Is Short Term Memory (STM) Modality and Gender Specific: A Study of Cell-Phone Assisted EFL Vocabulary Learning

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Abstract

The present research set out to investigate if dual modalities of verbal and visual presentations of vocabulary in a foreign language context are accommodated differently by STM as assessed through recognition and recall tests and also the relationship was examined for possible moderating effect of gender. The analysis indicated STM (high visual and high verbal) accommodates very well to delivery of materials with pictorial and/or written annotation(s), resulting in better learning on both recall and recognition tests. However, the results point to the insignificant relevance of STM to learners' gender in L2 vocabulary compared to the verbal/visual processing orientations.

1. Introduction

It is a long established theory that learners enjoy and utilize their cognitive information processing power as an important mediator to acquire knowledge. As Atkinson and Shiffrin (1968) maintained, human beings initiate learning through a multi-stage memory model. Their model begins with sensory memory whereby dual conjunctive or single unilateral functioning of ear and eye captures the input (Mayer & Sims, 1994; Sweller, 1994). Next, short term memory (STM) works out some verbal or pictorial organization of the received input; this is further integrated into the prior knowledge and retained in the long-term memory (LTM). More recently, Baddeley (2003) has expanded the idea of STM, calling it working memory model (WMM). He contends that external information is processed in three different segments of STM after it is captured via sensory memory. As shown below (Fig. 1), STM comprises one Control Executive with three subsystems, namely, the phonological loop (PL), visuo-spatial sketch pad (VSSP), and the episodic buffer (EB). The model further represents STM and LTM interface as a reciprocal interactive process, with light areas representing the fluid system of STM and dark areas representing crystallized knowledge of LTM. As such, STM is portrayed not only as a storage but also as a system with processing power. Thus, a number of scholars (e.g., Courtney, 1998) have argued that STM accommodates to the learning content types differently. That is, the content types could be processed variably depending on the learner's STM processing power (Craik, 2002). Many studies based on the processing abilities, especially in learning

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vocabulary, have used verbal and pictorial annotations in their instructional treatments to adapt the situation to the STM requirements (e.g. Chen, N.-S., Hsieh, & Kinshuk, 2008).

Fig. 1. Working memory model (Baddely, 2003)

As an important part, gender distinction has also been associated with STM processing power. And lots of investigations have tried to elucidate gender-specific hemispheric brain asymmetries both in regard to structure and function. Although the results are divergent, some general pattern of gender differences in functional asymmetry of language representation can be found. Baron-Cohen (2003) contends that while male brain is more lateralized to the left hemisphere for language the female brain tends to use both hemispheres for language. This pattern also gains support from neuropsychological evidence, indicating that left hemisphere dominance of language functions is greater in males than it is in females (Obleser, Eulitz, Lahiri, & Elbert, 2001). Due to this lateralization, Baker (1987) says, females usually excel in verbal skills and males excel in visuo-spatial and mathematical skills. Thus, the present study is an attempt to explore how short-term memory of males and females can respond to the English language vocabulary learning contents (verbal or visual) presented to them via mobile phones.

2. Research Purpose

Motivated by the role of STM in learning and conflicting results of gender differences in hemispheric lateralization, the present study investigates if dual modalities of verbal and visual presentations of L2 vocabulary are accommodated differently by STM and also if gender can have a role to play, thus affecting the results. In short, the study tries to explore the modality or gender specificity of STM.

3. Method

3.1. Participants

To carry out the study, as many as 158 out of 161 participants were selected from among those enrolled in EFL classes in an Iranian English Language institute. They were selected from 12 classes and homogenized through a proficiency test. Their age range was 19-23. The selected participants were then divided into four groups through STM ability tests, which are used to distinguish learners of different processing visual or verbal abilities. They are as follows: Group 1 (G1): learners with high-visual and high-verbal abilities; Group 2 (G2): learners with high-visual but low-verbal ability; Group 3 (G3): learners with both low-visual and low-verbal abilities; and Group 4 (G4): learners with low-visual ability but high-verbal ability. Also, the participants in each group were divided to male and female subgroups.
3.2. Materials

The materials used in this study are presented below:

Proficiency test: First of all, to make sure that the participants were all of the same level, they were required to participate in Nelson English language test.

