

Memory Retention in Second Language Acquisition and Instruction: Insights from Literature and Research

Elvira Sanatullova-Allison

Foreign Language/ESOL Education, School of Teaching and Curriculum Leadership
College of Education, Oklahoma State University, U.S.A., elvira.allison@okstate.edu

Abstract

This article reviews some essential theoretical and empirical research literature that discusses the role of memory in second language acquisition and instruction. Two models of literature review – thematic and study-by-study – were used to analyze and synthesize the existing research. First, issues of memory retention in second language acquisition (e.g., attention and awareness, explicit and implicit language learning and knowledge) are investigated. Second, instructional approaches conducive to memory retention in second language acquisition (e.g., incidental vocabulary learning, grammar processing instruction, focus on form method) are examined. Additionally, created by the author with the Inspiration software program, a literature map of the reviewed and additional research related to the topic is presented in the Appendix for reader's reference.

Keywords: memory, memory retention, second language acquisition, second language instruction

Introduction

This article presents a review of some essential theoretical and empirical research literature that discusses the role of memory in human learning, in general, and in second language acquisition and instruction, in particular. I used two models of literature review – thematic and study-by-study – to analyze and synthesize the existing research on the topic. I start with an investigation of underlying issues related to memory retention in second language acquisition and proceed with an examination of specific instructional approaches conducive to memory retention in the context of second language learning. To provide a visual summary of the reviewed and additional research, I created a literature map with the Inspiration software program, which is included in the Appendix 1.

Memory Retention in Second Language Acquisition

In this section, I provide an overview of related theoretical and empirical research by first examining the fundamentals of human learning and memory and, second, by investigating the issues of memory retention directly associated with second language acquisition.

Fundamentals of Human Learning and Memory

Houston (2001) analyzed the basis of human learning and memory presented in theoretical and experimental psychological research. According to Houston, retention processes cannot be separated from the acquisition and transfer parts of the entire learning process defined as “a relatively permanent change in behavior potentiality that occurs as a result of reinforced practice” (2001, p. 4). All of these processes are interconnected and distinctions among them are somewhat arbitrary.

The information-processing approach to memory is based on the separate-storage model and the levels-of-processing approach. In the separate-storage model, the individual is seen as an information-processing system. Once an item is perceived, it enters primary memory (PM) with short-term storage. Rehearsal is necessary for the item to remain in PM and, if rehearsal is long enough, the item may enter secondary memory (SM), which is long-term storage. Bruning, Schraw, and Ronning (1999) state that metacognition, the knowledge people have about their own thought processes, guides the flow of information through the three consecutive memory systems: sensory memory, short-term memory, and long-term memory. Long-term memory is made of declarative and procedural knowledge: the former is the knowledge about facts and the latter is the knowledge about how to perform tasks. Houston (2001) argues that in the levels-of-processing approach, “the durability of a memory trace is determined by the depth to which it is processed” (p. 270). Semantic-network models of memory deal with the storage of semantic, meaningful material. According to this model, knowledge is stored through multiple interconnected associations, relationships, or pathways (Houston, 2001). The issue of the distinction between long-term versus short-term memory, recall versus recognition, episodic versus semantic memory, automatic versus controlled processing, contextual cues and state-dependent memory are some of the essential issues in memory retention. Research shows that the processes of organizing to-be-remembered information improve retention. For instance, chunking, word associations, recall by category,

stimulus or cue selection, verbal and visual coding, use of pictures and mnemonics can improve memory through organization, elaboration, and imagery. Language enables humans to retain information and communicate in highly sophisticated ways. The psycholinguistic approach to language argues that language usage is genetically based and involves hypothesis testing as well as creative thinking. Word storage is thought of in terms of the principles of semantic-network models such as hierarchies, matrices, feature comparisons, and spreading activation. According to the principles of Chomsky's transformational grammar, by applying different transformations to the deep-structure content (the meaning of a sentence), humans can develop different surface structures (organization of words) to express the same ideas.

Now, I turn to the analysis of the issues of memory retention directly concerning second language acquisition, such as types of memory, awareness and attention, and implicit and explicit language learning and knowledge.

