The Effect of Instructional Method on Second Language Acquisition: An Examination of Some Contributing Factors

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A mini-lesson in Spanish vocabulary was taught to participants unfamiliar with the language using stimuli representative of one of two instructional methodologies, the grammar-translation approach or the communicative approach. Participants taught using the communicative approach recalled significantly more Spanish vocabulary words than those assigned to an uninstructed control group on a short-term post-test, but no significant differences emerged between any other groups on this measure. No differences in recall were found between any of the groups on a long-term post-test. Participants demonstrating some prior knowledge of Spanish recalled a significantly greater number of vocabulary words on the short-term post-test than participants unfamiliar with Spanish. The results suggest that instruction and prior knowledge of a second language can facilitate the early stages of second language acquisition.

In recent years, much research has been conducted in the interdisciplinary field of second language acquisition (SLA) as a result of expanding interest by linguists, psychologists, neuroscientists, and educators. Two related questions relevant to the aims of SLA research are whether instruction can facilitate SLA, and if so, which type of instruction is most beneficial. Although these questions may seem most relevant to applied linguistics, it is likely that their answers can be found in the basic science of the neurocognitive mechanisms that allow humans to acquire a second language (L2). The present research seeks to address both of these issues through the means of an experimental study of L2 vocabulary learning in which the effectiveness of two prominent instructional methods is compared to non-instructed, incidental learning, and in which individual differences in neurocognitive processing are examined during SLA.

The study examines which type of instruction facilitates SLA and whether prior knowledge of an L2 expedites subsequent re-learning, highlighting the importance of the cognitive processes subserving SLA.

Many approaches to L2 instruction have arisen during the past century, but two of the most well-known are the grammar-translation approach and the communicative approach. The grammar-translation approach, the older and more established of the two methods, originated from practices used to teach Latin to adolescent students enrolled in boarding schools in the 19th and early 20th centuries, and it remains entrenched in many L2 classrooms and curricula—especially at the novice level—to this day. Omaggio-Hadley (1993) points out that this approach is rooted in the belief that an L2 cannot be comprehended until the syntactic framework of the L2 has been acquired. Thus, in the grammar-translation approach, instruction is focused on the grammatical structure of the L2, and specific emphasis is placed on the accuracy of L2 spoken

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and written output. In general, practitioners of the grammar-translation approach believe that if students are taught the rules governing the grammar of the L2, proficiency in the L2 will follow of its own accord.

Some research suggests that the teaching of L2 grammar is an essential element of structured L2 instruction, especially that designed for adolescents and adults. In a meta-analysis of the effect of instruction on SLA, Norris and Ortega (2000) reported average effect sizes of 1.0 and 0.93 for studies in which students were taught some aspect of the target language, but only a 0.54 effect size for studies in which grammar was not explicitly taught. Thus, the results of this meta-analysis provided systematic quantitative evidence in favor of grammar instruction for SLA. More recent evidence in favor of instructional methods similar to the grammar-translation approach can be found in Klapper and Rees (2003), who tracked the L2 knowledge of two groups of ability-matched college students taught using a methodology based either on form-focused instruction, in which grammar is taught explicitly, or communicative skills, in which emphasis is placed on conveying meaning in the target language at the expense of grammatical correctness. These authors found that the students taught using the form-focused method acquired the L2 more quickly and accurately than their peers who were taught using the communicative approach, as measured by periodic standardized assessments of L2 grammar and proficiency.

Laufer (2006) compared the acquisition of novel L2 vocabulary by high school students who had obtained an advanced level of proficiency in the L2 given either a text comprehension and discussion exercise in which the vocabulary words appeared with clues to their meanings or a vocabulary learning exercise in which vocabulary words were presented with their meanings and examples of their usage. The results of this study revealed that, when students were tested on the meanings and uses of the vocabulary words immediately following the activities, those who had completed the vocabulary learning exercise learned more of the vocabulary words than those who had completed the text comprehension exercise, providing evidence that a focus on form facilitates short-term L2 vocabulary learning. Taken together, the results of these studies seem to suggest that adolescent and adult students are able to more effectively acquire various aspects of an L2 when taught using methods similar to the grammar-translation approach, highlighting the usefulness of instruction focusing on the grammatical structure of the target language.

