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FIRST PERSON SINGULAR

Ronald P. Leow's essential bookshelf: The L2 learning process in instructed second language acquisition (ISLA)

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Ronald P. Leow is Professor (Applied Linguistics) in the Department of Spanish and Portuguese and Language Program Director of Spanish Language Instruction at Georgetown University. He has initiated and published (over 100 articles and chapters) in several strands of research that include language curriculum development, research methodology, cognitive processes and depth of processing in language learning, (written and computerized) corrective feedback, textual enhancement, reactivity, and CALL. He has contributed to the field his 2015 Model of the L2 Learning Process in ISLA (in *Explicit learning in the L2 classroom: A student-centered approach*, Routledge) and his 2020 Feedback Processing Framework (in R. M. Manchón (Ed.), *Writing and language learning. Advancing research agendas*, John Benjamins) to provide a cognitive account for how L2 data and feedback are processed by L2 learners. His i10-index is 58 with over 6,500 citations.

The (instructed) second language acquisition or (I)SLA field has been in existence for over four decades yet how the second/foreign language (L2) learners learn or process L2 data still remains a tantalizing mystery and how the L2 should be taught in this instructed setting continues to be a debatable issue for, on one hand, researchers and, on the other hand, practitioners and in several cases both populations combined. I recall many decades ago in my country (Guyana) approaching this issue from a teacher-centered perspective: let us try different techniques, methods, methodologies such as Total Physical Response, Grammar Translation Method, Cognitive Code Method, Audiolingual Methodology, Direct Method, the Silent Way, Community Language Learning, and so forth. I even tried the Suggestopedia Method with a middle-age adult tutee and he promptly fell asleep as he listened to baroque music lying on a couch while I read Spanish to him.

I came to the USA just after the mid-1980s to pursue my Ph.D. and the rage was Krashen and Terrell's (1983) Natural Approach (and still going strongly, as evidenced at the 2022 ACTFL conference where comprehensible input remains the rage). It was around this time that the issue of how we teach and how L2 learners learn (acquire?) the L2 became both a theoretical and empirical issue with relatively strong pedagogical implications for the formal classroom setting (thanks, Stephen Krashen). Do we teach grammar explicitly or do we provide such grammatical information embedded within the L2 input? Surely, we can provide an immersion-like environment in this instructed setting that will encourage our L2 students to "pick up" or acquire the L2 like in a naturalistic setting. What do we teachers want to promote in this instructed L2 setting: Explicit learning or implicit learning? Implicit instruction that led to acquisition was clearly sexier than teaching grammar explicitly on the blackboard, which many researchers assumed would bore their students to death (albeit this was without empirical support).

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The works in on my bookshelf are publications in several strands of research that provide important information that helped shape my perspective of the L2 learning process in ISLA from a learner-centered perspective. Perhaps not surprisingly, the works include several that I and my colleagues (many ex-mentees) have conducted in our endeavor to better understand the process of learning in an instructed setting viewed from contextual (naturalistic vs. instructed), processing (explicit vs. implicit), and practical/curricular (laboratory-based vs. authentic classroom-based and curricular issues) perspectives. Importantly, these articles are selected from wearing, over many decades, three closely related hats: a language teacher (over five decades and still happily doing so), an ISLA researcher (over three decades), and a Language Program Director (LPD) (over three decades and responsible for language curriculum development and teacher education). To this end, the selections are to be viewed from a closely connected four-pronged approach, namely, theory, methodology, process-oriented research, and practice/language curricular issues. Hopefully, these selections should be of interest to applied linguists who are not only researching ISLA variables, but also interested in addressing potential pedagogical ramifications from their research findings or as current ISLA researchers/language teachers improving their own teaching and/or personal language curriculum development. The works span four decades (1982–present).

Strand 1: Theory

The L2 learning process in ISLA

The L2 learning process in ISLA is typically represented as comprising several stages as seen in the broad framework of input > intake > internal system > output. While some theoretical underpinnings (e.g., Robinson, 1995; Schmidt, 1990; VanPatten, 2007) have focused primarily on the early stages of input > intake, others have provided a more complete description of the different stages (Gass, 1988, and elsewhere; Leow, 2015). In addition, these theoretical underpinnings postulate several cognitive processes assumed to play an important role during these stages. In this section, I will provide some key publications that have shed some light on such cognitive processes, beginning with reports from cognitive psychology that addressed the early stages of input processing.

The role of noticing in L2 learning

(1) Schmidt, R. (1990). The role of consciousness in second language learning. *Applied Linguistics, 11*(2), 129–158.

Schmidt's (1990, and elsewhere) Noticing Hypothesis (modified during later years) draws from works in cognitive psychology on the role of attention but in direct relation to the construct of awareness (consciousness) at the early input-to-intake stage of the L2 learning processing. This seminal article provides an excellent summary of psychological research and theory on the role of consciousness and then addresses the role of consciousness in input processing from three angles: (1) whether conscious awareness at the level of "noticing" is necessary for language learning, which he references as the subliminal learning issue, (2) whether it is necessary to consciously "pay attention" in order to learn (the incidental learning issue), and (3) whether learner hypotheses, based on the input received, are derived from conscious insight and understanding or from an unconscious process of abstraction (the implicit learning issue). Schmidt rejects the occurrence of subliminal language learning and finds the implicit learning issue to be the most difficult to resolve. Schmidt's Noticing Hypothesis agrees with the notion that attention controls access to awareness and therefore is responsible for noticing; focal attention and awareness are two sides of the same coin and, consequently, he rejects the idea of learning without awareness. Besides noticing, Schmidt distinguishes a higher level of awareness that he places at the level of understanding, and that is related to the ability to analyze, compare, and test hypotheses about the linguistic input.