Memory in Second Language Learning

Ellis (2001) described the types of memory used in second language learning. He proposed a Working Memory (WM) Model, in which a Supervisory Attentional System (SAS) regulates information flow within the working memory. Ellis applied a constructivist approach to second language acquisition, which holds that general processes of human inductive reasoning lead to language learning. "There is no language acquisition device specifiable in terms of linguistic universals, principles and parameters, or language-specific learning mechanisms" (Ellis, 2001, p. 38). Bates, Thal, and Marchman, as referenced by Ellis (2001), found that "learners' language comes not directly from their genes, but rather from the structure of adult language, and from the constraints on communication inherent in expressing non-linear cognition into the linear channel provided by the human vocal-auditory apparatus" (p. 38). Chunking is a major principle of human cognition. Its essence, which is bringing together a set of already formed chunks in memory and welding them together into a larger unit, represents a fundamental associative learning process occurring in all representational systems.

Attention and Awareness

Attention and awareness seem to play a major role in understanding language learning and retention. How do attention and awareness affect learning and retention?

Schmidt (2001) stressed that attention is necessary in order to understand every aspect of second language acquisition. If there can be learning without attention, then unattended learning is possible. However, its relevance and scope seem to be limited for second language acquisition. Attended learning is far superior, and is also important and necessary for practical purposes in second language learning. Preparatory attention and voluntary orienting vastly improve encoding. Intentionally focused attention may be a practical necessity for successful language learning. Passive approaches to learning are likely to be taken by slow and unsuccessful language learners. A sole reliance on reading and listening for vocabulary learning is very inefficient. To choose between the encoding specificity hypothesis and the global attention hypothesis, Schmidt (2001) argues that attention must be specifically directed to a particular learning domain and not just global. Noticing, or relatively

concrete input data, is the interface between the input and the developing of language system.

Implicit and Explicit Language Learning and Knowledge

The question of how implicit and explicit language learning and knowledge occur enables a better understanding of the nature of language learning and retention.

Definitions. N. Ellis (1994a) pointed out that implicit learning is the acquisition of knowledge about the underlying structure of a complex stimulus environment by a process which takes place naturally, simply, and without conscious operations. In contrast, explicit learning is a more conscious operation where the individual makes and tests hypotheses in a search for structure.

Nature of implicit learning. Winter and Reber (1994) defined implicit learning as a “generalized, domain-free inductive process that derives information about patterned relationships in the stimulus environment, and represents these relationships in an abstract and tacit form” (p. 117). Presented with complexly structured sequences of stimuli of an artificial grammar, subjects are asked to memorize them. The crucial issue is not “to establish that no participation of consciousness is possible, but only that conscious knowledge as assessed by available indicators is insufficient to account for the subjects’ performance on a given task” (p. 130). Knowledge from implicit learning is at least partly tacit (implicit) and unavailable to conscious introspection. From an evolutionary perspective, the primacy of the implicit in unconscious processes encompasses the fundamental primary cognitive faculties that serve as the foundation for conscious capabilities. A generalized process of induction that is essentially content free is given innately. The process specific approach is contrary to the Chomskyan content specific approach that supposes an innate structure of language.

Role of explicit knowledge. R. Ellis (1994) described the theory of instructed language learning, the goal of which is to explain how instructed learners develop the ability to use their linguistic and pragmatic knowledge in their production of correct and appropriate sentences. If the acquisition of explicit knowledge involves memorization, problem-solving, and inductive and deductive teaching approaches, the input can become implicit knowledge when the learner carries out noticing (paying attention to specific linguistic features in the input), comparing (comparing the noticed features with the features the learner typically produces in output), and integrating (constructing new hypotheses in order to incorporate the noticed features into the interlanguage system). The process of developing implicit knowledge also has two stages: first, input becomes intake through the operations of noticing and comparing, and second, intake becomes part of the learner’s interlanguage system. “Intake occurs when learners take features into their short or medium term memories, whereas interlanguage change occurs only when they become part of long-term memory” (p. 93). Although adult learners benefit more than children do from explicit knowledge, explicit knowledge cannot substitute for implicit knowledge: “Ultimately, the success in L2 learning depends on implicit knowledge” (p. 97). Even though practice is the principle means of developing both types of knowledge, the forms of practice are different. Implicit knowledge becomes automatic by using corrective action, retrials, continual communicative practice, and confronting the mismatch

between flawed and model performance. The automatization of explicit knowledge may be attained through controlled and constant grammar practice activities. Achievement of automatization allows the learner to release attention for the controlled processing of new L2 forms. The learner's knowledge of the world and L1 are other types of knowledge that contribute to instructed and naturalistic second language acquisition.

