 186-198. https://js.vnu.edu.vn/FS/article/view/2426

Phantharakphong, P., & Pothitha, S. (2014). Development of English reading comprehension by using concept maps. *Procedia–Social and Behavioral Sciences*, *116,* 497–501. https://doi.org/10.1016/j.sbspro.2014.01.247

Pinandito, A., Hayashi, Y., & Hirashima, T. (2021). Online collaborative Kit-Build concept map: Learning effect and conversation analysis in collaborative learning of English as a foreign language reading comprehension. *IEICE Transactions on Information and Systems*, *104*(7), 981–991. https://doi.org/10.1587/transinf.2020EDP7245

Rassaei, E. (2019). Effects of two forms of concept mapping on L2 reading comprehension and strategy awareness. *Applied Linguistics Review, 10*(2), 93–116.

Riahi, Z., & Pourdana, N. (2017). Effective reading comprehension in EFL contexts: Individual and collaborative concept mapping strategies. *Advances in Language and Literary Studies*, *8*(1), 51–59.

Rojabi, A. R. (2018). Collaborative strategic reading (CSR) in improving the English Department students' reading comprehension achievement. *JET (Journal of English Teaching) Adi Buana*, *3*(2), 127-â.

Sadoski, M., & Paivio, A. (1994). A dual coding view of imagery and verbal processes in reading comprehension. In R. B. Ruddell, M. R. Ruddell, & H. Singer (Eds.), *Theoretical models and processes of reading* (pp. 582–601). International Reading Association.

Sadoski, M., & Paivio, A. (2013). *Imagery and text: A dual coding theory of reading and writing*. Routledge.

Sanchiz, M., Lemarié, J., Chevalier, A., Cegarra, J., Paubel, P. V., Salmerón, L., & Amadieu, F. (2019). Investigating multimedia effects on concept map building: Impact on map quality, information processing and learning outcome. *Education and Information Technologies*, *24,* 3645-3667. https://doi.org/10.1007/s10639-019-09943-x

Sari, M. H., Susetyo, N., Wardhana, D. E. C., & Kusumaningsih, D. (2020). Understanding the level of students' reading comprehension ability. *Universal Journal of Educational Research*, *8*(5), 1848-1855.

Smail, L., & Mahmoud, G., & Adel, D. (2024). The role of morphological awareness and orthographic awareness in reading comprehension in Arabic: Do reading fluency and working memory count? *Reading Psychology*, 3-44. https://doi.org/10.1080/02702711.2024.2405472

Soleimani, H., & Nabizadeh, F. (2012). The effect of learner constructed, fill in the map concept map technique, and summarizing strategy on Iranian pre-university students' reading comprehension. *English Language Teaching*, *5*(9), 78–87.

Su, F., & Zou, D. (2024a). Group concept mapping strategies for collaborative continuation tasks. *International Journal of Applied Linguistics*, 34(3), 991-1011. https://doi.org/10.1111/ijal.12547

Su, F., & Zou, D. (2024b). A comparative review of technology-assisted and non-technology concept mapping-based language learning. *International Journal of Educational Research Open*, *6*, 100319.

Tabatabaei, O., & Khalili, S. (2014). The effect of concept mapping on Iranian pre-intermediate L2 reading comprehension. *Journal of Language Teaching & Research, 5*(6), 1368–1380.

Tajeddin, Z., & Tabatabaei, S. (2016). Concept mapping as a reading strategy: Does it scaffold comprehension and recall. *The Reading Matrix: An International Online Journal*, *16*(1), 194–208.

Ta, N., & Razali, A. B. (2023). Concept mapping for improving reading comprehension in second language education: A systematic review. *International Journal of Learning, Teaching and Educational Research*, *22*(8), 287-300. https://doi.org/10.26803/ijlter.22.8.16

Trang, P. T. (2017). The effects of concept mapping on EFL students' reading comprehension. *European Journal of English Language Teaching*, *2*(2), 178–203.

Usman, B., Mardatija, R., & Fitriani, S. S. (2017). Using concept mapping to improve reading comprehension. *English Education Journal*, *8*(3), 292–307.

Vekiri, I. (2002). What is the value of graphical displays in learning? *Educational Psychology Review*, *14*, 261–312. https://doi.org/10.1023/A:1016064429161

Wang, W. M., Cheung, C. F., Lee, W. B., Kwok, S. K. (2008). Self-associated concept mapping for representation, elicitation and inference of knowledge. *Knowledge-Based Systems, 21*(1), 52– 61. https://doi.org/10.1016/j.knosys.2006.11.015

Wetzel, C. D., Radtke, P. H., & Stern, H. W. (1993). *Review of the effectiveness of video media in instruction.* Arlington: Office of Naval Research, Navy Personal Research and Development Center.

Wilson, A., & Kim, W. (2016). The effects of concept mapping and academic self-efficacy on mastery goals and reading comprehension achievement. *International Education Studies*, *9*(3), 12–23. doi:10.5539/ies.v9n3p12

[Downloaded from mail.ijreeonline.com on 2026-11-19]

Yen, J. C., Lee, C. Y., & Chen, I. J. (2012). The effects of image-based concept mapping on the learning outcomes and cognitive processes of mobile learners. *British Journal of Educational Technology*, *43*(2), 307-320. doi:10.1111/j.1467-8535.2011.01189.x

Yousofi, N., & Seidi, N. (2015). The impact of concept-mapping technique on EFL reading comprehension: a case study. *International Journal of Language Learning and Applied Linguistics World*, *8*(1), 163–172.

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