Basic Research on Learning, Cognition, and Emotion and its Implications for Language Teaching

Aydin Yücesan Durgunoğlu
Department of Psychology, University of Minnesota, Duluth, USA

Heng Xu
College of Foreign Studies, Jinan University, Guangzhou, China

[Abstract] There are extensive research on learning, cognition and emotion for language teaching. To acquire a big picture of previous research and current implications in second language acquisition, this paper identified and highlighted the most important principles and their general effects in language teaching. It assists researchers and practitioners to fully understand what has been validated and how to incorporate them into practice.

[Keywords] learning, cognition, emotion, Second Language Acquisition

Introduction

In the last century, extant research in education and cognition has identified some general effective teaching and learning approaches. More recently, Graesser and his collagues (Graesser, 2009; Graesser, Halpern, & Hakel, 2008; Pashler, Bain, Bottge, Graesser, Koedinger, McDaniel, & Metcalf, 2007) have compiled these teaching and learning principles and the strength of the empirical evidence behind each principle. In this paper, our goal is to highlight some of these principles and discuss their implications specifically for second language acquisition (SLA). While discussing the implications, we will also provide some relevant research from SLA illustrating the principle.

Contiguity Effects

This principle states that ideas that need to be associated should be presented all together. A contiguity effect can occur when verbal information is associated and presented with related and well-coordinated visual information in language learning. It supports learners to make connections and process the content (Roche & Scheller, 2008).

In SLA, this principle is very relevant in the teaching of vocabulary. One example (from Levelt, 1989) as illustrated in figure 1 below indicates that in spoken word recognition, a lexical entry involves both form- and meaning-based information. To know a word means knowing how it is pronounced, its meaning, syntactic category and morphological structure. Based on the contiguity principle, such different aspects of a lexical entry need to be closely associated and thus presented in together.

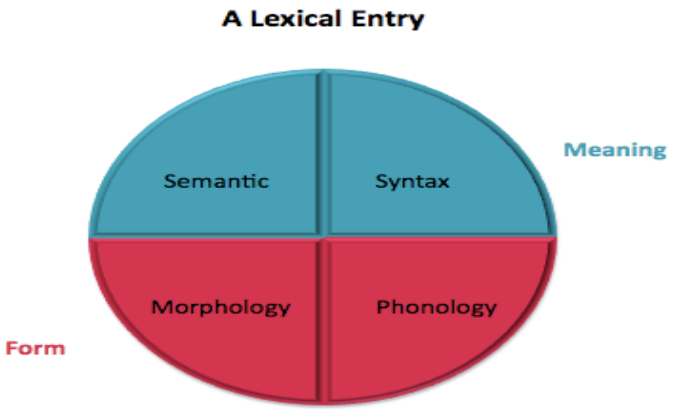

Figure 1. Levelt's (1989) Internal Structure of the Lexical Entry

According to the Lexical Quality Hypothesis (Perfetti & Stafura, 2014) written words are recognized, by integrating multiple sources of information. This model provides a detailed description of the reading process and shows why lexicon is considered a "pressure point" in language production and comprehension. As illustrated in the figure 2 below, lexicon straddles two systems: (a) word identification (b) integration of that word into the ongoing representation of the text. Hence weak lexical knowledge provides a challenge for both word identification and comprehension processes.