Schmidt's Noticing Hypothesis is arguably the most cited theoretical underpinning in both SLA and ISLA literatures since 1990. His seminal work, based on cognitive psychology literature, clearly

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raises the roles of attention and awareness in the L2 learning process and serves as a source for researchers interested in addressing the role of noticing in many strands of research; for example, instruction, textual enhancement, corrective oral or written feedback, interaction, and so on. Researchers can investigate other variables potentially associated with the process of noticing at the input-to-intake stage of the L2 learning process, for example, levels of awareness, depth of processing, working memory, and so on, including the issue of whether all noticed intake are logically further processed and internalized in the learners' internal system, that is, learned. Methodologically, there is much scope for further inquiries into the challenge of separating the constructs of attention and awareness. Schmidt's work, which has spurred the proliferation of studies either directly addressing the role of noticing or simply referencing this hypothesis to theoretically support empirical findings, belongs to any (I)SLA researcher's library interested in a learner-centered perspective of the L2 learning process.

The role of awareness or learning vs. acquisition

(2) Krashen, S. (1982). *Principles and practice in second language acquisition.* Pergamon.

Krashen's (1982) Monitor Theory comprises five hypotheses on SLA, namely, the acquisition-learning distinction hypothesis, the natural order hypothesis, the monitor hypothesis, the input hypothesis, and the affective filter hypothesis, of which the acquisition-learning distinction hypothesis is of primary interest on this bookshelf. Krashen's theory is arguably the first milestone in stimulating deep interest in the theoretical and empirical research on internal processes, albeit with a focus on a product (type of knowledge). The Monitor Theory, premised on children's first language (L1) acquisition, was then the first theoretical underpinning to: (1) raise the issue of the role of the construct awareness (called "consciousness" in those days) in the L2 learning process and (2) distinguish between LEARNING (with consciousness) leading to learned/explicit knowledge and ACQUIRING (without consciousness) resulting in acquired/implicit knowledge. Krashen also postulates that there is no interface (connection) between EXPLICIT (learned) and IMPLICIT (acquired) knowledge.

Krashen's no-interface postulation has famously led to quite a discussion of whether there exists in SLA a WEAK interface, for example, explicit knowledge can lead to implicit knowledge or implicit knowledge may be assisted by explicit knowledge; a STRONG interface derived from skill acquisition theory in cognitive psychology that postulates that SLA is largely a conscious process so we begin the learning process with declarative knowledge that can then become procedural knowledge after much practice; or none at all. In spite of how convoluted the issue has become, it remains charmingly challenging and stimulating to research, as evident in many studies probing the type of knowledge L2 learners gain from experimental exposure to both artificial (e.g., Rogers et al., 2016) and naturally occurring language (Nemati et al., 2019). It also underscores the distinction between the PROCESS of learning (with or without awareness) and the PRODUCT (explicit vs. implicit knowledge) gleaned from such learning. The theoretical question to address then is not only whether knowledge can be identified as IMPLICIT or EXPLICIT, but also HOW such knowledge got to be IMPLICIT or EXPLICIT. In other words, the end result or PRODUCT may not reflect the PROCESS of how the knowledge made its way into the learner's internal system. This is clearly an avenue of research that remains to be robustly addressed in the (I)SLA literature.

Krashen's scholarly contribution to the SLA field via his Monitor Theory should rank very high in one's estimation. While we have the phenomenon called "Krashen bashing" (cf. Gregg, 1984 and others who took him to task), without those theoretical postulations serious research on learners' internal processes would most likely have taken place at a later date. When scholars publish a study or postulate a model/theory or hypothesis – for example, VanPatten's (2007) Model/Theory of input processing, Krashen's (1972) Monitor Theory, or Schmidt's (1990) Noticing Hypothesis – and subsequently encourage a whole string of further investigation into the issue(s) or postulations they have initiated, they deserve one's highest respect, irrespective of any potential critique they may receive. What they have done, in a weird sense, is a contribution to a better understanding of

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the learning process by stimulating further and, ideally, more robust research. To appreciate how scholars arrive at their postulations regarding the L2 learning process, especially from a child acquisition perspective extrapolated to adult L2 learners, Krashen's book provides a classic example of such theory building that led to subsequent robust critique and research on his theoretical postulations.

A model of L2 learning across all stages from input to output

(3) Leow, R. P. (2015). *Explicit learning in the L2 classroom: A student-centered approach.* Routledge.

Wearing my three hats of language teacher, ISLA researcher, and Language Program Director, I take a unique five-pronged (theoretical, empirical, methodological, model-building, and pedagogical) approach to the issue of explicit learning in the L2 classroom from a student-centered perspective. I report, in both SLA and non-SLA fields (e.g., cognitive science and cognitive psychology) on the theoretical underpinnings and empirical studies investigating the constructs of attention, awareness, and depth of processing, and I offer a tri-dimensional perspective of the construct of learning. I also provide a comprehensive treatise of research methodology that is aimed at not only underscoring the major features of conducting robust research designs with high levels of internal validity, but also preparing teachers to become critical readers of published empirical research. These chapters are designed to support the proposal of my Model of the L2 Learning Process in Instructed SLA that accounts for the cognitive processes (e.g., attention, awareness, hypothesis testing, rule formulation, reactivation of prior knowledge, metacognition etc.) employed during this learning process across several stages of language learning (input > *input processing* > intake > *intake processing* > internal system > *knowledge processing* > output). The Model underscores the importance of further processing of L2 information lodged in working memory at the input > intake stage and differentiates between: (1) PRODUCT and PROCESS across the stages, (2) types of intake premised on level of attention (peripheral, selective, focal), depth of processing (low, mid, high), and awareness or lack thereof, leading to attended, detected, or noticed intake, respectively, and (3) activation of types of prior knowledge (old vs. new). It also provides an account of the roles of awareness and depth of processing at several stages (input, intake, knowledge processing) of the L2 learning process. The book concludes with pedagogical and curricular implications for the L2 classroom.

For young researchers seeking an overview of the roles of cognitive processing and processes such as attention, awareness, and depth of processing, the book provides a critical review of the pertinent theoretical and empirical literature in both the SLA and non-SLA fields. From a methodological perspective, they can also find specific criteria for both internal and external validity that are useful for guiding robust research designs once these criteria are adhered to during their creation. With regard to my Model, it differs from the other theoretical underpinnings (e.g., Gass, 1988; Robinson, 1995; Schmidt, 1990; VanPatten, 2007) in that it is bottom-up, that is, supported by empirical evidence gathered via the use of concurrent think aloud (TA) protocols to tap into learner cognitive processes over decades of empirical investigation. Consequently, the Model is testable at all stages of the L2 learning process, which will hopefully lead to more fine-tuning of the postulations put forward by the Model. Indeed, while there has been an exponential growth of studies addressing the beneficial role of Depth of Processing (DoP) in many strands of ISLA research that include vocabulary learning, individual differences, computerized feedback, reading, awareness, textual enhancement, instruction, phonology, incidental learning condition, writing, and written corrective feedback (see Leow, 2019a for many of these recent studies in different strands of research), there is clearly more room for further investigations.

