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Motivational and Learning Effects of Computer-aided Procedures on Students' Reading Comprehension

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Abstract

Reading development and instruction is a pedagogical priority at all academic levels. Historically, in the educational field, numerous efforts have been made to facilitate the complex process of foreign language reading comprehension. More recently, increasing attention has been paid to the use of computers for developing reading comprehension skills and various efforts have been made in this regard. The present study investigates the connection between computer technology and reading comprehension. It relies on the current models of reading which emphasize the interactive nature of reading and constructive nature of comprehension. The study sample consisted of 30 freshman students studying English Language and Literature at Semnan University. Of this total, 15 students were subjected to a computer-assisted instructional program. They filled out a background questionnaire and during ten sessions they read computerized texts provided with comprehension aids (texts, pictures, and sounds). The other 15 students, randomly selected from the group, received no computer training and served as a control group. Both groups took a reading comprehension pre-test and post-test. After the treatment, the experimental group filled out an attitude questionnaire. Both quantitative and qualitative findings of the study are clear indications that the computerized reading contributes to the development of EFL reading skills more significantly than the conventional academic reading method.

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1. Introduction

Today's contemporary world has been labeled the world of information explosion, where everyone strives to stay abreast of any new step taken in science and technology. In this world, hardly anyone denies the significance attached to reading as the most generally needed skill in EAP (English for Academic Purposes) worldwide and as one of the best ways to remain up-to-date and well informed. Learning to read and reading to learn is not an outworn slogan.

Emphasizing the importance of reading, Farhady, Jafarpour, and Birjandi (1994) have stated that, "reading is the most important of all skills for most language learners in general and for English as a foreign language (EFL) learners in particular" (p. 247). Reading in a foreign language is a very useful and relatively painless way to improve the command over the target language.

In spite of advancements in our understanding of the reading process, reading instruction has advanced very little beyond the type of instruction provided for students 30 years ago. Reading lesson today looks like and sounds much the same as it did in the 50’s.

Researching the effectiveness of new strategies, the educators have found that utilizing technology will assist the classroom in the improvement of reading. Some writers have even claimed that the incorporation of computer technology into the reading process may bring about a change in reading theory and reading practice (Reinking, 1989; Wilkinson, 1983). Since the initial introduction of computers into the field of second/foreign language education, a large number of practitioners have concurred that this technology holds great potential for language learning. This belief leads to what is known as Computer-Assisted Language Learning, more commonly referred to as CALL.

The enthusiasm over computer technology, as a model of instruction in language classes, stems from the view that computer is sometimes

more facilitating than teachers or tutors. Computers are capable of performing multiple tasks. They can organize, select, and present multiple sensory components (Al-Seghayer, 2001). In research on CALL, the question is no longer whether CALL is superior to non-CALL, rather the question is how CALL can be used effectively (Hegelheimer & Tower, 2004). One of the concerns often raised in the domain of CALL is how to use the potential of a computer to enhance the language learning process and how to use different media types in teaching and learning. This concern has been narrowed to the investigation of the efficacy of presenting information using multiple modalities such as text, audio, still picture, and dynamic video in the field of second and foreign language teaching (Al-Seghayer, 2001).

Regarding the fact that we live in an information age and as a result of the widespread effects of computer technology throughout the world, it is no surprise that university-level educators are being challenged to rethink and revise their approaches and goals in teaching in order to prepare students for what will be expected of them in the real world.

1.1 Objectives of the study

The present study is an exploratory investigation into the effects of using computer-mediated reading supports on the reading comprehension and reading behavior of EFL students during independent reading of relatively short texts. It aims to describe a method for enhancing reading strategies through the use of computer software designed for improving reading comprehension and motivation for reading. More specifically, the following questions were addressed.

1.2 Research questions

1. Do the CALL-based procedures contribute to the development of reading comprehension in comparison with a conventional EFL academic reading method?
2. Do the students have positive attitudes towards CALL?

– Do they have positive attitudes towards computer as a learning tool?

– Do they have positive attitudes towards hypermedia as a component of their EFL reading comprehension course?

– Do they have positive attitudes towards the easiness of Computer-Assisted Reading (CAR)?

– Do they have positive attitudes towards the future applications of CALL?

1.3 Research hypotheses

Based on the research questions, the following null hypotheses were tested:

1. There is no statistically significant difference between the achievement test scores of the students taught by CAR and those taught by non-CALL techniques.

2. There is no positive attitude, among students of the experimental group, towards CALL.

─ There is no positive attitude towards computer as a learning tool.

─ There is no positive attitude towards hypermedia as a component of the EFL reading comprehension course.

─ There is no positive attitude towards the easiness of CAR.

─ There is no positive attitude towards the future applications of CALL.

1.4 Theoretical framework of the study

During the past years, a considerable number of studies have investigated the effectiveness of marginal glosses under different premises (Bowles, 2004; Chun & Plass, 1996a; Jones, 2004; Jones & Plass, 2002) as well as the theoretical underpinnings supporting their use as a valid tool for second language acquisition (SLA) (Hulstijn & Laufer, 2001; Mayer, 2002; Schmidt, 1990). This study investigates the effects that different types of multimedia glosses, namely textual, visual, and verbal have on text comprehension. The motivation to do so came from some very different theoretical backgrounds, namely, Schmidt's (1990)

noticing hypothesis, Mayer's (2005) cognitive theory of multimedia learning, and interactive theory in reading comprehension. It also brings into perspective the issue of individual differences in language learning.

