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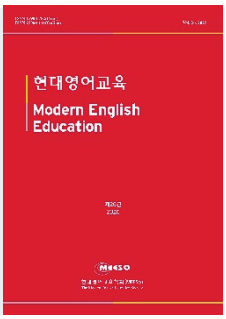

Processability and Frequency in Authentic Use: English Verb Phrase Development in Virtual Exchange

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처리가능성 이론, 함의적 위계, 가상문화교류, 동사구 발달

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Abstract

This study investigates the development of English verb phrase (VP) constructions among Korean undergraduate learners engaged in Virtual Intercultural Exchange (VIE). Five VP types—Simple Verb, Modal/*Do*+V, Progressive, Perfect, and Passive—were analyzed across two asynchronous VIE sessions involving both L1 and L2 speakers. Building on Processability Theory (PT), the study extends its application from categorical emergence to frequency-based usage in authentic communication. All VP tokens were identified through dependency parsing, and group differences were assessed using chi-square and Cramér's *V*. The results revealed a base-dominant distribution, with Simple Verbs accounting for over two-thirds of all tokens. However, auxiliary-based patterns showed subtle but meaningful contrasts. L1 writers consistently employed the Progressive more frequently, the Perfect remained infrequent but approached L1 usage levels, and the L2 learners' initial overreliance on the Passive declined in the second session. Modal/*Do*+V patterns remained stable across groups. Overall, the findings support an extension of PT's implicational hierarchy to frequency-based usage, suggesting that the frequency of use may be influenced by discourse mode and communicative purpose. This indicates that sustained intercultural interaction fosters selective, gradual convergence in how learners utilize tense–aspect–voice constructions during authentic language use.

INTRODUCTION

Verb phrases (VPs) constitute a central domain of grammatical development in second language (L2) acquisition. As the locus of tense, aspect, and voice, VPs reveal how learners gradually acquire morphosyntactic control during natural language use (Ellis, 2017; Pienemann, 1998). Yet despite extensive study, VP development in authentic communicative contexts remains underexplored, largely because most previous studies have relied on controlled tasks or elicited contexts (Keating

& Jegerski, 2015; Pallotti, 2007). As a result, little is known about how learners actually use progressive, perfect, and passive constructions during authentic communication. This limitation is particularly salient for Korean learners of English, whose first language encodes aspect and voice differently and lacks a direct morphological equivalent to the English perfect (Noh & Song, 2023; Park, 2009).

In recent years, Virtual Intercultural Exchange (VIE) has gained attention as an ecologically valid environment for observing L2 use in authentic interaction (Dooly & Vinagre, 2022; Helm, 2024). Through sustained online collaboration between L1 and L2 speakers, VIE promotes spontaneous negotiation of meaning and offers rich opportunities for incidental learning. Unlike short-term experimental designs, virtual exchanges sustained over a period of time allow researchers to capture how learners activate and extend grammatical resources in context. Such exchanges are particularly relevant to studies of VP development, since they provide extended opportunities to observe how learners employ and refine tense–aspect–voice constructions across sustained interaction. In this sense, data from virtual exchanges offer a valuable window into the procedural aspects of grammatical development—how learners gradually gain control over morphosyntactic encoding through repeated communicative practice. According to Processability Theory (PT; Pienemann, 1998), such procedural growth underlies the staged development of morphosyntax in a second language. With its opportunities for planning and reflection, asynchronous VIE provides favorable conditions for proceduralization, allowing learners to consolidate grammatical knowledge through repeated, authentic use. Accordingly, these data are especially valuable for examining the procedural growth predicted by PT, since they reflect genuine processing demands rather than task-induced performance (Pienemann, 1998).

Previous research grounded in Processability Theory (PT) has outlined a clear implicational hierarchy in the acquisition of English VPs: the progressive (be + V-ing) tends to appear earliest, followed by the perfect (have + V-en), with the passive (be + V-en) emerging latest due to its higher processing and discourse demands (Håkansson, Pienemann, & Sayehli, 2002; Pienemann, 1998). While these findings have been confirmed across diverse L2 populations (Di Biase et al., 2015; Tang & Zhang, 2015), most PT-based studies rely on experimental or classroom-elicited data. Consequently, it remains unclear whether the same developmental patterns hold in more naturalistic, meaning-oriented communication, where learners use language for genuine expression rather than in response to elicited tasks. Understanding how these conditions affect procedural development may offer important insights into the explanatory scope of PT.

