

Comparison of Kit-Build and Scratch-Build Concept Mapping Methods on EFL Reading Comprehension

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Abstract: In generally the reading comprehension is a very difficult task for students in all the stages of study, especially when they are reading text in a foreign language, the EFL reading” (English as foreign language) is one of the most common research topics in the learning field. This study aimed to investigate the effect of teaching EFL reading comprehension to Japanese students through Kit-Build concept mapping (KB-mapping) method. In doing so, we have conducted an experiment to compare the student comprehension with KB-mapping and Scratch-Build Concept Mapping (SB-mapping) Methods. In doing so, a comprehension test and delayed comprehension test (two weeks after using) were used. By comparing the results of the Comprehension Test (CT) scores and the Delayed Comprehension Test scores (DCT) for the both conditions groups, we found that the using of KB-mapping had the same effects of SB-mapping in the understanding the text just after the using, but KB-mapping had better effects in the recalling and remembering the text after a while.

Keywords: Technology-Enhanced Learning, Kit-Build Concept Map System, Reading Comprehension, EFL.

1. Introduction

Reading comprehension is one of the important learning activities, and needs a special ability from the learners to reap its benefits (Alkhateeb & Hirashima 2013). Reading comprehension poses many challenges such as slow reading, insufficient vocabulary comprehension and bad recalling (Alkhateeb & Hirashima 2014). Researchers have always tried to support this learning activity, by proposing methods or strategies. The main goal is to boost the comprehension skills in the target subject area. When they are deployed in a language course, the main aims are to improve student reading comprehension skills and to contribute to the acquisition of the target language (Rayner & Seidenberg 2001).

In this research, we are trying to support this complex learning task by using our KB-mapping method (Sugihara & Hirashima 2012). We have been developing learning tools to help both students and teachers within the learning process. One of these tools is Kit-Build concept map (KB-map). We found it a very useful tool for learning the sciences for the students in mother languages (Sugihara & Hirashima 2012), and we found that this tool yield good results for teachers and students. It should be noted that KB-map is a special kind of concept map and the using of KB-map needs a lot of concentration to recognize the two concepts that can be connected by a relation.

To investigate the effects of using KB-mapping, we designed an experiment where we compared the Scratch Concept mapping method (SC-mapping) for reading comprehension with our KB-mapping method. As known the SC-mapping is a flexible method that may be tailored to fit various types of information, and different skill-levels. As students read an EFL text, SC-mapping helps them learn to pay attention to the essential information within the text.

1.1 EFL Reading Comprehension

'Comprehension' as a concept is defined as "the ability to understand something" in the Oxford Dictionary, the definition of Cambridge Dictionary is "the ability to understand completely and be familiar with a situation, facts, etc."; For the purpose of this research, 'reading comprehension' will be defined as "a learner's ability to understand completely and memorize the important information that is included in the text that he/she is reading". The definition necessarily includes the level of understanding of a text/message. Such an understanding comes from the interaction between the written words and how they trigger knowledge outside the text/message (Sugihara & Hirashima 2012).

The reading comprehension in an EFL context is a special case of reading comprehension; it is highly complex, dynamic, multi-componential and multi-dimensional task in the learning process. We can explain it as multiple interactions between the reader background and knowledge in his Mother Language (ML) and in the Target Language (English). Broadly speaking, the reading comprehension of EFL is the same as the ML reading comprehension but it is slower and less successful than ML reading (Neil Anderson 1999). This can be explained in that the reading process is depending on many factors such as the level of reader's language proficiency, type of text, text difficulty and task demands.

It is a difficult task for students at all stages of study, especially when they are reading texts in a foreign language. Therefore, EFL reading has attracted attention in the teaching and learning field. Many researches came up and proposed methods, techniques and strategies to help students reading abilities. These attempts yielded significant improvements in students' comprehension just after using the proposed methods or the strategies. To mention a few of these methods, there are the Selective Underlining Strategy, Note-Taking Skills Reading (Piola & T.keelllogg 2005) , SQ3R (Survey, Question, Read, Recite, Review) (Huber & Jennifer A. 2004). The most new strategies that proposed to support the reading comprehension task are the Graphic Organizers (GOs) as a reading strategy used both in the teaching and learning of languages. As examples of GOs are Story Maps, matrix, Semantics Maps, Knowledge Maps and scratch concept map (Manoli & Papadopoulou 2012) .