The communicative approach to L2 instruction arose as an alternative to instructional methods emphasizing grammar acquisition. In contrast to grammar-focused methods, which were based on the tenets of behaviorism, emphasizing rote learning of the structure of the target language, the communicative approach focuses on the development of communicative competence—that is, learners' ability to communicate in true-to-life situations. There is disagreement about whether any grammar should be explicitly taught within the context of the communicative method; some scholars, such as Krashen (1982), believe that L2 grammar is learned implicitly as long as students are provided with comprehensible input in the L2, whereas other scholars, such as Long (2007), believe that it is beneficial to draw students' attention to certain grammatical structures within the context of a task-based lesson in the L2. In contrast with the developmental sequence of SLA hypothesized within the grammar-translation model, the communicative approach posits that proficiency in the L2 precedes explicit knowledge of L2 syntax, highlighting the need for meaningful, task-based activities within L2 instruction.

There is a body of research that supports the communicative approach and related teaching methodologies that do not focus explicitly on L2 grammar. One prominent example is Van Patten and Cadierno's (1993) experimental study supporting the efficacy of a communicative approach to L2 instruction. In this study, students were taught various object pronouns in Spanish using either the *Processing Instruction* approach, in which students completed a variety of meaningful comprehension exercises composed of sentences including an object pronoun, or a *Traditional Instruction* approach, in which the functions of the object pronouns were described to students, and students then practiced producing them within the context of traditional structured drills. Performance on sentence-level comprehension and production tests revealed that students taught using the *Processing Instruction* approach interpreted and produced object pronouns in the L2 more accurately than students taught using the *Traditional Instruction* method, thus demonstrating a deeper understanding of the pragmatic uses of object pronouns. The results of this study were replicated using similar assessments of L2 proficiency for several syntactic structures commonly found in Spanish, including the preterit (immediate past tense) (Cadierno, 1995), the *ser/estar* distinction (Cheng, 1995), and the subjunctive tense (Farley, 2001), as well as in other languages such as French (Van Patten & Wong, 2004) and Italian (Benati, 2001). Additionally, Skala (2003) found that instructional methods theoretically related to the communicative approach were more effective for teaching high school students of beginning French than grammar-focused methods, providing further evidence supporting the efficacy of communicative

approaches to SLA. All of this research suggests that, in contrast to the research supporting the grammar-translation approach, it is unnecessary to explicitly and extensively provide instruction about the structure of the L2, because as long as students are provided with comprehensible input in the L2, they will acquire the grammar of the L2 implicitly.

In order to fully understand the process of L2 acquisition, it is necessary to consider the neurocognitive mechanisms by which L2s are learned in addition to the effects of instruction on L2 acquisition. One cognitive process that is essential to L2 acquisition is working memory. It is generally agreed upon that working memory is an essential component of many higher-order cognitive processes, such as SLA. One theoretical construct of working memory relevant to SLA is the phonological loop, a system within working memory that continuously repeats the sounds of words that one has heard or read (Baddeley & Hitch, 1974). The phonological loop is hypothesized by some researchers to play an especially important role in the acquisition of novel words (Baddeley, Gathercole, & Papagno, 1998). Research on the relationship between the phonological loop and SLA has revealed that the accuracy of the repetition of pseudo-words (e.g., *mokka*) can predict the acquisition of L2 vocabulary (Ellis, 1996; Service, 1992). One piece of empirical evidence for the connection between working memory and SLA comes from correlational studies in which researchers observed that the ability of British schoolchildren to repeat unfamiliar pseudo-words contrived in accordance with the phonotactic rules of the French language was related to their knowledge of French vocabulary (Gathercole & Thorn, 1997; Thorn & Gathercole, 1999).

Furthermore, the modality in which verbal stimuli are presented can influence the functioning of working memory in language learning and processing. In discussions of articulatory suppression (that is, interference in the functioning of the phonological loop by words presented simultaneously with words to which one is attending), Baddeley, Thomson, and Buchanan (1975) claimed that the processing of purely aural or visual verbal stimuli is deleterious to the functioning of working memory. They pointed out that when verbal information is presented only in the aural modality, the complementary visual code is absent, and vice versa, resulting in impoverished information processing and representations. These assertions support the notion that stimuli rich in multimodal content are needed to ensure optimal functioning of working memory in language acquisition and processing.