Contrary to the input and interaction hypothesis, it is not comprehension of input per se that leads to learning, but rather a lack of comprehension and a gap in knowledge leading to mis- or non-understanding that aids learning: "Learning becomes possible when the learner admits responsibility for the problem and so is forced to pay close attention to the input" (Ellis, 1994, p. 103). In conclusion, not all input becomes intake. Explicit knowledge plays a central role in language pedagogy and formal instruction contributes primarily to explicit knowledge which can facilitate later implicit knowledge. Since automatizing their existing knowledge may interfere with acquiring new knowledge, learners will need to choose whether to process to achieve communication or to acquire knowledge.

Ellis (1994b) reviewed research to determine which human cognitive capabilities are acquired implicitly and which are learned explicitly. By reviewing implicit, incidental, and explicit vocabulary learning hypotheses, Ellis cited Jensen who said that "the crucial variable in vocabulary size is not exposure per se, but conceptual need and inference of meaning from context, which are forms of education. Hence, vocabulary is a good index of (academic) intelligence" (p. 220). Also, Stenberg, as cited by Ellis, added: "...simply reading a lot does not guarantee a high vocabulary. What seems to be critical...is what one has been able to learn from, and do with, that experience" (p. 219). Although interrelated, input and output processing abilities do not correlate highly with either cognitive mediational components or intelligence. Repetition priming with the use of lexical decision, word identification, and word stem completion tests are the main techniques for studying implicit memory. Imagery mediation using keywords methods, semantic mediation, and metalinguistic strategies for inferencing and remembering are explicit, deep processing, and mediational strategies in L2 vocabulary learning. To conclude, while naturalistic settings provide learners with exposure and motivation and reading for implicit acquisition of orthography, explicit, deep, and elaborative processing of semantic and conceptual/imaginal representations through explicit inferencing from context enhances memory retention of the multiple meanings of vocabulary.

Tasks and rules. Robinson (1996) examined if complex rules can only be learned implicitly whereas conscious explicit learning is effective when the rules are simple and salient to the learner. The study involved 104 intermediate adult English language learners in Hawaii, who were native speakers of Asian languages. The results indicated that the implicit and incidental conditions were not superior to the rule-search and instructed conditions in accuracy or speed of performance on complex rules. Participants' responses to simple rule sentences were significantly faster than responses to complex rule sentences in all conditions.

Second Language Instruction for Memory Retention

In this section, I review relevant research literature pertaining to two sets of issues: learning and teaching principles that improve second language acquisition and instructional approaches that enhance memory retention in second language learning.

Learning and Teaching Principles

The literature highlights the following principles in regard to effective second language learning and teaching: intentional versus nonintentional learning, sentence processing, task-based instruction, and task-induced involvement construct.

Incidental versus intentional learning. Hulstijn (2001) noted that the majority of L2 learners have to learn a large amount of vocabulary. Is incidental or intentional vocabulary learning more conducive to language learning? Three issues were considered: first, the quality of information processing when an unfamiliar word is first encountered; second, the quantity and quality of rehearsal activities needed for a word to be permanently available; and, third, the training of automatic access to word knowledge necessary for fluent language use. Functional architecture-style models and connectionist models are two means by which lexical knowledge is represented and processed. It is unclear which L2 lexical features must or may be acquired. For any lexical entry, an individual's mental lexicon will often comprise both less and more than the information included in dictionaries. The practice of discouraging procedures of intentional vocabulary learning is an ill-informed understanding of the terms 'incidental' and 'intentional' learning. Telling or not telling students that they will be tested afterwards on their knowledge is the critical operational feature distinguishing incidental from intentional learning. The quality and frequency of the information processing activities, such as elaboration on aspects of a words' form and meaning and rehearsal, and not the learner's intention, the task itself, or the presence or absence of post-test determines retention of new information.

Distributed practice with increasing intervals after correct retrievals and short intervals after incorrect retrievals generates a much higher retention rate than massed practice does. Items that are difficult to learn should be overlearned to ensure long-term retention (Hulstijn, 2001). Encountering new words in context and extensive reading, as advocated in current L1 and L2 pedagogy, are neither necessary nor sufficient for efficient vocabulary expansion. Readers should apply a variety of decontextualization skills and write down the lexical information encountered during reading. New information should be frequently reactivated, beginning with short intervals and leveling off at approximately monthly intervals (Robinson, 2001). To attain automaticity of high-frequency words, learners should be exposed to reading and listening texts which contain only familiar words, which is the 'i - 1' ('i minus one') level. Lexical information must be reactivated regularly for it to remain quickly accessible. Intentional vocabulary learning, as well as drill and practice, must have a place in the L2 classroom, complementary to (not instead of) the well-established principles of incidental and contextual learning. Computer programs and other electronically-mediated technologies can be well suited to help in that.

