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Concept Maps and Reading Comprehension among EFL Learners

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***Abstract* – This study was set out to find out whether the application of concept maps have any significant effect on the reading comprehension of Iranian EFL learners. Accordingly, the following null hypothesis was stated: The application of concept map does not have any significance impact on the reading comprehension of Iranian EFL learners. The students participating in this study were 60 university students. In order to ensure the homogeneity of the participants, a Nelson test was administered. Of the 60 subjects, 30 were exposed to the concept maps as the experimental group, and the other half only read the same texts without concept maps. Both groups had to complete reading comprehension tests after reading each text. Five passages were administered during the study. The statistical procedure used to describe the data and to test the null hypothesis was a t-test. Therefore; the t-test was applied to show that there was no significant difference between two groups' in their proficiency levels and to determine whether the difference observed between the two groups in reading comprehension test was statistically significant or not.**

***Keywords* – Concept Maps, Reading Comprehension, EFL Learners.**

I. INTRODUCTION

1.1 Statement of the Problem

Reading for meaning is a communicative process and involves mental processes similar to those of the other three language skills, that is, activation of relevant knowledge and related language skills to exchange information. Reading comprehension requires motivation, mental framework for holding ideas, concentration and good reading strategies. So applying good reading strategies would help the learners understand the learning materials in a more efficient way. Previewing, skimming, scanning, clustering, predicting, inferring, reviewing and concept mapping ate some of these strategies. Concept maps are visual representations of knowledge and pictures of conceptual relationship that show the main ideas and more inclusive concepts at the top of the map and the specific ideas and more concrete ones at the bottom. They reflect linkage of concepts or facts within a passage and help students generate questions about the content and understand the relationships between concepts better. There are numerous theoretical reasons why concept maps are good learning strategies. Fisher, Wanderce & Wideman (2000) presents three of them:

1. Chunking of information. A concept map provides not only a coherent graphic representation about a group of concepts, but also a manageable chunk of information, which is easily assimilated.
2. Dual-coding theory. A concept map presents a visual image as well as verbal information and, therefore, presumably taps into this dual-coding system.
3. Making relations among ideas explicit. A concept map makes relation between concepts and ideas explicit. These links often remain implicit in the text, and the students easily overlook them. A lot of studies were conducted to, see whether the employment of concept maps has any significance impact on learning or not. In a study done by Nunari (1999), the use of a concept mapping technique had a positive effect on the listening comprehension of students. Anderson-Inmann & Ditson (1999) found that students with learning disabilities prefer concept mapping to any other form of note taking because of its visual natures. The majority of studies show that concept mapping has a positive effect on learning, and some of them reveal that there is no relationship between the employment of concept maps and students' learning. The purpose of this study was to determine whether the application of concept maps has any significant effect on reading comprehension of Iranian EFL learners or not.

1.2 Significance of the Study

"Reading is an important activity in any language class, not only as a source of information arid a pleasurable activity, but also as a means of consolidating and extending ones knowledge of the language" (Rivers, 1986, p.259). Being able to read in a foreign language is considered to be one of the most important objectives of instruction in a foreign language. But, unfortunately, most of the learners have serious problems in reading a foreign language. Since much of school learning involves reading texts, it is important to find ways and factors which increase the probability of student's improvement. Second language teachers try to understand the processes involved in the reading of a written text. They, then, plan reading techniques to help their students develop habits of reading which lead them to better comprehension of the text. The concept-map technique is one of them. This technique is useful for students' reading comprehension in different ways. Concept maps can help learners (Novak, 2001):

1. Identify what they already know about a topic,
2. Enhance meaningful learning,
3. Elicit deep processing of knowledge,
4. Locate and remember key factors and ideas,
5. Introduce and rearrange text information,
6. Summarize text units,
7. View information as a meaningful whole, and
8. Make inter-relationships among ideas explicit.

1.3 Research Question and Hypothesis

This research addressed the following question:

Does application of concept map have any significant

effect on the reading comprehension of Iranian EFL learners?

In order to investigate the research questions empirically, the following null hypothesis was stated:

1. The application of concept map does not have any significance effect on the reading comprehension of Iranian EFL learners.

1.4 Limitation of the Study

The limitations of this study are as follows:

1. The researcher had to narrow down the scope of the study to only language Learners in one city, i.e. Andimeshk.
2. The number of participants in the experimental and control groups was limited.
3. Only seventy students participated in the study.
4. The participants had registered forthe English reading comprehension course at Islamic Azad University, Andimeshk branch.
5. The concept map technique was considered only with respect to reading comprehension.