Several investigations of reading comprehension strategies have specifically addressed challenges related to reading expository text. Positive outcomes have been found for students who were taught strategies to help students identify main ideas.

1.2 Scratch concept mapping method

SC-mapping is one of the most newly strategies that used to support the reading comprehension learning task and it gives good effects on EFL student's reading comprehension.

SC-map is visual representations of knowledge which can be employed as a learning strategy by the learners to find the relationship between current knowledge and new information (Salehi & Khodabandehlou 2013). The researches confirmed that the EFL students whom had treatment concept mapping gained high scores in reading comprehension (Salehi & Khodabandehlou 2013). Also there are many studies of students learning English reading through the use of concept maps showed that the concept mapping training or the semantic mapping technique could improve the students' reading comprehension because they could understand the text more easily through the concept map (Phantharakphong & Pothith 2014) (Chularut & DeBacker 2004).

Scratch concept mapping provides students with opportunities to become actively involved in their learning while linking knowledge to long term memory. Through the use of concept maps, students have opportunities to organize their thoughts in a concrete and/or graphic/visual format, while connecting concepts and linking prior knowledge to new knowledge. Related concepts become connected rather than fragmented. Concept maps also provide them with opportunities to think about their own thinking as they reflect on their conceptual understandings. The process of map drawing has a positive impact on student's awareness of the reading process and they can manage to have more control over reading comprehension in English by visually representing what is conveyed in the texts they read (Salehi & Khodabandehlou 2013).

1.3 Purpose of this experiment:

We have been developing learning tools to help both students and teachers in the learning process. One of these tools is KB-map. This tool was used in many fields of learning and we found that this tool has good effects in the reading comprehension of EFL students (Alkhateeb & Hirashima 2013). And it has effects in the remembering and recalling of the comprehended text after a while (Alkhateeb & Hirashima 2013). Also we found it very useful for learning sciences to the students in their mother languages (Sugihara & Hirashima 2012) and some studies suggest that KB-mapping is promising tool to estimate learners' understanding in class-room by using the diagnosis and feedback with the KB-map (Yoshida & Hirashima 2013), (-Funaoi & Hirashima 2012)). It also has good effects for the teachers and students.

Recently there are many researches proposed the scratch concept mapping method as a very effective method to support the EFL student's reading comprehension task, and they found that SC-mapping method is good for comprehend the text and for recalling.

In this research, we are trying to use KB-mapping method to support the reading comprehension of EFL students again by comparing it with the SC-mapping method to confirm the effects of KB-mapping and SC-mapping in the comprehension and recalling of the English text.

2. Kit-Build concept mapping Method

2.1 Overview of Kit-Build Concept Map

KB-map is "a framework to realize automatic diagnosis of concept maps built by learners and to give feedback to their errors in the maps" (Sugihara & Hirashima 2012). KB-map is a special kind of concept map. The creation of concept map consists of two steps: the extraction of the concepts and the relations from the text and the selection of the responsible relation that connects two concepts together. In KB-mapping, the supervisor makes the first step by creating the goal map from text and after that he can generate the kit from the goal map by dividing the goal map to concepts and relations, providing learners with this kit. After that, learners are tasked to build the concept map (called learner's map) by using the concepts and the relations that provided in the kit.

2.2 KB-map System

We have already developed a system based on the KB-map, explained in the previous section. This system is called as "KBmap System". It is a web application with two client systems: "Cmap Editor" and "KBmap Analyzer", and a server system: "KBmap DB". Cmap Editor provides an environment for the teacher, or the supervisor, to make a goal map kit, and for learners to make a learner's map. This system has been implemented by Java (version 1.6). KBmap Analyzer has functions to gather learner maps online, generate a group map and diagnose the maps. This system has been implemented by Flash and it supports Flash Player version 10. KBmap DB has a function to store and share maps. This system was developed by Ruby (version 1.8.7) on Rails (version 1.2.3) and MySQL (version 5.1.30) (Sugihara & Hirashima 2012).

The new version of Cmap editor has the functions to add concepts and relations to the learner's map so we can use it as computerized SC-map editor in addition to the original use to create KB-map from the provided kit, and this version use the Point & Click functionality so the students can use it very simply to create the student's SC-map. Figure 1 shows a part of the Cmap editor with the functional options.

