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IMPROVING READING COMPREHENSION BY USING COMPUTER-BASED CONCEPT MAPS: A CASE STUDY OF ESP STUDENTS AT UMM-ALQURA UNIVERSITY

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ABSTRACT: *This study aims to investigate the impact of using a computer-based concept mapping technique on a group of pre-medical Saudi students' reading comprehension. These students were registered for an ESP course during the second term of the academic year 2013-14.Twenty-five male subjects were engaged in this experiment which lasted for seven weeks. Participants completed a five-week training period on how to manipulate CMapTools software to generate concept maps to aid their reading comprehension. The findings indicate that using computer-generated concept maps as a learning strategy has a positive impact on students' reading comprehension level. It is found the students' mean score in a reading comprehension test has increased from (11.04) to reach (15.64) after they have completed their five-week training period to restructure their reading texts. The students have also shown very positive views towards this technique and report that it has made their reading process more tangible and interesting. They even claim the possibility of using this technique to facilitate learning other language skills and not only reading. These results verify the efficacy of this technique and the researcher recommends its application in Saudi institutions.*

KEYWORDS: concept maps, reading comprehension, background knowledge, cognitive load, MapTool.

INTRODUCTION

In this era of globalization, English has become the most dominant language used for international communication. It is widely used in a variety of fields and for a variety of purposes. It is the language most widely used in education, commerce, tourism and international debates. It is the language of much of modern sciences and technology. Indeed, a considerable amount of the world's scientific literature is written in English. Allen and Widdowson (1974) state that:

> *Every piece of knowledge is made available in English. Without knowledge of English, a man or a woman starting a new career is gravely handicapped. With knowledge of English he or she holds the key which opens many doors (P.1).*

Hence, the need for learning English and mastering its different skills, and particularly reading, is clearly justified. In the academic arena, which is the focus of this study, reading is rated as the most essential skill (Silver & Freed, 2002). Certainly if one considers the teaching of English around the world, he/she will find that reading is the main reason why many students, across the world, study this language.

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In many parts of the globe including the Arab countries, English is widely endorsed as a medium for teaching sciences, medicine, engineering and technology at tertiary level. In this case, students need to read extensively and comprehend material relevant to their specialization written in English. Here it becomes obvious that without a solid reading proficiency, these learners cannot hope to continue their studies.

Unfortunately, many foreign English language learners face a considerable difficultly in mastering the reading skill. Askov (1991) reports that reading is a complex skill that presents challenges for both teachers and learners. These challenges include, but not limited to, the mismatch between the written and spoken form, the length of words and sentences in written texts and the specialized vocabulary (terminology borrowed from Greek or Latin) which is commonly encountered in scientific texts. These are some of the key problems that render reading academic texts in English a cumbersome task.

In English for Academic Purposes (EAP) or English for Specific Purposes (ESP), students usually read authentic material relevant to their designated fields of specializations. Authenticity of such reading materials presents another challenge to foreign English language learners as no concessions are made to these students who come across non-simplified content (Harmer, 2001). Such authentic material could be quite de-motivating for students and it may impede their progress and jeopardize their future success. This is exactly the case of so many pre-medical students in the colleges of medicine and medical sciences at Umm Al-Qura University in KSA who find reading materials pertinent to their specialization quite hard to cope with.

Fortunately, over the past two decades or so, a substantial body of research on teaching reading comprehension strategies has been conducted. Such research has revealed very promising results. It has been clearly demonstrated that spatial learning strategies such as concept mapping and graphic organizers are found to be quite effective strategies that can be utilized by second language learners for successfully extracting, remembering and retrieving information from academic textbooks (Hashemain, Jan, & Narak, 2014; Dias, 2011; Novak 2006; Smith, 2010;and Gill, 2007).

Statement of the problem

Based on a fairly long experience of teaching reading at Umm-Al-Qura University in the Kingdom of Saudi Arabia, the researcher observes that a considerable number of his students have a low reading proficiency and that the students use a very limited number of reading strategies. For instance, they tend to place more focus on surface aspects of reading, and they use unsuccessful comprehension strategies. They rarely involve background knowledge and they have extremely limited vocabulary. Furthermore, these students usually fail to link new information with prior knowledge and hence fail to comprehend what they read.

Objectives of the study

This study aims to find a method that can be used to promote the level of students' reading proficiency and to increase their comprehension of what they read. It is also hoped that this method would motivate the students and help them to develop some positive attitudes towards reading.

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Questions of the study

This research intends to answer two main questions, these are:

1-What is the impact of using a computer-based concept mapping technique on the level of Saudi students' reading comprehension?

2- How do the subjects of this study view a computer-based concept mapping technique as a tool to support reading comprehension?

LITERATURE REVIEW

Theoretical issues

Reading comprehension is a process of constructing meaning from a text. It involves the complex coordination of several processes, including "decoding, word recognition and fluency, along with the integration of background knowledge and previous experience "(Klinger & Geisler, 2008, p.65). Nunan (2003) claims that reading comprehension is a fluent process of combining information extracted from the text with the existing schemata to understand the meaning. In this case, comprehension stands as the primary purpose of reading. However, students may, sometimes, fail to attain comprehension. This happens when the student does not possess suitable strategies for reading comprehension or when he/she does not know when or how to use a strategy possessed. (Gerstein, William, Fuchs & Baker, 2011).

