Concept Mapping as a Reading Strategy: Does It Scaffold Comprehension and Recall?

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ABSTRACT

Concept maps reflect the linkage of concepts or facts within a text. This study was set out to investigate whether concept mapping as a learning strategy would have any scaffolding effect on the reading comprehension and recall of propositions by L2 learners. Out of 60 high school students, 30 in the experimental group were exposed to concept maps, whereas the other half in the control group read the same texts without concept maps. Both groups took a reading comprehension test in a multiple-choice format and a recall test in which they were asked to write down the propositions they remembered from the texts. Results revealed that the experimental group outperformed the control group both in reading comprehension and in the recall of propositions. These findings suggest that concept maps can be embedded into reading textbooks to facilitate top-down interactions between the reader and the text and to enhance the recall of propositions.

INTRODUCTION

One of the main objectives of foreign language instruction is to enhance learners' ability to read fluently and comprehend a text in the target language. Many L2 learners have problems in reading and comprehending English language texts. It is, therefore, essential to find effective ways of improving their reading skills and comprehension ability. Several factors contribute to a failure of reading comprehension, including lack of motivation, attention, and appropriate reading skills and strategies. Applying good reading strategies is considered a key factor for success in an educational setting as it helps learners understand the learning materials more effectively.

Oxford (1990) states that learning strategies are "specific actions taken by the learner to make learning easier, faster, more enjoyable and more effective" (p. 8). There are different strategies used to improve reading ability of learners such as previewing, skimming, scanning, clustering, predicting, inferring, reviewing, and concept mapping. Concept mapping is a way of showing the main ideas in a text and displaying the relationship between them in a visual manner.

Concepts are usually arranged in a hierarchical order in which the more general and inclusive ones are placed at the top of the map and the more specific and detailed ones are placed at the bottom of the map. Against this backdrop, the purpose of this study was to measure the effect of concept mapping, as a scaffolding strategy, on the reading comprehension and recall of English as a foreign language (EFL) learners. In what follows, the notion of concept maps and research on concept maps will be reviewed.

BACKGROUND

The Notion of Concept Mapping

Concept maps represent a visual form of knowledge to make it meaningful to the learner. Concept mapping is a learning strategy that can be used to improve students' ability to learn autonomously and helps them become independent learners. It can be used as a pre-task, during task, and post-task activity. Meaningful learning is facilitated through concept mapping because it shows the relationship among concepts in a network in a hierarchical form. The advantages of using concept mapping are as follows: (a) being used as advanced organizer to improve learner's achievement (Kommers, 2004); (b) allowing students to think deeply about concepts and to store information more effectively in their memory; (c) being an excellent exercise for the promotion of creative thinking and identification of new problem-solving methods (Cañas, Coffey, Carnot, Feltovich, Feltovich, Hoffman, and Novak (2003); (d) helping students improve their ability to learn autonomously and become independent language learners, (e) helping students organize different concepts and visualize the relationships between the main concepts in a meaningful way; and (f) allowing students to concentrate only on the key concepts and ideas and not to go into the details of the text.

Concept maps can also be used as a cognitive tool to help students organize their knowledge and learning experiences and increase their self-awareness through reflective thinking (Kao, Lin, & Sun, 2008). They consist of nodes, containing a concept or item, usually surrounded by circles or boxes and connecting lines indicating the relationship between them. The words written on linking lines are called linking words or linking phrases, specifying the relationship between the two concepts. In drawing a concept map, the first step is to select the main concepts of a topic and then to place the most general concepts first and the most specific ones last. The combination of two concepts connected with the linking words forms a proposition, which is the smallest unit of meaning. For example, this sentence "The sky is blue" involves the two concepts of "sky" and "blue" and the linking word "is". These two concepts along with the linking words create a proposition. Liu, Chen, and Chang (2010) point out that concept mapping helps learners convert materials into a comprehensible and clear structure and retrieve information effectively. By listing the concepts and drawing connections between them, learners discover the ideas, comprehend the interrelation between concepts, and find out major and minor concepts (Liu et al., 2010).