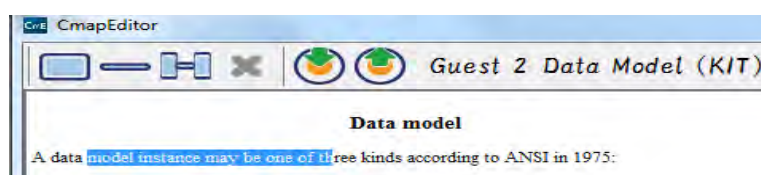


Figure 1. Part of the Cmap editor.

3. Experiment Methodology

Our research investigates the effects of using KB mapping method as a supportive tool for the reading comprehension tasks by comparing them with the effects of using SC-mapping method from two points of view:

1. In the short-term view: we are measuring the understanding of the participants just after using our method, and comparing it with the understanding of other participants who use SC-mapping method with the same conditions.
2. In the long-term view: we are measuring the recalled information of the participants two weeks after using our method, and comparing it with another participants' information who use SC-mapping method with the same conditions.

In this chapter we introduce three points of our experiment: the participants, the outline procedure of whole experiment and the detailed procedure of one session.

3.1 The Participants

The participants of our experiment are 11 Japanese students. They are in 3rd year and studying in the information engineering faculty. Their scores in TOEIC exam ranged from 390 to 730, so they had different reading abilities of English texts. We prepared an aptitude test to check their abilities in the reading comprehension. By using the information of their TOEIC records, the TOEIC reading scores and the aptitude test scores, we grouped them into two groups A (***) is the average TOEIC score) and B (***), which are almost commensurate with the reading ability.

We have done our experiment in 6 sessions and the two groups changed the conditions alternately. Every participant underwent three times the experimental conditions and three times with control conditions.

3.2 Procedure of the whole experiment

We planned to complete this experiment in six sessions of reading comprehension tasks for six different English texts. Firstly we introduced to the participants the strategy of this experiment, the procedure of every session and KB-map system. For the others session we started with the delayed comprehension test of the previous session. After that they did the current session, finally we did questionnaire at the end of the last session of the experiment. During this experiment every group did it with the experimental conditions for three times and with control conditions three times too. We tried to keep the balance between the different texts of this experiment.

3.3 Procedure of the first session:

In the experimental use, we are comparing the effects of using KB-mapping method and the effects of SC-mapping strategy in the reading comprehension process. We are measuring these effects over two stages: just after the using and after a while. We have designed the learning activity in this experiment in a limited period of time to avoid the effects of other supporting strategies. The process of one session, as shown in Figure 1, consisted of four steps:

In the first 10 minutes, both conditions groups were requested to comprehend the whole text by skimming it translating the difficult words in the text using a dictionary. Then, in the next 10 minutes the experimental conditions group was required to build the learner's KB-map of the text by using KB-editor and in the same time the control conditions group was required to build the learner's SC-map of the text by using KB-editor. After that both groups answered the comprehension test within five minutes. Finally, after two weeks both groups answered the delayed comprehension test.

time	Experimental conditions	Control conditions
10 min	Reading the materials (using dictionary is allowed)	
20 min	Making the KB-map by using KB-editor	Making the SC-map by using KB-editor
5 min	Comprehension test (CT)	
5 min	Delayed Comprehension test (DCT) (2 weeks after)	

Figure 2. The procedure of one session.

4. Experimental use

This experiment was done in 6 sessions with two groups of participants (A, B). Both of them had almost the same reading ability. For each group they use the KB-mapping method for 3 sessions and the SC-mapping method for 3 sessions too. In this chapter we introduced three points: the preparation of the used materials, examples of the real materials used in one session of this experiment.

4.1 Materials Preparation

Participants in this experiment were students in 3rd year at the faculty of information engineering, so they were interested in the topics of information engineering. Firstly we selected a text from Wikipedia in the information engineering field and checked it for the grammatical and semantically error. After that we created the corresponding KB-map (Goal map) that covered the main concepts and relations of the text. We prepared the comprehension test. And we checked all of the material again to be sure that materials did not contain any error. Finally we checked if the answers of questions of comprehension test were covered by the KB-map to marking the questions that were not covered.