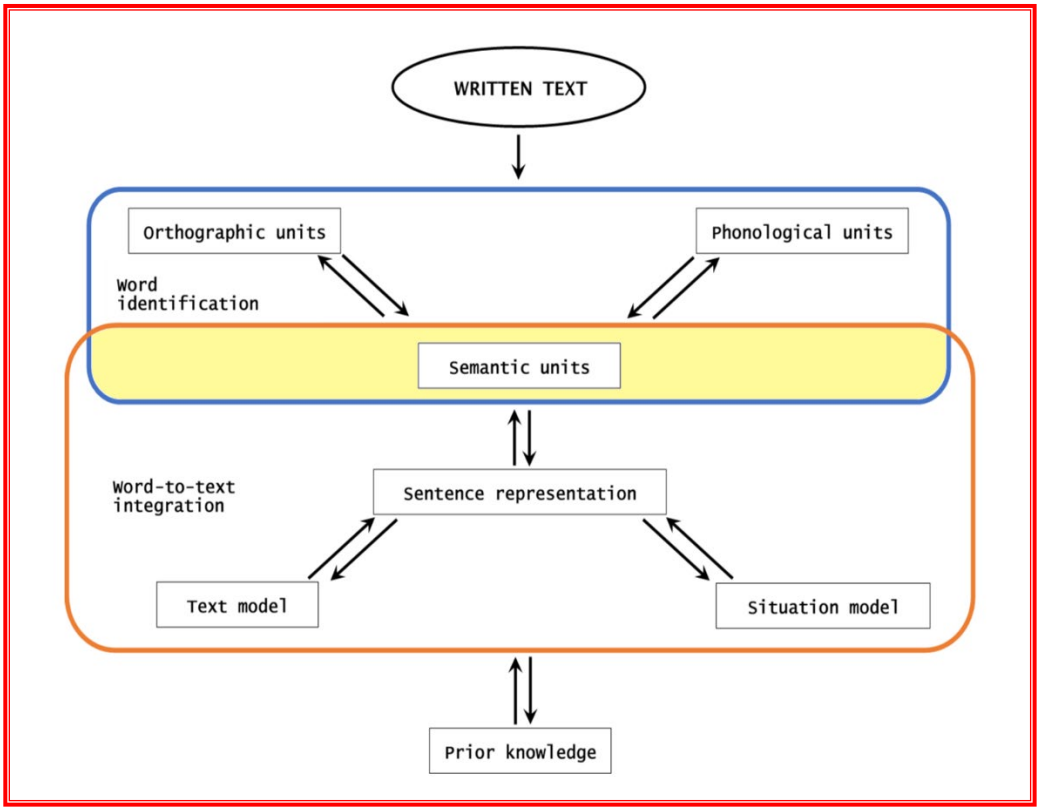

Figure 2. Model of the Reading Comprehension Process

Given vocabulary's central role and multifaceted construct, vocabulary teaching requires both depth and breadth. Although the number of words that are learned is important (breadth), just as important is the depth of knowledge about each word, including its connotations. Classroom instruction requires providing both a word's abstract meaning, but also concrete examples of how and where it is used. As R. Ellis (2005) discusses, vocabulary helps communicate and this is intrinsically motivating. Therefore, in addition to knowing what a word means, showing its use for communication purposes is extremely useful.

Zakeria & Khatibib (2014) also applied the contiguity effects into their research as they examined associative learning. It was found that the gaining of meanings through the observation of co-occurrence of the words and an instance of their meaning is an efficient approach to acquire vocabulary

Dual Code and Multimedia Effects

Materials presented in verbal, visual, and multimedia form richer representations than a single medium. Two reasons are provided to explain this advantage: (1) the integration of verbal and non-verbal non-redundant materials improves the learning by providing multiple pathways to the concepts. (2) Rich representations lead to active learning by engaging students. This topic is actually an active research area in SLA and in-depth discussions about the evidence indicating the benefits of multimedia presentations can be found in Alzahrani (2017) and Ranalli (2013).

However also noteworthy is another learning principle, the Coherence Effect, which states that materials and multimedia should explicitly link related ideas while at the same time minimizing irrelevant material that can be distracting, hence preventing cognitive overload. For example, in language learning, when verbal information is accompanied by related and well coordinated visual information, it can provide support for the learner's mental processing of the content. However, if the processing is not coordinated, interferences are likely to occur making it more difficult for learners to process and retain the information (Roche & Scheller, 2008).

Discovery Learning

Discovery learning is limited. It is hard for most students to discover important principles on their own, without careful guidance, scaffolding, or appropriately structured materials. This is a controversial area in SLA, as educators debate the merits of explicit instruction, especially of grammar. In their review Norris & Ortega (2000) found support for the explicit teaching of structure "*Treatments involving an explicit focus on the rule-governed nature of L2 structures are more effective than treatments that do not include such a focus". (p. 483). Likewise R.Ellis (2005) states that there is a need for both formulaic expressions that can become automatic and used without conscious attention to structure as well as* rule-based competence. Explicit knowledge includes rules, formulas, conjugations, word patterns, etc. that have been learned. It Involves conscious effort and becomes important especially when there is a misunderstanding or inability to express, "When you want to say something but don't know how "or" points of dysfluency" (N. Ellis, 2005).

Implicit knowledge, on the other hand, is usually below awareness, and involves noticing patterns, co-occurrences (esp. high frequency and typical occurrences). Because implicit knowledge develops a general abstract understanding from patterns that are encountered, it requires a lot of high-quality input and a good demand of exposure. It is used when communication is fast, clear and relatively automatic.