In educational settings, there are three main concept map techniques according to the degree of pre-structured maps. In *construct-a-map technique*, learners are asked to construct the maps completely by themselves. In this technique, the teacher may provide the concepts or linking words or may ask students to draw a map by themselves. In *fill-in-the-map technique*, students are provided with a concept map where some of the concepts or the linking words have been left out and they have to complete the missing parts of the map. In *expert-map technique*, students are

given completely pre-constructed maps. Novak and Cañas (2008) consider an *expert model of concept map* as one of the most useful techniques to students.

Concept mapping can be created either by hand using a paper-and-pencil or by computer software. Many kinds of computerized concept mapping software, such as Inspiration, EDGE Diagrammer, SemNet, Learning Tool, and IHMC Cmap Tool, have recently been made available. Computerized concept maps make the change of nodes and links easier and facilitate the drawing and modification of the structure (Liu et al., 2010). Moreover, they support easy manipulation, dynamic linking, and storage (Cañas et al, 2003). Chang, Sung, and Chen (2001) argue that constructing a map with computer software is more interesting and easier than constructing it with a paper and pencil. These advantages of combining computer software and concept mapping have been widely accepted by researchers (Chu, Hwang, & Huang, 2010; Chu, Hwang, & Liang, 2014; Liu et al., 2010; Panjaburee, Hwang, Triampo, & Shih, 2010; Sung, 2008).

Theoretical Underpinnings of Concept Mapping

Concept mapping was originally developed in 1972 at Cornell University as a research program by Novak and his colleagues where they attempted to follow and understand changes in children's knowledge of science (Novak & Musonda, 1991). During this program, the researchers interviewed several children and faced difficulty in identifying changes in the children's understanding of science concepts by examining interview transcripts. Since then, Novak and his colleagues have used concept mapping as one of their assessment tools in almost all of their research. Although concept mapping has been primarily used in science contexts, in recent years researchers have pointed out the advantages of concept mapping as a scaffolding strategy in second language context. Although concept mapping has been considered a useful tool for improving students' learning performance and increasing knowledge retention, researchers have pointed out that students, especially young children, might encounter difficulty in developing concept maps at the early stage of learning (Hwang, Kuo, Chen, & Ho, 2014). They might feel frustrated when they are constructing concept maps on their own, and it might decrease their learning motivation (Chang, Sung, & Chen, 2002). Therefore, several alternatives for applying concept mapping in learning activities have been proposed. For instance, to increase students' learning performance and motivation and to reduce cognitive loads, using concept mapping in fill-in-the-blank form is more beneficial than asking students to construct the whole concept map on their own (Liu, 2011).

The theoretical principle of concept mapping is derived from Ausubel's assimilation theory (1963). The fundamental idea in Ausubel's theory is that learning occurs through the assimilation of new concepts into the existing concept possessed by the learner. This knowledge structure as held by a learner is also referred to as the individual's cognitive structure (Novak & Cañas, 2007). In this theory, ideas are connected together in a hierarchical order. It follows that the more specific and detailed concepts are subsumed under the more inclusive and general ones. *Subsumption* is the main idea in Ausubel's learning theory. It helps learners absorb new information into their cognitive structure. Ausubel believes that having an obvious and categorized cognitive structure facilitates the learning and retention of new information.

Ausubel (1968) made the important distinction between two aspects of learning, i.e. rote learning and meaningful learning. According to Ausubel, meaningful learning takes place when learners consciously integrate new knowledge into the relevant concepts that they already possess. In meaningful learning or *subsumption*, learners store new information in long-term memory along with similar and related knowledge in order to remember and understand the new knowledge. Mayer (2003) considers three processes which are essential to fulfill the requirements of

meaningful learning: attending, organizing, and integrating. Learners should concentrate on the relevant and important content, organize the content structurally, and integrate the content into their existing cognitive structure. Novak and Gowin (1984) consider three fundamental requirements for meaningful learning: (a) the learner's relevant prior knowledge, (b) the teacher's construction of meaningful material, and (c) the learner's conscious choice to use meaningful learning. Unlike meaningful learning, rote learning is the process of acquiring material as "discrete and relatively isolated entities that are relatable to cognitive structure only in an arbitrary and verbatim fashion" (Ausubel, 1968, p. 108). In rote learning, there is little or no connection between the new and old information and the new knowledge is stored separated and unrelated from existing information. The information stored in this manner in long-terms memory is difficult to retrieve and will be forgotten easily.

