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Mapping Strategies

The purpose of this study was to investigate the impact of using two visual-while-reading strategies, knowledge-mapping (KM) and underlining, on the performance of intermediate students learning English as a Foreign Language (EFL) in multiple-choice reading comprehension tests. In doing so, 60 Iranian intermediate EFL students were selected from a larger population by means of a proficiency test. They were then divided into three groups: two experimental groups, i.e. KM and underlining, and one control group. First, the KM and underlining groups were taught how to use KM and underlining strategies respectively during reading. Then, all the subjects in the three groups took the same reading comprehension test. The results indicated that the underlining group scored the highest, followed by the KM group, with the control group performing the lowest.

Reading is an essential skill for both educational and professional success; it is the best way of staying in touch with vital new findings and increasing one's academic and professional standing. Moreover, it is an important source of pleasure, both in native and foreign languages (Chastain, 1988; Li & Wilhelm, 2008; Saricoban, 2002). Also, the benefits students obtain from this skill are much greater than those which they receive from other skills such as listening, speaking, and writing (Saricoban, 2002)**.** That is, they can comprehend more through reading than through speaking, listening, and writing. For this reason, reading should be emphasized in the initial stages of teaching a foreign language. Like the other three language skills, reading is a process involving the activation of relevant knowledge to accomplish an exchange of information from one person to another. Active mental processing is necessary for communication to occur. Reading is not only a receptive but an active skill (Chastain, 1988). It is a process that involves various mental activities and numerous subprocesses. To understand main ideas, readers use their background knowledge as well as the information provided by the reading text. Scholars (Basque &

Pudelko, 2004; Birbili, 2006; Celce-Marcia, 1991; Chastain, 1988; Mokhtari & Reichard, 2002; Yanez, 1987) advocate the use of reading strategies to aid students in adjusting to the demands of most texts. Using these skills can easily be initiated at beginning or intermediate levels to provide students with strategies that are considered, as Baker (2004) states, "an essential aspect of teaching English as a Foreign or Second Language" (p. 303). Furthermore, Mokhtari and Reichard (2002) believe that "increasing students' awareness of their comprehension processes while reading is an important first step toward their becoming constructively responsive, strategic and thoughtful readers" (p. 256). Clearly, not all strategies are equally effective, due to different types of reading texts, tasks, and strategies employed by individual readers (Phan, 2006). These strategies are divided into prereading, while-reading, and postreading (Jalilifar, Hayati, & Saki, 2008; Li & Wilhelm, 2008; Saricoban, 2002). Prereading and postreading strategies are not of concern in this study. From among the while-reading strategies, however, knowledge-mapping (KM) and underlining are discussed in more detail because they are part of a topic that is growing more and more significant, not only for EFL (English as a Foreign Language) students, but also for students who are native speakers of English. On the one hand, Amer's (1994) findings suggest that KM and underlining strategies play an important role in reading comprehension with regard to open-ended questions. On the other hand, there is a lack of universal agreement and clear-cut response regarding the usefulness of these strategies on the students' performance in multiple-choice reading comprehension tests.

Review of Literature
Research has indicated that visual aids have the potential for lowering the language barrier and making content information more comprehensible to readers. Visual aids can also be used to highlight the linguistic device of knowledge structures, recognition of which is a step toward academic, second-language acquisition (Birbili, 2006; Chang, Sung, & Chen, 2005; Rewey, Dansereau, Dees, Skaggs, & Pitre, 1992). In this regard, while-reading strategies require readers to delve into written texts. In other words, they help students to comprehend the content and to perceive the rhetorical structure of the text. As students master these strategies, their understanding of readings is greatly enhanced (Celce-Murcia, 1991; Yanez, 1987). A number of useful while-reading strategies can guide students through the text and help them comprehend it better. These strategies include identifying the main and supporting details of the text, identifying the organization of the text, and using strategies such as SQ3R (a five-step reading strategy: Survey, Ques-

tion, Read, Recite/Recall and Review), outlining, KM, and underlining (Baker, 2004; Mokhtari & Reichard, 2002). The last two strategies, KM and underlining, are explained below because they are the major focus of the present study.

