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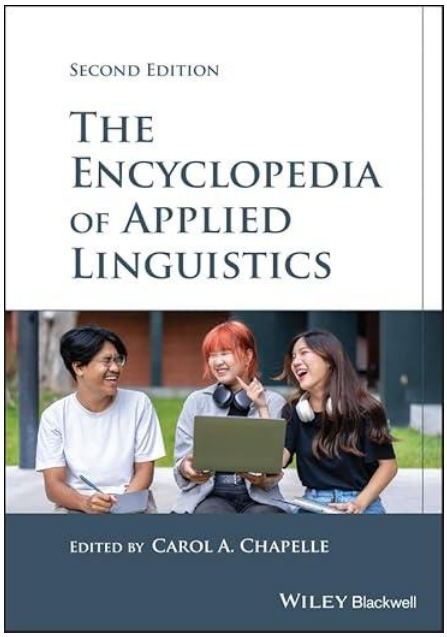

Abstract

Explicit knowledge is defined as the conscious awareness of the linguistic system. Its pivotal role is examined in relation to the development of knowledge and skills in a second language (L2). Rooted in cognitive science, skill acquisition theory provides a framework for analyzing the explicit learning process, encompassing deliberate practice, noticing, and hypothesis testing. This theory posits that learners transition from declarative knowledge (knowledge of rules and facts) to procedural knowledge (the ability to use language skills) and ultimately to automatization, where language use becomes accurate, rapid, and effortless. The characteristics and dynamics of L2 learning, as explored through the lens of skill acquisition, align closely with findings from other areas of cognitive science.

Explicit knowledge and skill acquisition in second language learning

Explicit Knowledge and Learning

When a language learner is consciously aware of how target language is used, we refer to this as explicit knowledge. For example, a second language (L2) learner might be able to verbally explain grammatical patterns, vocabulary meanings, pronunciation rules, and how to use language in different situations, like making requests. This kind of knowledge is often gained through formal instruction, like in classrooms or from textbooks. Even in the absence of instruction, metalinguistic awareness can arise through conscious reflection or comparison with other known languages. Critically, explicit or metalinguistic knowledge is distinguished from the capacity to use language. Despite this, metalinguistic knowledge, and explicit knowledge more broadly contributes to L2 skill development.

Just as explicit knowledge is consciously available, explicit learning is a conscious learning process with heightened attention and awareness in working memory. This process encompasses activities like deliberate memorization, guided instruction, text reconstruction, imitation, feedback, and self-monitoring, all contributing to the consolidation of explicit knowledge through noticing, hypothesis testing, and explicit instruction. Not all language learning is explicit, of course. Learning that happens through mere exposure and engagement with language, without conscious awareness of the underlying rules, is known as implicit learning.

The utility of explicit learning depends on linguistic (e.g., complexity, saliency) and learner factors (e.g., age, cognitive aptitude). For instance, it has been argued that simple linguistic structures can be learned more effectively via explicit learning with instruction, whereas implicit learning is superior for learning complex structures that are too challenging to consciously analyze and learn. Learners with higher aptitude in linguistic analysis and rote memory also tend to excel in explicit learning processes. In contrast, implicit learning relies on different set of cognitive abilities, such as priming and statistical learning, and may suit learners with different strengths (S. Li & DeKeyser, 2021).

Compared to implicit learning that requires massive amounts of L2 input and usage ideally in naturalistic acquisition settings, explicit learning can be a more efficient pathway to attain L2 skills. Thus, exploiting explicit learning mechanisms is a major avenue to facilitate L2 acquisition in various contexts including classrooms and study abroad. In what follows, we discuss one of the major SLA theories that account for explicit learning processes—skill acquisition theory.