Another theory underpinning concept mapping is the constructivist theory, which supports the use of concept mapping in education. According to this theory, learners bring with them their previous knowledge and personal interpretation of experience to the classroom. The fundamental concept of this theory is that what we know is constructed by our personal experience and we should use this knowledge for problem solving in our environment, so meaning is formed on the basis of our experience. According to this view, meaningful learning takes place when learners are actively engaged in the learning process and integrate feeling, thinking, and acting to build meaning and knowledge (Novak, 1998). Still another theory supporting concept mapping is Paivio's (2006) "dual coding" theory which integrates both nonverbal and verbal information processing. According to this theory, information is processed and stored in memory in two forms: a linguistic form (words or statements) and a nonlinguistic, visual form (mental pictures or physical sensations). It is based on the use of images in associative learning. Verbal learning is most effective when accompanied by visual representation like concept mapping since in this way there are two cognitive processes that support each other (Paivio, 2006).

Research on Concept Maps

Many researchers have pointed out that concept mapping is an effective task for organizing and representing knowledge (DeLauder & Muilenburg, 2012; Hagemans, van der Meij, & de Jong, 2013), reducing learners' cognitive load (Chu et al., 2014; Hwang, Yang, & Wang, 2013; Yang, Hwang, Hung, & Tseng 2013), summarizing information with diagrams (Cornelius-White, Motschnig-Pitrik, & Lux, 2013; Liu & Lee, 2013), and enhancing readers' self-regulation, self-efficacy, and motivation (Chu et al., 2014; Gurlitt & Renkl, 2010; Hwang, Wu, & Kuo, 2013; Khajavi & Ketabi, 2012). Moreover, many studies have been conducted to determine the effect of concept mapping on different language skills. While most studies support the positive effect of concept mapping on language learning (Berkowitz, 1986; Darayseh, 2003; Liu & Chen, 2008; Nobahar, Nemat Tabrizi, & Shaghaghi, 2013; Saqqa, 2006), some of them indicate no significant effect of using concept maps on learning (Chen, 1998; Han, 2006).

Chang et al. (2002) studied the effect of concept mapping on facilitating reading comprehension and summarization. They considered three approaches to concept mapping as map correction, scaffold fading, and map generalization and tried to determine their impact on reading comprehension and summarization ability. The experiment indicated that the map correction method enhanced reading comprehension and summarization abilities and that the scaffold fading method improved the readers' summarization ability.

Darayseh (2003) explored the development of students' English writing and reading ability in a proposed program based on semantic mapping and brainstorming strategies. The findings

showed significant differences between the mean scores of the students in the control and experimental groups. This difference is due to the use of the semantic mapping teaching strategy. In another study, Cañas, Hill, Carff, Suri, Lott, Eskridge et al. (2004) focused on four classes, made up of 112 eighth graders, over a period of one academic year. Two classes were taught through concept mapping with practicing. The other two classes were taught based on regular learning skills. Subsequent to the two types of instruction, the students in the four classes were tested on language mapping comprehension. The results documented the effect of using text concept mapping on reading comprehension. The researchers concluded that text concept mapping is an effective mediator for learning.

Clariana, Koul, and Salehi (2006) conducted a study to evaluate a computer-based approach to scoring concept maps and to describe the concurrent criterion-related validity of these scores. The findings indicated that automatically derived concept map scores can provide relatively easy-to-use and easy-to-interpret measures of students' science content knowledge. In another study, Saqqa (2006) studied the effect of computer-assisted semantic mapping and brainstorming on Jordanian students' reading comprehension and writing in English. The findings revealed that semantic mapping helped the students become very active, read the texts from their textbooks, and then suggest some changes on the first semantic map they drew. From these findings, the researcher recommended that more computer-assisted semantic mapping and brainstorming programs be employed to improve students' reading and writing abilities.

