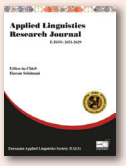

Applied Linguistics Research Journal

ALR Journal 2017;1(1):13-25

Original Research

doi: 10.14744/alrj.2017.29392

Improving the Reading Comprehension Skill of English Language Learners Using Cmap Tool: A CALL Perspective

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ABSTRACT

The application of computer technology in language teaching and learning has been an issue of great concern to ELT teachers. The use of technology-based Cmap in ELT pedagogy to facilitate language learning has attracted language teachers. This study investigated the effects of applying learner constructed Cmap tool on EFL learners' reading comprehension performance. To conduct the study, 77 upper-intermediate university students were selected non-randomly and were assigned randomly into paper-and-paper Cmap and electronic Cmap groups. They were trained to create concept maps by CmapTools software. Besides, an interview was applied to elicit the attitudes of participants toward computer assisted language learning. Conducting parametric statistics, the performances of the groups on the pretest and posttest were compared, and the results revealed that the technology-based Cmap group outperformed the paper-and-paper Cmap group. The technology-based group asserted their learning was facilitated and their motivation boosted. The findings have implications for learners and language teachers.

Keywords: Cmap; reading comprehension; CALL; ELT.

1. Introduction

Learning strategies are extremely important to learners as the greater awareness they have of what they are doing, more successful language learners they will be in the pedagogy. However, in most language classrooms, learners are unaware of suitable strategies that could help them deal with the reading materials (Barker & Brown, 1984; Wong & Nunan, 2011; Yang, 2002). Nowadays, the need for technological literacy in technology-based education classrooms is increasing and teachers and researchers ask for implementation of standards-based and technology-based curriculums. Technology-based instructions provide some opportunities and also some challenges to second and foreign language learners. Today, most of the learners utilize the Internet as a basic source of information in their academic activities.

A number of researchers have stated that the reading skill is one of the most crucial skills for educational and professional achievement and a means of consolidating and extending one's knowledge of the language (Alderson & Urquhart, 1984; Chai, 2001; ko, 1999; Yusuf, 2010). Remembering main ideas, recognizing and building rhetorical frames that organize the information, and linking the text to the reader's knowledge, make

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Article citation: Roy, A. (2017). Improving the reading comprehension of English language learners using Cmap tools: A CALL perspective. *Applied Linguisics Research Journal*, 1(1), 13-25.

Received Date: October 2017
Accepted Date: November 2017

Publisher: Kare Publishing

E-ISSN: 2651-2629

some of the most significant requirements of reading skill (Grabe & Stoller, 2002). Reading in L2 needs greater effort than the mother tongue or L1. L2 readers encounter a reading task with less knowledge about the target language and its structure, and they often do not know what the useful strategies are for them when they face a reading problem (McKenna, Labba, & Kieffer, 2007). Some researchers believe that technology-based educational tools are effective solutions to the difficulties of reading comprehension (Alfassi, 2004; De Corte, Verschaffel, & De Ven, 2001; Fischer, 2003; Johnson-Glenberg, 2000).

The appropriateness and effectiveness of employing technology in language classrooms are under question, whereas many research studies focused on technology-integration in reading classrooms. Teachers do not have a clear and fully prepared educational design for their classrooms, thus the majority of EFL learners complain that their lexical knowledge is transient since there is no opportunity to practice their knowledge out of class time. According to a well-researched journaling in the domain of concept mapping, the CM proponents stated that learning happens by encouraging learners to think both deeply and critically, and to comprehend thoroughly (Lynch, Fawcett, & Nicolson, 2000; Mathes, Torgesen, & Allor, 2001; Blok, Oostdam, Otter, & Overmaat, 2002; Nesbit & Adespe, 2006).