Schmidt (1990) claimed that learners have to "notice" the form in question before it can be processed further and that attention is critical in the acquisition process of a second language (L2). Support for Schmidt's "noticing hypothesis" and the different levels of awareness has been found in a number of studies (Leow, 1997; Rosa & Leow, 2004; Rosa & O'Neill, 1999). Based on the literature on noticing in language learning, much of which is based on Schmidt's (1990) noticing hypothesis, and the relationship of this body of research to language learning, supporting or prompting noticing has been recommended. This can be achieved conveniently using multimedia CALL programs. Bowles (2004) in her research found that glosses are designed to draw the reader's attention and help in comprehending unknown vocabulary items and the text. Familiarization with the concept of 'noticing' in language learning will help in fostering explicit language awareness in learners, and highlighting the benefits of encouraging such awareness. Much similar to noticing, awareness-raising about language has been suggested to help focus learner attention on language (Schmidt, 1990). In the present study different conditions were used to induce noticing and see whether this noticing led to a better comprehension of the text and vocabulary learning of the target words.

Another theory which this study is based on is Mayer's (2005) cognitive theory of multimedia learning which provides an ideal theoretical framework to investigate multimedia learning and the cognitive processes involved in L2 learning. Mayer (2005.) provides empirical evidence supporting his theory and contends that learning in multimedia environments is facilitated when the information is presented through the verbal and visual channels in a way which doesn't overload the working memory such as presenting information by accompanying words and pictures instead of only words, placing words and pictures

near rather than far from each other, presenting them simultaneously instead of successively, and so forth.

Based on recent theories of the L2 reading process that have focused on an interactive approach, i.e. the utilization of both top-down and bottom-up processing, this paper is also concerned with the question of how reading comprehension can be facilitated with a multimedia application for language learning. Chun and Plass (1997) have discussed how L2 reading research focuses increasingly on the cognitive processes involved in reading, that is, the interaction of lower-level, bottom-up processes such as vocabulary acquisition with higher-level, top-down processes such as activating prior knowledge. They have combined this knowledge with current research on learning with multimedia, focusing on how learners integrate verbal and visual information, particularly with respect to the individual differences among learners that moderate, if not determine, learning processes. Multimedia environments allow for the addition of visual and auditory information to a text in order to improve comprehension. In summary it is postulated that different cognitive processes are involved in micro level processing and macro level processing of multimedia information.

On a micro level (e.g. vocabulary acquisition), the presentation of visual information with verbal information can contiguously result in dual coding of the information in a verbal and a nonverbal system in the form of a verbal and a nonverbal mental representation. On a macro level (e.g. overall text comprehension), visual information serves as an aid for text comprehension and functions as supplemental information that is added to the mental model of the text by mapping the analog visual representation onto the analog mental model. Consequently, visual material to support vocabulary acquisition has to be designed differently from visual material to aid text comprehension, depending on the cognitive processes to be supported. Chun and Plass (1996b, 1997) claimed that their results support the dual coding theory and its extension to multimedia learning and underline the importance of visual

information in addition to verbal information to support both top-down and bottom-up processing in reading in a foreign language.

Individual differences are one of the most important factors in studying L2 text comprehension in multimedia environments. This is attributed to the fact that learners in such an environment are usually allowed to decide for themselves the type of information they prefer to access and the order in which they process different types or modes of information. Thus, psychological theories on individual differences in learning preferences come into play. One dimension of such theories that seems to be of specific relevance to learner-controlled information seeking and information-processing behavior in a multimedia learning environment deals with the distinction between visualisers and verbalisers (Keefe, 1989; Kirby, 1993). Multimedia technology allows for the development of adaptive systems that provide learner-controlled options to support the user's preferences, which in turn enhances reading comprehension (Chun & Plass, 1997). According to Salmon's (1989) preference model, one of the potentials of multimedia is to accommodate these individual differences and provide learners with the materials they need. The ability to use presentation modes best suited to aid a particular cognitive process, and the possibility to support a variety of individual differences within one application are unique attributes of instructional multimedia materials.

2. Background

According to Soe, Koki, and Chang (2000), students are expected to benefit from computer applications in reading instruction. Kim (2002) states that several advantages of using computer for enhancing reading comprehension have been identified, for example facilitating automatic word recognition and vocabulary acquisition, providing multimedia glossing, strengthening the benefits of reading strategy training, creating the opportunity of practice with instant feedback, and stimulating student motivation toward reading especially with students who may need special motivation to overcome their frustration with slow achievement. Kim and

Kamil (2001) assert that one main application of computer technology is in explicit instruction of basic strategies. They add, computers offer engaging, interactive activities for general and targeted practice. Computer-Assisted Instruction (CAI) is a great help to weak students who need much practice in using basic reading strategies.

A study by Arroyo (1992) examined the effect of extended use of computers on reading achievement. The subjects consisted of 75 students attending an elementary school located in predominantly low income socio-economic neighborhood of South Chicago. Of this total, 15 students were subjected to an intensive computer-assisted instruction program for the entire school year, while 15 others, randomly selected from the remaining group of 60, received no computer training and served as a control group. Results of the Iowa Tests of Basic Skills indicated a statistically significant increase in reading achievement of the students who used computers. In addition to an improvement in reading scores, the use of the computer also appeared to increase the students' motivation to learn.