Skill Acquisition Theory

Skill acquisition theory is rooted in various schools of psychology, ranging from behaviorism to cognitivism and connectionism. The key tenets of skill acquisition theory stipulate a series of sequenced stages, from initial representation of knowledge to highly skilled behavior, underpinned by a common set of basic principles. These principles take into account two aspects: (a) the two types of knowledge involved in the learning of a skill, i.e., declarative and procedural; and (b) the actual stages required for attaining full command of a skill or automatization—initial acquisition, gradual development, and final consolidation.

Declarative knowledge or "knowing that" refers to information about things and facts, which in the case of language is the knowledge of phonological and morphosyntactic rules as well as word meanings. For example, an L2 English learner might learn that to form the past tense of a regular verb, they should add "-ed" to the end. Declarative processing involves recruiting relevant information from long-term memory to working memory, which then retains the rule or word meaning during the execution of a linguistic operation. Consequently, this process "can place a heavy burden on working memory capacity" (Anderson, 1982, p. 381). Declarative knowledge largely overlaps with explicit knowledge in that learners can verbalize a rule but cannot necessarily apply it efficiently in spontaneous speech. At the same time, however, the use or retrieval of explicit knowledge can be speeded up and strengthened with further practice and often used during speech processing by advanced L2 users (Y. Suzuki & DeKeyser, 2015).

Procedural knowledge or "knowing how" concerns behaviors such as comprehension and production skills. Procedural knowledge is encoded in memory as a set of "productions" (Anderson, 1982). These productions can be conceptualized as a series of "if-then" rules that guide behavior, often without conscious awareness.

For example, in forming the past tense of the verb "talk," a first language (L1) English speaker might add "ed" to the stem of the verb without explicitly thinking about the rule. In L2 learning, this process can occur through a mental "program" that has been internalized through deliberate practice and exposure. In other words, cognitive processes that create procedural knowledge (i.e., proceduralization) often involve conscious analysis and reflection, drawing on declarative representation.

As procedural knowledge is further fine-tuned for more efficient processing, this long and gradual process culminates in automatization. As a function of practice, performance indicators such as the percentage of errors, time required to execute the task, attention, and awareness required decrease in a distinct learning curve. This type of learning trajectory for automaticity is described as the power law of practice. It applies to

all skill learning, from typing to L2 learning. After extended automatization process and the awareness is lost, procedural knowledge may become implicit, unconscious knowledge. While it is still an open question as to how precisely we can capture automatization processes, the role of declarative and procedural knowledge in skill acquisition is accounted for in the successive three stages. Such stages are described as declarative, procedural, and automatic. A three-stage model of L2 skill acquisition is supported empirically by advanced statistical modeling using reaction time (RT) and neuroimaging data (Tenison & Anderson, 2016).

While the exact cognitive processes underlying the conceived three stages are yet to be revealed for specific L2 domains and skills, the developmental stages are straightforward and well supported in cognitive science (e.g., Anderson & Fincham, 1994). Establishing a solid declarative and procedural base is considered a prerequisite for automaticity. As DeKeyser (2020) summarized, "automatization requires procedural knowledge. Proceduralization requires declarative knowledge and slow deliberate practice. The acquisition of declarative knowledge of a kind that can be proceduralized requires the judicious use of rules and examples. These stages cannot be skipped, reversed, or rushed." (p. 94) Next, we present key empirical research findings for skill acquisition theory in SLA.

Declarative and Procedural Knowledge

Establishing high quality declarative knowledge through explicit information about examples and rules is considered crucial for initiating proceduralization in L2 learning. Declarative knowledge needs to be strengthened through controlled, discrete-item-based practice in the shape of form-focused exercises that draw on learners' declarative knowledge (e.g., fill-in-the-blanks, sentence-combining, translation, picture-sentence matching activities).

Form-focused activities are often employed as pedagogical interventions aimed at proceduralization in L2 skill acquisition research, and they have been shown to be beneficial for anchoring declarative knowledge in the learner's mind. However, when a goal of L2 acquisition is developing communicative competence, declarative knowledge on its own can be of little practical value. Because learners proceduralize what they practice, it is argued that proceduralization needs to occur within communicative contexts. The importance of declarative knowledge becomes apparent in communicative L2 classrooms that utilize interactive activities, such as information-gap tasks, to foster genuine communication (e.g., Sato, 2023).