Laterality, the differential activation of the cerebral hemispheres, is a neurological construct that also affects L2 acquisition. In general, research on the role of laterality in information processing has shown that the left frontal cortex encodes and processes verbal stimuli, whereas the right frontal cortex encodes and processes visuospatial stimuli. In some studies (e.g., Kelley et al., 1998), bilateral hemispheric activation has been observed during the processing of stimuli containing both verbal and visual materials. In accordance with this traditional view of hemispheric specialization, some researchers (Galloway & Scarcella, 1979; Galloway, 1981) have found little evidence for the involvement of the right hemisphere in the processing of an L2; however, other researchers (Wesche & Schneidermann, 1982) have reported some evidence for the involvement of the right hemisphere in the beginning stages of SLA. This latter finding is consistent with Baddeley's (2003) hypothesis of increased involvement of the right hemisphere in language processing given a task that involves a high cognitive load (such as initial-stage language learning), as well as with Sundermeier, Virtue, Marsolek, and Van den Broek's (2005) observation of increased activation of the right hemisphere when processing unfamiliar verbal information. These findings suggest that it may be beneficial for people to learn an L2 in an instructional setting using multimodal materials that draw upon the processing specializations of both hemispheres, providing them with multiple channels by which they can establish representations of the L2 and later draw upon those representations to comprehend and produce the L2.

The purpose of this experiment was to compare the effectiveness of two prevalent L2 instructional methods, the grammar-translation approach and the communicative approach, in early-stage SLA. To that end, two experimental conditions were created in which materials representative of each method were used to teach L2 vocabulary. The first, the verbal condition, included purely verbal stimuli in the form of L2 vocabulary words paired with their translations in the participants' native language, in accordance with the use of translations within the grammar-translation approach. The second, the integrated condition, included a combination of verbal and visual stimuli, in the form of vocabulary words paired with illustrations that symbolized their meanings, in accordance with the use of non-linguistic representations within the communicative approach to convey the meaning of L2 utterances. In order to examine the role of the cognitive and neurological processes involved in SLA, participants' working memory efficiency and cerebral hemispheric activation were measured. Based on the findings of research highlighting the importance of the phonological loop in L2 acquisition (e.g., Thorn & Gathercole, 1999), I predicted that participants with more efficient working memory capacity would learn a

greater number of L2 vocabulary words. With regard to laterality, given the results of studies suggesting that visuospatial and verbal stimuli are processed differently in each hemisphere and that both hemispheres are active when both types of material are processed (e.g., Kelley et al., 1998), I predicted that L2 vocabulary would be more effectively learned under the integrated condition due to its use of both visuospatial and verbal materials.

Method

Participants

All participants were undergraduate students at a small liberal arts college located on the East Coast of the US, aged 18-23 years (M = 19.09; SD = 1.16). Thirty-two participants (6 men, 26 women), all of whom claimed to be unfamiliar with Spanish, the L2 presented in the experiment, volunteered in partial fulfillment of a credit requirement of the introductory psychology course. The original pool consisted of 35 participants, but the results of 3 participants were eliminated due to scores above the allowable level (1/5 correct) on a pre-experimental L2 vocabulary quiz, which were interpreted as evidence that the participants may have had some residual knowledge of Spanish.

Materials and Apparatus

Videos used in this study featured the author teaching a lesson in Spanish vocabulary that consisted of 30 words pertaining to the topic of sports and pastimes extracted from the introductory text *Puntos de Partida* (Knorre, Dorwick, Perez-Girones, Glass, & Villareal, 2004). The version of the video shown in the verbal condition included words paired with their translations, and the version shown in the integrated condition included words paired with pictures that illustrated their meanings. The duration of the videos was approximately 7 min each.

Forms used in this experiment included a demographic survey, a vocabulary list, a vocabulary worksheet, a pre-test, a metacognitive survey, and a short-term post-test and long-term post-test. The demographic questionnaire was used to measure several general factors of interest, including sex, age, academic background, and prior experience in SLA. The pre-test, which was intended to screen participants for prior knowledge of the L2, consisted of 5 Spanish words, chosen at random from the vocabulary used in the teaching portion of the experiment, to be translated into English. A vocabulary list and worksheet containing the words and their referents presented in the videos allowed participants to facilitate their L2 learning during and immediately after the lesson. The short-term and long-term post-tests included all of the words presented in the video, with half of the questions presented in a visual format and half presented in a verbal format, counterbalanced across test versions. Subjective and affective factors, such as enjoyment of the experimental lesson and perception of the effectiveness of the instructional method, were measured using a 7-question metacognitive survey.