The technology was integrated into language learning environments and eventuated in the advent of technology-based educational tools such as CmapTools. CmapTools is a kind of software that assists learners to construct CMs more easily and more effectively. In addition, scaffolding idea creation is a prevalent practice in organizations. Today's technology makes it easy for international and intercultural group members to construct CMs together remotely and deliver their ideas together very easily, but quite surprisingly little is known about how culture and medium shape the underlying concept mapping process. Although a large number of studies investigated the role of different variables in reading comprehension from different perspectives, there is not a sufficient attention by language teachers and researchers to the significance of integrating technology-based educational tools in strategy-based reading comprehension classrooms in developing language learning skills; therefore, the present study investigated the impacts of Cmap tool on learners academic achievements.

2. Review of Literature

Reading is an interactive process that attempts to elicit meaning by means of a variety of knowledge, such as linguistic or systemic knowledge as well as schematic knowledge (Alyousef, 2006; Cain & Oakhill, 2007). Comprehending of texts involves the flexible use of various sources of information, including the integration of linguistic information with graphic information (Verhoeven & Perfetti, 2008). Comprehension skills are essential to success not only during the school years, as they compose the foundation for subsequent learning in all academic subjects, but they are undeniably essential to success in life (Snow, Burns, & Griffin, 1998). Comprehension involves constructing a mental representation of the propositional content for the purpose of comprehending the reading or lecture's message. Nevertheless, additional input processing is required to decode linguistic system. Such processing involves making form-meaning connections from the input, or focusing attention on new forms and associating the new massage or knowledge with their functions or referents (Wade & Trathen, 1989).

Wong and Nunan (2011) stated that the relationship between learning styles and strategies established through the works of researchers such as Oxford, 2003. They also added that in these studies, learning styles and strategies described and defined in a variety of ways. Oxford (2003), for example, noted once learners become conscious about their own learning styles, it enables them to adapt their appropriate learning strategies and enable them to suit different learning tasks in different learning contexts. Learners can take advantage of their particular learning styles by matching learning strategies with their styles; similarly, learners can compensate for the disadvantages of their own learning styles to balance their learning by adjusting more effective learning strategies.

There are numerous learning styles and strategies that enhance reading comprehension skill

(Hedge, 2008; Nunan, 2004; Richarad & Renandya, 2002), but among various types of instructional reading comprehension techniques, concept mapping (CM) strategy is the focus of this study. This is a strategy which is preferred for text comprehension and specifically for accessing background knowledge. CM is a technique that allows learners to see the connections between ideas they already have, connect new ideas to knowledge that they already have in their minds, and in addition, allows learners to organize ideas in a logical structure. CM was developed in the 1960s by Joseph Novak of Stanford University. It is a metacognitive tool which is applicable to any discipline at any level and can be employed by both learners and teachers to better comprehend the content and process of meaningful knowledge (Novak, 1995; Amadieu, Van Gog, Paas, Tricot, & Mariné, 2009). Novak and Gowin (1984) introduced CM strategy as a way to facilitate the process of meaningful learning. They also defined it as a graphic organizational technique which is designed to help individuals and groups, explain and explore their knowledge and understand a topic in their classrooms. CMs are actually composed of concepts, in which they are shown in circles or boxes. The concepts are related by a connecting line which links two concepts. The linking lines contain some words which show the relationships between two or more concepts. Learners connect their previous knowledge to new information and create maps which show interrelated ideas. CM strategy provides additional motivation for language learners to detect the relationships among different sets of information (Mathes, et al., 2001).

As Novak and Cañas (2008) demonstrated, the CM technique is rooted in Ausubel's (1963) Assimilation Theory. The basic idea in Ausubel's assimilation theory is that learning takes place by the assimilation of new concepts and knowledge into existing conceptual propositional frameworks detained by the learners. According to this theory, CM has three distinctive features which include hierarchical structure, cross links and specific examples; among them the hierarchical structure is the most important and a basic feature. In Mintzes, Wandersee, and Novak' words (2000), the purpose of providing examples is just to clarify the new meaning of a given learning concept. Moreover, there are different versions of CM which includes expert-constructed, learner-constructed, fill in the map and cooperative CM.