4.2 Example of experimental material

In this section, we introduce one example of the materials that was used in the third session of our experiment. Figure 3 shows a part of the text that was used as the original text which learners tried to comprehend it. The participants requested to read and comprehend this text within 10 minutes and they had the ability to use online dictionary to translate the complex and unknown words to help them in understanding the whole text.

A language is typed if the specification of every operation defines types of data to which the operation is applicable, with the implication that it is not applicable to other types. In most programming languages, dividing a number by a string has no meaning. Most modern programming languages will therefore reject any program attempting to perform such an operation. In some languages, the meaningless operation will be detected when the program is compiled ("static" type checking), and rejected by the compiler, while in others, it will be detected when the program is run ("dynamic" type checking), resulting in a runtime exception."

Figure 3. Sample of the used text in the third session.

After that, the experimental conditions group tried to build learner's KB-map, within 20 minutes, by using the kit that was provided by the system which generated it from the corresponding goal map. Figure 4 shows the goal map of the text that was prepared by the supervisor. It contains most of the information of the original text; this goal map is divided by the system to generate the kit that is shown in Figure 5. Figure 6 shows one example of the learner's KB-map.

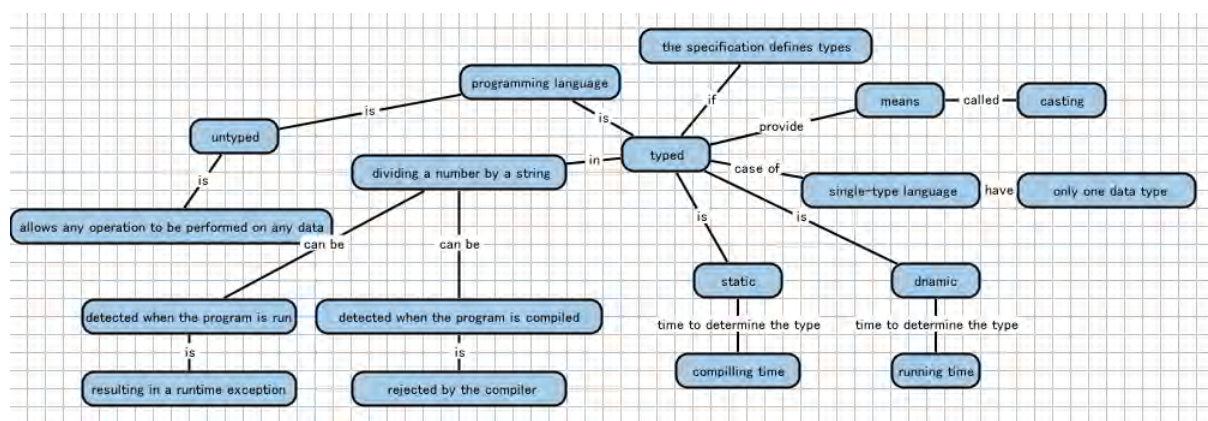


Figure 4. The Goal map of third session.

At the same time, the control conditions group tried to build learner's SC-map within 10 minutes too. The SC-map contains the important information of the text. Figure 7 shows one example of the learner's SC-map of the same text.

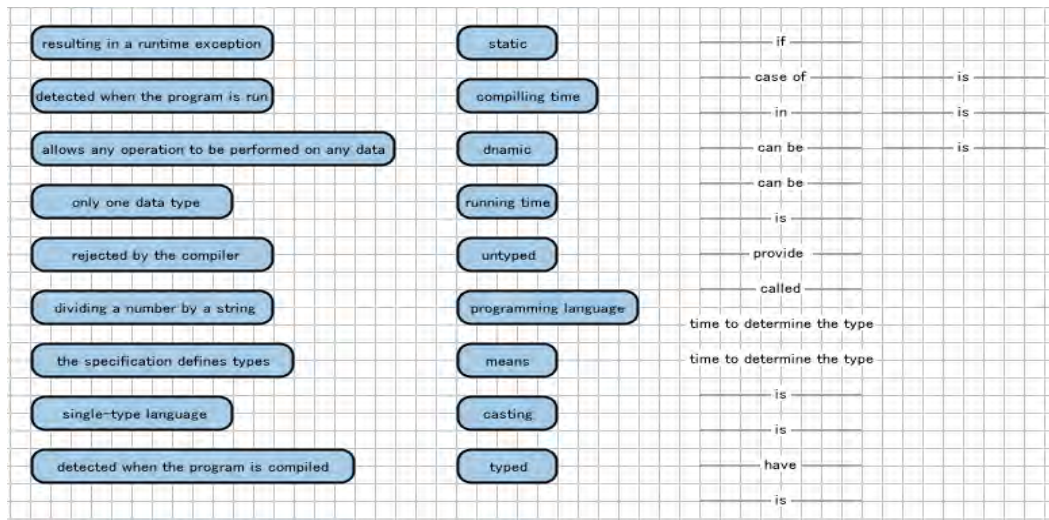


Figure 5. The kit of third session.