The following two sections will elaborate on the different aspects (methodology and empirical research) that provide support and L2 data to account for the cognitive postulations made in the Model.

Strand 2: Methodology

Operationalizing the process of attention and (un)awareness: Concurrent data elicitation procedures

There are several data elicitation procedures employed in (I)SLA studies that attempt to gather concurrent data on L2 learners' processing and processes during interaction with L2 data, namely, eye-

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tracking (ET), TAs, and serial reaction time (for a critical review of all three procedures, see Leow et al., 2014). Given that both the TA procedure and ET methodology are the two most popular ones, researchers interested in probing deeper into learner processing and processes should find these two books valuable resources for their research designs.

Think aloud protocols and the issue of reactivity

(4) Bowles, M. A. (2010). *The think-aloud controversy in second language research.* Routledge.

Bowles's (2010) book addresses the logical question raised about the validity of TAs. From a background of an historical overview of the use of TAs in cognitive psychology and other non-SLA fields, Bowles reports on the several ways verbal reports have served to answer different research questions in a variety of research areas. After a discussion on the major categories of verbal reports based on Ericsson and Simon's (1993) well-known model, she reports the results of a quantitative meta-analysis of findings from studies involving verbal tasks and TAs in the L2 literature. Bowles then offers a practical view of the collection and analysis of TA data and provides a summary of TA findings and implications and avenues for future research.

This volume is essential as a resource for any (I)SLA researcher interested in using TAs to probe deeper into the cognitive processes employed by L2 learners as they interact with L2 data. The historical perspective is important to situate the use of concurrent verbal reports across different fields of inquiry. The volume is also timely given that since TA protocols have been employed in (I)SLA after the mid-1990s (e.g., Leow, 1997) to operationalize and measure the process of attention and awareness, the validity of TAs, well known as the issue of reactivity, began to be raised. Reactivity raises the question of whether the act of thinking aloud can potentially impact the thought processes of the L2 learner and/or whether the act itself presents a dual task. This issue was crucial given that studies employing this concurrent data elicitation procedure premised their findings on the role of cognitive processes in the L2 learning process as being uncontaminated by the use of TAs. The results of Bowles's meta-analysis on the non-effect of TAs are clearly positive for researchers employing this still popular concurrent data elicitation procedure to gather important data on learner cognitive processes. At the same time, it is also advised that, whenever feasible, a non-TA control group be included in the research design. Finally, the practical information of the gathering and analysis of TA data provide a useful guideline for young researchers interested in applying this procedure in their research designs.

(5) Godfroid, A. (2020). *Eye tracking in second language acquisition and bilingualism: A research synthesis and methodological guide.* Routledge.

Godfroid's book is a comprehensive treatise of the use of ET in the (I)SLA field of research. It contains an introduction to ET methodology in relation to other real-time data collection methods and provides a synthesis of previous ET research in the cognitive psychology, SLA, and bilingualism literatures. A description of the basic principles of experimental design of ET studies is provided and followed by a comprehensive overview of ET measures in SLA and bilingualism and topics in data cleaning and analysis. Godfroid then provides practical advice on purchasing or renting an eye tracker, setting up a lab, tips for data collection, and ideas for research.

The book is also timely given the proliferation of studies employing the ET methodology over the last decade to probe not only the role of attention during the early stages of the L2 learning process, but also attempt to capture cognitive processes during L2 learners' interaction with L2 data. Like Bowles's (2010) book on verbal reports, the historical overview is of much importance to researchers interested in employing this data elicitation procedure. One commendable feature is that the book is accessible to readers with different levels of statistical literacy as Godfroid provides both an overview of statistical practices currently employed in ET research and an in-depth introduction to newer statistical techniques (linear mixed-effects models and growth curve analysis) that have gained prominence in recent ET

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studies. Indeed, the book is a ready-made treatise that provides enough information that allows researchers not only to conceptualize and design their own ET project, but also informative steps and information on data collection and analysis of eye-movement recordings for well-designed language research.

Strand 3: Process-oriented research

Using think aloud protocols to investigate levels of awareness

(6) Leow, R. P. (1997). Attention, awareness, and foreign language behavior. *Language Learning, 47*(3), 467–506.

This study is arguably the first attempt to operationalize and measure the construct of awareness in (I) SLA. It is also an early hybrid study of the role of awareness in L2 learning in relation to Schmidt's (1990) Noticing Hypothesis using both qualitative and quantitative analyses. After first discussing the problematic issue of operationalizing and measuring awareness in language learning owing to: (a) different definitions of what constitutes awareness, (b) the rapidity of a learner's subjective experience of cognitive registration, and (c) the potential inability to verbalize one's awareness, I report several definitions of levels of awareness from the cognitive psychology field that are used to guide my coding of such levels. I then create a specially designed problem-solving task (a crossword puzzle) that contains morphological mismatches connected to targeted linguistic items. The research design comprises a pretest – experimental phase – immediate posttest design employing two assessment tasks, namely, a written recognition and written production task. Twenty-eight college-level beginning learners of Spanish participants think aloud (non-metacognitive TA where participants simply say what is on their mind without the need to explain such thoughts) while completing the crossword puzzle. I operationalize the process of attention and levels of awareness based on their protocols, that is, whether they do notice the mismatch and how deeply such mismatches are processed. I initially examine each TA protocol from two broad categories (+cognitive change, ± meta-awareness) but, based on the protocols, expanded it to three (+ cognitive change, ± meta-awareness, ± morphological rule). I then report three levels of awareness, namely, at the levels of noticing, reporting, and understanding. A careful analysis of the TA protocols reveals that meta-awareness appears to correlate with the use of conceptually driven processing, such as hypothesis testing and morphological rule formation. In addition, the qualitative analysis of the data reveals that different levels of awareness lead to differences in processing. The quantitative analyses reveal that higher levels of awareness lead to more recognition and ability to produce in writing the noticed targeted items in the L2 input, underscoring the beneficial effects of awareness in L2 learners' behavior.