Perhaps by utilizing graphic organizers such as CMs in second language classrooms, learners' writing and reading skill will significantly progress. Researchers have found that the effectiveness of using this concrete model helps learners to develop and internalize their cognitive skills to a higher degree (Alderson & Urquhart, 1984; De Corte et al., 2001; Chai, 2001; Yusuf, 2010). Researchers have been demonstrated that CMs are the effective means of representing and communicating knowledge. From an educational perspective, a growing body of research indicated that the use of them can facilitate meaningful learning (Coffey, Carnot, Feltovich, Feltovich, Hoffman, Cañas, & Novak, 2003). In addition, CM tools have also been exposed to be of value as a knowledge acquisition tool during the construction and reconstruction of expert systems (Coulthard, 2005) and performance support systems (Coffey et al., 2003), and as a means of capturing and sharing experts' concepts and knowledge in their related fields of study (Coffey, Hoffman, Cañas, & Ford, 2002). Reviewing the related literature demonstrated that CM is consistent with the theories of knowledge representation, constructive learning (Novak & Cañas, 2008), and meaningful learning (Novak, 1995). In spite of the fact that many researchers have reported that CM is a useful tool for learning and instruction, they represented that constructing CMs using paper and pencil has some obvious drawbacks that are as follows:

- The difficulty of providing appropriate feedback to learners during CM construction for teachers
- The complexity and difficulty of CM construction for learners, especially for the beginners
- The difficulty of revising constructed CMs by paper and pencil
- The unsuitability of paper-and-pencil CM for classroom evaluation (Pressley, Johnson, Symons, McGoldric, & Kurita, 1989; De Corte, Verschaffel, & De Ven, 2001; Alfassi, 2004)

Because of the above difficulties which are involved in paper-and-pencil CMs, researchers built computer-based CM systems, helping learners to construct CMs more easily and effectively.

Fisher, Faletti, Patterson, Thornton, Lipson, and Spring (1990) designed a CM system that is called SemNet. According to the semantic network theory, they illustrated that SemNet had a

positive effect upon learners' map construction in the classrooms. Reader and Hammond (1994) used hypertext techniques to apply their CM system and found that those who used the CM system obtained a better achievement. The computer-based systems of Fisher et al. (1990) and Reader and Hammond (1994) prevailed over some of the limitations and the difficulties in paper-and-pencil CM, but some concerns must still be addressed. For example, the systems provided learners with an environment in which CMs could be constructed without any assistance. Beginner learners tended to be frustrated in this difficult construction process. In addition, these systems cannot provide appropriate feedback to the learners because teachers lack any effective function for evaluating the CMs. This lack of feedback means that learners have few opportunities to reflect upon their own thinking which reduces the beneficial effects of constructing a CM. Modern CM construction tools (CmapTools) provide a creative cognitive tool for organizing knowledge about concepts and ideas in different formats in which concepts are connected with lines and accompany linking words to form propositions and concepts (Novak & Cañas, 2008). This learning tool is based on the social constructivist learning theory in which learning is a self-regulated building of concepts with the help of previous knowledge (Biggs, 1999; Bransford, Brown, & Cocking, 2000). The studies that were conducted on elementary schools' learners indicated that computer-assisted reading strategies are most suited with below-average learners learning ability (MacArthur, Ferretti, Okolo, & Cavalier, 2001).