Richardson (1997) explains that reading comprehension is a result of using effective reading strategies. Effective use of strategies, he says, enhances cognitive skills such as attention, auditory analysis, sound blending, sound segmenting, memory processing, speed and visualization.Concept mapping is one of these strategies which is found to be very effective in promoting reading comprehension. Dias (2011) describes concept mapping as a useful technique for studying content, developing various language skills including reading comprehension and critical thinking.

What is concept mapping?

A concept map is a graphic tool for organizing and representing knowledge. It is used to classify information into a graphic form, create a visual representation of the concepts within the text, highlight the relationships between them and the text structure (Strum & Rankin – Erickson, 2002). A concept map normally includes concepts enclosed in circles or in boxes of different kinds. Lines and arrows are commonly implemented with words upon them to identify the relationships between concepts and propositions. The label for most concepts is a word, yet sometimes symbols are used. Propositions are statements about some objects or event in the universe, either naturally occurring or man-made

A concept map, as a graphical tool, has a power to convert a linear isomorphic text into a non-linear graphic presentation which renders the macro- structure of the text more salient (Novak & Canas, 2006). This non-linear property of a concept map helps the reader to identify, comprehend and retain information (Nikolaraizi 2012). This happens because the content within a text becomes conceptually transparent and easier for the reader to grasp, to retain and to retrieve. (Chang, Sun & Chin, 2002). Nickolaraizi (2012) adds that the spatial properties of a concept map "help readers identify, compare and retain information or draw inferences about relations, supporting cognitive processing that do not overload students' working memory" (P.1).

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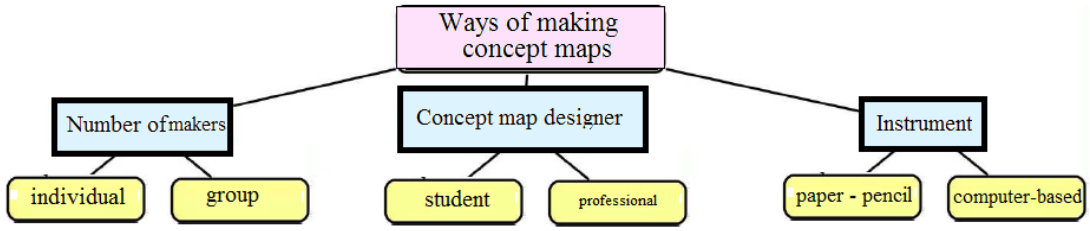
In a concept map, information is arranged in a hierarchical fashion with the most inclusive, most general concepts at the top of the map and the more specific, less general concepts arranged hierarchically below (Novak, 2010).

Another important feature of a concept map is the addition of the cross- links. These are used to denote the relationships between concepts in different domains of the map. They help to understand how some domains of knowledge included in the map are related to each other (Dolehanty, 2008). This cross-linking step is quite important for facilitating integrated understanding of the various aspects of the topic. The last feature that can be incorporated in a concept map is the specific examples of events or objects. These would make the meaning of a given concept clearer and more comprehensible**. (See the** concept map model below)



THEORIES SUPPORTING CONCEPT MAPPING

A-Cognitive Learning Theory

The concept map idea is based on Ausubel's (1978) Cognitive Learning Theory. The basic assumption of this theory is that learning takes place through the assimilation of new concepts and propositions into existing concept propositional frameworks held by the learner. To explain this assumption, Ausubel (1992) states that meaningful learning occurs when the learner can organize information and link the new knowledge to prior one in a cognitive structure. Ausubel claims that the cognitive structure is made up of a set of organized principles, concepts and information that have already been acquired by the learner. All these pieces of information form fields of knowledge which are organized naturally to form a pyramid-like structure. The most general ideas occupy the apex of the pyramid and the more specific details subsume under them (Ausubel, 1992).

Kalhor, (2012) elaborates on this pyramid-like structure saying that "The most inclusive ideas those located at the top of the pyramid are the prominent and most enduring elements in the hierarchy. These inclusive ideas stay longer in the memory than do particular and specific details which lie at the bottom of the pyramid"(P.725). New pieces of information and new experiences, according to this theory, are commonly fitted into the framework of prior knowledge. A structure that is clear and well organized, says Kalhor, facilitates learning and retention of new concepts and paves the way for meaningful learning.

Irvine (1995) claims that meaningful learning is strongly associated with three factors: first, meaningful learning involves the assimilation of new concepts and propositions into existing cognitive structures. Secondly, knowledge is organized hierarchically in cognitive structures and new learning occurs when concepts and propositions are placed into existing hierarchies. The third factor is that meaningful learning is more likely to take place when information is presented potentially in a meaningful manner and the learner is helped to anchor new ideas

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with the creation of links between old and new material. A well constructed concept map takes into account all these three factors to facilitate meaningful learning and to make learning tasks more salient.

Dual Coding Theory and concept mapping

In addition to its being grounded in Ausubel's Cognitive Learning Theory, concept mapping has taken many of its basic principles form the Dual Coding Theory of Paivio (1985). This theory places equal importance on both verbal and non-verbal processing. According to Paivio, there are two highly interconnected, but separate systems of information processing in the human mind: one is the verbal system that deals with linguistic codes, i.e., language, and the other is the visual system which deals with images and pictures (Paivio, 1985). In cases where information is presented both visually and verbally to the memory, one can observe a significant memory enhancement (Denis & Millet, 2002). Retrieval and internalization of this kind of information is relatively easy for language learners because instead of one mode of representation- visual or verbal - two simultaneous mental representations are made available for the learner (Kalhor, 2012).