This study (conducted over two and a half decades ago and republished in 2001 as part of a special volume in *Language Learning*), still serves as a classic example of a hybrid research design that seeks to first establish the cognitive processes under investigation via the collection of concurrent data before addressing its role in subsequent L2 performances. The data collection of concurrent verbal reports to operationalize the construct of awareness and its levels together with the coding and analysis of such data can and still serve as a guideline to conduct similar process-oriented studies. Of interest is the bottom-up approach to operationalizing levels of awareness that can be clearly improved by future research (see López-Serrano et al., 2019 below for their operationalization of depth of processing). I include this article because it raised, over two and a half decades ago, my own awareness (no pun intended) of the importance of type of methodology (concurrent vs. nonconcurrent data elicitation procedures) employed in research designs that seeks to address not only internal cognitive processes in the L2 learning process, but also the internal validity of studies viewed from a process-oriented approach. While the role of awareness has been addressed in several strands of research (e.g., computer-based feedback, reading, vocabulary learning, phonology, instruction, textual enhancement, learning conditions, semi-artificial languages etc.), it remains an attractive, albeit controversial, area of interest in the L2 learning process that can be viewed from both an SLA and ISLA perspective. Indeed, the challenge that still remains current to researchers is to test further the theoretical approaches to the

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role of awareness in (I)SLA and improve the operationalization of what constitutes awareness in L2 learning in studies conducted in the classroom setting.

Using eye-tracking methodology to measure the relationship between attention and L2 learning

(7) Godfroid, A., Boers, F., & Housen, A. (2013). An eye for words: Gauging the role of attention in L2 vocabulary acquisition by means of eye tracking. *Studies in Second Language Acquisition, 35*(3), 483–517.

This is one of the early studies that employs the ET methodology to gather concurrent data on learner attention and its role in incidental L2 vocabulary acquisition measured via subsequent recognition of pseudowords. Participants are 28 female Dutch-speaking college students who read 20 short paragraphs in English while an eye-tracker records their eye movements. The authors include pseudowords as learning targets in their texts to control for prior word knowledge. They control the lexical targets for part of speech and syntactic function – only nouns in direct object position are selected for substitution or modification by a novel pseudoword. To minimize the effect of low-level visual factors on eye-fixation times, the existing words and their corresponding pseudowords are carefully matched for word length and number of syllables. Out of the 20 paragraphs that participants read, eight paragraphs are fillers, and 12 are critical (i.e., they contained a new, unknown word in all but the control condition). On the computer monitor, text lines are displayed with two hard returns in between to assure accurate recording of participants' gaze position. The lexical target area always appears roughly in the middle of the second screen (i.e., never as the first or final word of a line or at the top or bottom of the screen). To measure amount of attention paid to the target items in the texts, the authors analyze participants' eye-fixation durations on the targets during reading. Participants then complete with a vocabulary recognition assessment task immediately after reading. The findings reveal that the longer participants look at a pseudoword during reading, the more likely they are to recognize that word on the vocabulary posttest. The authors conclude that more attention appears to lead to more learning.

This study is included in my library not only for it being one of the early studies employing the ET methodology (see also Smith, 2012), carefully described, but also for the additional insights one can gain from ET data on the input > intake stage of the L2 learning process that appear to overlap with data from TA studies. For example, in this study there are also cases where paying attention to the target words does not automatically lead to an ability to recognize such words after exposure. This ties in neatly with what previous research employing TA protocols had reported, namely, evidence of learners demonstrating noticing of targeted items in L2 written input yet were unable to even recognize some of the targeted items, much less produce them (e.g., Leow, 1997; Bowles, 2003). The role of further processing of L2 data after the input > intake stage of the L2 learning process is clearly an area that warrants further investigation and the use of the ET methodology, together with the TA procedure, provides a solid contribution to researchers' efforts to address the role of attention and cognitive processing in the L2 learning process. Given that different concurrent data elicitation procedures (e.g., ET, TAs, reaction times) have different strengths and limitations (Leow et al., 2014), several researchers have called for a triangulation of data procedures in an effort to maximize the strengths of each procedure (e.g., Godfroid, 2020; Leow et al., 2014; Révész & Michel, 2019).

Depth of processing

(8) Craik, F. I. M., & Lockhart, R. S. (1972). Levels of processing: A framework for memory research. *Journal of Verbal Learning and Verbal Behavior, 11*(6), 671–684.

The concept of level or depth of processing (DoP) is usually attributed to Craik and Lockhart's (1972) levels of lexical processing framework in the cognitive psychology field. Craik and Lockhart employ this concept to refer to conceptual or semantic processing (i.e., deep processing) versus perceptual processing (i.e., shallow processing). Recalling information, according to the authors, depends not only on having attended to it during its occurrence or having rehearsed it after its occurrence, but also on how

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deeply it is processed. Examples of shallow processing may include structural processing, such as encoding physical features of something (e.g., the appearance of letters in a word), or phonemic processing, such as encoding the sound of the item. Given that this type of shallow processing only involves maintenance rehearsal or repetition to hold it in short term memory (working memory), the chances for retention are not strong. Deep processing, on the other hand, involves elaboration rehearsal that incorporates deeper analysis of the item such as activation of prior knowledge and meaningful analysis and leads to superior recall of the item. Craik and Lockhart report on several studies conducted in cognitive psychology that provide support for their level of processing postulations.

