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Multimedia Glosses, Spatial Intelligence, and L2 Vocabulary Learning

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Abstract

This study investigated the effect of different kinds of multimedia glosses and spatial intelligence on L2 vocabulary learning. It also explored the learners' attitudes toward the use of multimedia software in L2 vocabulary learning. Ninety-four Iranian pre-university students were assigned to five experimental groups and a comparison group. The experimental groups were required to read the reading sections of three units of their textbook for six sessions by using Scaffoglossing software and consulting one of the designated glosses, including L1, L2, pictorial, pictorial plus sound, and video glosses. All groups took a Persian equivalent test, a multiple-choice test, and a sentence completion test once as the immediate posttest and 25 days later as the delayed posttest. Repeated measures ANOVAs and the pairwise mean comparisons lent support to the positive effect of the L1 and video glosses. The analyses also revealed the positive effect of the video glosses on the retention of vocabulary. The results of the Persian equivalent and multiple-choice tests provided evidence to the cognitive theory of multimedia learning, though in the sentence completion test the pictorial glosses group performed better than the pictorial + sound glosses group, which was in marked contrast to the cognitive theory of multimedia learning. There was no significant difference between the high and low spatial ability groups in terms of vocabulary learning. The findings of the attitude questionnaire revealed positive viewpoints of participants toward the use of multimedia software. Participants favored the L1 and video glosses more than the other types of glosses.

1. Background

When the learner fails to bring enough vocabulary knowledge to reading a text, s/he has to stop reading repeatedly and look up the unknown words in a dictionary, which may make her/him lose motivation and terminate reading. For facilitating L2 vocabulary learning explicit instruction, independent strategy development, and incidental learning for improving L2 vocabulary learning have been suggested to be employed in EFL classes.

Our primary purpose in the present study was to examine the impact of glosses and in particular the effect of spatial intelligence on L2 vocabulary learning in the context of multimedia. We also sought to explore the attitude of participants toward multimedia software.

Glosses can be delivered as textual definitions, pictorial glosses, or interactive multimedia elements. Glossing is essentially bottom-up lexical help, which provides direct support for L2 vocabulary acquisition.

Lenders [1] identified three types of glosses: dictionary-type glosses, ready-made glosses, and special types of glosses. Dictionary-type glosses contain information about the meaning/s of a word in the form of a definition, synonym, antonym, L1 equivalent, phonetic script, or example sentences. Ready-made glosses are specially prepared for the particular needs of learners in a given course and they may contain a spoken or written L2 definition, an L1 translation, or a still or moving image depicting

the glossed word. And, the third set of glosses is called special types, which besides elaborating on target words, they include a task for the learner such as multiple-choice glosses.

Glosses can be textual or textual coupled with picture. There is evidence to suggest that people learn more from words and pictures than from words alone [2]. Dual-coding theory provides theoretical justifications for the use of visuals in the instructional presentations [3]. According to this theory, words and sentences are processed and encoded in the verbal system, while images are processed and encoded in the nonverbal system. It is claimed that the simultaneous use of two channels of information delivery aids the retrieval of information and results in better learning.

For learners with high spatial intelligence, Kim [4] proposed CALL activities such as playing card games, using graphic programs, learning with pictures on CD or DVD or with video clips on the Web, using presentation software, and creating videos or digital storytelling products. Learners who have high visual preference might show more ability in decoding information that is image-based [5].

2. Research Questions

This study addressed the following research questions:

1. Do different types of multimedia glosses, including L1, L2, pictorial, pictorial + sound, and video, differ in their effectiveness on L2 vocabulary learning and retention?
2. Is there any difference between high and low-spatial ability learners' L2 vocabulary learning and retention gained from multimedia glosses (pictorial, pictorial plus sound, and video)?
3. What kind of multimedia glosses (i.e., L1, L2, pictorial, pictorial plus sound, and video) do learners favor?

3. Method

3.1. Participants

A total of 94 pre-university students from one of the pre-university centers in Ardabil, Iran, participated in this study. Participants were 18–20 years old, bilingual in Azari-Turkish and Persian. Participants in this study were randomly assigned to six groups: L1 (Persian) glosses (n = 16), L2 (English) glosses (n = 16), pictorial glosses (n = 17), pictorial plus sound glosses (n = 17), video glosses (n = 16), and no glosses (n = 12).

3.2. Materials

Multimedia Glosses Software A team of computer experts and we designed a multimedia software, which was labeled as Scaffoglossing. The software included three units of participants' textbook along with five kinds of glosses: L1, L2, pictorial, pictorial plus sound, and video glosses. The video glosses were short silent clips. By clicking on the target words (typed **bold face**, in different color, and underlined) participants could use the glosses.

Multiple Intelligences Questionnaire A 10-item questionnaire in the form of five-point Likert scale measuring the spatial intelligence was used as the first instrument of the study. The overall internal consistency reported for the questionnaire was .89.