Ghanizadeh (2007) found a positive effect for concept map construction on EFL learners' reading comprehension, as well as on the attitudes toward EFL reading comprehension. The study indicated that as the result of integrating concept mapping technique during reading or post-reading phase, EFL students learned to point out the interrelationships existing in the passage by identifying the main ideas and placing them in circles or boxes and by establishing the connections between ideas and forming propositions. In another study, Pishghadam and Ghanizadeh (2011) studied the issues related to reliability and validity of using concept maps to assess L2 reading comprehension. The findings revealed that concept map can be a reliable and valid instrument for L2 reading assessment, having the potential to measure discourse comprehension and connected understanding.

Liu and Chen (2008) examined the effect of computer-based concept mapping on reading strategies of a group of Taiwanese EFL learners. The results showed that computer-based concept mapping has more reading benefit on the high-level group than on the low-level one. Besides, Marriott, and Torres (2008) investigated the use of concept mapping in developing a student's reading, writing, and oral skills. The result of the study indicated the improvement of the above-mentioned skills. In 2010, Liu et al. investigated the effects of computer-assisted concept mapping learning strategy on reading comprehension of high and low EFL learners. The researchers found that concept mapping strategy had more benefit on the low EFL group than the high EFL group. They concluded that computer-assisted concept mapping strategy improved EFL learners' abilities in using other reading strategies, i.e. listing, enforcing, and reviewing. In a study by Lim, Lee, and Grabowski (2009), they concluded that students in the fully learner-generated map group significantly outperformed the participants in the expert-generated map group. They also found that students with high self-regulated skills significantly outperformed those with low self-regulated skills.

Liu et al. (2010) conducted research on the effect of the computerized concept mapping strategy on reading abilities of poor and good readers. They concluded that concept mapping strategy increases poor readers' reading ability and reduces the difference between the reading

ability of good and poor readers as this strategy helps poor readers to better comprehend the reading materials by transferring the written text into concrete images, hence learners can get the main idea at the first glance. They found that the poor readers gained more reading benefits from this strategy than the good readers. The reason may be that good readers already have their own effective reading strategies.

Chu et al. (2014) investigated the effect of cooperative computerized concept mapping on students' learning performance in web-based information-seeking activities. They used a computerized, cooperative concept-mapping approach as a scaffolding tool to help students in interpreting and organizing data collected in web-based information-seeking activities. To evaluate the effect of this approach, 225 students participated in the study and were divided into two groups: an experimental group, in which the students learned with the proposed approach; and a control group, in which the students learned with the traditional computerized concept-mapping approach. Chu et al. found that the students in the experimental group had significantly better learning attitudes, self-efficacy, and achievements than those in the control group. Moreover, the results showed that the experimental group had lower cognitive load than that of the control group.

It should be noted that research findings on the effects of concept mapping on reading ability are not consistent. According to Chen (1998), concept mapping does not have a significant effect on learners' reading comprehension and summarization. Similarly, in another study, Han (2006) compared the effectiveness of traditional reading instruction and concept mapping reading instruction for Chinese EFL students. Three reading areas of main idea reading, subordinate idea reading, and reading between the lines were examined. Findings showed no significant difference in the three reading areas between the two types of instruction.

PURPOSE OF THE STUDY

The purpose of this study was to determine whether the concept maps accompanying the text have any significant effect on the reading comprehension and recall of EFL learners. Accordingly, the study addressed the following questions:

1. Does the concept map accompanying the text have any significant effect on EFL learners' reading comprehension?
2. Does the concept map accompanying the text have any significant effect on EFL learners' reading recall?

METHOD

Participants

This study was conducted with 60 third-grade high school students who were all female. They had already experienced 5 years of language education at school. The participants were chosen from intact classes. A proficiency test was given to the participants to ensure that there were not any significant differences between the control and experimental groups regarding their language proficiency. Then, they were assigned randomly to the experimental and control groups of 30 participants in each group. While the experimental group received a concept map for the reading task, the control group read the texts accompanied by no concept maps. The students participated in this study on a voluntary basis.