Craik and Lockhart's (1972) article, together with their other publications and my 2015 chapter is a good starting point for researchers interested in the role of DoP in the L1 and L2 learning process. While, as mentioned above, there has been an exponential growth of studies addressing the role of DoP in many strands of (I)SLA research, the challenge posed to this DoP strand of research rests primarily on how to operationalize DoP, either indirectly via experimental conditions or tasks assumed to promote deeper processing; for example, Laufer and Hulstijn's (2001) Involvement Load Hypothesis, or directly via concurrent verbal reports (e.g., Leow et al., 2008). What remains also to be further investigated are the correlations I made in Leow (2012) between levels of awareness (noticing, reporting, understanding) with levels of processing (low, mid, high), especially the correlation between + awareness at the level of understanding and + high depth of processing. For example, while + awareness at the level of understanding logically includes + high depth of processing, +high depth of processing may be ±awareness at the level of understanding based on whether the learner does achieve some level of understanding the underlying rule. In addition, researchers may also want to revisit or fine-tune my coding scheme for DoP (Leow, 2015 for lexical and grammatical items) given the broad scope of variables being addressed. One effort to fine-tune my DoP criteria is reported below in López-Serrano et al. (2019).

Moving the methodology on cognitive processing and processes along

(9) López-Serrano, S., Roca de Larios, J. & Manchón, R.M. (2019). Language reflection fostered by individual L2 writing tasks: Developing a theoretically-motivated and empirically-based coding system. *Studies in Second Language Acquisition, 41*(3), 503–527.

López-Serrano et al. (2019) underscore the paucity of writing studies that have methodologically addressed the relationships between L2 writing processes, reflection on language while writing, and language learning. To this end, 21 EFL learners are asked to TA while writing an individual argumentative essay. To address how individual L2 writers process linguistic problems encountered while completing this L2 writing tasks, López-Serrano et al. follow Leow's (2015) coding scheme and criteria to analyze the TA data on the basis of a reconceptualization of language-related episodes (LRE) as problem-solving strategy clusters. They employ five criteria to code each LRE: (1) length of the LRE and pausing behavior, (2) number of alternatives generated and assessed (both in the L1 and the L2), (3) analysis and manipulation of different levels of linguistic representation (from analyses of discrete elements such as morphemes to syntactic and semantic analyses), (4) amount and variety of strategies deployed to solve the LRE, and (5) use of metalanguage associated with: (a) connecting items to rules or to prior knowledge of the L2, (b) analyzing form-meaning relationships (L1–L2 or L2–L2), and (c) formulating hypotheses about the L2. Based on the TA protocols, the authors reveal three levels of depth of processing: (a) non–problem solving when participants momentarily attend to language followed by an almost immediate application of knowledge, (b) problem solving with a medium depth of processing characterized by the deployment of a low number of strategies and the generation and evaluation of a small number of alternatives, and (c) problem solving with a high depth of processing that involved spending a considerable amount of time trying to solve the LRE, producing and evaluating a relatively high number of forms, and deploying a series of strategies in a flexible way. While identifying the limitations of their study (e.g., one genre, a one-shot laboratory-type task, varied population etc.), they also call for future studies to include examples of

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various types of tasks and genres to capture the inherent complexity and diversity of writing and the need to further explore the meaning making and rhetorical nature of argumentative writing more fully and the role of individual differences.

The result of López-Serrano et al.'s study is a comprehensive, theoretically motivated, and empirically based coding system that probes deeper into how deeply L2 writers process while completing one genre of writing (argumentative) via identified and coded LREs. The strengths of this study lie in the authors' manifested analytic approach to first grounding their coding system from a theoretically motivated and empirically based foundation and then minutely analyzing an array of variables found in the TA protocols. Indeed, the coding system can be used to conduct quantitative analyses of the data (e.g., calculating the occurrence of specific categories across proficiency levels or tasks) and/or to elaborate qualitative accounts that describe particular phenomena within LREs (e.g., descriptions of successful/unsuccessful orchestrations of strategies). The authors' effort to go beyond Leow's (2015) original coding scheme, based on lexical and grammatical processing, to encompass other areas of inquiry is a welcome expansion to the coding of DoP. This effort provides more avenues for future research in cognitive processing and processes in this writing domain, especially with regard to potential language learning still to be addressed in the study.

Strand 4: Practice/curricular issues

Moving toward a process-oriented ISLA applied direction situated within the L2 language curriculum

(10) Leow, R. P. (2019b). From SLA > ISLA > ILL: A curricular perspective. In R. P. Leow (Ed.), *The Routledge handbook of second language research in classroom learning* (pp. 483–491). Routledge.

I begin the chapter with a succinct report of the origin of SLA that was situated within the field of applied linguistics, which in turn fell under the umbrella of linguistics. The descriptor "applied" was attached to "linguistics" in the 50s and applied linguistics was viewed both in the UK and in the USA as a practice-related research field associated with L2 students learning an L2. However, the notion of applied linguistics began to widen, leading to a separation between "APPLIED LINGUISTICS" (e.g., from linguistic, sociological, anthropological, psychological perspectives etc.) versus "LINGUISTICS APPLIED" (applying the findings of research to language teaching primarily in the classroom setting). It was within this broad definition of applied linguistics encompassing both classroom-based and non-classroom-based (e.g., linguistic, sociological, and psychological approaches) research that SLA research was born.

About four decades ago, the connection between APPLIED LINGUISTICS and LINGUISTICS APPLIED became quite blurred in terms of learning context. To address this issue, the emergence of instructed SLA came into being with definitions clearly differentiating classroom-based research from the more naturalistic setting (subsumed under SLA). To understand the naturalistic setting and the more formal instructed setting, I provide several affordances that clearly differentiate what each context provides to the L2 learners, including the naturalness (that promotes acquisition) versus formalness (that promotes learning) and the relative amount of exposure to and interaction with the L2. I also discuss the disparity between the two contexts from a processing perspective, namely, while in the naturalistic setting processing is typically described as low depth of processing and absence of awareness (as in implicit learning), in the instructed setting processing is typically of a higher depth of processing and much awareness (as in explicit learning). Finally, I observe that in ISLA research, the fact that the classroom is situated within a language curriculum is usually not addressed in research designs. Based on the discussion above, I comment that instructed language learning (ILL) provides a more precise description of what comprises ISLA research that seeks to impact directly language pedagogy. I propose that ISLA may be divided into two sub-strands: (1) APPLIED ISLA, namely, studies that investigate the many variables in the instructed setting without any need to provide pedagogical ramifications and (2) ISLA APPLIED, namely, studies that seek to inform pedagogical practice in an effort to promote a level of learning that is successful from a curricular perspective. I conclude with several suggestions for further ISLA APPLIED studies that include deeper probing into L2 learners' cognitive processes,

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methodologically situating research designs within the syllabus and language curriculum, and gathering data over longer periods of time to simulate the learning environment.