In 1994, Aweiss investigated the effect of computer-mediated reading supports on comprehension during independent reading. The worth-mentioned finding of this study was that the access to computer-assisted reading aids caused readers to score significantly higher on the immediate recall protocol while such increase was not evidenced in the scores of those with no access to any reading aids. In addition, motivation benefits were also observed for the computer-displayed group. The design of this study, however, did not make it possible for the researcher to investigate whether the use of traditional reading supports would have rendered similar results for the participants.

The question if schools should use computers no longer exists. It is a technological must. Teachers must be willing to take control of this technology and use it to their advantage; only when this occurs, will the students benefit the most (Arryo, 1992).

2.1 Facilitating text comprehension with multimedia

The process of reading and comprehending in a second language (SL) or a foreign language (FL) is very complex. In facilitating SL and FL reading comprehension, the use of sound, pictures, and animated pictures or video in addition to text, has played an important role in vocabulary acquisition and in overall text comprehension, and these are unquestioned components of instructional materials for language learning (Iheanacho, 1997). The retention and comprehension of information can be improved by multimedia presentation (Kim & Kamil, 2001).

New digital technologies such as hypermedia, hypertext, or multimedia have great potential for teaching and learning because of the innovative ways they present information, the motivation that they provide for learners and the control and freedom they give learners over their learning (Preece, 1993; Sakar & Ercetin, 2005).

Hypertext and hypermedia both store and give access to information in a nonlinear way with the only exception that hypertext makes use of texts only, whereas hypermedia takes advantage of multimedia recourses as well. In conclusion, hypermedia is a computer-based application that combines hypertext and multimedia within one system (Ercetin, 2003). However, hypertext and hypermedia are generally used interchangeably in the field (Sakar, 2003).

The educational benefits of multimedia are well documented (Moore, 2000). Several researchers have argued for the positive effects that multimedia has for SL/ FL readers, because a text can be made more comprehensible on them by annotating it with multiple types of media glosses (Sakar & Ercetin, 2005).

More recent studies in the area of computer and reading have examined the effects of multimedia reading software on reading comprehension. These studies mostly used computer programs with different types of reading supports such as annotations of individual words, visual supports, verbal supports, and information on the text.

Annotations in a hypermedia reading text provide extra information about the vocabulary or the topic through multiple forms of media like

text, picture, sound and video. Glossing is particularly useful in FL reading, because it is a means for learners to understand a text.

Sakar and Ercetin (2005) explored intermediate-level English learners' preferences for hypermedia annotations while they were engaged in reading a hypermedia text. The participants were 44 adult learners of EFL studying English for Academic Purposes. Data were collected through a tracking tool, a reading comprehension test, a questionnaire, and interviews. Results indicated that learners preferred visual annotations significantly more than textual and audio annotations. The qualitative data revealed that the participants had positive attitudes towards annotations and hypermedia reading in general.

In the study conducted by Plass, Chun, Mayer, and Leutner (1998), significant interaction was found among learning preferences, annotation type, and text comprehension. On the basis of an analysis of learning preferences for visual and verbal information in multimedia learning settings, 103 college students, enrolled in German language courses, were classified as visualizers that prefer to learn from the visual modes of the presented material, and verbalizers that prefer to learn from verbal options. In two 50- minute class periods on two consecutive days, the students had access to a multimedia program presenting a German short story in which for 82 words a translation with pronunciation was available along with its corresponding picture or the video. On the vocabulary test, the students were asked to report which annotation type came to their mind first when they saw the vocabulary word. And for the comprehension test, they were instructed to write a summary of the story in English. The results of the study demonstrated that visualizers performed better when both verbal and visual information were available, whereas verbalizers benefited more from verbal information. Thus, the researchers concluded that multimedia reading programs that can offer readers chances to select their preferred mode from both options, have a great potential to address individual differences in visual and verbal preferences. They tried to provide a rationale for the effectiveness of multimedia reading programs by saying that they skillfully address

individual learning differences, and hence they improve students' motivation for reading.

Tozcu and Coady (2004) in their research investigated the effect of direct vocabulary learning using CALL on vocabulary knowledge, reading comprehension, and speed of word recognition. They found that students who used Tutorial CALL to learn highly frequent vocabulary did learn a significantly larger number of words than those in the control group. Although both groups showed increases in vocabulary gain, reading comprehension, and a decrease in reaction time for frequent word recognition, the treatment students performed better in the post-test and showed significantly greater gains than the control students

It is clear from the background that various studies have been conducted to assess the effectiveness of the use of computer programs for improving reading comprehension. Although some studies reported contradictory findings, previous research has generally supported the notion that computer-assisted reading programs facilitate SL and FL reading comprehension. However, partly due to the limitations of many studies, such as small sample size, insufficient treatment time, absence of a control group, and use of immediate recall protocol as a measurement tool, caution is needed in measuring the truly reliable pedagogical value of using computers for developing FL reading comprehension until more convincing research findings in this area are available.