II. Review of the Related Literature

2.1 Concept Maps

Concept maps are sometimes referred to as graphic organizers, knowledge maps, story maps, cognitive organizers, advance organizers, or concept diagrams (Hall & Strangman, 2001). Concept mapping was first used in Novak and his colleague's research programs at Cornell University (1984) to evaluate growth in children's understanding of scientific concepts as a result of audio-tutorial instruction. A concept map is a graph consisting of nodes and labeled lines (Figure 2.1). The nodes correspond to important concepts in it domain (Novak 1984, p.4) defines concept as "a perceived regularity in events or objects, or records of events or objects, designated by a label." For example, "chair" is the label we use to designate an object with legs, a seat, and a back that is used for sitting on. The lines denote a relation between a pair of concepts, and the label on the line tells how the two concepts are related. Relationships included on a concept map are usually of two kinds: propositions and examples (Anderson-Inman & Ditson, 1999).

A proposition is the basic unit of meaning in a concept map and the smallest unit that can be used to judge the validity of the relationship drawn between two concepts (Shavelson 1998). In other word, propositions contain two or more concepts connected with other words to form a meaningful statement. Sometimes these are called semantic units or units of meaning (Novak, 2001). An example is a specific type of relationship in which one of the linked concepts is an/example of the other (Anderson-Inman & Ditson, 1999) .Therefore, concept maps are intended to represent meaningful relationships between concepts in the form of propositions. For example, "sky is blue" would represent a simple concept map forming a valid proposition about the concepts "sky" and "blue" (Novak & Gowin, 1984, p.1S) .

The purpose of concept mapping is not the production of a map which represents in absolute terms the relationships between concepts, but the production of a "visual layout," which can make that specific issue c1earetand certainly more understandable-to the learner who produced the map (Cicognani, 2000, p.22). Fisher et al. (2000, p.4) believe that a map typically includes "the most important concepts" in a topic usually expressed as noun-centered ideas. The concepts are drawn in boxes, ovals, or circles and are linked to one another by lines labeled with named relations, usually represented by verb or prepositional phrases. Another characteristic of concept maps is that the concepts are represented in a hierarchical fashion with the most inclusive, most general concepts at the top of the map and the more specific, less general concepts arranged hierarchically below, because meaningful learning proceeds most easily when new concepts or concept meaning are subsumed under broader, more inclusive concepts (Novak & Gowin, 1984). The hierarchical structure for a particular domain of knowledge also depends on the context in which that knowledge is being applied or considered. For different learning segments, the super ordinate-subordinate relationships of concepts will change (Novak & Gowin, 1984). Therefore, it is best to construct concept maps with reference to some particular questions we seek to answer or some situations or events that we are trying to understand through the organization of knowledge in the form of a concept map. Another important characteristic of concept maps is the inclusion of "cross-links.': (Novak, 2001) These are relationships between concepts in different domains of the concept map. Cross-links help us to see how some domains of knowledge represented on the map are related to each other. In the creation of new knowledge, cross-links often represent creative leaps on the part of the knowledge producer. The final feature that may be added to concept maps is the specific examples of events or objects that help to clarify the meaning of a given concept (Novak, 2001).

2.2 The Theory Underlying Concept Maps

One of the important advances in our understanding of learning is that the human memory is not a single "vessel" to be filled, but rather a complex set of interrelated memory systems: sensory memory, short-term memory, and long-term memory. While all memory systems are interdependent, the most critical memory system for incorporating knowledge into long-term memory is the short-term or "working memory." All incoming information is organized and processed in the working memory by interaction with knowledge in long-term memory. The limiting feature here is that working memory can process only a relatively small number of psychological units at anyone moment. This means that relationships among two or three concepts are about the limit of working memory processing capacity. Therefore, to structure large bodies of knowledge requires an orderly sequence of interactions between working memory and long-term memory as new knowledge is being received. Novak (2001) believes 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. Concept mapping is

based on the learning psychology of Ausubel (1963). The fundamental Idea in Ausubnel's cognitive psychology is that learning takes place by the assimilation of new concepts and propositions into existing concept propositional frameworks held by the learner (Novak & Gowin, 1984).