This chapter is a recent effort to provide a global overview of the applied linguistics field as viewed from the perspectives of a researcher, teacher, and Language Program Director. More specifically, it addresses the mismatch between many (I)SLA studies that use classroom students as their populations and the academic context they purport to represent. Indeed, two decades ago Lightbown (2003) underscored the need for pedagogical ramifications to be derived from SLA research situated within the classroom setting, a need that still is clearly not reflected in the applied linguistics literature. This two-decades old observation remains an important issue if the role of the applied linguist is viewed as being the bridge between theory/research and practice, and perhaps more importantly, if the applied linguist is still associated with and/or aware of the language curriculum and changing instructed setting and student population. I am happy to be a part of an increasing group of applied linguists who are conducting studies associated with potential pedagogical and curricular ramifications. Let us take a look at two such studies situated within the syllabus and language curriculum.

The role of CALL in ISLA and the language curriculum

(11) Cerezo, L., Caras, A., & Leow, R. P. (2016). Effectiveness of guided induction versus deductive instruction on the development of complex Spanish "*gustar*" structures: An analysis of learning outcomes and processes. *Studies in Second Language Acquisition, 38*(2), 265–291.

Situated within my 2015 Model of the L2 Learning Process in ISLA, we employ a video game that implements "guided induction" to successfully instruct complex grammar (the Spanish *gustar* structure) online and compare this group (GI) to a typical teacher-centered face-to-face (FTF) or deductive instruction group (DI). GI is an instructional approach in which teachers help learners co-construct grammar rules by directing their attention to relevant aspects in the input, asking guiding questions, or both. More specifically, the videogame is carefully designed to promote deeper processing (explicit learning) of the target structure as participants play the game. We incorporate the following three major features of an e-tutor, namely: (1) "task-essentialness", that is, participants need to minimally pay attention to the targeted items in the task in order to successfully complete the task, (2) concurrent implicit feedback (to confirm or disconfirm previous hypotheses or rule formulations facilitated by task-essentialness), and (3) prompts that encourage deeper processing (e.g. hypothesis formulation or testing, reactivation of prior knowledge etc.). Using a pretest – experimental phase – immediate posttest – delayed posttest, 70 Beginning students of Spanish were randomly assigned by class to one of three conditions (GI, DI, control). The results on one receptive (recognition) and two controlled production tasks (written and oral sentence translation) immediately after the treatment and two weeks later revealed that while both instruction groups (GI and DI) improved significantly across time, outperforming the control group, GI achieved higher learning outcomes on the productive posttests and experienced greater retention. More specifically, while the gain scores on the immediate posttests for both GI and DI groups indicated relatively robust learning (GI: 83%, 91.3% and DI: 63.2%, 60.2% for the oral and written production assessment tasks, respectively), only the GI group maintained such learning after two weeks on the delayed posttests (GI: 72.6%, 81.6% vs. DI: 38.2%, 39.7% for the oral and written production assessment tasks, respectively). Based on the participants' robust learning outcomes, we conclude that the video game-based instruction, carefully manipulated to promote deeper processing and high levels of awareness, can replace the FTF instruction, which will allow teachers to migrate complex L2 material online to free up classroom time for communicative practice.

What is noteworthy in our study is the retention ability of the GI group that may have been associated with the high degree of cognitive engagement during the experimental phase, as revealed in the TA protocols and also in several previous and future process-oriented studies. Importantly, robust findings are also reported in subsequent replications with different target linguistic items (Spanish *para* and *por* in Leow et al., 2019; Chinese *ba* structure in Zhuang, 2019). In addition, the creation of

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the maze game to purposely manipulate participants' cognitive processes appears to fall neatly within Loewen's (2015) definition of ISLA that includes an aim "to understand how the systematic manipulation of the mechanisms of learning … facilitate the development and acquisition of a language other than one's own" (p. 2), together with Leow and Cerezo's (2016a) call for a curricular inclusion in the definition.

The study also provides an avenue for future research to acknowledge the increasing use of technology and hybrid curricula in the instructed setting and use the affordances of the computer-assisted language learning (CALL) platform and the usefulness of e-tutors to experimentally manipulate learner cognitive processes (see Leow et al., 2016b for a psycholinguistic approach to technology and language learning). Such future investigations can adopt the curricular approach that places a premium on the need to acknowledge the impoverished amount of exposure to which L2 learners are exposed, the curricular learning outcomes, and the challenge to promote robust learning within a relatively short period of time. The findings can be useful in providing empirical support for the potential to migrate complex L2 material online to free up classroom time for communicative instruction (FTF vs. online) while promoting robust learning that is considerably above the passing grade. In sum, the scope of similar research designs addressing the role of technology in language learning with the potential of migrating such practice to an online platform is great for new empirical investigations focused on potential curricular modifications.

An exemplar of a PROCESS-oriented ISLA APPLIED study

(12) Leow, R. P., Thinglum, A., & Leow, S. A. (2022a). WCF processing in the L2 curriculum: A look at type of WCF, type of linguistic item, and L2 performance. *Studies in Second Language Learning and Teaching, 12*(4), 653–675.