Pre-test We compiled a pre-test to check the homogeneity of participants in terms of their reading comprehension and lexical and grammatical knowledge. It included vocabulary, grammar, and reading comprehension questions extracted from their English book which is taught in Iranian Pre-university classes. The Cronbach alpha coefficient computed for the pre-test was .52.

Reading Materials and Target Words The texts were adapted from units 6, 7, and 8 of the pre-university textbook, simply because the study was conducted in the second semester of academic year, during which the students were supposed to study these units. Thirty glossed words were selected after consulting several high school and pre-university English teachers and pre-university students.

Immediate and Delayed Posttests To measure vocabulary learning as a result of different glosses, participants took the posttest immediately after they read the passages in the last session. The immediate and delayed posttests were the same and participants were required to take the delayed posttest 25 days after the immediate posttest. The package included two production tests and one recognition test.

Attitude Questionnaire At the end of the study the students in the experimental groups were asked to complete a questionnaire. It included some background questions surveying their access to computer at home and school, and whether they used software in learning English. It also included some questions to see if participants of the experimental groups had any interest in the use of some software in addition to the presence of a teacher in English classes. Also, it examined if participants favored holding English classes in the computer site. Participants were also asked to declare their preferences regarding the multimedia glosses, i.e., L1, L2, pictorial, pictorial plus sound, or video. An open-ended question that asked participants to express their opinions as to the quality of the software employed in the present study brought the questionnaire to its end.

3.3. Procedures

On the day before the treatment sessions, the six participating groups took the pretest and completed the spatial intelligence questionnaire. They were homogeneous in terms of their reading comprehension, lexical, and grammatical knowledge, $F(5, 88) = 2.173$, $p = .064$. The treatment took eight sessions. Every session lasted 45 minutes; session 7 was an exception and lasted 90 minutes. Participants read the texts by using Scaffoglossing software and consulted specific glosses provided for them. Group 1 consulted L1 glosses; group 2 used L2 glosses; group 3 took advantage of pictorial glosses; group 4 were provided with picture plus sound glosses; and group 5 received videos of the target words. At the end, all participating groups took the immediate posttest and completed the attitude questionnaire. After a 25-day interval they took the delayed posttest.

4. Results

Persian Equivalent Test The first ANOVA examined the effect of multimedia glosses on L2 vocabulary learning in the Persian equivalent test.

The output of the omnibus analysis showed that the main effect for the multimedia glosses condition was statistically significant with a large effect size, $F(5) = 13.27$, $p < .001$, $\eta_p^2 = .43$. A significant interaction effect was also observed between the treatment and time with a large effect size, $F = 3.85$, $p = .003$, $\eta_p^2 = .18$. But, the main effect for time was not significant, $F = .68$, $p = .411$, $\eta_p^2 = .008$.

The post-ANOVA analysis (Bonferroni adjustment) showed that in the immediate posttest, the pictorial + sound, video, and L1 groups outperformed the pictorial group. The significant differences among the experimental groups observed in the immediate posttest disappeared in the delayed posttest.

Multiple-choice Test The second ANOVA showed that the effect of multimedia glosses was statistically significant with a large effect size, $F(5) = 4.12$, $p < .001$, $\eta_p^2 = .19$. There was a significant interaction effect between the treatment and time with a large effect size, $F = 3.95$, $p = .003$, $\eta_p^2 = .18$. Also the effect for time was significant with a moderate effect size, $F = 11.12$, $p < .001$, $\eta_p^2 = .11$.

The post-ANOVA analysis (Bonferroni adjustment) indicated that in the immediate posttest, only the difference between the L1 and the comparison group reached statistical significance. In the delayed posttest the video group outperformed the pictorial group. Also, the video, L2, and L1 groups outperformed the comparison group.

Sentence Completion Test The output of omnibus analysis of the scores of the sentence completion test demonstrated that the main effect for the multimedia glosses was statistically significant with a substantial effect size, *F(5)* = 14.62, $p < .001$, $\eta_p^2 = .45$. There was a significant interaction effect between the treatment and time with a large effect size, $F = 17.22$, $p < .001$, $\eta_p^2 = .49$. But the effect for time was not significant, $F = 1.61$, $p = .207$, $\eta_p^2 = .18$.

The post-ANOVA analysis (Bonferroni adjustment) demonstrated that in the immediate posttest the experimental groups outperformed the comparison group. The video group performed better than the pictorial + sound group and the L1 group outperformed the pictorial + sound group, and the pictorial group performed better than the L2 group. In the delayed posttest there was a statistically significant difference between the pictorial + sound and L2 groups and the L2 group gained better results than the pictorial + sound group. The video and L1 groups outperformed the pictorial group. The post-ANOVA analysis (Bonferroni adjustment) for the delayed posttest showed that of the experimental groups, the video, L2, and L1 groups outperformed the comparison group.

Results of Spatial Intelligence In the next stage, the participants of the pictorial, pictorial + sound, and video glosses groups were ranked according to their spatial intelligence indices and were divided into high and low spatial ability learners. There was statistically significant difference between the high and low spatial ability groups with a large effect size, *F(48)* = 9.97, $p < .001$, $\eta_p^2 = .67$.