There are few experiences of using CM and its effects on learners' reading comprehension in educational contexts. A study distinguished between more and less skilled readers by Gascoigne (2002). His study showed that good or successful readers have been applied top-down strategies. The attitudes of the learners about the CM were positive, but the result of this study revealed that the CM has no significant effect on students' reading comprehension skill. The findings stated that learners with low prior knowledge benefit more from CMs than those with high prior knowledge. The process of creating CMs for a domain helps learners to gain insight into how they teach more effectively (Cañas, Hill, & Lott, 2003). Liu, Chen, and Chang (2010) investigated the effectiveness of the CM learning strategy on learners' English reading comprehension skill. The result of the study indicated that the CM learning strategy was more effective for the low-level learners than for the high-level group, in terms of their performance on reading comprehension skill. In contrast, other studies believed that CMs promoted other skills such as reflection, a self- regulatory process that is related to motivation, self- control, and self-efficacy. In other words, it increases learners' motivation in the classroom (Coulthard, 2005). In the same vein, Dias (2010) examined the effect of the strategy of CM on the second language learners' reading comprehension. The findings represented that the construction of meaning by the generation of CMs could be an effective reading comprehension strategy in English language learning contexts. Another experience by Chang, Sung and Chen (2007) on using two versions of compute-based CM: construct-on-scaffold and construct-by-self on learner learning represented that both of them are the same. In these strategies, the learners have to complete the blanks to complete the framework. And in the construct-by-self the learners face with the opportunity to construct their CMs freely and without scaffolding help. The result of the study confirmed that CM with teacher scaffolding is more effective on learner learning. Numerous educational applications of CMs can be identified in research studies that are: 1) a help in understanding, 2) a tool for the consolidation of educational experiences, 3) a tool for enhancement of affective conditions for learning, 4) an aid or alternative to traditional writing assignments, 5) an effective strategy to teach critical thinking, 6) a mediating illustration for supporting interaction among learners, and 7) a help in the process of learning by teaching. CMs have been used in collaborative and cooperative learning, and as a formal evaluation tool. CMs have been used to manage and present new information, including use as an advance organizer, use by teachers in the course or curriculum design, and use as an aid in hypermedia.

Learners in technology-based education classrooms need to develop conceptual understandings of the contexts in technology-based instruction in order to be technologically literate. The technical aspects of the technology education curriculum have become more and more difficult for our educators to update and maintain in our ever-changing technological society; therefore, knowledge in technology and its related tools may be difficult for learners to comprehend or to work with. There

has been a lack of research in the field of technology education or technology-based curriculum in regard to the conceptual knowledge gained from student learning in the technology-based education classrooms, especially through design and problem-solving activities. The CM strategy has been utilized, especially in science classrooms and other educational classrooms to help assess learners and learn concepts and ideas and it has been described as an important meta-cognitive tool in science education. Science educators have also been utilizing and applying the CM strategy in their classrooms to help learners to learn science concepts and new ideas.

Research questions

In this study, the researcher intend to answer the following research questions:

1. Is there any statistically significant difference between paper-and-pencil and technology-based CMs in developing ELT learners' reading comprehension achievements?
2. What is the participants' attitude toward employing technology-based educational tools in teaching and learning?

3. Method

3.1. Participants

To conduct the study, 77 upper-intermediate female university students with different majors in a university in Canada were invited. Based on the the universities English language placement test, they all were in upper-intermediate level. The participants age ranged from 18 to 24 years old. They studied in different disciplines such as Architecture, Management, Engineering, Mathematics, and Microbiology. Then they were assigned to four classes randomly in order to investigate the effects of employing CmapTools software on their reading comprehension ability. They were taught by four different instructors as two groups: A control group, N= 38 (class A, N=19 and class B, N= 19) and one experimental group, N=39 (class C, N= 19 and class D, N=20). It should be stated that all the participants attended the course regularly.

3.2. Materials and instrumentations

To conduct the present study, the following materials and instruments were employed:

Michigan English Language Assessment Battery (MELAB). MELAB is a standardized test created at the University of Michigan which evaluates reading competence of adult non-native speakers of English. This test battery consists of three parts including written composition, listening comprehension, and grammar, cloze, vocabulary and reading comprehension multiple-choice questions, and also one optional speaking test in the form of a one-on-one interview with an examiner. In the current study, reading comprehension part of MELAB (1997) test was administered to the participants to determine their reading comprehension competence. This test included four reading passages with total 20 multiple-choice reading comprehension questions for learners to be answer in 30 minutes. This test was administered as the pretest in the current study.