In addition to the distinction between the discovery learning process, where the attributes of concepts are identified autonomously by the learner, and the reception learning process, where attributes of concepts are described using language and transmitted to the learner, Ausubel (1963) made the very important distinction between rote learning and meaningful learning. He stressed that meaningful learning require three conditions:

1. The material to be learned must be conceptually clear and presented with language and examples relatable to the learner's prior knowledge. Concept maps can be helpful to meet this condition, both by identifying general concepts prior to instruction in more specific concepts, and by assisting in the sequencing of learning tasks though progressively more explicit knowledge that can be anchored into developing conceptual frameworks.
2. The learner must possess relevant prior knowledge. This condition is easily met after age 3 for virtually any domain of subject matter.
3. The learner must choose to learn meaningfully. The one condition over, which the teacher has, only indirect control is the motivation of students to choose to learn by attempting to incorporate new meanings into their prior knowledge, rather than simply memorizing concept definitions or propositional statements.

2.3 Findings of Research on Concept map

In the recent two decays, concept maps have been widely used both to promote and to measure meaningful learning in various disciplines. Although reading is by far the -most well studied application, science, teaching, social studies, language arts, and math are additional content areas that are represented in the research base on concept maps (Hall &Strangman, 2001).It also has been applied in a range of contexts such as teacher education (Papajohn, 2002), evaluation of students' misconceptions, and conceptual change (Novak & Gowin 1984). Two of the most common uses of concept maps at all educational levels are the enhancement of learning and measurement of knowledge structures. Concept map researchers, along with other learning theorists, suggest that adequate understanding in a content area requires knowledge of the relationships among important concepts. Concept maps provide a visual representation of knowledge structure, and the quality of a ' constructed concept map reflects how well the mapper understands a particular topic. Research has provided evidence for a relationship between concept maps and achievement. Numerous studies have demonstrated that students who construct concept maps have higher achievement on measures of learning than students who do not use concept maps (Novak & Gowin, 1984; Nunan, 1999; Joseph, 2000; Saeedi, 2001). In a study done by Nunan (1999), the use of a concept mapping technique had a positive effect on the listening comprehension of students. In his study students were put into one of three groups, and asked to listen to an interview. Only the third group was required to complete a concept map. The study showed that the additional depth of processing required by third group resulted in superior comprehension. In another study done by Saeedi (2001), the use of a concept mapping techniques had a positive effect on the reading comprehension of university students. In his study, students were put into two classes. The first class was required to read a passage and answer the comprehension tests, but the second class was required to complete a concept map before answering the comprehension tests. The study showed the positive effects of the concept mapping on the comprehension of the readers. In science education, concept mapping has been widely recommended and used in a variety of ways. It has been used to help teachers and students build an organized knowledge base in a given discipline or on a given topic (Joseph, 2000). It has been used to observe changes in students' understanding of concepts over time (Novak & Gowin, 1984) and to reveal unique thought processes. It has been used in the development of science curriculum and the evaluation of instructional activities for promoting conceptual understanding. It has been used to promote positive self-concepts, positive attitudes toward science and increased responsibility for learning. The use of concept maps, as an assessment tool of academic achievement is an important recent application (Novak, 2001). Although there is a general consensus in favor of the use o~ concept maps in the classroom to facilitate learning, there is some disparity as to whether concept maps should be used as an evaluative technique. While some researchers believe that the use of a concept map in evaluating the level of understanding of the student is more effective than standardized testing, others believe that the concept map should be used strictly as a teaching device due the difficulties that arrive when a concept map is to be assessed for work quality and understanding and given an appropriate grade. With all these evidences from studies, concept mapping is a very powerful mechanism in promoting students meaningful learning to enhance their achievement and performance. More study must be taken to know how we can use this mechanism easily and usefully to the classroom.

III. METHODOLOGY

In many parts of the world, reading in a foreign language is important for academic studies. Since much of school learning involves reading texts, it is important to find ways and factors which improve students' reading comprehension. As indicated earlier, the purpose of this study was to determine whether the application of concept maps has any significant effect on the reading comprehension of Iranian EFL learners. This chapter aims at the explanation and justification of all the procedural steps taken by the researcher throughout the course of this study.

3.1 Participants

This study was conducted with 70university students at Islamic Azad university of Andimeshk, Iran. Theage of the

participants ranged from 18 to 22 years. They wererandomly assigned to either experimental or control group of 35 each. They were 38 females and 32 males.

3.2 Instruments

In this study the following instruments were used:

A. a proficiency test,

B. a reading comprehension test,

D. concept maps

3.2.1 The proficiency test

The Nelson test was given to the participants in order to ensure the homogeneity of control and experimental groups regarding their general language abilities. The proficiency test was composed of 50 questions in the multiple-choice form from Nelson Book (see Appendix A). Then, participants were divided randomly to the experimental and control groups.