A key prediction of skill acquisition theory is the skill specificity, where

procedural knowledge, derived from declarative knowledge, is fine-tuned for specific cognitive processes such as production and comprehension skills. The skill specificity effect has been confirmed across different types of L2 skills and linguistic domains such as pronunciation, grammar, and pragmatics. An exemplary study was conducted by M. Li and DeKeyser (2017), who explicitly taught American university students with no prior knowledge of Chinese about the four tone patterns in Mandarin Chinese. After establishing the solid declarative knowledge (i.e., new words and the tone rules), participants engaged in either production or in comprehension practice for proceduralization over three training sessions on separate days. On the immediate posttest, they were tested in both comprehension and production skills (procedural knowledge). The results showed that both accuracy and reaction times were significantly worse when participants were tested on the non-practiced skills than on the practiced skills. This corroborates the skill-specific nature of procedural knowledge in L2 acquisition.

Procedural knowledge is also durable. Skill retention theory (Kim, Ritter, & Koubek, 2013), which aligns with the three stages of skill acquisition theory, suggests that the more advanced the stages of learning, the less likely the skill will be lost. As procedural skill is solidified through repeated, systematic practice, it is less prone to decay over time compared to declarative knowledge, which can be acquired instantaneously (e.g., through explanation and observation).

Systematic practice at short intervals or even massed practice may accelerate the proceduralization that resists skill decay. For instance, Y. Suzuki (2017) trained participants on morphological structures in a miniature language across four practice sessions under either shorter-spaced (twice a week) or longer-spaced (once a week) conditions. The participants took an oral, procedural grammar test on the target structures both before and after each practice session to track the retention and attrition of knowledge. The test results showed that the shorter-spaced practice led to higher retention of procedural knowledge gained in the previous session than the longer-spaced practice. This suggests that more intensive/frequent practice enhances the durability of procedural knowledge against erosion of time.

Furthermore, durability of procedural knowledge depends on the frequency of practice opportunities following the initial establishment of procedural knowledge. Serfaty and Serrano (2023) compared the retention rates of explicit grammar learning under one-, two-, three- and four-relearning opportunities. After three relearning opportunities, the highest retention rates were obtained, as evidenced by a delayed posttest conducted two weeks after the last session. This suggests that a fourth relearning session might constitute overlearning and be redundant for enhancing further retention,

though this conclusion requires further investigation. In sum, this emerging line of research underscores that practice retention of procedural knowledge is enhanced particularly when it is reinforced through consistent and frequent practice (see "Repetition, retrieval and spaced practice in second language acquisition" section).

Automatization

There is general agreement that as knowledge becomes more automatized, the less attention it requires and the less error-prone its use is. Furthermore, a qualitative change is often viewed as a hallmark of automatization, distinguishing it from a mere increase in the speed of existing cognitive processes. In the qualitative shift view, automatized knowledge is the result of restructuring, in that the relevant behavior—language production or comprehension—relies on a new and more efficient circuit. This restructuring entails converting various co-occurring production rules together into one chunk, which is then retrieved from long-term memory as a whole.

How can we tell if some aspect of L2 knowledge has been automatized? Y. Suzuki and Elgort (2023) have conducted a synthesis of tasks used over the past three decades to assess automaticity in vocabulary and grammar processing in L2. For instance, judgement tasks are commonly used to assess automaticity in both lexical and grammatical processing. For lexical assessments, primed lexicality judgment tasks are often employed. In these tasks, participants rapidly decide whether a presented string of letters is a real word or not, often with a prime word briefly presented beforehand. Their speed, indicated by reaction time (RT), of these judgments can indicate the level of automaticity in lexical access.