Reading posttest

A reading posttest was constructed based on Select Reading (Lee & Gundersen, 2011) to determine the learners' reading comprehension competence at the end of the research after the treatment. This researcher-made course-based test contained 20 items: Four reading passages followed by five multiple choice questions similar to the content of the reading textbook. Three experts reviewed the test items for content validity and reliability, and then it was revised according to the experts' comments. The revised measure was then piloted with 20 learners similar to the test-takers. Cronbach's Alpha formula for multiple choice items was employed, and the results showed a relatively high reliability index (r= .818).

Semi-structured interview

To elicit the attitudes of participants about technology in strategy-based learning environments, a semi-structured interview was conducted with eight instructors; the researcher conducted this 30

minute face-to-face interview to investigate in-depth information about the participants attitue on technology-based instruction. The learners participated in these interviews voluntarily. Prior to interviewing, they were informed of the purpose and the nature of the study.

Select readings: Upper-intermediate

Select Reading by Lee and Gunderson (2011, 2nd Edition) is a teacher-approved American English reading textbook series for upper secondary and university students. It contains a range of high interest reading texts approved by American experienced teachers. This four-level American English reading course uses carefully selected reading texts to assist learners to read more effectively.

CmapTool

The CmapTools software (Cañas, Hill, & Lott, 2003, available for download at: http://cmap.ihmc.us) has been developed at the Institute for Human and Machine Cognition brings together the strengths of the CM strategy with the power of modern technology. This software not only makes it easy for users of all ages to construct and modify CMs in a similar way that a word processor makes it easy to write a text, but also allows users to cooperate at a distance in the construction in their maps and publish their CMs so anybody on the Internet can access them. In addition, they can link resources to their maps to further explain their contents and modify them, and search the WWW for information related to the map (Cañas et al., 2003). This software allows the user to connect resources (photos, images, graphs, videos, charts, tables, and texts) located anywhere on the Internet or in personal files to concepts or linking words in a concept map.

4. Procedure

To examine the effect of the treatment (the effects of employing technology-based educational tools such as CmapTools software on EFL learners' reading comprehension ability), the participants' reading comprehension was evaluated at the beginning of the study; therefore, the participants in two groups were asked to answer the MELAB at the outset of the study. During 10 sessions (two sessions per week, every session one hour and half), the participants in the experimental group were exposed to task-based classroom reading activities using Select Readings Upper-Intermediate textbook. The participants were assigned into two groups randomly; paper and pencil constructed CMs and technology-based constructed CMs. In the control group, the learners were taught how to draw a CM by themselves through papers and pencils and had their CM through their handouts and submitted them to their teachers. Learner-constructed CMs can show teachers how learners are linking the knowledge together, instead of having learners memorize facts in a linear way. CMs allow the learners to connect concepts presented in labs, lectures and readings to their prior conceptions. They promote conceptual change, even in delayed transfer tests. In the experimental group, the learners did the same, but they made and submitted their CMs through the educational software. In the two first sessions, the teacher taught participants how to use the CmapTools. The participants were taught how to bring together the strengths of CM with the power of technology, particularly the Internet. After assuring that all of the participants learned how to work with the tool, the regular sessions started. These regular sessions were started with warm up questions. In the next phase, participants constructed appropriate CMs based on sessions' topics. Constructing these CMs, they used different sources of information such as the Internet, textbook, and their peers. The software allowed users to collaborate at a distance in the construction of their maps and publish their concept maps; therefore, anybody on the Internet could have access to them, link resources to their maps to further explain their contents, and search the WWW for information related to the map.

A time limit of thirty minutes was finally selected as one which would permit group members to express all the ideas occurred to them within the work period (though not to exhaust all possible ideas) and yet which would not result in excessive periods of silence for individual subjects. Actually, for both individuals and groups, appreciable periods of silence appeared between responses near the end of the thirty minutes. The teacher began the session by reading the instructions aloud, the first part of which was designed to ensure a high degree of subject motivation. First, it was explained that the experiment was part of a program of research on problem solving and creative thinking.