Instruments

In this study four instruments were used: (a) a proficiency test, (b) a reading comprehension test, (c) a recall test, and (d) four concept maps. They are described below:

The Proficiency Test: A proficiency test (Fowler & Coe, 1976), made up of 50 questions in the multiple choice form, was given to the participants to ensure that there were not any significant differences between the control and experimental groups regarding their language abilities. The test was composed of cloze reading passage as well as vocabulary, grammar, and pronunciation sections.

The Reading Comprehension Test: A reading test composed of four passages with 20 items in the multiple-choice form was administered to the two groups. The only difference between two groups was that participants in the experimental group first received the concept map about each passage. Next, they returned the concept map received the passage which was supplemented with the reading comprehension test. However, the passages in the control group were without concept maps and participants in the control group used no concept mapping as a scaffolding device to answer the reading questions.

The Recall Test: After gathering passages and concept maps in the experimental group and the passages without concept maps in the control group, a recall test about main concepts in passages was given to the participants. In the recall test, only main concepts were left out and the two groups had to fill out the blanks according to the passage. The purpose of this test was to determine whether the concept maps accompanying the texts would have any significant effect on the participants' recall of propositions.

The Concept Maps: In this study, there was a concept map for each passage; therefore, there were four concept maps for the four passages. Only the participants in the experimental group were given the concept maps. They received a concept map about each passage before they read it.

Data Collection Procedure

To accomplish the purpose of the study, the following procedure was followed. First, to ensure the homogeneity of the participants, the proficiency test was administered. Once the administration of the test was finished, the mean scores of two groups were compared. The comparison showed that the difference between the means of the experimental and control groups was not significant at the outset of the study. The next step was to validate reading comprehension and recall tests. To this end, the 28-item test of reading and 24-item test of recall were administered to a group of students with characteristics similar to those of the target groups. First of all, item facility (IF) and choice distribution (CD) indices for each item were computed. Too easy and too difficult items were removed. Items with facility values below 0.37 were considered too difficult and items with facility values beyond 0.63 were considered too easy, so they were removed. Therefore, 8 items of the reading comprehension test and 9 items of the recall test were removed; and the rest of the items, 20 reading comprehension items and 15 recall items, functioned as a main criterion to compare the performance of experimental and control groups.

The participants in the experimental group first received a concept map about each passage; then, the concept map was gathered and they received the passage and answered the reading comprehension questions. This process was carried out four times for the four passages. However, in the control group, the participants read the passage; next, they answered the reading comprehension questions. This reading comprehension test was composed of four passages

followed by 20 multiple-choice items. To select the passages, two important points were considered. First, the difficulty levels of the passages were computed. Three passages were selected from the students' textbook to determine their readability level. According to this readability index, four passages were selected. The comparison showed approximate equality of the two readability indices. Second, the passages were all descriptive passages because the concept map technique, due to its nature, is assumed to have the greatest effect on the descriptive texts. Next, the participants were given a recall test after the concept map and the passage had been gathered. This recall test consisted of 15 items about the main concepts of each passage. The participants had to complete the sentences according to the passage.

Data Analysis

The statistical analysis in this study was based on the purpose of the study, i.e. to measure the effect of concept maps accompanying texts on the reading comprehension and recall of propositions. A t-test was applied to show whether there was any significant difference between two groups in their proficiency levels. Another t-test was also applied to determine whether the difference observed between the two groups in reading comprehension and recall test was statistically significant or not.