Obviously, concept maps represent direct applications of the Dual Coding Theory because most of these maps reflect both verbal and visual displays (Kalhor, 2012). Indeed, a number of research findings confirm that concept maps enhance remembering information read in texts because these maps perform dual processing in the brain which belongs to different channels simultaneously (Novak, 2010; Robinson & Shrew, 1994; Denis & Millet, 2002).

Cognitive Load Theory and concept maps

The cognitive load refers to the amount of information that needs to be processed by the learners' memory. Hence, the less cognitive load a learner has to carry, the easier the learning would be (Chalmers, 2003). The Cognitive Load Theory assumes that if a person can reduce the amount of incoming variables through deleting unimportant extraneous information that puts obstacles in the way of converting working memory into long-term memory; this can consequently maximize the learners' comprehension capacity (Sweller, 1988). In fact, the working memory or (the short-term memory) has quite a limited capacity; yet, this short- term memory is responsible for incorporating knowledge into long-term memory. Naturally, the working memory can process only a small number of units of information at a time (Novak, 1990). Therefore, to structure a large amount of knowledge calls for an orderly sequence of interactions between working memory and long- term memory when new information is being received (Anderson, 1991).

The concept mapping technique endorses this principle of decreasing the amount of excessive and unessential information that overloads the memory. Kiutsch Van & Dijk (1978) confirm that through eliminating extraneous unnecessary details, and emphasizing more essential points and relationships between concepts, concept maps reduce cognitive load and hence facilitate meaningful learning processes. Ellis (1998) confirms that concept maps and other graphic organizers reduce the cognitive load on the learners by organizing information in a meaningful way, thus making it easier to understand and to retain for longer time.

Types of concept maps

Concepts maps are commonly found in two forms: experts generated or student-generated. The idea of student- and expert- generated concept maps is initially established by Mclogg and

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Dansereau (1991). Expert- generated maps are designed by professionals with the intention of maximizing communication between the student and the teacher. They are used as pre-organizers, post- organizers, lecture props and can also be given as handouts. They generally present the structure of the learning material (All & Hawens, 1997). On the other hand, student-generated maps are less formal and intended to express individual personal interpretation of ideas and their meaning. Irvine (1995) reports research findings indicating that student-generated maps enhance learning, facilitate peer and group discussion and improve students' comprehension. Gold (1984) reserves that some students may need more time mastering concept mapping technique; yet, he admits their significant academic improvement.

The traditional way of constructing concept maps uses paper-and- pencils; however, with the rapid development of information and communication technology, a number of computer-based concept mapping systems and software are made available. So based on the instrument used for making a concept map, the concept mapping process can be categorized into two types: paper-pencil and computer-based concept maps. A concept map can be generated by individual map makers or it can be generated in collaboration with others. In fact dozens of studies conducted recently have revealed that computer-oriented concept mapping technique is quite effective in enhancing the learning process (Assan, 2007; Chang, 2011 and Chiou, 2008). Moreover, the majority of these studies reveal that students have positive attitudes towards using technology to aid their learning processes.

Previous Studies

A wide range of research has been conducted over the last few years to investigate the impact of concept maps on learning; however, a selected review of studies on the influence of concept mapping on reading comprehension is particularly needed here to support the claim for its implementation in this study. In the field of English language reading, concept maps and most particularly computer-based concept maps are found to be beneficial for learners in terms of enhancing reading comprehension and in terms of helping students recall and organize information read in a text. Other studies have shown that concept mapping helps students to develop positive attitudes towards reading.

One of the famous studies in this area is the one by Chang, Sun and Chin (2001) in which they compared the effect of two versions of concept maps: construct-on-scaffold and self-constructed maps on students' learning. Construct-on-scaffold is the same as fill- in - the blank version of concept map in which incomplete frameworks of an expert concept map with some blanks are provided as a scaffold for students. The students had to fill in the blanks to complete the framework. In the self-constructed version, students were asked to construct their own concept maps freely without any scaffolding assistance. The findings of this study indicated that concept mapping with scaffolding instruction yields better results on students' learning than self-constructed maps.

The effect of concept mapping technique on reading comprehension was investigated by Dolehanty (2008). The subjects of this study were asked to respond to a survey both before and after they completed a concept mapping period of instruction. The participants had practiced concept mapping on six chapters of their reading textbook. Then they were subjected to a reading comprehension test based on the six chapters they had covered. The result of this test indicated that concept mapping had a limited impact on the students' reading

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comprehension. However, most of the participants reported that they had positive attitudes towards this technique.

Effectiveness of concept mapping learning strategy on English reading comprehension was also investigated by Liu (2009). The sample of his study was formed of students in two groups: a low level and a high level group. Participants were assigned to read English texts relevant to their levels. However, both groups were allowed to use concept maps as a tool to enhance their reading comprehension. Results of this study had indicated that concept mapping technique is more effective with the low level group than the high level one.Lonka, Lindblom, Ylanne & Maury (1994) conducted a study to evaluate how concept maps affect detailed learning, synthesis tasking, and critical reviewing of a text. The participants were allowed to take notes either in-text or on a separate sheet of paper. The results indicated that the hierarchical position of the concept maps helps to direct students' attention and enhance their retention of content.

In Taiwan, Wu, Hwang, Maryland & Ke, (2012) conducted a study that aimed to check the efficacy of an innovative concept map approach for improving students' learning performance with an instant feedback mechanism. In this study, a computer-based concept map-oriented learning strategy with real-time assessment was proposed in order to cope with the problem of delayed feedback to students. Findings of this study revealed that this innovative approach which involved a computer-based concept map associated with immediate feedback was quite effective in promoting learners' achievement as well as improving their attitudes towards learning.