The software package *Laboratory in Cognition and Perception, Third Edition* (Levy & Ransdell, 1998) was used to administer a computerized version of the Sternberg task (1966), a standardized task of working memory efficiency in which a series of digits varying in length is presented, followed by a special symbol signifying recall, and then by a single digit to which participants respond as quickly and accurately as possible, indicating whether it was present in the previously-presented set of digits.

In the neurological portion of the experiment, the Edinburgh Inventory (Oldfield, 1971) was used to determine handedness of participants, given that the results of past research (e.g., Knecht et al., 2000) have revealed a relationship between handedness and hemispheric dominance in language processing. Hemispheric activation was measured using a transcranial Doppler, an instrument that measures blood flow through the middle cerebral arteries of each hemisphere via ultrasound technology. Readings were averaged over a two-minute period during the experimental task for analysis of hemispheric activation during the online processing of target language vocabulary.

Procedures

Main session. Based on experimental session, participants were assigned to one of the three conditions described above: verbal, integrated, or control. Seven participants (3 men, 4 women), all right-handed native speakers of English, took part in the neurological component of the experiment. In addition to an independent analysis of these participants' hemispheric cerebral hemodynamics, their results on the behavioral measures were included in the overall analysis. Small groups of 3-6 participants were recruited for each experimental session using a sign-up sheet with multiple lines for each time slot. To ensure that all participants had at most minimal knowledge of Spanish, the L2, it was stipulated on the sign-up sheet that volunteers must have had no more than one academic year of Spanish instruction in middle or high school or no more than one semester of Spanish instruction in college. When participants arrived for the experimental sessions, after providing their informed consent, they completed the pre-test, which was immediately scored by the experimenter to ensure minimal prior knowledge of L2 vocabulary. Participants then proceeded to complete

the demographic survey and then the Sternberg task of working memory efficiency.

In the learning portion of the experiment, participants in the experimental conditions were seated in an arrangement similar to that of a typical classroom. Prior to the lesson, participants were given a printed vocabulary list containing the vocabulary words paired either with their translation or a pictorial representation of their meaning in accordance with the stimuli presented in the instructional segment of the video for their assigned condition, and were encouraged to use the list to follow along with the video. After the lesson, they completed a non-evaluative review sheet containing all of the vocabulary words, half of which were represented by purely verbal stimuli (i.e., translations) and half of which were represented by visual stimuli (i.e., images). The experimenter then played the second part of the video, in which the correct answers were provided for the exercises on the review sheet. After watching the second part of the video, participants filled out the metacognitive survey, completed the short-term post-test, and were debriefed, ending the experimental session.

The procedure used for the control group was identical to that used for the experimental groups, except that the videos containing the experimental lessons were not played and the vocabulary lists, practice worksheets, and metacognitive surveys were not distributed. The purpose of the control condition was to determine the guessability of the questions on the post-tests, making it possible to account for the effects of random guessing on the results for participants assigned to the experimental conditions. None of the sessions for the experimental or control conditions lasted longer than 60 min.

Long-term post-test session. A subset of 18 participants (4 verbal, 8 integrated, 6 control) from the experimental and control conditions returned 2 weeks after the main session to complete a follow-up session, for which they received an additional experimental credit. In this session, participants provided their informed consent a second time, took a long-term post-test that was similar but not identical to the short-term post-test, and were then debriefed and released. None of these sessions lasted longer than 15 min.

Neurological component. Participants who volunteered for the neurological portion of the study performed all tasks in the same sequence as participants in the experimental groups of the behavioral component of the study. The only differences in procedure were: (a) participants were run individually; (b) participants were assigned either to the verbal or integrated condition, but not to the control condition; and (c) blood flow velocity through the middle cerebral arteries to each cerebral hemisphere was measured in mm/s via Transcranial Doppler during the instructional segment of the video, as participants learned L2 vocabulary. After completing all tasks, participants were debriefed and released. None of the sessions in the neurological component of the study lasted longer than 75 min.