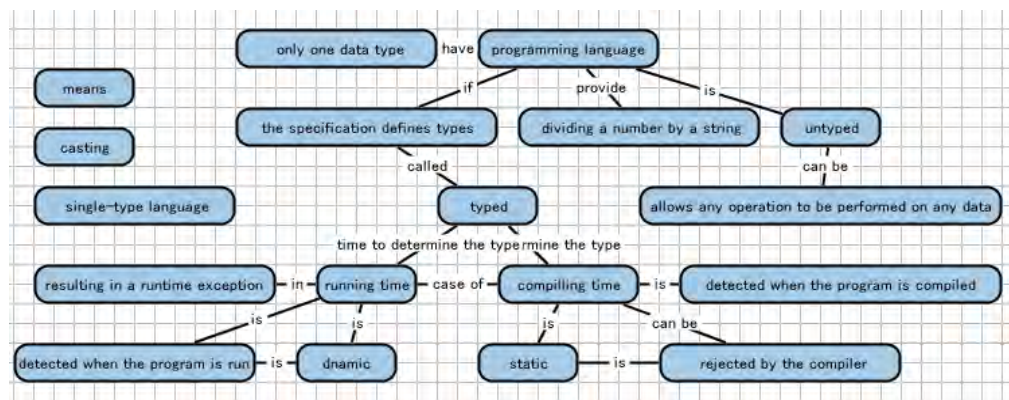


Figure 6. Example of the learner's KB-map.

After that all the participants did the same comprehension test within 5 minutes which is a set of multi-choices questions. All of these questions are asking about information included in the original text, some of them are included in the goal map and some are not, and for the SC-mapping it is the same. Figure 8 shows a part of the comprehension test of this session.

By the end of this test they finished the experimental use of that day and 2 weeks after they did the comprehension test again as a delayed comprehension test.

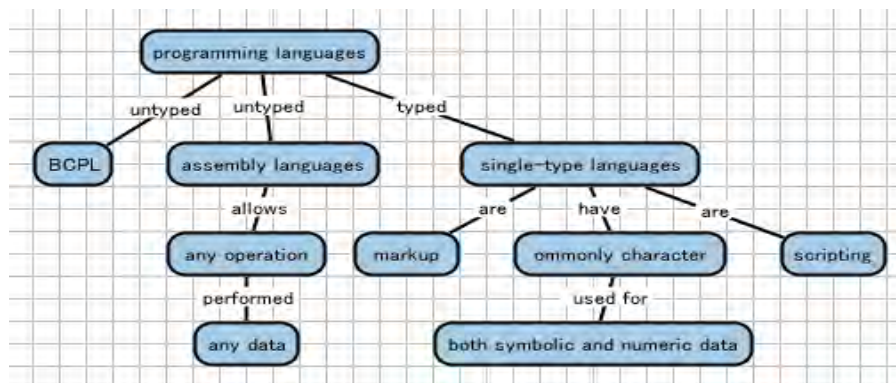


Figure 7. Example of the learner's SC-map.

Q2: with typed languages, if the error of types of data did not discovered in compiling can we discover it?
a. can b. cannot. c. can with conditions d. I don't know.

Q3: In the untyped languages can we do operation with two types of data?
a. can b. cannot. c. can with conditions d. I don't know.

Q4: with untyped languages, if the error of types of data did not discovered in compiling can we discover it?
a. can b. cannot. c. can with conditions d. I don't know.

Figure 8. Samples of the comprehension test.

5. Results:

We performed our experiment with 11 students in 6 sessions. In three sessions we had 5 participants as experimental conditions group and 6 as control conditions group and in the others we had 6 participants as experimental conditions group and 5 as control conditions group. The participants were exchanging the conditions every session.