With respect to computer software programs, it is worthwhile to mention that not many computer programs used in the reviewed studies incorporated well-founded theoretical principles of reading and appropriate practices in reading skills. It is a fact that many reading softwares have been criticized for their poor quality due to lack of theoretical foundations (Balajthy, 1995; Lange, MacCarty, Norman & Upchurch, 1999; Reinking, 1989; Singhal, 1998). Based on such an analysis, it is clear that current theoretical views about what reading is, and what the reading process entails need to be taken into consideration when computer programs are designed and implemented for reading instruction.

Finally, it is worth pointing out that review articles of CALL research have typically focused on outcomes or methodology. Researchers commonly have left out or failed to gather relevant data on the subject characteristics. Most of the previous studies have not provided information about either the students' previous experience with CALL or their general level of "IT literacy", information which Felix (2005) observes as crucial. Discussions of most of these characteristics have been quite sparse in the CALL literature.

This research study aims to add to that literature by looking at specific elements related to the characteristics of CALL research subjects, many of which have not been addressed previously. The present study takes into account subject characteristics and their attitudes as well as outcomes and methodology.

3. Method

3.1 Participants

A total of 30 college students of English Language and Literature took part in this study. All the students were from Semnan University. They were freshman students enrolled for the Reading Comprehension II course. The study was carried out in spring 2009 for 20 sessions (10 sessions for each group). There were three male and 27 female participants. Their ages ranged from 17 to 23, with a median of 19. The research design consisted of one experimental group and one control group. The 30 students were randomly assigned into two subgroups. When registering for the course, the students did not know in which class they would be taking part during the study. Despite the absence of TOEFL scores or other standardized proficiency indicators, based on the students' reading comprehension scores in the previous semester (the mean for the Ex-group was 14.79 and for the C-group was 14.73), the proficiency level of the students could be characterized as intermediate, an assessment which was further supported by pre-test, so the students were nearly homogeneous in their English proficiency level.

The students in the control group read the texts from the printed pages of actual book in a conventional classroom, while the experimental group read the same texts provided with comprehension aids (texts, pictures, and sounds) on computer screen in the university computer lab. The two groups followed the same aim and scope of the course and they were taught by the same teacher.

3.2 Data collection instruments

3.2.1 Reading comprehension pre-test

Four texts were chosen from Engelman, Meyer, Johnson, and Carnine (2001) for pretesting. These texts were given to the participants to measure the level of their language proficiency and reading comprehension before the treatment. The passages were short (around 150 words each) on general topics. Following each text, there were a number of multiple-choice questions. There were 20 questions altogether and the students were allowed 22 minutes to read the four passages and answer the questions. Regarding the reliability of the test, Alpha was computed using SPSS version 16. The reliability index was 0.81, which is highly reliable. This test was reviewed by a colleague to ensure its validity.

3.2.2 Background questionnaire (pre-course questionnaire)

After randomly assigning the students into two subgroups, the experimental group filled out a questionnaire in the first session. Before the questionnaire was handed out to the students, the items had been reviewed by other colleagues. The aim of this review process was to avoid any unclear items or instructions and to ascertain the approximate time required to fill out the questionnaire. Based upon the feedback received from them, some of the items were rephrased and clarified. Responding to this questionnaire, the participants gave some demographic information on their age and gender and then answered some questions about their access to computer, their ability in using computer before this course, and their expectations and predictions of success in this course. The first eight questions were answered based on

the polar options *yes* and *no* and the next six questions were answered based on the three options *yes*, *to some extent*, and *no*. To ensure the reliability of the instrument, it was given to 15 EFL college students who had taken it before, after a lapse of two weeks. The test-retest reliability index was 0.78, which is highly reliable.

3.2.3 Computer-assisted reading program

This software, entitled *Reading Tutor*, is a computer program that the researchers designed for improving reading comprehension skills (see Appendix for more information). It is based on the reading textbook "Skill application" written by Engelman, et al. (2001) from which the contents of this software were taken both for teaching and testing purposes. The contents were general in subject and interesting. This book has been written specially for reading comprehension courses and compared with other reading comprehension textbooks is more voluminous and shows more variety, so the researchers enjoyed so much freedom in choosing the texts. Moreover, there are more visual aids such as photos, and drawings in this book. Since this book is based on new findings and recent trends which view reading as an interactive process, the researchers preferred to use this book as the basis of their software. The texts chosen seemed appropriate for the intermediate-level EFL learners after applying three criteria: syntactic complexity, text length, and content. They met the criterion of appropriate syntactic complexity for intermediate students because they consisted of short and uncomplicated sentences. The length of the texts was decided based upon the time limit in the computer lab. There were about 150 words in each text. With regard to content, there was no reason to assume that any group of EFL learners knew more or less about the texts.

The participants read the text for its content, using the annotations (texts, picture, and sound) to help them understand the text better. Then they completed the comprehension test. After answering reading comprehension questions, they clicked on the result icon to know the number of correct items and incorrect ones and the percentage.

3.2.4 The reading textbook

The reading textbook "Skill application" was a different version of the above program. The same texts, the same pictures and the same questions were used for the control group, but there were no other support tools here.

3.2.5 Reading comprehension post-test

Upon the completion of the course, the two groups took another reading test (post-test). There were 20 questions and the subjects were allowed 22 minutes to read the passages and answer the questions. The results were compared to see which group performed better. Again the reading tests were taken from Engelman, et al. (2001). This test was reviewed by a colleague to ensure its validity. Regarding the reliability of the test, Alpha was computed using SPSS version 16. The reliability index was 0.82.