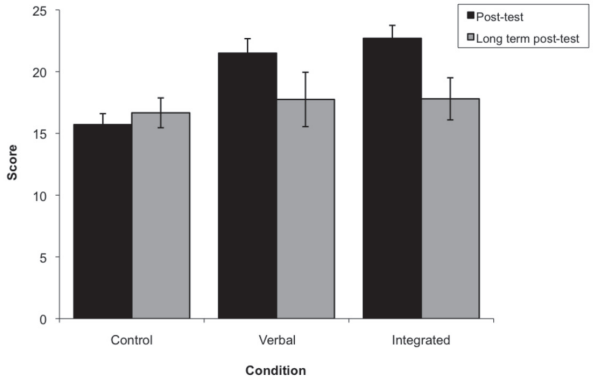
Results

A univariate analysis of variance (ANOVA) procedure confirmed the presence of a significant difference in the short-term post-test scores of participants assigned to the control, verbal, and integrated conditions, $F(2, 29) = 4.34$, $p = .02$; partial $\eta^2 = .23$ (see Figure 1). An examination of Bonferroni-corrected post-hoc analyses revealed that the short-term post-test scores of the integrated and control groups differed significantly, $p = .02$, but that the scores of the verbal and control groups ($p = .23$) and the integrated and verbal groups ($p = 1.0$) did not differ substantially. Among participants assigned to the experimental conditions, significantly higher scores on the short-term post-test were achieved by those who obtained a score of 1/5 correct on the pretest than those who scored 0/5 correct, $t(22) = 22.69$, $p < .001$. There were no differences between the scores of participants assigned to the experimental and control conditions on the long-term post-test.

Correlational analysis revealed a non-significant positive relationship between working memory efficiency and vocabulary learning, $r(33) = .33$, $p = .07$. The mean for participants' reaction time during the Sternberg task, a measure of working memory efficiency, was 4644.03 ms ($SD = 1093.36$ ms), and the mean for scores on the short-term post-test, which measured vocabulary

FIGURE 1

Mean scores achieved on short-term and long-term post-test by participants in control, verbal, and integrated groups (Y-error bars represent standard error).



knowledge, was 18.91 items correct (*SD* = 4.50). These statistics suggest that participants with lower reaction times on the Sternberg task, which measures working memory efficiency, tended to obtain higher scores on the short-term post-test by recalling more L2 vocabulary words, resulting in the observed positive correlation between working memory efficiency and vocabulary retention. No significant differences in hemispheric activation during vocabulary learning were observed between participants in the verbal and integrated conditions, as measured by the velocity of blood flow to the left and right cerebral hemispheres via the middle cerebral arteries.

Discussion

The results of this study demonstrate a significant advantage of instruction and prior knowledge on the acquisition of L2 vocabulary by novice adult learners. A significant advantage of assignment to the integrated condition, in which instruction in the L2 was delivered using materials that included both verbal and visual stimuli, over assignment to the control condition, in which instruction in the L2 was not provided, was observed in the short-term post-test scores of participants. However, no significant difference was observed between the short-term post-test scores of participants assigned to the verbal and integrated conditions, suggesting that neither instructional method is more effective than the other. The difference between the short-term post-test scores of participants who scored a 1/5 and a 0/5 on the pre-test indicates that prior knowledge of an L2 may be advantageous when (re)learning vocabulary from the same L2, supporting the memory savings hypothesis of Ebbinghaus (1913). Taken together, these results highlight the role of instruction and prior knowledge of the L2 on early-stage SLA, demonstrating the importance of taking advantage of one's existing cognitive processes in SLA.

The significant difference in L2 vocabulary acquisition observed between participants assigned to the integrated condition and the control condition reflected in the short-term post-test suggests that the communicative method may be an effective way to jumpstart initial SLA. The benefit of a communicative, integrated approach in initiating the process of SLA is consistent with the findings of Van Patten and Cadierno (1993) and Skala (2003), which demonstrated the effectiveness of task-based, meaning-focused activities that make use of multimodal stimuli in facilitating the acquisition of vocabulary and grammatical competence in beginning- and intermediate-level L2 learners. In both these past studies as well as the integrated condition of the study described here, students were encouraged to associate L2 forms with their meanings, thus facilitating their access to the mental lexicon, in which linguistic forms are stored and associated with their referents. Nevertheless, although the results of this study suggest that the communicative approach may convey a significant immediate advantage over incidental learning of the L2, the restriction of the advantage to the short-term post-test coupled with the lack of a significant difference between the verbal and the integrated conditions in either the short-term or the long-term post-tests suggests that it is premature to definitively conclude that the communicative approach is an overall more effective method of L2 instruction than the grammar-translation approach.