Saeed, Saif and Qavan, (2013) conducted a more comprehensive study that compared the effectiveness of computer-based, paper-and-pencil and teacher-prepared concept maps on reading comprehension. The sample of this study was formed of 66 subjects (33 males, 33 females). Participants were randomly assigned to three treatment groups and one control group. Treatment groups included computer-based concept map, paper-and-pencil concept maps, and teacher-prepared concept maps with a reading text. The control group in this study did not receive any concept map instruction or training. The results of this experiment revealed that the use of teacher-prepared concept maps had significantly improved the subjects' level of reading comprehension compared to computer-generated maps and the control group. The researchers concluded that the use of teacher-prepared concept maps could have been more effective if the teachers had prepared them in collaboration with their students.

This result of Saeed; et al., (2013) study confirmed the findings of a study conducted earlier by Willerman and MacHarg (1991) who found that teacher-designed concept maps were more effective in enhancing students' reading comprehension. Willerman and MacHarg claimed that the concept maps designed by teachers were more accurate than student-made maps.Phantharakphong & Pothitha (2013) conducted a study on Thai students with the aim of developing their reading comprehension capacity using concept maps. The study also aimed to investigate the students' attitudes towards English reading comprehension. A reading comprehension test and an interview were used as tools to collect data for this study. The findings of this study revealed that the participants' reading comprehension and their attitudes towards reading had improved significantly .This result led the researcher to conclude that concept maps could enhance the students' English reading comprehension as well as their attitudes towards reading.

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Some more studies conducted recently have clearly demonstrated the efficacy of computer-oriented concept mapping techniques in supporting the learning process (Assan, 2007; Chang, 2011; Chiou, 2008, and Ibrahim, 2014). The majority of these studies revealed that students have strong tendency towards using technology in construing their concept maps .The students believe that these computer-programs are creative tools that guide them on their problem-solving paths. Fisher (2014), for instance, reported that *SemNet* (a concept mapping system) has a positive effect upon students' map construction. Erdogan (2009) indicated that computer-based concept map strategies are much more effective and produce better results than the conventional methods in teaching reading comprehension. Sometime earlier, Dais (2011) had used concept maps powered by *CMapTools* software to enhance Brazilian students reading comprehension .Findings of this study indicated that concept mapping, facilitated by computer software can be a useful strategy to improve comprehension.

From the above literature review, it can be concluded that concept mapping technique is a powerful tool for improving reading comprehension and perhaps other language skills. Indeed, the findings of most of studies reviewed so far have shown that the students' comprehension level had significantly increased as a result of using computer-based concept maps. Furthermore, some of the students participated in these studies stated that concept maps had helped them understand English text better. Such findings have encouraged the researcher to investigate the effectiveness of such technologically-oriented techniques to enhance the reading comprehension level of a group of Saudi pre-medical students. This comes in line with The Kingdoms' policy of modernizing its educational system.

Furthermore, staff members in the English Language Center (E.L.C.) at Umm Al Qura University are seriously planning to upgrade the teaching methods they use to teach the various language skills. This, of course, requires the search for, and application of some innovative techniques and methods to revitalize their English language teaching practice. Along this line, comes this study in which computer-based concept maps are used as a study tool to promote the reading comprehension of the students and help them to understand reading as a process. It is also hoped that this tool will help the subjects enjoy their reading tasks and to become more positive towards reading.

METHOD

Participants and setting

The sample of this study was formed of 25 subjects registered as pre-medical students for the second term of the academic year 2013 – 2014 at Umm Al-Qura University. These subjects belonged to group 23 which was randomly assigned from among 36 other groups to be taught by the researcher. All these subjects had studied English for six years before they joined the university.

At university, they were given a placement test and divided into homogenous groups. During their first term, the students studied a general English language course which was intended to strengthen their general language skills. However, during the second term, in which this experiment was conducted, the students took an ESP course which was aimed to prepare them for their intended specialization. All subjects were Saudi and they speak Arabic as their first language. Their ages ranged between 18 and 19 years. They all lived in or around the Holy City of Makah. The preparatory college where these students take their ESP course is a new

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building with spacious classrooms. The classrooms are well equipped with modern educational technology and advanced teaching aids. There is a desk-top computer linked to Net service assigned for each individual student, and the instructor has his own control desk. The classrooms are furnished with comfortable seats and study round tables in addition to the desk-computers assigned for students. Each classroom is designed to accommodate a maximum of 25 students.

Procedures

This study (a within-subject design) involved 25 male subjects who belong to group 23 which was chosen randomly from among 35 other groups of pre-medical students doing an ESP course. The study began on the eleventh of January 2014, and lasted for seven consecutive weeks. It was conducted in three stages: the baseline stage (one week), the experimental stage (five weeks) and the post-experimental stage (one week). The data were collected through a pre-experimental reading comprehension test, a post-experimental comprehension test, and a questionnaire given to the subjects during the post-experimental stage.

Pre-experimental stage

This stage started on Sunday, the eleventh of January 2014 and lasted for one week. A few weeks before, the researcher had made all the necessary preparations for the study. These involved getting permission to conduct the study, getting students' consent to participate in the experiment, checking the classroom assigned for the experimental group and preparing a detailed plan of the experiment. Reading materials, handouts, pre- and post-tests were all made ready and checked by highly qualified members in the ELC for validity. During this pre-experimental week, the researcher met with the subjects twice: once on Sunday and once more on Tuesday. Each meeting lasted for 90 minutes.