Educators rightfully point out that we want the second language learners to use the language fluently, without necessarily being aware of the rules, with the assumption that knowing and deliberately using a rule will be a slow, controlled process. However, there is no need to assume that explicitly teaching a rule precludes a student from eventually using it automatically and fluently as they become more proficient. In other words, teaching of explicit rules does NOT mean that learners will always rely on explicit rules to understand and produce language.

Explicit knowledge facilitates the learning process by highlighting what needs to be noticed (e.g., note that the final -ed makes a verb past tense *walk-walked*), providing an analogical basis for understanding and using new constructs (e.g., -er changes the verb to a noun *walk-walker*). When the learner does not have the opportunity to encounter large quantities of high quality input, explicit knowledge provides a shortcut. Learners can also analyze parts of formulaic expressions and monitor their output with the help of explicit knowledge. Finally, through practice and chunking, the explicit knowledge becomes fluent and automatic. In other words, there is a continuous interaction between explicit and implicit knowledge and it is a loop rather than a dichotomy.

Active Learning

Learners best retain and apply the information that has been learned through an effortful process. Several different active learning processes have been empirically verified.

a. Generation Effect. Learning is enhanced when learners actually produce rather than recognize answers.
b. Deep questions. Students benefit more from asking and answering deep comprehension questions that elicit explanations (e.g., why, why not, how, what-if) than shallow questions (e.g., who, what, when, where) asking for basic descriptive details
c. Organization Effects. Outlining, integrating, and synthesizing information produces better learning than rereading materials or other more passive strategies.

The active learning processes have also been studied in SLA contexts. For example, Eckerth & Tavakoli (2012) examined the reading conditions that led to the learning of the target words. College students read texts under one of three conditions: Task 1: Read a text with marginal glosses, Task 2: Read a text with gaps for target words, to be filled from the items in a word list; Task 3: Read a text with marginal glosses but also write a summary, using one of two given questions and by including all target words. (The texts were counterbalanced and all participants did all three tasks). The study also manipulated whether a target word occurred 1 or 5 times in the study. The whole learning process was three weeks long followed by immediate testing and by delayed testing three weeks later.

When tested immediately, across the four different types of vocabulary tests, Tasks 2 and 3 which required learners to generate information helped vocabulary performance compared to only reading (Task 1), especially for low-occurrence items. On delayed testing, again across four different types of vocabulary measures, Task 3 (summary) was better than Tasks 1 (read only) and 2 (choose words to fill the gap), regardless of how many times a target word occurred. These results indicate that in actively processing the vocabulary items led to better retention across time.

Space Effects

When repeating information during the study phase, spacing the repetitions produces better long-term retention than a massed repetition. That is, learning is improved when new information is incorporated gradually into the memory store with some intervals between the episodes, rather than when it is massed all at once.

A classic example for this effect in SLA is eight-year retention of Spanish vocabulary by English speakers (Bahrick & Phelps, 1987). Items studies with a 30-day interval between the two exposures led to better memory than items studied with no interval between the two presentations. In a more recent study Nakata (2018) asked Japanese speakers to learn 48 low-frequency English words by typing in the Japanese translation for these words. In one condition, the words were presented four times in sequential blocks with random distribution of items in each block, which yields massed presentations, with possible spacing ranging between 0-10 items. In the spaced presentation condition, words were repeated across blocks, which made the intervals to range between 2-29 items. Although massed presentation led to better initial learning, on the delayed test given a week later, spaced presentation led to better retention of the translations.

Testing Effect

Information is retained better when it is tested during the learning process, requiring its retrieval from memory. The studies discussed in Section 6 above did not just have active studying, but also instances of retrieval during the sessions. Research clearly shows that testing enhances learning, therefore it is must be determined whether active studying or multiple instances of retrieval improves learning. Addressing this issue, Karpicke & Roediger (2008) tried to disentangle the effects of multiple instances of retrieval (testing) from multiple instances of studying. College students learned 40 Swahili-English word pairs and were tested on these words a week later. There were four different conditions in the study: In one condition, all 40 pairs were studied and tested until all were learned. In the second condition, words that were correctly recalled were not studied any longer, but continued to be tested. In the third condition, if a word pair was correctly recalled, it was still studied, but was no longer tested. Finally, in the fourth condition, recalled items were neither studied nor tested any more. The crucial comparison is between Conditions 2 and 3, namely whether repeated testing (Condition 2) or repeated studying (Condition 3) leads to better recall after a week. The data showed that even if a word is studied multiple times, if tested only once, there is weaker final recall (.36) compared to the condition where studying occurs once but testing is repeated (.80). These data illustrate repeated testing which requires items to be retrieved multiple times, leads to better retention.