The lack of a significant difference observed between the short-term post-test scores of participants assigned to the verbal and integrated conditions could be due to a number of factors. One possibility is that it may be attributable to the similarity of the two conditions, as manifested in the L2 vocabulary words, which were presented as text, and the format (L2 word + translation/visual representation) of the stimuli in both conditions. If this is the case, differences in L2 vocabulary retention may only become noticeable when the vocabulary words are presented in a single modality and/or in different formats. However, aside from the difficulty of creating purely visual stimuli to convey linguistic information, prior research has shown that impoverished verbal stimuli can negate the normal processing of the phonological loop (Baddeley, Thompson, & Buchanan, 1975), so the feasibility of creating such stimuli is uncertain. It may also be the case that a longer period of exposure to the L2 is necessary for any differential effects due to instructional methodology and stimulus type to emerge. The research of Skala (2003) and Klapper and Rees (2003) suggest that this possibility may be valid, given that the findings were based on observations made over the course of a semester and four years, respectively. At any rate, longitudinal research on the role of instructional method in SLA should be conducted so that a more concrete conclusion can be reached.

The greater number of L2 vocabulary words correctly associated with their meanings by participants who scored 1/5 correct on the pre-test as opposed to those who scored 0/5 correct demonstrates the importance of savings in relearning an L2. According to Ebbinghaus (1913), prior exposure to information allows for faster learning in subsequent trials, and the increase in efficiency between trials is referred to as savings. The significance of the advantage for participants who scored 1/5 items correct on the pre-test suggests that savings due to prior learning of the L2 may be quite substantial. When considered in combination, the benefit of prior knowledge of the L2 and the non-

significant trend toward a positive correlation between L2 vocabulary learning and working memory efficiency suggest that the episodic buffer, a component of working memory proposed by Baddeley (2000) to package information from working memory for storage in and later retrieval from long-term memory, may be one of the cognitive mechanisms that subserves SLA. According to Baddeley, the episodic buffer channels information from working memory into a unified, multi-faceted code for long-term storage and later retrieval. If working memory efficiency and prior exposure to the L2 facilitate vocabulary learning as a result of the episodic buffer's ability to transfer information between working memory and long-term memory, it is possible that the episodic buffer may also play a role in long-term SLA, suggesting that domain-general cognitive mechanisms play a key role in supporting SLA. Although these effects might not be manifested as strongly in long-term SLA as in early-stage L2 vocabulary learning, it is possible that they affect SLA in subtle ways, possibly contributing to individual learning style preferences. Further research should attempt to gauge the long-term impact of prior knowledge of the L2 through a longitudinal design, helping to further clarify the roles of long-term memory savings and working memory in SLA.

Measures of cerebral blood flow velocity gained using TCD showed no significant differences in activation between the two hemispheres during L2 vocabulary learning under the two conditions. This finding is interesting in light of the consistent findings from numerous past experiments that the left hemisphere is more active in the processing of verbal stimuli (see Jung-Beeman & Chiarello, 1998, for a review). The lack of laterality differences may be an indication that participants used mental imagery to process the purely verbal stimuli presented in the verbal condition, resulting in increased blood flow to the right hemisphere under this condition, which may have disguised any differences in hemispheric blood flow due to condition. It is also possible that the observed effects could be attributed to a lack of sufficient data due to the small size of the participant pool for the neurological component of the study. Whatever the case, further research into the role of laterality in the initial stages of SLA should be conducted to clarify these results.

Overall, consistent with prior research (see Norris & Ortega, 2000), the results of this experiment provide evidence for the short-term benefits of instruction and prior knowledge on SLA. More specifically, the results demonstrate that although materials similar to those used in the communicative method may provide L2 learners with an initial benefit over incidental learning in vocabulary acquisition, this benefit does not extend to long-term retention. Perhaps the findings of this study will be informative to foreign language teachers, applied linguists, and cognitive psychologists alike, helping them to better understand the relationship between the roles of instruction and the neurocognitive mechanisms underlying SLA.

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