This preliminary quasi-experimental study, part of a larger written corrective feedback (WCF) research project, explores the cognitive processes of ten adult L2 writers with minimal previous exposure to Spanish interacting with WCF (both direct and metalinguistic) on morphological (Spanish noun–adjective agreement) and syntactic (the Spanish *gustar* structure) errors. The study design is embedded in the syllabus of the course adhering to the usual learning outcomes of the writing component of the curriculum. Participants/students receive a topic together with several specially designed prompts to elicit target linguistic items covered in the course and a specified length of words (300–325 words). They write the compositions in a Word document at home, submit them to their teachers for written feedback, rewrite their compositions based on the feedback once again at home, and then submit their final draft for their composition grade. The only difference in this study is that participants also think aloud as they compose their original drafts and during their rewrites. While we follow the usual and ecologically valid unfocused feedback procedure of the writing component of the language curriculum to provide WCF to our participants, our study is on focused feedback on our two target linguistic items contained within these compositions. TA data gathered from three compositions written across the semester (as part of the syllabus) are transcribed, coded for depth of processing (Leow, 2015), and correlated with subsequent performances on the target items on two curricular-based tests during the semester and the final exam. The results reveal: (1) a higher DoP for metalinguistic WCF although depth of processing was relatively very high for either WCF, (2) differences in processing of linguistic items, (3) similar relatively high DoP over time, and (4) a beneficial relationship between DoP and subsequent performances. More specifically, participants (70%) who demonstrated + high DoP/+awareness at the level of understanding showed over 95% agreement accuracy on Test 1, Test 2, and the final written and oral exams, in which agreement items were embedded. For the *gustar* structure, accurate performance required a high DoP plus awareness at the level of understanding. Participants (60%) demonstrating a high level of DoP, indicating awareness of the underlying rule, were 90% accurate on the two tests and final exam for the lower level of *gustar*, while only two participants who were + high DoP/+understanding for the higher level were accurate on similar structures on the final exam. Participants showed no substantial preference for type of WCF.

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The research design employed in this study falls neatly within the recent calls (Leow & Manchón, 2022b; Manchón & Leow, 2020) to approach the writing strand of research from a PROCESS-oriented versus a PRODUCT-oriented perspective and tied to an ISLA APPLIED perspective. The strengths of this study are: (1) data are gathered within the natural writing conditions of participants' language curriculum across the semester instead of the typical one-shot design employed in many WCF studies, (2) performances are assessed via tests and exams that form part of the curriculum, and (3) these performances are relatively high for this level of proficiency. Based on such robust findings, in addition to feedback from the teaching staff of other sections of the language program participating in the wider WCF research project, curricular modifications in the writing component can be made with much confidence. The scope for further investigations in this writing strand of research is excellent if viewed from a PROCESS-oriented ISLA APPLIED perspective given the many variables still to be addressed that include the role of awareness, type of linguistic item, level of proficiency, type of feedback, individual differences, genre, length, writing conditions, modality, medium (paper and pen vs. computer-mediated), timing and so on. Indeed, the scope for a PROCESS-oriented ISLA APPLIED perspective can also be transferred to many strands of classroom-based areas of research.

Final thoughts

I have attempted to provide several strands of research that have guided my personal quest (as a teacher, researcher, and Language Program Director, a relationship I have found quite challenging to separate) to have a better understanding of the L2 learning process in the instructed setting. As a teacher, I do need the help of the researcher to bridge that gap between theory, research, and practice. As a researcher, I need to critically review empirical research for high levels of internal validity, ensure that my own empirical studies have an acceptable level of internal validity, and from an ISLA APPLIED perspective, also ensure that my findings do have pertinent implications for robust learning in the instructed setting. As an LPD, both of these roles are crucial for me to provide a theoretically-driven and empirically-supported language curriculum in addition to providing a strong teacher education for the teaching staff comprised mostly of graduate students with some adjuncts, visiting instructors, and tenure and non-tenure-line faculty members. Indeed, I have personally found this tri-hat possession crucial to assist me in having quite a broad picture of many variables that contribute to language learning, teaching, and language curriculum development. It allows me to not only improve my limited knowledge of how L2 learners process the L2 data in the instructed setting, but also increase the potential of both using this knowledge as I teach to promote robust learning and sharing this important information with my students and teaching staff. As an LPD, I can include in the Methodology course (teacher education) components that combine the applied linguist (e.g., theories and research on many variables), teacher (e.g., classroom management, materials preparation, lesson planning), and LPD (e.g., syllabus creation and curriculum development) backgrounds.

In this bookshelf, I know that I have omitted many important publications that have, in their own right, contributed greatly to a better understanding of the L2 learning process, including from different theoretical perspectives. What I do hope to have accomplished is to underscore the strong connections between theory, methodology, process-oriented research, learner-centered practice, and language curriculum development that can allow one to have a relatively broad overview of the L2 learning process in ISLA from a learner-centered perspective.

References

Bowles, M. A. (2003). The effect of textual input enhancement on language learning: An online/offline study of fourth semester Spanish students. In P. Kempchinshky & C. Pineros (Eds.), *Theory, practice, and acquisition: Papers from the 6th Hispanic linguistic symposium and 5th conference on the acquisition of Spanish and Portuguese* (pp. 395–411). Cascadilla Press. doi:10.1177/1362168814561903

https://doi.org/10.1017/S0261444823000113 Published online by Cambridge University Press

Bowles, M. A. (2010). *The think-aloud controversy in second language research*. Routledge. doi:10.4324/9780203856338

Cerezo, L., Caras, A., & Leow, R. P. (2016). Effectiveness of guided induction versus deductive instruction on the development of complex Spanish "gustar" structures: An analysis of learning outcomes and processes. *Studies in Second Language Acquisition*, *38(2)*, 265–291. doi:10.1017/S0272263116000139

Craik, F. I. M., & Lockhart, R. S. (1972). Levels of processing: A framework for memory research. *Journal of Verbal Learning and Verbal Behavior*, *11(6)*, 671–684. doi:10.1016/S0022-5371(72)80001-X

Ericsson, K. A., & Simon, H. A. (1993). *Protocol analysis: Verbal reports as data (rev. ed.)*. MIT.

Gass, s. M. (1988). Integrating research areas: A framework for second language studies. *Applied Linguistics*, *9*(2), 198–217. doi:10.1093/applin/9.2.198

Godfroid, A. (2020). *Eye tracking in second language acquisition and bilingualism: A research synthesis and methodological guide*. Routledge. doi:10.4324/9781315775616

Godfroid, A., Boers, F., & Housen, A. (2013). An eye for words: Gauging the role of attention in L2 vocabulary acquisition by means of eye tracking. *Studies in Second Language Acquisition*, *35*(3), 483–517. doi:10.1017/S0272263113000119

Gregg, K. (1984). Krashen's monitor and Occam's razor. *Applied Linguistics*, *5*(2), 79–100. doi:10.1093/applin/5.2.79

Krashen, S. (1982). *Principles and practice in second language acquisition*. Pergamon. doi:10.2307/3586656

Krashen, S. D., & Terrell, T. D. (1983). *The natural approach: Language acquisition in the classroom*. Prentice Hall.