For grammar assessments, tasks such as picture-sentence matching, self-paced reading, and word-monitoring are frequently used. In picture-sentence matching tasks, participants quickly decide if a sentence matches a presented image, testing the automaticity of syntactic processing. Self-paced reading tasks measure how quickly participants can process grammatical structures in real-time, while word-monitoring tasks assess sensitivity to grammatical errors during listening comprehension. These tasks provide insights into the automaticity of grammatical processing through RT measures.

While RT measurements often serve as useful fine-grained index of processing automaticity (Godfroid, 2019), the use of coefficient of variance (CV), which indexes processing stability, has been added to the toolbox for measuring automaticity in SLA. It is calculated as the ratio of an individual's standard deviation (SD) in RT to mean RT. For example, consider two L2 learners performing a lexical decision task: Learner A (Mean RT = 500ms, SD = 100ms, CV = 0.2) and Learner B (Mean RT = 500ms, SD = 50ms, CV

= 0.1). Although both learners have the same mean RT, Learner B has a lower CV, indicating more stable (less variable) performance. This stability suggests more automatized processing, as the learner can perform the task efficiently, not just quickly. Some researchers thus argue that CV can capture restructuring or *qualitative* changes of mental processes (e.g., elimination of an inefficient sub-process) rather than *quantitative* changes, i.e., sheer process acceleration.

Despite ongoing debates about the utility of CV as a measure of automatization, CV often provides additional insight and complements the interpretation of development of automaticity along with accuracy and RT data in intervention research including instructed SLA studies. To date, CV has been used as an additional dependent variable to better understand automatization of intentional-deliberate practice of single words and collocations, incidental vocabulary learning as well as grammar practice. For instance, McManus and Marsden (2019) achieved successful automatization through extended training with advanced L2 French learners under training conditions with deliberate attention to target structure (i.e., *imparfait* verbal morphology). In their study, provision of explicit information and practice about L1 processing routines, in addition to L2 explicit information, facilitated automatization measured by both RT and CV.

Undoubtedly, efficient or automatized lexical and grammar processing underlies fluent L2 skills such as reading, listening, speaking and writing (e.g., S. Suzuki & Revesz, 2023). Beyond vocabulary and grammar, however, empirical research on other linguistic domains is less common. In the domain of pragmatics, for instance, where it is of importance to efficiently understand speech acts in a communication setting, researchers investigated the extent to which L2 speakers can automatically activate the meaning associated with a specific speech act (e.g., request, promise, thank) when they read a communication scenario (Holtgraves, 2007).

Recent research has highlighted the pivotal role that individual difference factors, particularly cognitive aptitudes, play in L2 automatization. For instance, Pili-Moss, Brill-Schuetz, Faretta-Stutenberg, and Morgan-Short (2020) found that accuracy in a target morphological structure was initially predicted by declarative memory ability, whereas automatization, as measured by CV, was predicted by procedural memory ability. Notably, the contribution of procedural memory to learning was particularly strong for learners with high declarative memory ability. This pattern is consistent with a key tenet of skill acquisition theory stipulating that successful declarative learning is a precondition for subsequent proceduralization and automatization.

Conclusions

Explicit knowledge serves as the foundation for explicit learning. Skill acquisition theory postulates three developmental stages in this process: learners acquire declarative knowledge through instruction or observation; they then engage in proceduralization relying on the declarative base; and ultimately, they reach a stage of automaticity where the skill can be performed rapidly and accurately. The characteristics and dynamics of L2 learning, as explored through the lens of skill acquisition, align closely with findings from other areas of cognitive science.

See also:
wbeal0035.pub3 Aptitude in second language acquisition
wbeal20349, Repetition, retrieval and spaced practice in second language acquisition
wbeal20366, The interface between implicit and explicit learning in second language acquisition
wbeal1433.pub2 Communicative Grammar and Communicative Competence
wbeal0884.pub3, Behavioural measures of bilingual processing and comprehension
wbeal20340, Behavioural measures of second language production
wbeal20344, The effects of sleep on learning and consolidation in second language acquisition

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Suggested Readings

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