Task-induced involvement construct. Laufer and Hulstijn (2001) stated that elaboration and motivation in L2 vocabulary demonstrated higher retention and

proficiency. However, there is a need for further theoretical exploration and empirical investigation concerning the development of cognitive concepts. Laufer and Hulstijn (2001) proposed a construct of task-induced involvement with three motivational and cognitive dimensions – need, search, and evaluation – that are conducive to elaboration necessary for learning. No Interface (no effect of the explicit knowledge on the acquisition of implicit knowledge), Strong Interface (explicit knowledge transfers into implicit knowledge), and Weak Interface (explicit knowledge may indirectly affect the acquisition of implicit knowledge by focusing learners' attention on features in the input) are three known positions for grammatical knowledge. Schmidt's Noticing Hypothesis is the development of the Weak Interface position. Being subject to manipulation, incidental learning design enables the researchers to investigate the effect of the particular kind of information processing of interest. Involvement as a motivational-cognitive construct explaining and predicting learner's success in the retention of hitherto unfamiliar words combines three factors to determine vocabulary retention: need, search, and evaluation. The need component – a motivational and non-cognitive dimension of involvement – is based on a drive to comply with the task requirements which can be either externally (a moderate need) or internally (a strong need) imposed. Search and evaluation – the two cognitive dimensions – are contingent upon noticing and allocating attention to the form-meaning relationship (Schmidt, 1994a, 2000). Search is the attempt to find the meaning of an unknown L2 word by consulting a dictionary or another source/authority, such as a teacher. Evaluation entails a comparison of a given word or a specific meaning with other words or meanings. According to the second assumption, the higher the involvement load will be, the better the retention of words will be. According to the third assumption, teacher/researcher-designed tasks with a higher involvement load will lead to higher vocabulary retention. The Involvement Load Hypothesis does not give any preference to input or output tasks nor does it depend on different types of mode, such as visual, aural, or oral. It only predicts that higher involvement in word induced by the task – either input or output – will result in better retention.

Now, I proceed with a closer examination of the following instructional approaches and conditions which prove to be conducive to memory retention in second language acquisition: incidental vocabulary learning, grammar processing instruction, and focus on form method.

Incidental Vocabulary Learning

Here, I address the question of vocabulary learning in incidental condition, tested and implemented in second language research and instruction. The literature pertaining to methodological questions and to issues of input, output, and tasks is also analyzed.

Historical and methodological perspectives. The term 'incidental learning' has been consistently used in psychological literature since the beginning of 20th century. Laufer and Hulstijn (2001) indicated that from the standpoint of methodological meaning of incidental learning adopted in research experiments "learners are typically required to perform a task involving the processing of some information without being told in advance that they will be tested afterwards on their recall on that information" (p. 10). So, a test unexpected by language learners that measures their vocabulary retention after the information-processing task is essential to so-called

“incidental learning design” (Laufer & Hulstijn, 2001, p. 10) and distinguishes it from intentional learning design in which learners are forewarned about the presence of a subsequent retention test. During the 1960s and early 1970s there was a shift from the behaviorist paradigm toward the cognitive paradigm, resulting, in the case of incidental learning, in the recent interest on the part of second language researchers in the nature of the way in which stimulus information is processed by learners. It seems that a deeper understanding of the way in which information is processed can enable language educators to enhance learners’ incidental vocabulary learning and overall language acquisition.

Input, output, and tasks. Research shows that particular types of input, output, and tasks enhance information processing in incidental vocabulary learning.

Vygotskiiian Activity Theory. McCafferty, Roebuck, and Wayland (2001) applied Zinchenko’s hypothesis, based on Vygotskiiian Activity Theory, to second language acquisition to test if materials connected with the goal of an action would be better remembered than the materials connected with the means or conditions of action. Five university English-speaking learners of Spanish in their third semester were randomly assigned to experimental and control conditions. The results showed that increased mental effort and the relation of a word to the goal of an activity enhanced vocabulary learning.

Generative and communicative tasks. Joe (1998) investigated whether generative processing tasks lead to vocabulary learning for 48 adult learners of English who were randomly assigned to experimental, comparison, and control treatments. The results indicated that the participants who performed the task and had high background knowledge outperformed those who did not perform the task and had low background knowledge. In conclusion, greater levels of generation led to a greater vocabulary knowledge gains for completely unknown target words as opposed to partially known words.