So we had 33 scores as experimental conditions and 33 scores as control conditions, by analyzing these results we found that the using of KB-mapping method has the same effectiveness of the SC-mapping method for the comprehending of the text just after using the methods (comprehension test), but the KB-mapping method is more effective for recalling the comprehended information from the text after a while (Delayed comprehension test). The detailed results are presented in this section and we are presenting the results of the questionnaire that we did it in the last session.

5.1 Comparing KB-map Conditions group Scores and SC-map Conditions group Scores

By comparing the results of the Comprehension Test (CT) scores and the Delayed Comprehension Test (DCT) for the both conditions groups, we found that, for the Experimental Conditions Group (EC), the average difference between the DCT and the CT is -7.76 and for the Control Conditions group (CC), the average difference between the DCT and the CT is -17.23. We can notice that the differences of the EC group are better than the differences of the CC group for all the sessions of the experiment. And for more confirmation of these results we did more detailed analysis of the delayed CT and the CT scores of the two conditions group. Tables 1,2 shows the results of the T-Test for our results.

➤ For the comprehension test:

By comparing the comprehension test scores of the both conditions groups we found that the total average score of the experimental conditions group is slightly better than the control conditions group average score. For every session we found the same results. Figure 9 shows the average score for every session. For more confirmation of this result we used the statistical test student's TTest. By using the this test we found that there is not a real difference between the CT scores of the two conditions groups but as we see in table 1($P(TTest)=0.191 > 0.05$) that the average score of the EC group is slightly better than the average score of the CC group.

Table 1: the comprehension Test average score.

CT. Scores	Experimental conditions group	Control Conditions group
Mean	85.313	80.323
SD	11.986	16.941
P(TTest)	0.1910	

Table 2: the delayed comprehension Test average score.

DCT. Scores	Experimental conditions group	Control Conditions group
Mean	79.063	66.1293
SD	12.083	20.269
P(TTest)	0.004	

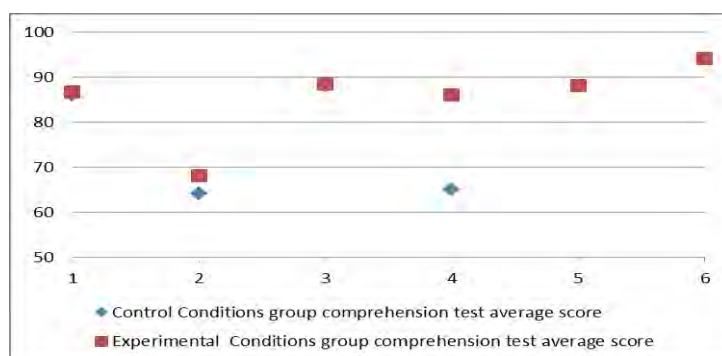


Figure 9. CT Average Scores for Experimental Conditions group and Control Conditions group for each session.

➤ For the Delayed Comprehension test:

By comparing the Delayed comprehension test scores of the both conditions groups we found that the total average score of the experimental conditions group is better than the control conditions group average score. For every session we found the same results. Figure 10 shows the average score for every session. For more confirmation of this result we used the statistical test student's TTest. By using the this test we found that there is a significant difference between the DCT scores of the two conditions groups but as we see in table 2 ($P(TTest)=0.0040 > 0.01$) that the average score of the EC group is better than the average score of the CC group.

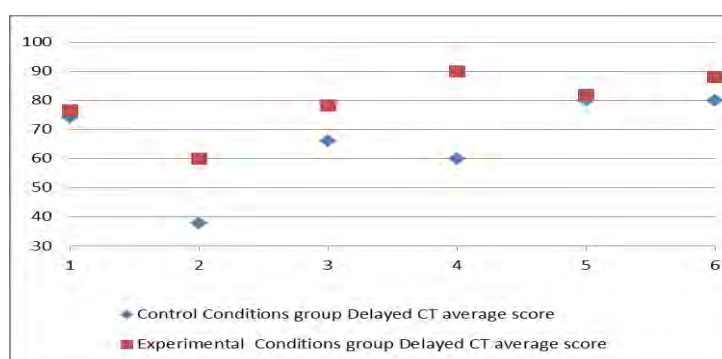


Figure 10. DCT Average Scores for Experimental Conditions group and Control Conditions group for each session.