In the first meeting, the researcher received the students cordially and informed them about the experiment; its objectives and its expected benefits for them. During this session, the idea of concept maps was briefly introduced and its use as an effective tool to facilitate reading comprehension was explored. Generally, the participants were informed that concept maps were instruments for organizing and representing knowledge visually. Different types of concept maps such as computer- based concept maps were introduced and models of such maps were projected on the white board for the students to see. The students were then given a chance to reflect on the concept map idea and to ask questions. All questions were carefully answered and students were promised that they would learn more about the concept map technique. They were also promised that they would receive adequate training on how to construct and use this tool to help them better understand what they read and improve their reading capacity.

Towards the end of this session, some handouts on concept maps written in simplified English and illustrated with drawings and figures of computer-generated concept maps were distributed to students. Some electronic sites dealing with concept maps including *CmapTools "http //cmap.ihmc.us"* were highlighted and the students were asked to check for more on the net. A detailed plan of the various stages of the experiment was given to the students and discussed with them. The experiment plan was designed in a way that did not disrupt the students' time-table. Finally, the participants were informed that they were going to sit for a reading comprehension test in their next session on Tuesday.

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On Tuesday, all participants came to their class and were enthusiastically welcomed back by the researcher. Initially, they were told that each of them would be given one extra grade to be added to his year-work score for completing each assignment in this experiment. This news was received with great enthusiasm and happiness and the students became more motivated to take part in this study.

Students were told that they were going to take a reading comprehension test that was intended to measure their initial reading ability. The reading text was extracted from their assigned textbook '**Nursing *One***' by Tony Grice of Oxford University. The text selected was entitled: *'Improving Patient Care* '. It included seven paragraphs and it involved 367 words. Ten comprehension questions were prepared in a multiple-choice test format and together with the reading text sent to students' e-mails. Students were instructed to check their e-mails to read the text on the screen and answer the comprehension questions associated with it. When the students finished with the comprehension part, they were instructed to save it and send it back to the researcher. Students' responses to this pre-experimental comprehension test were checked instantly and recorded to represent their reading comprehension ability before treatment.

The experimental stage

This phase began in the second week of the study and lasted for five weeks. Each week, the researcher met twice with the students on Sundays and Tuesdays from ten to eleven - forty in the morning. During this stage, the computer-based concept maps were carefully introduced to the participants and the students were trained on how to use CmapTools to construct the concept maps to aid their reading comprehension. Below are the details of what was done during the five weeks of the experimental stage.

First week of experimental stage (Introduction &training on concept maps begins)

In the first meeting of this week, i.e., on Sunday from ten to eleven-forty in the morning, the researcher received the participants and allowed them to sit in groups of five around the five round-tables in the classroom. The idea of concept mapping in general and computer-based mapping in particular was reintroduced in more details; its theoretical background was explored and real samples of computer-generated concept maps using CMapTool software were projected on the board. The students were informed that concept maps were tools for organizing and representing knowledge visually. The students were told that visualizing of knowledge makes it easy to comprehend and that visualizing of knowledge becomes possible when the major concepts and ideas in the reading passage were extracted from texts and enclosed into boxes or circles of some kind and the relationships between these main ideas and concepts are indicated by lines in the form of a concept map.

Participants were also informed about cross-links which are used to connect concepts in different domains of knowledge involved in the reading text. Furthermore, the participants were told that a concept map is commonly presented in a hierarchical structure with the most inclusive, more general concepts placed in the top of the map and the more specific, less general concepts placed hierarchically below. Then a large model of a computer-based concept map was selected and projected on the white board and its different parts were slowly explained.
Students were then instructed to go back to their desk-top computers and switch them on CMapTools *<"http://cmap.ihmc.us" >* , a free software that can be used to facilitate the construction, modification, sharing and publishing of knowledge models represented as

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concept maps (Dais, 2011).This software can also be used to support collaborative construction of concept maps and can ultimately help to ease learning and retention (Novak &Canas,2004). Students were told that they were going to use this software as a tool for creating their concept maps to visually represent what they read. They were then instructed to download this software onto their desk-top computers.

In the remaining time of this session, the students together with the researcher took the tutorial on concept map making provided at < *http:// cmap.inhc.us/Support /Help/*>. This tutorial gives clear instructions on how to use CMapTools to create a concept map, to add concepts, or to delete some, and to create propositions etc… The researcher read these instructions slowly and explained them very carefully to the students. At the end of this session, participants were told they were going to apply this software to create their concept maps during the coming meetings. The students were advised to download this software onto their own personal computers at home and to study it carefully before they come back to their class the following Tuesday.

On Tuesday of the same week, the participants continued their training on concept mapping using CMapTools software. Training in this session involved a demonstration of using the software to construct a concept map about "The *Hospital Team*" using input from a reading text passage in the students' textbook. This task was performed in a whole-class discussion format. After completing this task successfully, participants were encouraged to individually create a biographical concept map each about himself using CMapTool software. In the second part of this session, the participants were given a chance to individually or in pairs construct maps similar to the map task they constructed earlier. More specifically, students were given an incomplete skeleton of concept map and directed to fill in the empty boxes with ten pre-identified concepts selected from a reading passage in their textbook under the title "*Wheel Chair*" (***Nursing One, p*: 15**). Students read the text and worked in pairs and with assistance from the researcher to fill in the empty boxes in their concept maps. When the students' maps were completed, instant feedback was provided and students were encouraged to revise their maps in the light of the feedback provided by the system and make the necessary amendments through editing, or deleting of unnecessary details or even through making links among concepts.