3.2.2 The reading comprehension test

The reading comprehension test was composed of 5 passages selected from TOEFL practice tests (Pyle, 2001). The test was piloted by a group of 10 university students who had signed up for reading comprehension course and had the same proficiency level as the main subject of the study.

Based on the results of pilot study, five difficult items were excluded. The final version of the reading comprehension test which was employed for the main study had 22 multiple-choice items. The reliability index of the reading test was (r= 0.80).

3.2.3 The concept maps

In this study, participants in the experimental group received a concept map for each passage; therefore, there were five concept maps for five passages.

3.3 Data Collection Procedures

Prior to conducting the research, consent letter from administrators of university was obtained and all students were informed that participation in the study was voluntary and they also signed the consent letter for participation in the study.

Proficiency test was administered to 90university students in order to choose a homogeneous sample among them. From this sample, 75 students whose scores fell between one standard deviation above and below the mean were chosen as the main participants and randomly assigned to control and experimental groups of 35 each and extreme scores excluded from the study.

In the next session, the participants in the experimental group were received concept mapping along with reading comprehension test (as a while reading activity) but those in the control group received only reading comprehension and they were not provided with concept maps.

3.4 Data Analysis

The analysis of the data was carried out using descriptive statistics (mean and standard deviation) and inferential statistics. T test was conducted to investigate the hypothesis

IV. Results and Discussion

As mentioned earlier the purpose of this paper was to investigate the effect of concept mapping on Iranian university student's reading comprehension. As a result, the following hypotheses were stated:

1. The application of concept maps do not have any significant effect on the reading comprehension of Iranian EFL learners.

To ensure the homogeneity of participants in both control and experimental groups, t-test was conducted.The following table shows the descriptive analysis of the Nelson test.

In the Nelson test the Experimental group's mean score and standard deviation were respectively 24.914, 7.285. And for control group, they were respectively 25.142, 5.971 (Table 4.1). As table shows, the mean of control group in Nelson test exceeds the mean of experimental group.

To see whether the difference in the mean of experimental and control groups in Nelson test was statistically significant; a t-test was performed. As the result of the t-test showed the calculated Sig. (2-tailed) = 0.886 exceeded the p-value (.05), so the proficiency test of these two groups were not significantly different (Table 2).

Table 4.1: Descriptive statistics of the Nelson test

	Group	N	Mean	Std. Deviation	Std. Error Mean
Nelson test	Experimental group	35	24.914	7.285	1.231
	Control group	35	25.142	5.971	1.009

Table 4.2: t-test for Nelson test

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig	T	df	Sig (2-tailed)
Nelson test	Equal variances assumed	1.252	.267	-.144	68	.886
	Equal variances not assumed			-.144	65.475	.886

After ensuring the homogeneity of the experimental and control groups, the participants in both groups were given the reading test; the experimental group received a concept map as a while reading activity along with each passage. Then they answered the reading questions. However, the control group had no concept mapping as visual aids while they read the passages. In order to test the effect of concept maps on reading comprehension, a t-test was conducted between the scores gained by the experimental group and the control group. The results showed whether

the differences were significant or not and whether the null-hypothesis was rejected or confirmed.

In the Reading test the experimental group's mean score and standard deviations were respectively 14.028, 2.781. And for control groups were respectively 10.885 and 2,482. Comparing the two means, the researcher found that the mean of the experimental group (14.028) exceeded the mean of the control group (10.885). The calculation of t-test showed that there was a significant difference between experimental and control group in reading test. As seen in table 4.5, the calculated Sig. (2-tailed) = 0.000 was less than the p-value (.05), so the mean scores of two groups in reading test were significantly different and the null hypothesis was rejected. (Table 4.4).Therefore, application of concept maps has a significant effect on the reading comprehension of Iranian universitystudents. Table 4.3 and 4.4 show the results:

Table 4.3: Scores on the reading test

	Group	N	Mean	Std. Deviation	Std. Error Mean
Nelson test	Experimental group	35	14.028	2.781	.470
	Control group	35	10.885	2.482	.419

Table 4.4: t-test for Nelson test

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig	t	df	Sig (2-tailed)
Reading test	Equal variances assumed	1.131	.291	4.988	68	.000
	Equal variances not assumed			4.988	67.142	.000

V. Discussion

As the results presented above indicate, the hypothesis were rejected and we come to this conclusion that the use of concept mapping as a while reading activity helps students better comprehend reading passages. The finding of this study, as the differences found between the two groups were statistically significant, might be accounted for by resorting to the following explanations.