Table 1. Descriptive statistics for MELAB (Pretest)

Group statistics			
Groups	**N**	**M**	**SD**	**SEM**
Pretest				
Control group	38	11.32	2.13	.34
Experimental group	39	12.13	2.48	.39

Table 2. Results of independent samples t-test of MELAB (Pretest)

Independent samples test									
	Levene's Test for Equality of Variances		**T-test for equality of means**						
	F	**Sig.**	**T**	**df**	**Sig. (2-tailed)**	**Mean difference**	**Std. error difference**	**95% Confidence interval of the difference**	
								Lower	**Upper**
Equal variances assumed	.451	.504	-1.53	75	.12	-.81	.52	-1.86	.24
Equal variances not assumed			-1.54	73	.12	-.81	.52	-1.86	.23

Secondly, each subject was asked to read the first three paragraphs. These three paragraphs were quite favorable to CM. Finally, subjects were specifically asked to do their best. The second part of the instruction was designed to make certain that subjects fully understood the nature of CM. Next, the groups took a reading comprehension posttest in order to check and compare their reading comprehension achievement. The participants of two groups took the post-test at the very last session of their intensive reading course. Data were collected for further statistical analyses. Finally, to elicit the attitudes of participants about technology in strategy-based learning environments, the researchers administered a semi-structured interview with eight instructors; the researchers conducted this 30 minute face-to-face interview to investigate in-depth information about technology-based instruction. The learners participated in these interviews voluntarily. Prior to interviewing, they were informed of the purpose and the nature of the study.

5. Results and Discussion

Having collected the results of MELAB in the pretest, the data were analyzed employing independent samples *t-test*. The purpose of this analysis was to estimate the participants' level of reading comprehension at the outset of the study.

Table 1 shows the mean and standard deviation of two groups: (M= 11.32, SD=2. 132) for the control group, and (M= 12.13, SD= 2.483) for the experimental group respectively. The results do not show significant difference between the two groups in their general level of reading comprehension at the outset of the study. Meanwhile, to ensure true homogeneity of the participants' reading comprehension competency (N=77), independent samples *t-test* was conducted (see Table 2).

An independent-samples t-test was conducted to compare the results of the pre-test for the participants of both control and experimental group. There was no significant difference in scores of the control group (M= 11.32, SD=2.132) and scores of the experimental group, M= 12.13, SD= 2.483; t (75) = -1.538, P = .128. The results of Table 2 confirm the homogeneity of the participants at the outset of the study.

To determine the effects of treatment and examine the related hypothesis, independent-samples t-test was run (see Table 3).

As Table 3 shows, the mean and standard deviation of the two groups (M= 11.95, SD=1. 888;

Table 3. Descriptive statistics for reading posttest (Posttest)

Group statistics			
Groups	**N**	**M**	**SD**	**SEM**
Posttest				
Control group	38	11.95	1.88	.30
Experimental group	39	16.72	1.80	.28

Table 4. Results of independent samples t-test of reading posttest (Posttest)

Independent samples test									
	Levene's Test for Equality of Variances		**T-test for equality of means**						
	F	**Sig.**	**T**	**df**	**Sig. (2-tailed)**	**Mean difference**	**Std. error difference**	**95% Confidence interval of the difference**	
								Lower	**Upper**
Equal variances assumed	.461	.499	-11.33	75	.00	-4.77	.42	-5.60	-3.93
Equal variances not assumed			-11.36	74	.00	-4.77	.42	-5.61	-3.93

M= 16.72, SD= 1.806) reveal a difference between the two groups in their general level of reading comprehension at the end of the study. Meanwhile, to ensure statisticaly significant difference of the participants' reading comprehension competency (N=77), independent-samples *t-test* was conducted (see Table 4).