RESULTS AND DISCUSSION

The purpose of this study was to explore whether concept maps accompanying the text have any significant effect on the reading comprehension and recall of EFL learners. To select the participants and to minimize the individual differences between control and experimental groups, a proficiency test was used to choose a homogeneous sample. In the proficiency test, the control group's mean score was 19.80. As for the experimental group, it was 19.90 (Table 1). The employment of an independent-samples t-test showed that these two groups were not significantly different in terms of language proficiency (t=.83, df=58, p<.05)

Table 1. Control and Experimental Groups' Scores on the Proficiency Test

	GROUP	N	Mean	SD	Std. Error
	Control	30	19.80	6.47	1.18
Proficiency Test	Experimental	30	19.90	5.31	.97

Effect of the Concept Map on Reading Comprehension

The first purpose of the study was to examine the effectiveness of concept maps accompanying the text on reading comprehension. By comparing the two means (Table 2), it was found that the mean of the experimental group (M=11.40) exceeded the mean of the control group (M=9.43). To decide whether the differences were significant, an independent-samples t-test was conducted. The calculation of the t-test showed that the difference in the mean scores of the two groups in the reading comprehension test was significant. The t value of 2.17 was significant at the *p*<.05 level (with df=58). This indicates that the concept maps accompanying the text had a significant effect on the reading comprehension of FFL learners.

Table 2. Control and Experimental Groups' Scores on the Reading Comprehension Test

	GROUPS	N	Mean	Std. Deviation	Std. Error Mean
Reading test	Control	30	9.43	3.39	.61
	Experimental	30	11.40	3.61	.66

Effect of the Concept Map on Reading Recall

The second purpose of the study was to investigate the effect of concept maps accompanying the text on the recall test. As presented in Table 3, the comparison of the two means showed that the mean of the experimental group (M=9.40) exceeded that of the control group (M=5.50). To decide whether the difference was significant, an independent-samples t-test was run. The t-test analysis of the difference between the means yielded the value of 3.711. This was significant at the *p*<.01 level (with df=58). Therefore, the concept maps accompanying the text had a significant effect on the recall of propositions by FFL learners.

Table 3. T-Test for the Difference between Control and Experimental Groups' Scores on the Recall Test

	GROUP	N	Mean	Std. Deviation	Std. Error
Recall test	control group	30	5.50	4.158	.759
	experimental group	30	9.40	3.979	.727

On the whole, the results showed that the concept maps accompanying the texts had a significant effect on both reading comprehension and recall of EFL learners. In other words, providing readers with concept maps about the conceptual structure of the passages might be an important step in scaffolding the comprehension and recall of information from L2 texts.

As the results presented above indicate, the use of concept mapping as a reading strategy helps students better comprehend reading passages and better recall the materials. In other words, if the students have a description or preview of the organization of a text before reading it, they will comprehend and recall it better. The findings from this study confirm those by Liu and Chen (2008) and Khajavaj and Ketabi (2012), who concluded that concept mapping has a positive and significant effect on learners' reading comprehension ability. The findings also lend support to Liu et al.'s (2010) study, which indicated the positive effect of the computer-assisted concept mapping learning strategy on reading comprehension of high and low EFL learners. The researchers also found that low EFL learners benefited concept mapping strategy more than high EFL group. Moreover, they concluded that computer-assisted concept mapping strategy improved EFL learners' abilities in using other reading strategies, i.e. listing, enforcing, and reviewing. On the other hand, the results of the study contradict the findings by Chan (1998) and Han (2006), who found that there is no significant difference between performance of learners in the concept-map group and the traditional group in the reading comprehension test.

The results of this study regarding the differences between concept-map and no-concept-map groups might be explained for in light of the following reasons. The first reason is based on Ausubel's (1961) argument that concept mapping provides the reader with scaffolding which would enhance learning and retention of a related text. This enhancement finds further support from the concept of scaffolding through other-regulation in Vygotsky's sociocultural theory. Due to limited linguistic or discourse competence, readers may not be able to process a text effectively. To enhance processing, scaffolding from teachers or materials, as a source of other-regulation, helps readers have assisted performance to regulate their processing of texts (Lantolf & Thorne, 2006). In this study, concept mapping assisted the group provided with concept maps to facilitate their reading comprehension and recall. The no-concept-map group, by contrast, was deprived of the scaffolding benefit of concept maps and hence had to draw on their existing reading ability.

Another reason might be that the various cohesive ties between the components of the text can be highlighted by drawing different kinds of graphic patterns to show the intended meaning or by utilizing an already developed concept map accompanying a text. This will help learners better comprehend the materials. It also enhances top-down processing and activates learners' background knowledge. Through concept maps, they are provided with a clearer or more detailed illustration of the key concept in the text. This function of concept maps allowed the group receiving concept maps to improve their comprehension and recall.