5.2 The questionnaire results:

After we finished the last session, the participant answered the questionnaire to evaluate the learning method of using KB-mapping and compared it with the SC-mapping method. Table 3 shows the results of this questionnaire.

Questions (1-6, 9&10) are 5 multiple-choices questions that measure the participant's agreement with the mentioned point by the question. The choices used are (A. Strongly agree, B. Agree, C. Natural, D. Disagree and E. Strongly Disagree), and the questions (7&8) are 3 choices questions that compare between the two learning methods. The choices used are (A. KB-mapping, B. Same, C. SC-mapping). To normalize the results of this questionnaire, we tried to summarize all the results of our questionnaire and converted them to arithmetical form that means (1 Strongly Agree, 0.5 Agree, 0 Natural, -0.5 Disagree, and -1 Strongly Disagree). At the same time, it means (1 KB-mapping, 0 same and -1 SC-mapping). As a summarization of the questionnaire evaluation, 0 means the normal, the positive means agreement and the negative means disagree and the value shows the strength of the agreement or the disagreement.

In questions (1&4&7)(2&5)(3&6), participants thought that the KB-mapping method was as useful to understand English text as the SC-mapping. They also said that it was useful to answer the comprehension test just after the learning activity. But they thought that KB-mapping method was more useful to answer the delayed comprehension test two weeks after. Also in questions (8, 9) they thought that the KB-mapping method is easier to carry out, and they like to use KB-mapping method in reading comprehension task but they needed more time to do it.

Table 3: Evaluation of the proposed methods for EFL comprehension.

N	Explanation	Average Agreement
1	Do you think that SB-mapping was useful to understand English text?	0.4
2	Do you think that SB-mapping was useful to answer the test after reading?	0.5
3	Do you think that SB-mapping is useful to answer test two week later?	-0.05
4	Do you think that KB-mapping was useful to understand English text?	0.6
5	Do you think that KB-mapping was useful to answer the test after reading?	0.55
6	Do you think that KB-mapping is useful to answer test two week later?	0.1
7	Which method is more useful to understand English text?	0.6
8	Which method is more difficult to carry out?	-0.6
9	Do you like to use KB-mapping to understand English text?	0.2
10	Do you like to use SB-mapping to understand English text?	0.05

In general, we can say that the participants thought that the using of KB-mapping is similar to the SC-mapping for comprehension test but it was more useful to recalling the information after a while and it was easier to carry out. They liked to use it in reading comprehension task.

5.3 Considerations

The results of this experiment show that the using of KB-mapping method has almost the same efficiency as the using of SC-mapping method for comprehending the English text just after the using (the comprehension test), so we can say that the provided kit by the system has no advantage for the EC group to understanding the text in comparing with the SC-mapping method. But the KB-mapping method has better efficiency for recalling after a while (the delayed comprehension test). We can explain these results as the Using the KB-mapping required concentration in reading the text and the need to read with attention to distinguish the two concepts that could be related and to find the corresponding relation that can connect them together. At the same time, this process required the learner to understand the information in the text deeply and required them to comprehend the text in whole. But for the SC-mapping, the learner can parse the text sentence by sentence to distinguish the important concepts in the sentence and the corresponding relation that connects them in the same time. So we can explain our results by the required high load on the learner memory to comprehend deeply the whole text to complete the student map, this load force the learner's memory to keep most of the information that he has already comprehend.

6. Conclusion and future work:

In this paper, we describe the effects of using KB-Mapping method as a supportive tool for the reading comprehension of English texts as EFL reading.

Overall, from this experiment we can conclude that the using of KB-map as learning supportive tool for reading comprehension is as good as SC-mapping in the short term, but it so better for the long term.

Our next step goal is to generalize the results for larger groups, the research should be extended its time and the study should have been involved more participants at different levels. We are looking to study the effects of using KB-mapping method in the learner's reading comprehension skills and developing more attractive environment to support this special kind of learning activity for enhancing text learning. Even given its limitations, this study has provided many ideas for ways to modify teaching practices. It seems that KB-mapping can help to stimulate and challenge students to look deeper into their reading. The scope of this study was only limited to reading comprehension. It is suggested that in future research the scope should be expanded in terms of other three important skills; writing, speaking and listening. By making the scope wider, the researchers can get a clear view of the utilization of KB-mapping in all aspects.

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