Second week :(Scaffolded instruction on concept mapping to aid reading)

At the first meeting of this week, the participants met with the researcher at the scheduled time in the same classroom to continue the scaffolded implementation of the computer-based concept mapping using CMapTool software to enhance reading comprehension. Specifically, the participants were asked to check their e-mails to find the martial designed for that day's activity. This material included, a text selected from the students' reading course under the tile, "A *Surprise Passenger* "(***Nursing One, p*: 25)**. The reading passage was accompanied by a list of the major concepts in the text and an incomplete concept map that represented the reading passage.

First of all, the objectives of the lesson were clearly stated and the scaffolding instruction began. The researcher guided the students on how to read and to complete concept maps. Instructions involved: 1- reading the scrub up part which is intended to activate background knowledge relevant to the reading topic 2-explaining new vocabulary items,3-reading the text silently focusing on the main points in the text , 4-reading the list which involved some of the

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major concepts in the text .5- trying to find out some more concepts with support from researcher , 6-reading the incomplete concept map of the text 7- filling in the empty boxes in the map using concepts from the list with assistance from the researcher , 8- answering the comprehension questions by referring to the text and with aid from the concept map , 9- instant feedback was provided and revision was made .

In the second session of this week, the students were given their next reading assignment under the title, "*Pain*". The text was taken from **Nursing One** p: 31. The lesson started as usual by discussing the scrub up part to activate background knowledge and vocabulary items were explained slowly. An incomplete list of concepts was provided to be completed after reading the text. In the meantime, students were instructed to read the text silently focusing their attention on the most important ideas in the text. In conference format, the students and researcher, identified the missing concepts and used them to fill in the empty boxes in their maps. Finally, the students answered seven MCQ comprehension questions related to the main ideas in the text. The students were reminded to check their concept maps to help them find answers for the questions .

Week Three (Scaffolding Continued)

In this week the scaffolding process continued. Students started their reading task with a scrub up and vocabulary explanation as usual. Participants were asked to read the text under the title "*Mystery Syndromes*" taken from "***Nursing One***" P.38. A shorter list of concepts was provided this time. The students were asked to work together with the researcher to identify the rest of the main concepts in the text and fill in some of the empty boxes in the map designed for that text. Students' maps were checked and they received feedback to correct them. Finally, the students did their short reading comprehension test supported by their concept maps.

In the second session of this week, the participants took their reading comprehension lesson following the same steps of the previous session. However, the students were provided with even less pre-selected concepts and more empty boxes in the concept map. In this session, the reading subject was "*Old Age and the Brain*" adopted from "Nursing *One "(:**p 41).***

Week four (Minimal support)

In the first meeting of this week, the participants were given their reading lesson as usual, but this time they were instructed to develop their own concept lists and use them to fill an incomplete skeleton of a concept map for the text. Students were encouraged to work in pairs and in groups. They identified the main concepts with minimum help from the researcher and filled their maps. The researcher provided them with some feedback which they used to complete their tasks. This time, the students read a text entitled, "Eat *Yourself to Death* ", from "**Nursing *One "(:p 49***).

In the second session of this week, the students followed the same steps of the previous session and received minimum support to identify the major concepts in a text titled "Blood Pattern Analysis" from "Nursing *One "(:**p 72***). The students used these concepts to fill a skeleton of a concept map and to answer the comprehension questions.

Fifth week (Independent construction of concept maps)

In this last week of the experiment, scaffolding was completely withdrawn, and participants were left to use CmapTools to draw their own concept maps after they carefully read and identified the major concepts in the texts they read. During this week, students read and

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mapped two reading texts entitled: "The *Hope Children Hospice*" and "*Schizophrenia-The Facts*". They also managed to answer the comprehension questions related to them. At the end of the second session of this last week of the experimental stage, the participants were informed that they were going to be given a reading comprehension test similar to that they took during the pre-experimental stage. However, the participants were informed that they would be given the opportunity to apply CMapTools to construct concept maps to map their reading passage so as to aid their reading comprehension. The participants were reminded once more of the steps of using CMapTools to construct concept maps and advised to reread the tutorial provided at <*htt://ihmc.us/support/help/>* before they come for their test next week.

Post-Experimental Stage (Administration of post-experimental test and the questionnaire)

The post-test was conducted during the seventh and last week of the study. Here the participants were given a reading text chosen from a ***reading bank*** prepared by Oxford University Press as part of the supplementary reading material for those who study "***Nursing One***". The text was formed of seven paragraphs and included about 387 words. The text together with 10 comprehension questions (MSQ format) was downloaded onto the students' desk-top computers. The participants were instructed to read the text carefully, to identify the major concepts involved, organize them hierarchically and use CMapTools to construct concept maps that represent the reading visually. They were required to use the concept maps together with their text to answer the comprehension questions. Students' responses to the comprehension test were automatically checked and registered to represent their achievement after using the concept mapping technique to enhance their comprehension. This task was completed in fifty minutes and in the remaining time of the session, the participants were instructed to respond to the second tool designed to generate data for this study.

The second tool used was a questionnaire which was intended to identify the participants' point of view regarding the use of computer-generated concept maps to foster reading comprehension.