3.2.6 Attitude questionnaire (post-course questionnaire)

After the experiment, the participants in the experimental group filled out a questionnaire. The aim of its administration was to find out information about the participants' experience with electronic reading. Prior to the development of the questionnaire, certain measures were taken to make sure the questionnaire is valid. To check for the content validity of the instruments, all components of the method such as the elements of the software program, the computer lab, the execution and administration were taken as areas for which subjects to comment; therefore, the questionnaire asked them about their perceptions of computer as a learning tool, as a component of the EFL reading comprehension course, its easiness or difficulty and its future. This questionnaire was also face-validated by asking another colleague to comment and check. His comments and suggestions were taken into consideration in the final draft of the questionnaire. To ensure the reliability of the instrument, it was given to 15 EFL college students who had taken it before, after a lapse of two weeks. The test-retest reliability index was 0.80.

There were 33 items in the questionnaire. The items were related to the participant's experience with technology, in general, and the usefulness or difficulty of use of certain features of this software, in particular. In this questionnaire for the first 30 questions the subjects were allowed to express their ideas on a 5-point Likert scale: 1 (strongly agreed), 2 (agreed), 3 (no idea), 4 (disagreed), 5 (strongly disagreed). The early 31 questions were all closed, so as to facilitate the easier analysis of the results later. Two open-ended questions were included in the final section to gather some qualitative data from the participants that would hopefully help to clarify some of the responses to closed questions.

3.3 Data collection procedure

The data were collected over five consecutive weeks. All subjects took the pre-test one week before the onset of the study. The experimental group met in the university computer lab to receive the treatment. They filled out a background questionnaire in the first session. Then they began reading the texts on the computer. The subjects were individually seated in front of the computers. Then, they read the text for its content, using the annotations (texts, pictures, and sound) to help them understand it better. While reading, they were able to look up the meaning of unfamiliar words, by clicking on the highlighted words in the text, by clicking on level one and level two icons, or by typing the word in the related section. They also used the pic and sound icons. Then, they completed the comprehension test and could be informed of the number of correct items and incorrect ones and the percent by clicking on the result icon. In the last session, they took a post-test and were asked to respond to an attitude questionnaire asking them to indicate their experience in the CALL environment. It should be mentioned that the teacher was present in all sessions, but she mostly assumed the role of an observer and facilitator.

The physical setting of the control group was a conventional classroom. They received the instruction in the classroom setting, and were taught in the conventional way of teaching reading comprehension

(using print reading format) by the instructor. The teacher explained the unknown words in each text and then they were asked to do the assignments on the accompanying worksheet. At the end of the course, this group also took the post-test and the results were compared with the other group to see which one performed better.

3.4 Data analysis

The data that were available for analysis consisted of reading comprehension scores (pre-test and post-test) and the information available in the questionnaires. These were consolidated into subtotals for each student and used in subsequent descriptive and inferential analyses. After scoring the tests and investigating the questionnaires, the results were statistically analyzed to provide answers for the research questions. The results of the scores (pre and post-test reading comprehension) were tabulated in terms of means and standard deviations. T-test was utilized at the .05 level of significance to determine if there was any statistically significant difference between the mean scores. The obtained data from questionnaires permitted investigation of the research question two in detail.

4. Results

4.1 Results for reading comprehension tests

Table 1 presents the mean scores and standard deviations of pre-test and post-test scores for both groups.

Table 1: Descriptive statistics of reading comprehension tests in terms of groups

name of the group		pretest of reading comprehension	Posttest of reading comprehension
Ex—group	Mean	14.13	18.07
	Std. Deviation	2.066	1.580
C – group	Mean	14.27	16.00
	Std. Deviation	2.086	1.464

Analyses of the mean pre-test scores suggest that the experimental group and the control group were not significantly different at the beginning: the Ex-group with a mean of 14.13 and the C-group with a mean of 14.27. A review of the mean post-test scores points out that after the experiment, the C-group's mean achievement score in reading is 16.00 while the Ex-group's mean in reading is 18.07. Therefore, there is a statistically significant increase in reading achievement of the Ex-group and the difference in means can be attributed to the type of instruction received.

A two-tailed t-test ($p<.05$) for independent samples was done on these four sets of scores to determine if there was a statistically significant change in reading achievement after being subjected to the computer-assisted instruction. Table 2 shows the outcome of the analyses of t-test.

Table 2: T-test results

	Levine's Test for Equality of Variances		**T-test for Equality of Means**						
								95% Confidence Interval of the Difference	
	F	Sig	T	Df0	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Pretest of reading comprehension (Equal variances assumed)	**.131**	**.720**	**-.176**	**28**	**.862**	**-.133**	**.758**	**-1.686**	**1.419**
Posttest of reading comprehension (Equal variances assumed)	**.410**	**.527**	**3.717**	**28**	**.001**	**2.067**	**.556**	**.928**	**3.206**

The t-test scores for the pre-test results (-.176) and the post-test results (3.717) show a significant change in reading scores for the two groups. As a result of the use of CAR techniques, students in the experimental group performed better in their final exam (post-test) and obtained better scores than the students in the control group. The analyses of the data in Table 2 show that at the .05 level of significance there was a significant difference between the post-test reading mean scores of the subjects from the CAR group and the post-test reading mean scores of the subjects from the control group (t observed (3.717) is bigger than t critical (.001)).