Feedback Effects

Students benefit from feedback on their performance. In SLA, one area where this has been investigated systematically is the effectiveness of the feedback provided by the teachers when they recast an error. The effectiveness of recasts have been questioned because of several concerns: One question is whether learners notice the error that is corrected. There may be “limited uptake” by the learners if they do not grasp what the teacher is correcting. Another concern is the lack of deeper information in recasts. Recasts may mark an error, but not necessarily allow the learner understand why it is wrong. Finally, high-proficiency learners may benefit more from such indirect feedback.

In his study on the effectiveness of recasts, Nassaji (2017) manipulated how extensive the recasts were and observed their effectiveness on learning English articles. Learners interacted with

a native speaker while doing picture labeling and description tasks. In extensive recasts, teachers provided feedback on all types of errors, whereas in intensive recasts, the feedback was only for articles. Control group received no feedback. After this learning phase, one of the outcome tasks was to judge the grammaticality of given sentences, and correct he sentences if there was an article error. The testing was done immediately or after two weeks. Results showed that all groups were similar at pretest. On posttests, extensive recast was better than control, but intensive recast was not better than control, indicating that a broader focus on language rather than a specific construct may be more helpful with recasts.

In another study with English learners, recasting was compared to scaffolded feedback (Rassaei, 2014). As participants learned about wh- questions, teachers provided either recasts, scaffolded feedback or no feedback (control group). Scaffolded feedback consisted of detailing the error and continuously asking the learner what the correct form should be. On the outcome test (written grammaticality judgments) control group showed no change, while the scaffolded group performed better than the recast group.

Motivation, Interest and Self-efficacy

When students are interested, they engage for a longer period of time, put in more effort, use deeper and more active processing. As a corollary, students are more motivated when the materials and skills are anchored in real world problems that matter to them.

Motivation has played a vital role in SLA and also it could be the best friend or the worst enemy for practitioners in language learning. Learning a second language takes a considerable amount of time. It is a challenge to allot enough class time to one subject while other subjects also need to be delivered. Therefore, the endeavor of learning a language should not begin and end in a language classroom. The learners' motivation moves us into an area where learners can initiate and direct their own learning in and beyond classroom. The role of motivation is to spur the learners to invest time and effort outside the classroom and choose different cognitive strategies to achieve the proficiency.

When students are motivated, they are more interested in participating, communicating, engaging and initiating. The more time and effort they are motivated to invest in, the more they master and the more competent they are. Wlodkowski (1985) stated that motivation not only propels the learning but it also mediates learning and finally, is a consequence of learning.

Self-determination theory is one of the most influential theories in motivational psychology and has been applied to SLA extensively (Dörnyei, 2003). It claims that people have three innate psychological needs that individuals want to fulfill, which are relatedness, autonomy and competence. Interest is the first step to move forward in learning and it can always trace back the rationale of relatedness. Not all students are intrinsically motivated to learn a new language, even if it is potentially beneficial to them. Students are more likely to internalize and "take ownership" of the practices of those with whom they feel connected and in contexts where they feel a sense of belonging (Niemiec & Ryan, 2009). The concepts like context personalization (e.g., Bernacki & Walkington, 2018), situated learning and active personalization (e.g., Zou & Xie, 2018) are all deeply rooted in it. Autonomy is defined as freedom to choose. The sense of being autonomous form a very positive effect on students' attitude and performance. Students are more motivated and engaged in learning when they choose to do so. Self-efficacy is the core of competence. Students want to know that they are good at what they do. Success breeds motivation. Bandura (1997) stated that the mastery experiences (or being competent) provides striking testimony to

one's capacity and serve as transforming experiences to improve self-efficacy and motivate to succeed in different undertaking.

Learning is deeper when students are more motivated. In any learning context, students can choose to use many different learning strategies, from memorization to deep processing. High level of interest is linked to deeper and more active processing. In SLA, Xu and Durgunoğlu (2019) studied how Chinese college students read English texts and answered relatively superficial, text-based questions or questions that required deeper processing and critical analyses. For text-based questions, extrinsic motivation was a strong predictor of performance. However, for questions that required deeper processing, intrinsic motivation was a strong predictor. It presented that the motivation can also have an impact how deep the learners can process besides interests and engagement.

Conclusion

Overall, it is clear that just like in any learning and teaching context, SLA classrooms can also benefit from implementing the principles of learning that have been supported by empirical evidence. The highlighted important principles and their general effects in language teaching have been illustrated in the paper. Ideally, it could help researchers and practitioners to fully be informed what has been validated and how to incorporate them into practice.