Laufer, B., & Hulstijn, J. (2001). Incidental vocabulary acquisition in a second language: The construct of task-induced involvement. *Applied Linguistics*, *22(1)*, 1–26. doi:10.1093/applin/22.1.1

Leow, R. (2015). *Explicit learning in the classroom. A student-centered perspective*. Routledge. doi:10.4324/9781315887074

Leow, R. P. (1997). Attention, awareness, and foreign language behavior. *Language Learning*, *47(3)*, 467–505. doi:10.1111/0023-8333.00017

Leow, R. P. (2012). Explicit and implicit learning in the L2 classroom: What does the research suggest? *The European Journal of Applied Linguistics and TEFL*, 1*(2)*, 117–129.

Leow, R. P. (Ed). (2019a). *The Routledge handbook of second language research in classroom learning*. Routledge. doi:10.4324/9781315165080

Leow, R. P. (2019b). From SLA>ISLA>ILL: A curricular perspective. In R. P. Leow (Ed.), *The Routledge handbook of second language research in classroom learning* (pp. 485–493). Routledge. doi:10.14746/ssllt.2016.6.1.3

Leow, R. P. (2020). L2 writing-to-learn: Theory, research, and a curricular approach. In R. M. Manchón (Ed.), *Writing and language learning. Advancing research agendas* (pp. 95–117). John Benjamins. doi:10.1075/lllt.56.05leo

Leow, R. P., & Cerezo, L. (2016a). Deconstructing the "I" and "SLA" in ISLA: One curricular approach. *Studies in Second Language Learning and Teaching*, *6(1)*, 43–63. doi:10.14746/ssllt.2016.6.1.3

Leow, R. P., Cerezo, L., & Baralt, M. (Eds.). (2016b). *A psycholinguistic approach to technology and language learning*. De Gruyter Mouton. doi:10.1515/9781614513674

Leow, R. P., Cerezo, L., Caras, A., & Cruz, G. (2019). CALL in ISLA: Promoting depth of processing of complex L2 Spanish "Para/Por" prepositions. In R. DeKeyser & G. Prieto Botana (Eds.), *SLA research with implications for the classroom: Reconciling methodological demands and pedagogical applicability* (pp. 155–178). John Benjamins. doi:10.1075/lllt.52.08leo

Leow, R. P., Grey, S., Marijuan, S., & Moorman, C. (2014). Concurrent data elicitation procedures, processes, and the early stages of L2 learning: A critical overview. *Second Language Research*, *30*(2), 111–127. doi:10.1177/0267658313511979

Leow, R. P., Hsieh, H.-C., & Moreno, N. (2008). Attention to form and meaning revisited. *Language Learning*, *58*(3), 665–695. doi:10.1111/j.1467-9922.2008.00453.x

Leow, R. P., & Manchón, R. M. (2022b). Expanding research agendas: Directions for future research agendas on writing, language learning and ISLA. In R. M. Manchón & C. Polio (Eds.), *The Routledge handbook of second language acquisition and writing* (pp. 299–311). Routledge. doi:10.4324/9780429199691-31

Leow, R. P., Thinglum, A., & Leow, S. (2022a). WCF processing in the L2 curriculum: A look at type of WCF, type of linguistic item, and L2 performance. *Studies in Second Language Learning and Teaching*, *12*(4), 653–675. doi:10.14746/ssllt.2022.12.4.6

Lightbown, P. M. (2003). SLA research in the classroom/SLA research for the classroom. *Language Learning Journal*, *28*, 4–13. doi:10.1080/09571730385200151

Loewen, S. (2015). *Introduction to instructed second language acquisition*. Routledge. doi:10.4324/9780203117811

López-Serrano, S., Roca de Larios, J., & Manchón, R. M. (2019). Language reflection fostered by individual L2 writing tasks: Developing a theoretically-motivated and empirically-based coding system. *Studies in Second Language Acquisition*, *41*(3), 503–527. doi:10.1017/S0272263119000275

Manchón, R. M., & Leow, R. P. (2020). An ISLA perspective on L2 learning through writing. Implications for future research agendas. In R. M. Manchón (Ed.), *Writing and language learning. Advancing research agendas* (pp. 335–355). John Benjamins. doi:10.1075/lllt.56.14man

Nemati, M., Alavi, S., & Mohebbi, H. (2019). Assessing the effect of focused direct and focused indirect written corrective feedback on explicit and implicit knowledge of language learners. *Language Testing in Asia*, *9*(1), 1–18. doi:10.1186/s40468-019-0084-9

https://doi.org/10.1017/S0261444823000113 Published online by Cambridge University Press

Révész, A., & Michel, M. (Eds.) (2019). Methodological advances in investigating L2 writing processes. *Special Issue, Studies in Second Language Acquisition*, *41*(3), 491–501. doi:10.1017/S0272263119000329

Robinson, P. (1995). Review article: Attention, memory and the 'noticing' hypothesis. *Language Learning*, *45(2)*, 283–331. doi:10.1111/j.1467-1770.1995.tb00441.x

Rogers, J., Révész, A., & Rebuschat, P. (2016). Implicit and explicit knowledge of inflectional morphology. *Applied Psycholinguistics*, *37(4)*, 781–812. doi:10.1017/S0142716415000247

Schmidt, R. (1990). The role of consciousness in second language learning. *Applied Linguistics*, *11(2)*, 129–158. doi:10.1093/applin/11.2.129

Smith, B. (2012). Eye-tracking as a measure of noticing: A study of explicit recasts in SCMC. *Language Learning and Technology*, *16(3)*, 53–81. doi:10125/44300

VanPatten, B. (2007). Input processing in adult second language acquisition. In B. VanPatten & J. Williams (Eds.), *Theories in second language acquisition* (pp. 115–135). Lawrence Erlbaum. doi:10.4324/9780203628942

Zhuang, J. (2019). Computer-assisted guided induction and deductive instruction on the development of complex Chinese ba structures: Extending Cerezo et al. (2016). In R. P. Leow (Ed.), *The Routledge handbook of second language research in classroom learning* (pp. 391–406). Routledge. doi:10.4324/9781315165080

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