The third reason concerns the function of concept maps in depicting meaningful relationships between concepts in the form of propositions. A characteristic of concept maps is that the concepts are presented in a hierarchical fashion with the most inclusive and general concepts at the top of the map and the more specific concepts arranged hierarchically below. This is based on the evidence that meaningful learning proceeds most easily when new concepts are subsumed under broader and more inclusive concepts (Novak & Gowin, 1984). A concept map aids students in focusing on the conceptual relationships underlying the content of what they were studying, rather than the sentences and paragraphs used to describe the content. These relationships are key elements to understanding and reveal the intended meaning which will help learners better comprehend the materials. However, they often remain implicit in the text, and thinking about the nature of the links is something students easily overlook without a support tool such as concept mapping. Concept maps, as a result, can depict the information structure of a text, which enhances text processing for comprehension and later recall of propositions from the text.

Besides representing meaningful relationships between concepts, concept maps provide specific examples of events or objects that help clarify the meaning of a given concept (Novak, 1998). As Novak put it, one of the reasons that concept mapping is so powerful for the facilitation of meaningful learning is that it serves as a kind of template to help organize knowledge and structure it. As some of the questions in the reading passages employed in this study required understanding examples and details, the learners in the group provided with concept maps outperformed the other group.

The final reasoning might be that the purpose of concept mapping is the production of visual layout. Visuals (e.g. diagrams, graphs, and maps) can play an important role in learning. Humans are typically visually oriented, and the retention of the information presented in the visual form usually exceeds the retention of information presented verbally (Levie & Lentz, 1982). This can explain the better performance on the recall of the concept-map group, who had access to the visual manifestation of the contents of reading passages.

To sum up, reading comprehension can be improved by three primary cognitive processes: (1) directing the learners' attention to the critical information in the text; (2) directing learners to

build internal connections among ideas found in the text; and (3) building connections between ideas in the text and the learners' existing knowledge. The concept map technique enhances all these three processes by identifying general concepts prior to reading for more specific concepts and by scaffolding the sequencing of learning tasks though progressively more explicit knowledge that can be anchored into developing a conceptual framework.

Conclusion

The result of this study showed that intermediate proficiency learners can benefit from the concept map accompanying the text to improve their reading comprehension and recall of propositions. It might be reasonable to supplement reading materials with concept mapping. As an active reading process, concept mapping stimulates readers to think more deeply about the ideas in the text because they must figure out relationships between ideas and their textual organization. Instructional activities involving concept maps help learners attend to stimuli, access background knowledge, restructure that knowledge, and place the new information into memory. Learners can also use concept maps as a tool for self-assessment. While students construct their maps, it becomes obvious either through the difficulty in construction or the lack of creative links that their knowledge is not sufficiently developed

As the findings from this study imply, a concept map can also be used as a prereading activity in the classroom setting. It helps students keep searching their cognitive structures for relevant concepts and construct propositions among the concepts provided in the text and the concepts they know. The end product of this pre-instruction mapping will be a good conceptual benchmark from which students can construct richer meanings. They can also be used as a postreading activity in the classroom; however, this time the teacher just provides the students with blank concept maps which need to be completed by students. They might help students recall the content of the text later on or take advantage of them to write a summery

The findings of this study lend support to the use of the concept map technique for the development of reading skills (Ojima, 2006; Redford, Thiede, Wiley, & Thomas, 2012). Teachers can provide different concept maps along with the texts. As Craik and Lockhart (1972) argue, the use of concept mapping with a text creates both verbal and nonverbal codes as well as connection between the two, and, therefore, it leads to better comprehension of the text. Moreover, using concept mapping in learning contexts helps students become more self-regulated and independent. Although the teacher explains the features and the way the students construct a map at the early stage of learning this strategy, students gradually become more independent. Concept mapping can also be used as a teaching tool for presenting and highlighting the main points of the lesson in the classrooms. To conclude, materials developers and language teachers need to give more weight to concept mapping.

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