The role of modified input and output. Ellis and He (1999) investigated the effects of various exposure conditions for 50 university intermediate learners of English who performed a listen-and-do task in three experimental groups: the premodified input, the interactionally modified input, or the negotiated output treatment. Despite high levels of acquisition in all conditions, the results indicated that the modified output group scored significantly higher on the comprehension of the directions, vocabulary recognition, and vocabulary production. Negotiation of new vocabulary in a collaborative and problem-solving manner led to deeper input processing.

Grammar Processing Instruction

Grammar Processing Instruction is an explicit focus on form that aims to alter the way in which learners perceive and process input. It seeks to provide learners’ internal learning mechanisms with richer grammatical intake by explaining, practicing, and experiencing input data with learner strategies (VanPatten & Cadierno, 1993). It is opposed to explicit grammar instruction involving explanation and output practice of a grammatical point.

VanPatten (1990) explored if learners could consciously attend to both form and meaning when processing input. Two hundred and two university students of Spanish on three levels – first and fourth semesters and third-year conversation – were randomly assigned to four conditions: attention to meaning alone, simultaneous attention to meaning with an important lexical item, a grammatical factor, and a verb form. Results indicated that simultaneous processing was rather difficult for learners. The following questions arise as possible implications for future research and instructional practice: Is consistent and constant awareness of form in the input improbable if the learner's task is to process the input for meaning? Do learners concurrently process the form subconsciously while consciously processing for meaning? If all forms are processed consciously, does the ability to consciously process both meaning and form develop over time?

Focus on Form Method

Doughty and Williams (1998) referred first to Long (1991) to distinguish focus on formS from focus on form (FonF). Focus on formS “characterizes earlier, synthetic approaches to language teaching” which is focused on “the accumulation of individual language elements” (Doughty & Williams, 1998, p. 3). However, focus on form “entails a prerequisite engagement in meaning before attention to linguistic features can be expected to be effective” (Doughty & Williams, 1998, p. 3). Focus on form “overtly draws students’ attention to linguistic elements as they arise incidentally in lessons whose overriding focus is on meaning or communication” (Long, 1991, pp. 45-46) and “often consists of an occasional shift of attention to linguistic code features...triggered by perceived problems with comprehension or production” (Long & Robinson, 1998, p. 23).

Communicative focus on form. Doughty and Varela (1998) discussed whether and how learners’ attention can be drawn to formal features without distracting them from their original communicative intent in a content-based ESL classroom. Thirty-five middle schools students studying science at an intermediate ESL level were assigned to FonF and control groups. Results indicated the effectiveness of incidental focus on form tasks in a communicative content-based classroom.

Conclusions

The research literature reviewed in this article addressed the following two themes pertaining to the role of memory in second language acquisition: underlying issues of memory retention and specific instructional approaches fostering memory retention. Regarding the former, the fundamentals of human learning and memory (What are the bases of learning and memory?), memory in second language learning (What type of memory is used in second language learning?), attention and awareness (How do consciousness, attention, and awareness relate to each other and affect language learning?), and implicit and explicit language learning and knowledge (What factors affect both kinds of learning and knowledge?) provide a better understanding of the memory retention mechanism in second language acquisition. Concerning the latter, specific teaching and learning principles (What teaching and learning principles enhance language learning?), incidental vocabulary learning (What reading and writing, input and output tasks and research conditions promote incidental vocabulary learning?), grammar processing instruction (How and why does processing instruction

lead to language learning?), and focus on form method (How and why does focus on form increase language learning?) prove to be conducive to language learning and memory retention.