There was a significant difference in scores of the control group (M= 11.95, SD=1.888) and scores of the experimental group, M= 16.72, SD= 1.806; t (75) = -11.33, P = .000. As the results in Table 4 displays, the learners in the Cmap group outperformed those in the conventional paper-and-pencil group. Through a purposeful design, it deals with linguistics learners' problems such as text comprehension as higher-level issues. The results of the present study indicated that the difficulties of implementing reading strategy instruction in classrooms may be reduced with computer assisted language learning strategies.

The following sections would present detailed discussions on the results of the analyses applied to the data. One of the methods most often recommended by researchers for enhancing reading ability is using learning strategy. Through a deliberate design, it deals with linguistics learners' problems such as text comprehension as higher-level issues. In recent years, researchers have tried to deduce the principles of reading strategies from research studies. Some of the more widely recommended approaches are determining the main messages such as summarization, using text improvement, illustrations, mental images, and question and answer drills. The results of the present study as confirmed by the previous research studies indicated that computer assisted language learning strategies might be successful to a great extent (Fisher et al., 1990; Reader & Hammond, 1994; Johnson-Glenberg, 2000; De Corte et al., 2001; Fischer, 2003; Alfassi, 2004; Yusuf, 2010).

In the interviews, the learners magnified the positive effects of technology and computer-assisted learning. They stated that:

- "Computers and educational software can provide instant and direct feedback"
- "Computers allow students to control the pace of learning by themselves"
- "Computer-assisted reading strategy training such as concept maps is an appropriate approach to enhance students' ability to deal with texts"
- "Beyond the positive effects of technology-based instruction on students' language competence,

it increases the motivation of students to deal with educational content to a great extent"

- "Students are so motivated when they work with computers and they learn the content more effectively".

Computer-assisted instruction (e.g. employing CM tools) has been very popular during the last two decades, and scholars agree on the feasibility of applying computers in reading instruction under appropriate designs. Consistent with the previous studies, there are several advantages of incorporating technology in reading instruction. Firstly, computers can provide immediate individual feedback based on learners' learning condition (Novak, 1995; Lynch, et al., 2000). Secondly, learning with computers allows learners to control the pace of learning (Mathes, et al., 2001; Novak & Cañas, 2008). Thirdly, properly arranged courses may be operated independently with computers; therefore, reducing teachers from some of the burden and giving learners more opportunities to learn independently. And finally, through managements of using different media, learners' motivation to read may be strengthened (Coulthard, 2005; Chang, Sung, & Chen, 2007). The findings are consistent with the learners' attitudes in the interviews in that, they stated that learners are strongly motivated when they are working with modern technologies in their language classrooms.

Although the computer-assisted reading has had some impressive results, there are some limitations as well. The learners in the interviews argued that:

- "Dealing with computers is stressful for those who do not have enough technology literacy
- "The software is not effective for advanced students; they are not as motivated as beginners"

Caverly (1998) used software for gathering strategies, arranging and presenting materials, while Chang et al. (2007) used the concept mapping strategy. Because currently, much emphasis is placed on using the learning strategeis in classroom situations (Paris & Paris, 2001; Pressley et al., 1989; Coffey et al., 2003), based on the results of the present study, the researchers suggest it is important to find out how to design proper multiple strategies with computer technology to facilitate text comprehension abilities. As argued by the learners in the interviews, this learning strategy is most suited for low level learners. The literature studies on computer-assisted reading that largely were conducted on elementary school children concluded that these kinds of strategies are effective for learners with below-average learning ability (MacArthur, et al., 2001). In contrast, there are fewer research studies using learners of average or above-average abilities as participants. Some research studies on strategy instruction indicated that children of lower learning ability benefited less than those with average or above-average abilities (Garner, 1982; Liu et al., 2010). In similar extent, the present study demonstrated that CMs are evn effective for upper-intermediate and advanced language learners. It is also consistent with the findings of researchers conducting research studies on using strategy such as De Corte et al. (2001). The positive results of applying the concept map system support the argument that strategy should be reasonably feasible in a computerized environments (Novak & Cañas, 2008).