KM Strategy

A knowledge-map is a graphical display that can be used to present information in the form of node-link-mode assemblies. The nodes contain key ideas and the links specify the relationships between nodes and add structure and organization to the map (Canas, 2003; McCagg & Dansereau, 1991). Similarly, the knowledge-map provides students with a skeletal representation of information. It strips away the minor connecting words and gets at the essence of meaning. A map typically includes the most important concepts in a topic. The concepts are drawn in boxes, ovals, or circles and are linked to one another by lines labeled with the named relation—usually represented by verbs or prepositional phrases. When subjects are engaged in creating such knowledge-maps for their reading passages and given feedback regarding their efforts, they tend to exhibit significant knowledge gains in learning (Reutzel, 1985). A knowledge-map may consist of main ideas and sequential details, comparison and contrast, cause and effect, and so on. In this regard, Vail (1999), drawing a line between two types of knowledge, i.e., implicit and explicit, elaborates on implicit knowledge as containing "mental models" of experience and skills that are difficult to communicate. Explicit knowledge, however, can be communicated externally and represented in formal models, rules, and procedures. Vail, therefore, views the knowledge map as a good way to share explicit knowledge and to capture what people with implicit knowledge hold in a given area. Furthermore, Nist and Simpson (2002) suggest that mapping most benefits students who are persistent in using the strategy and who have high content knowledge in a particular domain (Hall & O'Donnell, 1996; Lambiotte, Dansereau, Cross, & Reynolds, 1989; Novak & Gowin, 1984; Yiğiter, Sariçoban, & Gürses, 2005).

Studies in knowledge-map (KM) strategy has led, in some cases, to contradictory outcomes. For example, in Rewey, Dansereau, Skaggy, and Hall's (1989) investigation, KM vs. text vs. no supplement was studied across three styles of instruction: cooperative learning vs. cooperative teaching vs. individual study. One of the important results of the study was that the KM groups did not outperform the other supplement groups.

However, Hall and O'Donnell (1996), focusing on recall memory of material presented as either text or as a KM, concluded that the KM

group demonstrated better recall for both kinds of materials, that is, superordinate and subordinate. Another study, as cited by Canas (2003), Moreland, Dansereau, and Chmielewski (1997), tested the effect of two types of strategies, concept-mapping (CM) vs. text annotations, on learning. To them, the latter refers to learner-generated strategies such as underlining, marginal notes, etc. According to their study, no statistically significant difference on recall existed between both conditions: text annotations and CM, though a difference in favor of the mapping group approached significance. (KMs are very similar to CMs except that KMs restrict more the nature of links and restrict less the content of nodes.)

Miller, Canas, and Novak (2006) carried out a study with teachers beginning training in the *Conéctate al Conocimiento* Project's workshops which concluded that, although a very high percentage of teachers are familiar with CM and a great many claim to use them in their classrooms, most of them have serious conceptual errors regarding this tool.

O'Donnell, Dansereau, and Hall (2002) suggest the following helpful guidelines in teaching students how to use KM:

1. Begin with a content that is extremely familiar to students so that they do not need to expend much effort in searching for appropriate information.
2. Provide a completed knowledge-map of the content with its textual analog.
3. Ensure that students can recognize the isomorphic relationships of the text and the knowledge-maps' presentations; that is, ensure that they can reproduce the sample map from the text and that they can reproduce the text from the knowledge-map.
4. Use a number of well-constructed maps as initial examples (i.e., maps that are designed according to gestalt principles).
5. Have students work in pairs to summarize the content from the maps using techniques such as scripted cooperation (p. 84).

In line with the remarkable advances achieved in technology, teaching English has also benefited from devices such as the computer. More specifically, some scholars have suggested software which arms language learners with enough convenient tools to do work with on their own. In the case of reading strategies, too, computer programs have been suggested (Birbili, 2006; D'Amore, Konchady, & Obrst, 2000). For example, in the Knowledge Mapper Prototype System, the most recent version of KM software developed by Chung, Baker, and Cheak (2002), instruc-

tors are allowed to define tasks for the students by specifying concepts and linking terms.