The outperformance of the experimental group to control group can be attributed to application of the concept mapping which is a visual representation of knowledge. Visual representation through concept mapping has several advantages:

- Visual symbols are quickly and easily recognized;
- Minimum use of text makes it easy to scan for a word, phrase, or the general idea; and
- Visual representation allows for development of a holistic understanding that words alone cannot convey.

For the learner, concept maps help make evident the key concepts or propositions to be learned, and also suggest linkages between the new knowledge and what he or she already knows. For the teacher, concept maps can be used to determine pathways for organizing meanings and for negotiating meanings with students, as well as pointing out student's misconceptions, because concept maps are externalized representations of the learner's knowledge. Concept maps consistently provide excellent opportunities for teachers to discover how and what students are thinking and to help students clarify their thinking and communication skills (Anderson-Inman & Ditson, 1999). Moreover, during the concept mapping process, teachers will have the opportunity to identify and reduce ambiguities, enabling them to deliver clearer and more coherent explanations to students (Chau, 1998). Concept mapping can be used for several purposes:

- To generate ideas (brainstorming);
- To design complex structures (long texts, hypermedia, large web sites);
- To communicate complex ideas;
- To aid learning by explicitly integrating new and old knowledge; and
- To assess understanding or diagnose misunderstanding.

The benefits of using concept map for the students with disabilities in reading and writing are as follows:

- Bridging the gap between information,
- Simplifying the information,
- Viewing important relationship,
- Viewing text as a sequence of relationships from one paragraph to the next.

The concept maps used in this study help us illustrate the semantic relations in the text. The assumption is that these nodes, lines, etc., may facilitate cognitive processing and help retention of the materials. So, it might be reasonable to supplement reading materials with concept maps. The teachers can easily provide every reading passage with a concept maps whether by supplementing each text by the concept map or drawing it on the board.

VI. Conclusion

Studies have shown that the deficiency to read in a foreign language is, to a great extent, due to the · inappropriate application of reading strategies; therefore, strategy training is effective in enhancing EFL reading. Nunan (1999) presents different reading strategies. Previewing, skimming, scanning clustering, predicating, inferring, evaluating, reviewing, and concept mapping are some of these reading strategies. As mentioned before, the purpose of this study was to investigate the effectiveness of one of these reading strategies, called concept mapping. The present study was an attempt to figure out whether the application of concept maps has any significant effect on the reading comprehension of Iranian EFL learners or not.

As a result, the following questions were raised:

1. Does the application of concept maps have any significant effect on the reading comprehension of Iranian EFL learners?

In order to investigate the research questions empirically, the following null hypotheses were stated:

1. The application of concept maps does not have any significant effect on the reading comprehension of Iranian EFL learners.

The results of this study showed that the null hypothesis was rejected because p-value (0.000) was less than 0.05 at 68 degree of freedom, so concept maps accompanying the text have significant effect on the reading comprehension of Iranian EFL learners. Therefore, it was concluded that the application of concept maps has significant effect on the reading comprehension of Iranian EFL learners.

Concept mapping can be used for several purposes:

1. to generate ideas;
2. to design complex structure;
3. to communicate complex ideas;
4. to aid learning by explicitly integrating new and old knowledge; and
5. to assess understanding or diagnose misunderstanding

On the other hand, visual presentation of knowledge has several advantages:

1. They are quickly and easily organized.
2. Minimum use of text makes it easy to scan for a word, phrase, or the general idea.
3. It allows for development of a holistic understanding that words alone cannot convey.

As for pedagogical implications, Mayer (1994) mentioned several advantages for visual aids. First, if graphical representations allow for the creation of a context for speaking, they can certainly be effective. Second, by setting such meaningful learning activities as problem solving and task-based learning, as the goal of instruction, the teacher will see the use of concept mapping can be most effective. Third, it is important to ask students to brainstorm some words related to the topic of conversation. This brings active involvement in the conversation class. Finally variety in class activity can be achieved through the use ofconcept mapping when strictness and formality of language learning classrooms is removed. The results of this study may furnish teachers and students with empirical evidence that concept mapping plays a rolein the process of enhancing readingability of language learners.

Suggestion for Further Research

Based on the findings of this study the following topics can be suggested for further research.

a) The participants of this study were university students; another study can be conducted to determine the impact of concept maps on different age groups. Therefore, it may be the case that if this research were conducted with younger or older students, different results would come up.

b) The participants of this study were both female and male students; another study can be conducted to control gender variable.

c) This study focused on the effect of concept mapping on reading comprehension. Another line of research can be pursued on the effect of concept mapping on listening and writing abilities.

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