Vocabulary level test: The test was administered to assess the learners' original knowledge of words with a view on excluding the words with which learners were already familiar in the learning phase of the study. The word items for the vocabulary level test were selected from Bauman's General Service List (GSL) which consists of 2284 words. One word from every 40 words was selected, starting from the 40th word (40/2203 more) to 2000th word (2000/15 scenery). The Bauman's GSL is based on the Brown's corpus which contains 1000,000 words. For each word item, the following three types of representation were made: Type 1 represents the English word, pronunciation, part of speech, and the Persian meaning of the word. Type 2 represents the materials shown in type 1 plus the written annotation (i.e., a sentence). Type 3 represents the materials shown in type 1 plus the pictorial annotation. Examples of three different representation types, for the word ‘hut’ are shown in Fig. 2. To enhance the result, all the sentences for type 2 were selected from the Longman Dictionary of Contemporary English.

Software package: The objective in this study was to work out a server-side solution and develop user-friendly system presenting the materials in compatibility with cell-phones. Thus, a software package for conducting STM ability, recognition and recall tests and delivery of materials was designed. The installation, its different parts, and how to use it are all described along with the software CD.

Open-ended questionnaire: The open-ended questionnaire was prepared to let the learners express their interest in learning vocabulary through electronic devices, here cell-phones. The purpose was to remove those reluctant from the analysis. This procedure led to the indirect omission of 3 from the final list of analysis.

Visual and verbal STM tests: Two 20 item tests (20 for visual ability and 20 for verbal ability test) were prepared to assess the learners’ visual and verbal abilities. The basis of the STM tests was the model which was proposed by Chen, C.-M., Lee, and Chen, Y. (2005).

English vocabulary recognition and recall (EVRR) tests: Two 18 item tests of Recognition and Recall were prepared for testing the learners’ vocabulary learning. This decision was made based on the fact that such tests are often used to examine the learner’s vocabulary knowledge (Jones, 2004) and that they provide good conditions for learning vocabulary both receptively and productively (Nation, 2001).

3.3. Procedure

The main procedure for this study consisting of four phases took place in the language laboratory of the institute. Before this main phase, learners sat for the proficiency and the vocabulary level tests and thus their levels were determined.

In the first phase, all the details and objectives of the experiment were explained to the participants. Then, the background questionnaire was distributed among the learners to complete. As was mentioned before, this
questionnaire was intended to exclude those unwilling to learn vocabulary through the devised method.

In the second phase, each learner was provided with a cell-phone for STM test. First, they took part in a visual STM ability test and then, a verbal STM test. Based on Chen, C.-M., et al. (2005) model, for the visual test, initially a picture was displayed for eight seconds; then, a question was asked about the picture. Learners were given six seconds to answer the question. Concerning the verbal test, first, a sentence was displayed for eight seconds, then a question addressing the sentence was asked; the learners had to answer in six seconds. Each learner’s answers were recorded and the learners were assigned two types of score (i.e., raw score and standard score with a mean of zero and standard deviation of one). On the basis of their z scores of visual and verbal STM abilities, participants were divided into four groups, with 55 in group 1 (male=28, female=27) (G1), 30 in group 2 (male=17, female=13) (G2), 42 in group 3 (male=24, female=18) (G3) and 31 in group 4 (male=13, female=18) (G4) (See section 3.1. Participants)

In the third phase, every participant was delivered 18 new English vocabulary items. Although, according to Jones (2004) and Nikolova (2002), the sensible time for learning new English vocabulary item is about 120 seconds, each new item was delivered into the learners' cell-phones with an interval of 90 seconds as experience showed it more comfortable to the learners. In this research project, the first six words were delivered to first participant in type 1, then six words in type 2, and finally six words in type 3. At the same time, the second participant received the first six words in type 2, then six words in type 3, and the six last words in type 1.