Underlining Strategy

The procedures below are also suggested to familiarize the students with the underlining strategy (Santa, Havens, & Maycumber, 1996):

1. Explain to students that, when used selectively, underlining sections of text and taking notes in the margins are helpful comprehension strategies. Explain that underlining is one way to organize information in texts.
2. Using a transparency of an assignment, model how to underline. First, read through the selection, then reread and begin underlining, not whole sentences, but words and phrases that get at key ideas. Note main ideas with numbers or other notations. For key ideas, come up with short topic names, and write them in the margins.
3. Underline main ideas and details with different colored markers. For example, main ideas may be in blue while details are in red.
4. When main points are not explicit, generate one's own main points, jot them in the margins, and color appropriately.

While underlining is perhaps the most widely used of all reading and study strategies, according to Anderson and Armbruster (1985), it has not been investigated extensively either (Ahmad & Asraf, 2004). Like KM, underlining has faced controversial reactions from some researchers. For instance, based on Lorch, Lorch, and Klusewitz's report (as cited in Sadeghi, 2007), underlining or "light signaling" helps the reader's recall more than no underlining or "heavy signaling" in which other unimportant information is underlined as well. In their study, Hsieh and Cifuente (2006) adopted mixed methods to investigate the effects of student-generated visualization on paper and on computers as a strategy for middle school science concept learning. After administering a posttest, they analyzed the data obtained from the paper/computer and the control groups. They concluded that students who made use of visual conventions to represent concepts on paper/computer performed better on the comprehension test than did the control group, who used the traditional manner of rereading, underlining, and highlighting. In the same vein, Taraban et al. (as cited in Vianty, 2007), working with Indonesian students, came to a quite different conclusion. They found that students used some of the analytic strategies (evaluating reading goals and inferring) more frequently when reading in their native language, Bahasa. However, when reading in English, the same students

used pragmatic reading strategies (such as underlining and highlighting) more frequently.

So, given the contradictory views surrounding the use of KM and underlining strategies in reading comprehension, one of the main purposes of the present study is to investigate the applicability of either one of the above-mentioned strategies in an Iranian EFL context.

Statement of the Problem

Since English is treated as a foreign language in Iran, reading comprehension is the main objective in Iranian ELT contexts; therefore, learners rarely find enough opportunities to interact with native speakers and learn about their culture (Ghassemi, 2006). For the same reason, most of the Iranian EFL learners show serious problems in reading and comprehending a foreign language. This inability can be partly due to the lack of linguistic knowledge, world knowledge, and lexical knowledge. But more specifically, this deficiency can also be due to the failure to exploit while-reading strategies such as KM and underlining.

Research Questions

This study intended to answer the following questions:
1. What is the effect of using a KM strategy on the performance of intermediate EFL students in multiple-choice reading comprehension tests?
2. What is the effect of using an underlining strategy on the performance of intermediate EFL students in multiple-choice reading comprehension tests?
3. Which one (KM or underlining strategy) is more effective for improving students' performance in multiple-choice reading comprehension tests?

Research Hypothesis

The above questions lead to the following null research hypothesis:

There is no relationship between while-reading strategies (KM and underlining) and the performance of intermediate EFL students in multiple-choice reading comprehension tests.

Methodology

Subjects

From a large population of students studying English as a Foreign Language (EFL) at Shahid Chamran University of Ahvaz, 60 participants (40 females and 20 males) were selected by means of a Proficiency Test. (Gender, not taken as a factor here, could be considered as a limitation

of the study.) In order to maintain a homogenous proficiency level, students whose scores ranged from 35 to 50 out of 80 were selected to participate in the study. Then, they were randomly divided into three groups: two experimental, i.e., KM and underlining, and one control.

Instruments
Two different tests were administered in two separate sessions. Test A was the Michigan Test of English Language Proficiency (1984) containing 80 multiple-choice items designed to assess the participants' knowledge of grammar, vocabulary, and reading comprehension. Test B was an intermediate reading comprehension test selected from a book entitled "Intermediate Reading Comprehension"(Dehmireh, 1991). It contained four passages, each of which was followed by nine multiple-choice questions.

Procedures
A proficiency test was given to 135 junior EFL students. Then, based on their scores on the test (35 to 50 out of 80), 60 students were selected as the intermediate participants of the study. Later, the subjects were randomly divided into three groups, i.e., knowledge-mapping, underlining, and control. Each group consisted of 20 subjects. Just before the administration of the reading comprehension tests to the three groups, the KM and underlining groups participated in 60 minute KM and underlining training sessions respectively.