References

- Bruning, R. H., Schraw, G. J., & Ronning, R. R. (1999). *Cognitive psychology and instruction, 3rd ed.* Upper Saddle River, NJ: Prentice Hall.
- Coady, J. (1997). L2 vocabulary acquisition through extensive reading. In J. Coady & T. Huckin (Eds.), *Second language vocabulary acquisition* (pp. 225-237). Cambridge, UK: Cambridge University Press.
- Doughty, C., & Varela, E. (1998). Communicative focus on form. In C. Doughty & J. Williams (Eds.), *Focus on form in classroom second language acquisition* (pp. 115-137). Cambridge, UK: Cambridge University Press.
- Doughty, C., & Williams, J. (1998). Issues and terminology. In C. Doughty & J. Williams (Eds.), *Focus on form in classroom second language acquisition* (pp. 1-11). Cambridge, UK: Cambridge University Press.
- Ellis, N. (1994a). Implicit and explicit language learning – An overview. In N. C. Ellis (Ed.), *Implicit and explicit learning of languages* (pp. 1-33). London, UK: Academic Press.
- Ellis, N. (1994b). Consciousness in second language learning: Psychological perspectives on the role of conscious processes in vocabulary acquisition. *AILA Review, 11*, 37-56.
- Ellis, N. (2001). Memory for language. In P. Robinson (Ed.), *Cognition and second language instruction* (pp. 33-68). Cambridge, UK: Cambridge University Press.
- Ellis, R. (1994). A theory of instructed second language acquisition. In N. C. Ellis (Ed.), *Implicit and explicit learning of languages* (pp. 81-113). London, UK: Academic Press.
- Ellis, R., & He, X. (1999). The roles of modified input and output in the incidental acquisition of word meanings. *Studies in Second Language Acquisition, 21*(2), 285–301.
- Han, Y., & Ellis, R. (1998). Implicit knowledge, explicit knowledge and general language proficiency. *Language Teaching Research, 2*(1), 1-23.
- Houston, J. P. (2001). *Fundamentals of learning and memory, 4th ed.* Fort Worth, TX: Harcourt Brace Jovanovich College Publishers.
- Hulstijn, J. (1992). Retention of inferred and given word meanings: Experiments in incidental vocabulary learning. In P. J. L. Arnaud & H. Bejoint (Eds.), *Vocabulary and applied linguistics* (pp.113-125). London, UK: Macmillan.
- Hulstijn, J. (1993). When do foreign-language readers look up the meaning of unfamiliar words? The influence of task and learner variables. *The Modern Language Journal, 77*(2), 137-147.
- Hulstijn, J. (2001). Intentional and incidental second language vocabulary learning: A reappraisal of elaboration, rehearsal and automaticity. In P. Robinson (Ed.), *Cognition and second language instruction* (pp. 258-286). Cambridge, UK: Cambridge University Press.
- Joe, A. (1998). What effects do text-based tasks promoting generation have on incidental vocabulary acquisition? *Applied Linguistics, 19*(3), 357-377.
- Laufer, B., & Hulstijn, J. (2001). Incidental vocabulary acquisition in a second language: The construct of task-induced involvement. *Applied Linguistics, 22*(1), 1-26.
- Long, M. H. (1991). Focus on form: A design feature in language teaching methodology. In K. DeBot, R. Ginsberg, & C. Kramsch (Eds.), *Foreign*

- language research in crosscultural perspective* (pp. 39-52). Amsterdam, Netherlands: John Benjamins.
- Long, M. H., & Robinson, P. (1998). Focus on form: Theory, research, and practice. In C. Doughty & J. Williams (Eds.), *Focus on form in classroom second language acquisition* (pp. 15-42). Cambridge, UK: Cambridge University Press.
- McCafferty, S., Roebuck, R., & Wayland, R. (2001). Activity theory and the incidental learning of second-language vocabulary. *Language Awareness, 10*(4), 289-294.
- Robinson, P. (1995). Aptitude, awareness, and the fundamental similarity of implicit and explicit second language learning. In R. Schmidt (Ed.), *Attention and awareness in foreign language learning* (pp. 303-358). Honolulu, HI: University of Hawai'i, Second Language Teaching and Curriculum Center.
- Robinson, P. (1996). Learning simple and complex second language rules under implicit, incidental, rule-search, and instructed conditions. *Studies in Second Language Acquisition, 18*(1), 27-67.
- Robinson, P. (2001). *Cognition and second language instruction*. Cambridge, UK: Cambridge University Press.
- Schmidt, R. (2001). Attention. In P. Robinson (Ed.), *Cognition and second language instruction* (pp. 3-33). Cambridge, UK: Cambridge University Press.
- VanPatten, B. (1990). Attending to form and content in the input: An experiment in consciousness. *Studies in Second Language Acquisition, 12*(3), 287-301.
- VanPatten, B., & Cadierno, T. (1993). Explicit instruction and input processing. *Studies in Second Language Acquisition, 15*(2), 225-243.
- Winter, B., & Reber, A. S. (1994). Implicit learning and the acquisition of natural languages. In N. C. Ellis (Ed.), *Implicit and explicit learning of languages* (pp. 115-146). London, UK: Academic Press.

Appendix 1