It is widely agreed by many researchers that proper multiple strategies with computer technology facilitate text comprehension abilities. However, the practical application of comprehension strategies in reading course leaves much to be investigated (Alfassi, 2004; De Corte et al., 2001; Pressley et al., 1989). But this study also finds that the advantages of strategy training as described above are not unconditional, and the performance is different with the style of learners, their levels, and their background knowledge. For example, some participants had difficulty in producing suitable concept maps when they had little background knowledge in that especial reading topic. Several possible reasons emerge after analysis. Since the reading texts used in this study are mainly scientific in nature ("A Young, Blind Whiz on Computers"), the students may have difficulty in elaborating related concepts by describing the details, citing examples and continuing the text without prior knowledge or exposure to related material. As a result, even if the learners have the intention and ability to use the strategy of integrating prior information with new concepts and ideas, they may not be able to put this strategy into real practice. In contrast, the content of the narrative ("How to Make a Speech") may provide messages that are more concrete and closer to living and to give the readers more room for imagination, so that the integration with

prior knowledge and the elaboration of the concepts in the text may be easier.

The results of the current study indicated that the computer assisted language learning, which is also a process oriented teaching environment can benefit learners with low reading ability. Another possible reason for this benefit might be attributed to the characteristics of computer-based instruction such as individual instruction, monitoring and immediate feedback. Computer-based CM allows personalized progress by placing a learner in an independent and threat-free situation in which develops the effects of practice. This study found that these characteristics may not only have a high potential for helping learners with lower abilities in their acquisition of higher-level skills, but also for lower-level reading skills such as word-recognition and phonological awareness. This study found that while computer assisted language learning with strategy has a potential for reading instruction design, there are some points worthy of investigation.

6. Conclusions

Computer assisted language learning has significant effects on learners' academic achievements in general and reading comprehension in particular. The results indicated that the learners in the Cmap tool outperformed those in the conventional paper-and-pencil CM. Integrating computer technology with strategy instruction has a potential for reading instruction design, there are some points worthy of investigation. To elaborate the design of systems like Cmap concept mapping, researchers may consider providing a wider variety of appropriate reading strategies for learners or teachers to choose from, or arrange strategies according to their own needs or preferences. Accordingly, the results of the present study indicated that this type of design can effectively enhance learners' abilities.

This process of constructing a CM strategy is a powerful learning strategy that forces the learner to actively think about the relationship between the terms. This makes CM especially suited to studying science as the learners often perceive, incorrectly, that studying science means simply memorizing facts. With CMs, information can be presented in a condensed manner, without the loss of complexity and meaning. The visual presentation allows the learners and teachers to identify the information without the dense presentation of words and verbal compositions. An increasing number of studies highlight its use in identifying learners' pre-instructional understanding of a subject. In addition to identifying learners' prior knowledge of a subject, CMs can also be used to promote cooperative learning. In this situation, learners can work in small groups and discuss their understanding of a topic and then collaborate together and produce a group CM. This approach engages learners in discourse about the concepts and encourages them to articulate their thoughts about, and experiences with, the concepts. This allows the learners to identify the connection between their conceptions they have already processed and the new learning material. The tool is extremely flexible and can be used both in instruction and assessment.

Further research should be conducted using concept maps as assessment tools as a result of the instruction and design and problem-solving activities in the technology education classrooms. A method for identifying the students' understanding of design and technology concepts could be establishing an expert's concept map on the knowledge domain. The educator may use the expert's concept map to help guiding the instruction and lessons. The students' concept maps may be compared to the expert's concept maps. Concept maps should not be utilized as a method of scoring or grading, instead, as a way to evaluate the student's cognition. Future research could be conducted on the usage of concept maps in the technology education classroom to help students develop propositional statements when constructing concept maps, thus to further help assess the students conceptual knowledge of the domain of knowledge and the representation of the technical knowledge.

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