KM Training
The subjects in the KM group participated in a 60-minute KM training session. First, the students were told the potential advantages of KM as a visual reading aid to enhance reading comprehension and how a text that may seem complicated and hard to understand can be visually converted into a knowledge-map to make it easier to understand and remember. Then, each student was given a handout including the steps to be followed to construct a knowledge-map. The steps adopted from Pauk (1989, p. 101) are as follows:
    1. Read the text thoroughly in order to recognize the main theme;
    2. Select the most important concept and put it at the *top* of a sheet of paper;
    3. Reread the text, and circle or list other key concepts;
    4. Rank these concepts hierarchically, that is, from most inclusive to least inclusive;
    5. Show the relationships between concepts by drawing a line

between related concepts and labeling these lines with a
word or phrase that explains the relationship;

6. Review the knowledge-map to make sure that it is as accurate
   as possible.

Next, each student was given a handout of a passage. First, the students
were allowed 20 minutes to read the passage and generate their own
knowledge-maps in accordance with the given steps. While they were
reading, the researchers moved round the class to make sure they were
focusing on the task. This was followed by a class discussion. The purpose
of the discussion was to generate a knowledge-map on the blackboard to
make sure that students could generate accurate knowledge-maps.

Underlining Training
The students of the second group participated in a 60-minute underlining
training session. First, each student was given a handout including the
steps to be followed to underline important information while reading
a text. These steps are taken from Smith (1985, p. 102):
1. Read the whole passage thoroughly;
2. Do not underline words or sentences as they are first read;
   underlining should be done after recognizing the main theme
   of the passage;
3. Re-read the passage;
4. Underline the key words, main ideas in each paragraph, and
   their supporting details.

Then, the students were given a passage and were allowed to read
and underline important information within the text following the
given steps. This was followed by a class discussion in order to check
the students' underlining procedure.

After the training sessions, the subjects in the three groups were given
four reading passages with the average of 300 words each followed by
a total number of 36 multiple-choice items. The topics of the passages
were "Atomic Clocks," "Industry in Liberia," "Wit vs. Humor" and "Visual
Arts." To read the texts, each group was asked to use the strategy they
had been taught. That is, the KM group was asked to use KM strategy,
and the underlining group the underlining strategy. The subjects in the
control group did not receive any training in this regard; instead, they
were asked to read the passages on their own. At the end, the three
groups were asked to answer the questions within 40 minutes. The
questions were selected from the source of the original texts (Dehm-
ireh, 1991). Before scoring the test, all the three groups' papers were
checked by the researchers to make sure that each group had used the
required strategy.

Data Analysis

After scoring the test, the results were analyzed statistically to evaluate some relationships (if any) among the KM and underlining strategies on the one hand and students' performance in multiple-choice reading comprehension tests on the other. In doing so, the means and standard deviations for reading test scores of the three groups were examined to compare the students' performance on the multiple-choice reading comprehension test. Then an ANOVA of the reading test scores was assessed to determine the relative significant differences between the results of the three groups of subjects. Finally, Tukey's HSD procedure was used to compare the mean scores of the three groups.

Results

As shown in Table 1, students using the underlining strategy during reading scored the highest (M = 25.40), followed by those who used the KM strategy (M = 22.25), with those reading the same passages without using these strategies doing the worst (M = 16.35).

Table 1 Means and Standard Deviations for Reading Scores

	Test type	N	Mean	SD	SE
Group 1	Control	20	16.35	4.49	1.00
Group 2	Knowledge-mapping	20	22.25	2.86	0.64
Group 3	Underlining	20	25.40	3.87	0.86
Entire Sample		60	21.33	5.31	0.68

Note. N = Number of subjects; *SD* = Standard Deviation; *M* = Mean; *SEM* = Standard Error of Measurement.

Table 2 ANOVA of the Reading Scores

	SS	df	MS	F	P
Between groups	844.23	2	422.11	29.16	0.00
Within groups	825.10	57	29.47	—	—
Total	1669.33	59	—	—	—

Note. SS = sum of squares; *F* = statistic value; *df* = degree of freedom P = probability value; *MS* = mean square.

Table 2 shows the results of the one-way ANOVA for the reading comprehension test. As it is observed, there is a significant difference among the performance of the three groups ($df = 2$, $F = 29.16$, $P = 0.00$).