After the third phase (i.e., learning phase), learners took part in EVRR tests. First, they took part in recognition test which consisted of 18 multiple-choice questions and then they participated in the recall test which consisted of 18 fill-in-the-blank questions, too. It must be borne in mind that each test comprised 18 items, with 6 for each representation type.

4. Results

The study was launched to investigate the way STM can accommodate to the verbal and visual modalities and the role gender can have in the relationship between the two. The results obtained through recognition and recall tests indicated that STM is aligned with the modes of presentations to a large extent. The high visual and high verbal group as representatives of high STM responded very well to the associated modes, namely, verbal and pictorial materials and performed meaningfully on both types of tests compared with the materials with no annotation (sig: 0.000, P<.05). Interestingly enough and indirectly in support of the above finding, the low visual and low verbal group as representative of the extreme end of STM continuum performed better on no annotation materials compared to the verbal and visual annotation materials, again indicating that STM has a substantial bearing on the processing of data (Sig: 0.000, P<.05). Despite the full alignment of STM with the modes in the first two groups reviewed above, the results in the next two groups which stand half way between the two extremes of high and low processing capacities were a bit mixed. While high visual and low verbal group displayed better performance for pictorial materials on recognition test, it did not follow the same trend on recall test, with no difference between the two modes of pictorial and verbal materials (Sig: 0.37, P<.05). In the same vein, the low visual and high verbal performed similarly on both recognition and recall tests of different annotations (Sig: 0.43, P<.05). The results in the second two groups may indicate that linear STMs, i.e., either high visual/verbal or low visual/verbal, can have a more vivid role in responding to the modes of presentations while a mixed STM of high and low capacity may require more efforts on the part of the learners to adjust the processing capacity to one or the other direction.

The results of gender based analysis, however, did not reveal any significant difference in any of the above mentioned groups, signifying that STM may have no relationship with gender. Of course, the small scale study of this kind cannot offer much to depend on.

5. Discussions and Conclusions

As the results of the present study indicate, the learners’ STM with special cognitive propensities is most likely to accommodate to the related represented modality, i.e., high verbal learners show a better performance through the
verbal modality and high visual learners through the visual modality. This finding is in line with the results reported by Chen N.-S. et al. (2008) and Geva and Ryan (1993). Overall, the results thus obtained seem to bear testimony to the claims that the learners’ processing capabilities play a better role in case the conditions provided for learning have got the most congruity with their inherent abilities. This implies that learners with different cognitive inclinations can be more likely to succeed if their internal mental characteristics are respected through the contrived media (Jones, 2004). Also, another finding of the present study showing that the low verbal and low visual learners can take advantage of the basic materials with no annotation substantiates the modality specificity of STM further. The finding has already been explained by Sweller (1994). He maintains that such learners are likely to get overwhelmed in the presence of multimodal representations of contents. This explanation, referred to as Cognitive Load Theory (Sweller, 1994), argues that some learners with limited processing capacity, say low verbal/visual, tend to avoid the information overload by relying on the basic and single dimensional content. However, the finding sounds a bit counterproductive if judged against the Dual-Coding theory suggested by Paivio (1986). This latter theory upholds the idea that different modalities combined together present an optimal condition for accommodating more channels of learning simultaneously, thus increasing the likelihood of learning such materials.

However, the findings of the study cast doubt over the gender specificity of STM. Although literature already recognizes the gender-specific hemispheric asymmetries (e.g., Baker, 1987), it is very likely that gender sensitivity to uniform conditions of teaching and learning diminishes and the distinctions get blurred to a large extent especially if learning is assessed through a limited number of vocabulary items. Also, we may attribute the gender impartiality of the results to the fact that the tests given to the learners immediately after treatment focused on their short term memory while gender differences may manifest in the long run, indicating that such differences are long term memory attributes. Anyway, the results of the study of this nature where subjects, conditions, treatment, etc. are specific need to be cautiously interpreted or generalized.

References