Data Analysis

Data collected through the pre- and post- tests were compared to check if there were any significant differences in the level of participants' performance which could be attributed to concept mapping intervention. The questionnaire was administered to generate the participants' views towards using computer-based concept maps to enhance reading comprehension. The data collected through these two tools were analyzed quantitatively using SPSS program. Students' scores in the pre- and post-tests were compared and statistically analyzed using the means and t-test. The students' responses to the questionnaire were analyzed using percentages to identify the participants' opinions and views towards using computer-generated concept maps to aid reading comprehension

FINDINGS

Results from reading comprehension tests

Results of pre- and post-test of the reading comprehension are demonstrated in Graph 1 below, which shows that level of all students' achievement has improved after the intervention.

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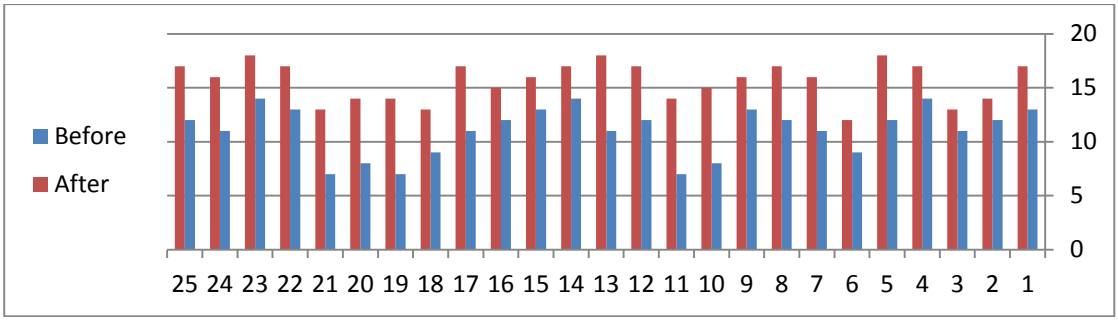


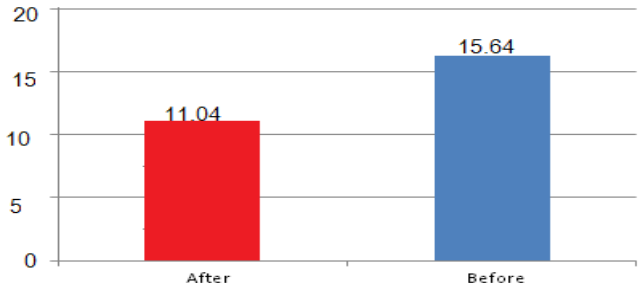
Graph 1: Students' scores before and after intervention

Since the scores of individual students have increased, the mean score of all participants has concurrently increased in the post- test. The mean score of all students reached (15.64)out (20)in the post-test compared to only (11.04) in the pre-test (see Table 1 & Graph 2 below).

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
before	25	11.04	2.263	.453
After	11.04	15.64	1.800	.360

Table 1: Students' mean scores in pre- and post-test



Graph 2: The mean scores of all students before and after treatment

But to check whether this difference in the mean scores of students in pre- and post-test is significant and attributable to the computer-based concept mapping intervention, a t-test was performed. Table 2 below summarizes the result. The t-test reveals a significant difference between the levels of performance in the pre-test and the post-test.

Paired Samples Test								
	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
before - after	4.600-	1.607	.321	5.263-	3.937-	4.310	24	.000

Table 2: t-test

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The result of the t-test shown is in Table- 2 above reveals that the t-value is 4.31 which is significant at (0.05) .This result confirms that computer-based concept map intervention improves the reading performance of the subjects of the study.

This finding can be cited to answer the main question of the study which inquires about the impact of using the concept mapping technique on students' reading performance.

Results of the questionnaire

The questionnaire was administrated after the completion of the intervention stage to identify students' view about the use of computer-based concept maps on reading comprehension. Results of this questionnaire are summarized in Table-3 below:

Statement	Yes %	No %	Not sur %
1-Do you entertain using CMapTools to create concept maps during reading?	92	5	3
2-Do you think Computer-based concept maps make reading comprehension easier?	87	9	4
3-Do concept maps help you to remember details?	89	7	4
4-Do you think it is possible to use this technique for every reading task?	76	5	14
5-Do you think you would obtain the same amount of information without concept map?	40	30	30
6-Do you think concept maps can facilitate learning other language skills?	86	6	8

Table 3: Summary of the questionnaire results

From **Table 3** above, it is shown that the participants have very positive views about concept mapping technique. In fact, more than (90%) of the subjects state that they entertain using CMapTools to create concept maps during reading, (87%) think that concept maps software makes reading easier, and (89%) of them believe concept maps help to remember details of material read. Furthermore, (86%) of the subjects interrogated think that concept maps can help in learning other language skills, and more than three quarters of the subjects think it is possible to use this technique for all types of reading.

The above results can be used to answer the second question of the study which tried to identify the point of view of the participants towards this technique. Obviously, the greatest majority seems to be very positive towards this computer-based concept mapping technology.

DISCUSSION

Findings of previous studies on concept mapping conducted in different parts of the world have clearly demonstrate that concept maps are instrumental in improving reading comprehension (Chang, Sun and Chan, 2002); Dais, 2011; Canas et.al. 2004; Novak 2010; Ojima, 2006; Yin, et al. 2005; Conlon, 2008 and Lee & Nelson, 2005). The results of this study of the impact of computer-based concept maps on Saudi students' reading comprehension comes in line with results of these other studies conducted elsewhere. The results of this study have shown a significant improvement in the level of performance of the students after their completion of

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the intervention period that involves training on using software known as CmapTools to construct concept maps to aid reading comprehension.