Table 3 illustrates Tukey's procedure of comparing the sets of mean scores of three groups on the reading comprehension text. It shows a significant difference among the students' performance in the three groups. That is, the underlining group scored the highest followed by KM and the control group respectively. This suggests that the use of KM and underlining strategies during reading has important effects on the students' performance in reading comprehension, especially in multiple-choice reading comprehension tests. Therefore, the null hypothesis stating that "there is no relationship between KM and underlining strategies and the performance of intermediate EFL students in multiple-choice reading comprehension tests" is rejected.

Table 3 Tukey's HSD Procedure for Comparing Means of Reading Scores

Group	M	Control	Knowledge-mapping	Underlining
Control	16.35		5.90*	9.05*
Knowledge-mapping	22.25	5.90*	—	3.15*
Underlining	25.40	9.05*	3.15*	

Note. M = mean; *The mean difference is significant at the 0.05 level.

Discussion

This research investigated the impact of two while-reading strategies, KM and underlining, on the performance of intermediate EFL students in multiple-choice reading comprehension tests. As can be inferred from Tables 1, 2, and 3, both the experimental groups (KM and underlining) outperformed the control group. Therefore, the data strongly suggests that the use of KM and underlining strategies during reading can improve the performance of intermediate EFL students in multiple-choice reading comprehension tests. An interesting finding is that there is a significant difference between the means of KM and underlining groups in favor of the underlining group.

With regard to the first research question, the results suggest that

the use of a KM strategy during reading has a facilitative effect on the students' performance on multiple-choice reading comprehension tests. One explanation for this finding is that KM helps students identify the main ideas in the passage by presenting the interrelationships between ideas and the meaningful connections between superordinate and subordinate ideas. The knowledge-map provides the readers with the power to put the ideas in the passage in a hierarchical order, that is, from major to minor, and shows the relationships between ideas by drawing a line between them and labeling them with a word or phrase that explains the relationship. When students are engaged in generating such maps, they gain a lot of information from the passage. Whenever they want to answer a particular question, they look at the knowledge-map from top to bottom and, thereby, find the answer to the question. Another explanation for this finding is that KM provides students with a graphic plan for organizing information. This graphic plan includes all the main ideas and the supporting details of the passage. Thus, students use this graphic plan as a summary of the text in order to answer the multiple-choice reading comprehension tests.

As for the second research question, the results indicate that the use of an underlining strategy also has a positive effect on the students' performance in multiple-choice reading comprehension tests. One explanation for this finding is that underlining improves retention of passage material because it motivates students to focus on identifying ideas of high structural importance. High level sentences (main idea or topic sentences) help readers integrate more specific lower level sentence ideas (supporting sentences). This effect could be justified by connectionist models which "attempt to achieve theoretical generalizations by explaining reading in terms of basic principles of learning, knowledge representation, and information processing that govern many aspects of language and cognition" (Rayner, Frooman, Perfetti, Pesetsky, & Seidenberg, 2001, p. 53).

With regard to the third research question, the underlining group outperformed the KM group. The findings suggest that underlining is a more effective reading comprehension strategy than KM because, given prior research, it requires students to process the text at a deeper level than does KM strategy (Duchnowski, Sheffield, & Kutash, 2005). Also, the procedures used for KM seem to be more complicated than those of underlining strategy. Another possible reason may be the novelty of KM compared to the underlining strategy. It seems that using "underlining" is more common among students, although they may not be familiar with basic principles of this strategy.

Pedagogical Implications

The results of this study can help a diversity of professions concerned with teaching reading, language learning curriculum development, and textbook writing. Reading teachers have to raise their students' awareness by using KM and underlining strategies during reading and teaching them how to use these strategies (Salataci & Akyel, 2002). Research indicated that "in the first place, teachers themselves need to be aware of the strategies underlying their classroom practices; secondly, in addition to making these strategies explicit to the students, they need to create opportunities for students to apply them in class" (Nunan, 1997, p. 72; Bang & Zhao, 2007).

Language curriculum designers can make use of the findings of such studies in order to design some curricula in which reading courses dedicate much more attention to the underlining strategies. The writers of reading textbooks also can help their readers master these strategies by incorporating them into the writers' textbooks. Language students, too, may use such strategies to improve their reading comprehension.

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