Results of the analyses show that when leveled on their pre-test scores, the students who received CAR instruction did score significantly higher than the participants of the other group. Generally, the analyses of Tables 1 and 2 lead to the conclusion that the two groups were not equal in reading achievement after the treatment. Students taught reading using instructional computer software program obtained significantly higher reading scores than those in the conventional classroom.

4.2.2 Results for pre-course questionnaire

One of the research tools used in this study was a background questionnaire which was distributed among the students of the experimental group before starting the treatment. Although their age varied between17-23, the majority of them were 19. There were three male and 12 female students in the experimental group. They were asked to report whether they had a computer at home and whether they had used a computer before. 86.7 percent of the students reported that they had their own computers at home, while 6.7 percent reported that they used computer only in the university (i.e. free access computer labs). They also reported that they had used computer before this experiment. Students were also asked to report what abilities they had in using computers. 53.3% reported that they could use computer to send e-mail, and 66.7% could use computer for word processing (e.g. typing reports and class assignments). With regards to web surfing, 53.3% reported that they surfed Persian sites, none of the students surfed only English sites,

and 46.7% of the students surfed both English and Persian sites. The final questions in the questionnaire asked the students to report about their expectations and predictions of success in this course. Most of them were confident that they could do well in this class and would receive an excellent grade at the end. The results of the pre-course questionnaire indicate that the majority of the students were already familiar with the use of computer and surfing the web before they entered this instructional course. These results are indicative of the latest trend among teenagers worldwide, and this is not surprising since we live in an information age, and everyone should be familiar with computer.

4.2.3 Results for post-course questionnaire

There were 30 statements and three questions in the post-course questionnaire on the effectiveness of this software for reading comprehension. The statements fell into four major threads of investigation: what the students thought of computer as a learning tool, what they thought of hypermedia as a component of their EFL reading comprehension course, the ease or difficulty of using CALL, and the likelihood of the future use of CALL. The two open-ended questions at the end asked students to write what they liked about the course and what they did not like. The results obtained from post-course questionnaire are elaborated in turn.

4.2.4 Computer as a learning tool

Overall, the students found the computer a valuable learning tool, and 100% strongly agreed that being able to use the computer software was a valuable skill. With respect to the different skills that CALL helped them practice, the students found that they definitely learned more computer skills (86.7% strongly agreed) and that the software was effective in helping them read English web sites (80% strongly agreed). However, the students did not find the software effective for learning English grammar (60% strongly disagreed with learning it). Since this was a reading course, students did not get explicit instruction on English grammar, so it is understandable that they felt they did not learn much grammar. 86.7% strongly indicated that the software had helped them in

improving their reading skills and vocabulary. Finally, in order to make sure that the students were not just clicking numbers on the questionnaire mindlessly, the researchers included a negative statement (i.e. the use of computer is unnecessary for this course). Almost all of the students disagreed with this statement. (80% strongly disagreed and 20% disagreed).

4.2.5 Computer as a component of the EFL reading comprehension course

In general, the students liked using computer for their EFL reading comprehension course (93.3% strongly agreed). They found that the computer made the course more interesting (93.3% strongly agreed), and it helped them talk to their classmates more (86.7% strongly agreed). 93.3 % reported that they communicated with their teacher more. A large percentage of the students (86.7% strongly agreed and 13.3% agreed) hoped that if they used computer for their reading comprehension course, they would get a better grade. In their evaluation of the components of the software, 80% believed that the topics were interesting and all of them (100%) reported that the guided feedback in the texts was helpful. 100% found that the words in level one were easier than those in level two. The picture was helpful in understanding the text (86.7% strongly agreed). Because there were not enough facilities in the computer lab for hearing the sound, most of them (60%) asserted that the sound was not clear. The guided feedback in the test section was a new experience for the students and a large percentage of them (86.7 %) strongly reported that this section was helpful in understanding their level of comprehension of the texts. And finally, a large percentage of them (86.7% strongly agreed) reported that they had enough time to do the assignments and that the reading comprehension questions were too easy for them (80% strongly agreed).

4.2.6 Ease/ Difficulty of using CALL

A very positive result was that having taken our CALL course, the students were confident using computer technology (73.3%). They strongly indicated that by using this software, they could do reading

alone (86.7% strongly agreed). The students also strongly agreed that the software was an easy program to learn (100%) and that they were comfortable using the software to find the information they needed (80% strongly agreed). They generally (100%) agreed that the activity instructions were easy to follow. These results are not surprising, since the majority of the students had already reported that they were familiar with some kinds of computer skills (see the results for the pre-course questionnaire) before entering the CALL course. All of them (100%) believed that reading English texts on the software was easier than that from English textbooks.

4.2.7 Likelihood of the future use of CALL

A good indication of success of the CALL course was the students' assertion that they would continue to surf English websites after the end of the course (80% strongly agreed). 86.7 % of the students also reported that they would use the computer software even after they finished their CALL course and 80% strongly indicated that they would like to register for another course with a computer component. Apparently, the students' overall enthusiasm and satisfaction with the CALL course outweighed any technical problem or other difficulties they encountered during the course.