References

Alzahrani, S. (2017). Linking multimedia vocabulary CALL research to SLA cognitive theories. *American Journal of Educational Research, 5*, 821-827, doi:10.12691/education-5-7-19.

Bahrick, H. P., & Phelps, E. (1987). Retention of Spanish Vocabulary Over 8 Years. *Journal of Experimental Psychology: Learning Memory and Cognition*, *13*(2), 344-349.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY, US: W H Freeman/Times Books/ Henry Holt & Co.

Bernacki, M. L., & Walkington, C. (2018). The role of situational interest in personalized learning. *Journal of Educational Psychology, 110(*6), 864-881. doi: 10.1037/edu0000250.

Dornyei, Z. (2003). Attitudes, orientation, and motivations in language learning: Advances in theory, research, and applications. *Language Learning, 53*, 3-32. doi:10.1111/1467-9922.53222.

Eckerth, J. & Tavakoli, P. (2012). The effects of word exposure frequency and elaboration of word processing on incidental L2 vocabulary acquisition through reading. *Language Teaching Research. 16*. 227-252. doi:10.1177/1362168811431377.

Ellis, N. C. (2005). At the interface: Dynamic interactions of explicit and implicit language knowledge. *Studies in Second Language Acquisition, 27*, 305-352.

Graesser, A. C. (2009). Inaugural editorial for *Journal of Educational Psychology*. *Journal of Educational Psychology, 101*(2), 259-261.

Graesser, A. C., Halpern, D. F., & Hakel, M. (2008).25 principles of learning. Washington, DC: Task Force on Life long Learning at Work and at Home. Retrieved August 20, 2019, from https://louisville.edu/ideastoaction/-/files/featured/halpern/25-principles.pdf

Levelt, W. J. M. (1989). *Speaking: From intention to articulation*. Cambridge, MA: MIT Press.

Nakata, T. (2008). English vocabulary learning with word lists, word cards, and computers: implications from cognitive psychology research for optimal spaced learning. *ReCALL 20*, no. 1: 3–20. doi: 10.1017/S0958344008000219

Nassaji, H. (2017). Language instruction and language acquisition: A complex interplay. *Language Teaching Research*, *21*(5), 543–545. https://doi.org/10.1177/1362168817727203

Niemiec, C. P., & Ryan, R. M. (2009). Autonomy, Competence, and Relatedness in the Classroom Applying Self-Determination Theory to Educational Practice. *Theory and Research in Education, 7*, 133-144.

Pashler, H., Bain, P., Bottge, B., Graesser, A., Koedinger, K., McDaniel, M., and Metcalfe, J. (2007) Organizing Instruction and Study to Improve Student Learning (NCER 2007-2004). Washington, DC: National Center for Education Research, Institute of Education Sciences, U.S. Department of Education. Retrieved from http://ncer.ed.gov.

Ranalli, J. (2013). Designing Online Strategy Instruction for Integrated Vocabulary Depth of Knowledge and Web-based Dictionary Skills. *CALICO Journal 30,* 16-43, doi:10.11139/cj.30.1.16-43.

Rassaei, E. (2014). Scaffolded Feedback, Recasts, and L2 Development: A Sociocultural Perspective. *The Modern Language Journal*. *98.* 10.1111/j.1540-4781.2014.12060.x.

Roche, J., & Scheller, J. (2008). Grammar Animations and Cognition. In F. Zhang, & B. Barber (Eds.), *Handbook of Research on Computer-Enhanced Language Acquisition and Learning* (pp. 205-218). Hershey, PA: IGI Global. doi:10.4018/978-1-59904-895-6.ch012

Wlodkowski, R. J. (1985). Stimulation. *Training & Development Journal, 39*(6), 38-43.

Xu, H. & Durgunoglu, A. (2019). Motivational factors underlying different levels of reading comprehension of English language learners. *TESOL Journal*. doi:e00448. 10.1002/tesj.448.

Zakaeria, J. & Khatibib M. B. (2014) A much-needed boost to EFL learners' vocabulary; the role of associative learning. *International Conference on Current Trends in ELT*

Zou, D., & Xie, H. (2018). Personalized Word-Learning based on Technique Feature Analysis and Learning Analytics. *Journal of Educational Technology & Society, 21*(2), 233-244. Retrieved from http://www.jstor.org/stable/26388402

Acknowledgment

This research has funded by Guangdong Planning Office of Philosophy and Social Science "thirteen five" project (GD16XWW26).