One of the main reasons that make this computer-based maps technique work is that it allows students to use their visual intelligence to enhance their linguistic knowledge when reading a text. Concept mapping helps the students to convert the linear information into non-linear spatial knowledge through visual representation. This visual representation allows students to get a holistic understanding of the text and helps them to visualize certain knowledge structure that the written text alone cannot do. It is generally known that information represented in graphic forms and images is easier and faster to learn (Silver, 2002).

In accordance with the Dual Coding Learning Theory , concept mapping provides learners with two simultaneous mental representations- visual and verbal - of the information and , as a result, information will be easily attained as it comes into the mind through two different channels instead of one (Paivio, 1985). So the efficiency of this technique of concept maps can be justified based on the opportunity it offers to learners to benefit by visual ability as well as other abilities (Suleemani & Nabizadah, 2012).

Novak and Gowin (2003) report that the act of drawing concept maps requires creativity through which the learners try to clarify the meaning embedded in a text read and to find the relations and links between different concepts. Novak and Gowin believe that the process of concept map drawing in itself is an excellent exercise for promoting creative thinking and discovering of new problem solving approaches. Here it can easily be observed that concept maps encourage creative thinking which is an inherent property of concept mapping and, as it is shown in this study that practicing mapping of textual information has enhanced students' creativity and consequently their reading comprehension ability.

Another good reason for the effectiveness of concept mapping in enhancing reading comprehension lies in its capacity to provide meaningful learning. This technique involves the activation of prior knowledge and organization of the relationship between concepts. Activation of prior knowledge is an essential step for achieving meaningful learning. In a concept map, knowledge is organized hierarchically and this serves as an effective technique for remembering and retaining information. Considering this point in this study, the subjects are first taught to identify the most general concept of the text and then encouraged to find other related concepts and try to order them hierarchically from the most general to the most specific. In the meantime, students are trained to focus on the most important points and concepts and eliminate unnecessary details. Through this act, the amount of cognitive load on the memory is decreased and the learning process becomes easier and retention of information is secured.

Schema Theory suggests that a person takes new information and stores it in pre-existing hierarchies or channels (Dye, 2000). Concept maps assist language learners to construct appropriate schemas through making links between the new information and the existing knowledge in the brain of the student, and consequently meaningful learning takes place.An important point to be discussed here is that the use of CmapTools software as an advanced computer-based technique has really revitalized the teaching- learning process and enticed and fascinated students. This software has facilitated scaffolded teaching and encouraged the process of collaboration among learners. CmapTools software has granted access to different

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internet sites and also made it possible to get immediate feedback. This software can also make it possible to get in touch with other users who have similar interest in concept map development. All these unique characteristics of computer-generated concept maps seem to make the reading process more interesting, entertaining and fruitful.

CONCLUSION

This present study is intended to investigate the effect of using a computer-based concept mapping technique on a group of pre-medical Saudi students' reading comprehension. These students were registered for an ESP course during the second term of the academic year 2013-14.Twenty-five pre-medical male subjects were engaged in this study which lasted for seven weeks. Participants completed a five-week training period on how to manipulate CMapTools software to generate concept maps to aid their reading comprehension. Pre- and post reading comprehension tests and a questionnaire were used to collect data for this study. The findings indicate that using computer-generated concept maps as a learning strategy has a positive impact on students' reading comprehension level. It is found the students' mean score in a reading comprehension test has risen to reach (15.64) after they have completed their five-week training period to restructure their reading texts. Their mean reading comprehension score was barely (11.04) before this intervention. A t-test reveals that the difference between these two mean scores is significant at (0, 05). At the affective domain, this technique of concept mapping seems to have a very positive impact on the students' feeling towards this computer- based technique. Indeed, the students have shown very positive attitudes towards this technique and reported that it has made their reading process more tangible and interesting. They even claim the possibility of using this technique to facilitate learning other language skills. These results are in line with results of previous studies reviewed in this paper (Chang, Sun and Chan, 2002); Dais, 2011; Canas et.al. 2004; Novak, 2010; Ojima, 2006; Yin, et al. 2005; Conlon, 2008 and Lee & Nelson, 2005).

RECOMMENDATIONS

The findings of this study have clearly demonstrated the efficacy of using computer-based concept maps to enhance students' reading comprehension and their views about reading. This supports the assumption that concept maps can be used as an effective teaching strategy. Therefore, the researcher will continue to use this tool as a means to aid reading comprehension and to entice his students. The researcher will also recommend that other staff members in the English Language Center at Umm-Al-Qura University and in other Saudi Institutions should use this tool in its computer-based version (CmapTools) to promote their teaching practice and to boost their students' enthusiasm for reading.

Concept mapping has proved to be an effective learning strategy for teaching this particular sample of the study ; however, further research needs to be conducted on students of different levels and abilities. This study has mainly involved male students at pre-medical level, other studies; therefore, need to be done on female students and on students at various educational stages to check the validity of this technique on the reading comprehension of such groups.
The scope of this study is limited to reading comprehension. It is; therefore, recommended that future research should investigate the effect of concept mapping on other language skills, i.e., listening, speaking and composition writing.

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Finally, it is important to note that concept mapping is not the only approach to introducing effective and meaningful learning activities in the classroom. This tool is just one of the kinds of modern innovative pedagogy that needs to be explored to achieve the revitalization of teaching practice and to realize the Kingdom's policy of modernizing its educational system.

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