4.2.8 Students' likes/dislikes

In asking the students whether they would suggest this instructional program to their friends, all of them (100%) strongly answered they would. The two open-ended questions at the end of the questionnaire asked students what they liked in this course and what they did not. The results reported here have been collected based on the highest frequency of answers. The students reported that in this course they liked the opportunity of speaking to their classmates in English. The in-class component of the CALL course puts emphasis on speaking and sharing information with classmates. Such involvement in meaningful tasks and social interaction are key components in active learning and can lead to effective learning with computers (see also Egbert, 2000). The students also liked learning English and computer skills simultaneously and

expressed that in this class they had more opportunities to get individual assistance. The complete privacy of teacher-student interaction was new for them because they believed that while others were working, they could talk to the teacher without distracting other students' attention. They said in the traditional classrooms, the teacher is very authoritative; s/he decides upon everything and the students are expected to follow him/ her, but in this class the case was not so. Moreover, being allowed to determine their own rate, path, feedback, and schedule and going individually through the exercises were encouraging for them. They said knowing the in-context definition of the words and the result of the test by clicking on the relevant icons was a new experience for them. Surfing English web sites and using e-mail at the end of the class were also liked by many students. In the end, some of them said that this was the best reading class that they had ever had and suggested designing computer softwares for other courses too (such as reading literary texts or grammar instruction). On the other hand, the majority of students complained that some computer systems in the lab did not work well. Some students also asserted that the class time in some days was not suitable. Few of the students felt that they did not get enough chance to talk with the teacher (mainly because the in-class component of the CALL course included student-student speaking activities), and others reported that they would like to have more pronunciation teaching

5. Discussion

Hypothesis one states that the post-test scores of the experimental group will not be different from those of the control group. The analyses and comparison of the results on the post-test given to the subjects revealed that the subjects in the experimental group scored better than did those in the control group (see Tables 1 & 2). It was thus concluded that the main difference in the students' scores was due to the use of CAR techniques and that we can strongly reject the first hypothesis. Tozcu and Coady (2004) in their research found that CALL can lead into increases in vocabulary gain and improvement of reading comprehension. In their

study, the treatment students showed significantly greater gains than the control ones. Consistent with this research and the other studies reviewed in the background (Arroyo, 1992; Aweiss, 1994; Plass et al., 1998), the present study also indicates that comprehension scores should increase when readers read computerized texts that provide reading supports.

The second research hypothesis states that the students in the experimental group will not have positive attitudes towards CAR. The analyses of the results of the Likert Attitude Scale showed that the students had positive attitudes towards it. They found the computer a valuable learning tool. Based on the responses to the questionnaire, most of the subjects (90%) agreed on the effectiveness of computer software for learning and improving reading comprehension skills. The Students' comments showed that in, general, they believed this program was helpful in improving their reading skills and use of strategies because of the various types of activities, and explanations offered by it. They considered using CALL easier than reading materials from textbooks and finally they asserted that they liked to use computer in their future courses. In Sakar and Ercetin's study (2005), the qualitative data revealed that the participants had positive attitudes towards annotations and hypermedia reading in general. The results of the present study confirm the results of their study and what other researchers claimed in terms of this factor (Akyel & Ercetin, 2009; Arryo, 1992; Aweiss, 1994; Chun & Plass, 1997; Plass et al., 1998). So, it can be argued that CALL-based teaching of reading comprehension can be an extremely powerful educational tool and that this kind of instruction positively affects students' reading comprehension. Based on the above arguments, the second hypothesis and its sub-divisions can also be strongly rejected.

The students in the CAR class showed higher interest in their learning than thode in the traditional class. Reduction of anxiety was one of the advantages of the CAR class. An important factor in lessening anxiety during learning is privacy. When the reader of the CAR class worked with the computer, only the machine (and sometimes the teacher

too) knew his mistakes. CAR offered individualized attention and allowed the students to work at their own paces. It also provided immediate feedback, letting students know the level of their reading comprehension.

Consistent with Levine, Ferenz, and Reves (2000), this study also indicates that computer changes the nature of the EFL teacher's role in the academic reading class. Computerized education would change the role of teachers, but would never eliminate nor downgrade them. On the contrary, teachers would remain extremely important, but with a radically different focus. The teacher's role in the computerized EFL classroom was mainly of mentor and facilitator. Computer relieved her of some of the burden in preparing and correcting large numbers of individualized exercises in basic concepts and skills and in recording grades. So, the teachers should consider computer as a new and powerful tool for helping them to teach their students more effectively.

Reading instruction via computer has the potential to actively engage students in the reading and learning process because of its capabilities to meet their varying needs, and help students perceive the value of success, and their own potential as readers.

In this experiment, the students who learned to use hypermedia became active learners. Hypermedia instructed students by presenting textual, verbal and visual information about unknown words and the topic. The students played a much more active role than was possible with traditional textbooks. They were required to make decisions about the information they were accessing and reading on the computer screen and were mentally active while interacting with the texts. Consequently, the experimental group became more student-centered because hypermedia required active readers.