Three repeated measures ANOVAs were run to assess the differences between the high and low spatial ability groups in the immediate and delayed posttests. There was no statistically significant difference between the two groups in the immediate and delayed Persian equivalent test, *F(1)* = .63, $p = .42$, $\eta_p^2 = .01$, multiple-choice test, *F(1)* = .25, $p = .61$, $\eta_p^2 = .005$, and sentence completion test, *F(1)* = .20, $p = .65$, $\eta_p^2 = .004$.

In the Persian equivalent and multiple-choice tests, the effect for time was not significant, $F = .05$, $p = .82$, $\eta_p^2 = .001$. Neither was there any significant interaction effect between the treatment and time, $F = .14$, $p = .70$, $\eta_p^2 = .003$. In the sentence completion test, the effect for time was significant with a large effect size, $F = 18.46$, $p < .001$, $\eta_p^2 = .27$. There was no significant interaction effect between the treatment and time, $F = 1.92$, $p = .17$, $\eta_p^2 = .39$.

Attitude Questionnaire The experimental groups were required to complete the attitude questionnaire. The results demonstrated that 54 participants out of 82 in the experimental groups (65%) had access to personal computers at home. Seventy percent of them had the experience of using software for learning English and expressed satisfaction with their efficiency. The fourth question of the attitude questionnaire asked whether their previous English teachers had used any educational software in addition to the textbook assigned. The answer was negative. The fifth question asked them to express their preference regarding learning just by a teacher or by the teacher using educational software; seventy eight percent of the respondents favored the second choice. The seventh question asked informants to rank the five kinds of multimedia glosses provided according to their interest and preference.

Finally, an open-ended question required respondents to express their attitude about Scaffoglossing. Their opinion was encouraging and a majority of participants had a positive view of the software.

5. Discussion

In the immediate and delayed Persian equivalent and multiple-choice posttests, the pictorial + sound group outperformed the pictorial group; on the theoretical side, this finding provides evidence for CTML, suggesting that providing verbal and visual input leads to meaningful learning.

The pictorial group performed better than the pictorial + sound group which did not lend support to the CTML. Contrary to our expectations, in the delayed sentence completion posttest all of the experimental groups outperformed the pictorial + sound group which disapproves the dual coding and CTML.

In the delayed posttest, except for the Persian equivalent test, the video group performed better than the other groups. Viewed in the light of the involvement load hypothesis, the reason for this result can be attributed to the higher rate of the involvement load imposed by video glosses.

In the Persian equivalent posttest, the L1 group performed better than the other groups which is in line with a majority of previous studies supporting the positive effect of the L1 glosses compared to other glosses, especially L2 glosses [6].

In the immediate multiple-choice posttest, a significant difference was observed between the L1 glosses and the comparison group. In this test, the L1 group gained better results than the other groups. In the immediate and delayed multiple-choice posttests the L1 group outscored the L2 group.

Contrary to our expectations, no significant difference was observed between the high and low spatial ability groups in the immediate and delayed posttests. There can be two justifications for the result obtained. First, it can be related to the cognitive architecture of learners and in particular to the constraints associated with working memory. Due to the limitations of working memory, in multimedia environments we have to take the cognitive load which the task imposes into account. It can be assumed that in the present study the cognitive load imposed by the pictorial, pictorial + sound, and video glosses exceeded the limited capacity of participants and individual learners in the high spatial ability group were not able to manage the cognitive load imposed, which resulted in their failure in surpassing those in the low spatial ability group in L2 vocabulary learning. For getting assurance as to the efficiency of visual presentations we should measure cognitive load to ensure that the cognitive load imposed by tasks does not exceed learners' working memory capacity. Subjective and objective measures have been proposed for assessing cognitive load. Subjective measures of cognitive load include subjective rating scales, in which learners are required to express their subjective assessment of task demands. Time-on-task, navigation behavior, help seeking behavior, task complexity, data pertaining to behavior (e.g., heart rate, pupil dilation), secondary task analysis, and eye-tracking analysis are categorized as objective measures of cognitive load [7].

The second reason can be associated with this assumption that high spatial ability may lead to outperformance when instruction induces high levels of cognitive load, for example, when it presents complex visio-spatial materials. While the low spatial ability learners may not be able to process such high-load materials deeply, learners with higher spatial ability are assumed to have the cognitive capacity to benefit from them [8]. In the present study, the pictorial, pictorial + sound, and video glosses did not appear to warrant high levels of cognitive processing, in which the high spatial ability group might have been able to perform better than the low spatial ability group.

The data obtained from the attitude questionnaire showed that participants favored the L1 glosses more than the other kinds of glosses. The pattern of their preference is noticeable: L1, video, pictorial + sound, L2, and pictorial. Interestingly, this trend roughly matched the results of the main analyses. Viewed generally, the findings of this study advocate the use of the L1 glosses and video glosses with beginners and pre-intermediate learners.

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