The computer's ability to combine sound reading practices with non-threatening, humanistic feedback in a pleasingly structured environment makes it ideal for students with reading problems. When used with discerning eye, the computer can become a "natural" part of any reading classroom. Therefore, the question is no longer whether or not to use

computer as an educational tool, but rather how they can be used most effectively as part of the learning process. The multimedia computer programs provide important capabilities to assist in meeting this challenge.

6. Conclusion, Pedagogical Implications and Suggestions

CAR is a new and enriching learning experience for the Iranian students. Computer applications to teach reading hold great promise as instructional tools to increase the students' engagement in reading, promote reading comprehension, stimulate interest, and improve reading skills. By using such a tool, teachers can vary the pace of instruction, review and reinforce learning, teach and address specific skills and strategies, enhance motivation, and provide immediate feedback. This study provides support for the value of CAR and, based on its results, it can be concluded that the computer can be an effective teaching tool when integrated into classroom teaching.

While students become responsible for their own learning process, teachers play the role of a guide by helping the students enhance the use of computer in the process of reading comprehension. Computer is not meant to replace the teacher or reduce the number of teachers needed, but rather to improve and enhance classroom reading instruction. The thrust of computer-assisted reading is to raise the quality of education, not to reduce its cost.

As far as pedagogical implications are concerned, what has been mentioned above constitutes evidence addressing the design of computer programs for second and foreign language reading. There are very few instructors in Iran who integrate computer technology into their teaching. The findings of such research efforts are encouraging and should be of great benefit to teachers who choose to use computers in their reading classrooms. It can be argued that computers are so important to the future of students that they need to be part of their education. Teachers working in computerized environment need support and preparation to adopt new roles. They must be prepared to change and adapt their teaching style

according to new developments and findings in the pedagogy of computer-based language teaching. There should be extensive training and awareness rising both among university administrators and teachers. This new perspective on language education suggests the need for radical reform in English education curriculum at various levels to incorporate computer technology as an integral part of English classes especially reading comprehension ones because many non-native speakers prefer improving this skill to the other three skills. Curriculum designers should be convinced that computers with powerful software and internet access have the potential to be extraordinarily creative thinking tools. This technology may actually make the process of reading significantly faster and play a key role in the improvement of a country's educational system.

This study represented a preliminary effort to empirically examine the efficacy of the computer instructional software on reading comprehension of students by comparing two modes of teaching. Surely it had its own limitations and pitfalls. However, it tried to break the ice and pave the way for other researchers interested in teaching English through computer. Further research is needed for a thorough understanding of this issue and for confirmation of the findings. It is recommended that this study be replicated with a larger number of participants from the same background. More research is recommended to address EFL students of different ages, different languages and language skill levels, other skills, text length, text type, degree of student control over computer supports, transfer of learning and long-term training effects of CALL. Thus, there are different aspects which need further investigation. These suggested avenues of research might shed more light on teaching English involving computer. Finally, it is hoped that this study will speed up the belief of computer-based teaching among instructors in Iran and can provide language professionals and instructors with a good starting point from which to discover further educational opportunities that CALL has to offer.

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Appendix

Program description

This program consists of 20 texts. Some unique parts of the program are described as follows:

Instructions page: In the first page of the software, there is an instructions page in which the activity instructions have been described

in an easy way. By following these instructions, the students knew what to do.

Bold words in the text: At the beginning of each unit, the number of the lesson and its part appear. Then, the readers can see the text in the following space. In the text, some words are in bold face. The students used a mouse to click a word for its in-context definition, synonym, antonym, and some usage examples. The researchers used Axford Advanced Leraner's Dictionary (2007) for providing the meaning of words.

Enter your considered word: By typing the unfamiliar word in this section and clicking on the execution, the definition and explanation of the word appear on the screen.

Level one and level two icons: The other support tools are level one and level two icons. Explanation of the new words and expressions of the text was done on these two levels. Level one is an easy level and level two is a more challenging one. The division of the new words of each text in these two levels was based on the comments of some students in a pilot study carried out before designing the software. By clicking on these two icons, the students could see the in-context definition, synonym, antonym, and some usage examples of words.

See "pic" icon: Below the level two icon, there is another icon entitled "see a pic". By clicking on this section, students could observe the picture related to the text.

Sound icon: In the sound icon, the students could hear the voice of the instructor reading the text herself. It helped the students to hear the exact pronunciation and the stress of words. This part was a great advantage of this software, because it added listening to seeing, just like a real classroom. With the help of this part, they could read the texts independently and they did not need the teacher's help for reading the texts.

Test icon: By clicking on the test icon, the reading comprehension questions appear. For each text there are at least six multiple-choice

comprehension questions. These questions are displayed in a gray cloudy box and help the students check their general understanding of the text.

Result icon: At the end of the questions, there is a part named "result". By clicking on this part, the students could understand the number of their correct and incorrect answers and then the percent of the correct answers.

Next page and last page icons: By clicking on the two icons of next page and last page, the students could turn the page.

The computer program provided the subjects who were reading the text, with annotations for target words. Practically speaking, if a student came across an unfamiliar word or concept to which the researchers had chosen to assign a hyperlink, s/he could click on the word with a mouse pointer in order to immediately display the researchers' definition or additional explanation on the screen.

This program was written in the basic language, and published on CD-ROM. The audio component was processed with jet audio, and the pictures were processed with Object (Image Box). This program might not function under any computer program. No specific hardware is required for this project.