Building on this framework, the present study investigates how English VP patterns develop among Korean L2 learners engaged in asynchronous VIE interaction. The data analyzed were generated by undergraduate university students in their twenties, reflecting the young adult learner cohort. In this setting, learners participate in sustained, meaning-focused communication with L1 peers, where they can take more time to formulate and adjust their language use while still engaging in authentic exchange. Specifically, the study analyzes changes in the distribution of progressive, perfect, and passive constructions between L1 and L2 speakers across two course-based VIE sessions, using both quantitative and qualitative approaches. By focusing on authentic, interaction-driven language use, this study aims to provide a contextually grounded view of VP development and to assess whether sustained intercultural communication promotes convergence between L1 and L2 speakers.

Accordingly, this study explores the following research questions:

i) How does L2 English VP development unfold through naturally occurring VIE interaction?
ii) To what extent does authentic peer communication promote convergence between L1 and L2 speakers across two VIE sessions?

LITERATURE REVIEW

VP Domain as a Site of L2 Grammatical Expansion

Within the domain of L2 grammar, the English VP system offers a particularly revealing lens on learners' morphosyntactic development by showing how tense, aspect, and voice interact to encode temporal and relational meaning (Bardovi-Harlig, 2000; Ellis, 2017). Temporal meaning is encoded by tense and aspect: tense anchors events in time (past/present/future), while aspect profiles their internal temporal contour—for instance, distinguishing ongoing from completed or habitual events (Andersen & Shirai, 1996; Bardovi-Harlig, 2000). Relational meaning is encoded by voice and argument structure, which configure participant roles and information structure, allowing speakers to highlight or background agents and patients (Creissels, 2024). Crucially, these choices are context-sensitive: appropriate VP selection depends on discourse

purposes such as presenting an event as in progress, linking prior events to the present, managing topicality, or defocusing agency. Thus, examining variation in VP use shows not only whether learners can mark forms but how they deploy them to express time and participant relations in communicative contexts.

Earlier research on VP has focused largely on the accuracy and emergence of morphological marking (Andersen & Shirai, 1996; Bardovi-Harlig, 2000; Salaberry, 1999), yet subsequent studies have shown that developmental progress is not limited to form-based accuracy but also involves increasing flexibility and diversity in verb-phrase patterns. Some of them have explored how learners manage—or at times avoid—complex verb-phrase structures when communicative or processing demands are high. Schachter (1974), in her pioneering study of English relative clauses, first demonstrated that limited production of structurally complex forms may reflect strategic avoidance rather than lack of grammatical knowledge. Building on this insight, later work on verbal expressions has shown that L2 learners similarly tend to circumvent or simplify morphosyntactically demanding constructions such as the perfect or passive.

According to Han (2009), fossilization involves the inability to use acquired forms appropriately in context. This helps explain why Korean learners often overuse passive morphology but fail to employ it in pragmatically appropriate contexts (see Park, 2009; Shin, 2011). This conceptualization suggests that learners may struggle not only with acquiring complex forms but also with using them functionally and contextually appropriately. A similar pattern was observed in Kim and Choi (2019), who examined learner development of tense–aspect distinctions in Korean EFL learners' written discourse. Their longitudinal analysis showed that while learners initially experimented with a wider range of aspectual forms such as present perfect, they gradually reverted to the simple past as communication became more meaning-focused, indicating a tendency to prioritize fluency and content engagement over morphosyntactic precision.

Corpus-based research has also shed light on how even advanced L2 users differ from native speakers in their deployment of verb-phrase patterns. Römer (2009), drawing on corpus-linguistic analyses, demonstrated from a usage-based perspective that lexis and grammar function as inseparable dimensions of language use, forming recurring lexico-grammatical patterns that shape fluent expression. From this perspective, learners' limited use of multi-verb sequences, compared with simple verb phrases, may indicate that such complex lexico-grammatical patterns are not yet fully entrenched in their developing interlanguage. Even advanced EFL learners tended to underuse multi-verb sequences such as modal + verb and aspectual + verb combinations compared with L1 speakers, suggesting a partial integration of syntactic and collocational knowledge. Huensch and Tracy-Ventura (2017) further demonstrated, in a longitudinal corpus of study-abroad learners, that gains in morphosyntactic accuracy do not necessarily entail native-like frequency or distribution. Learners increased their overall VP diversity over time but continued to rely on a narrower range of forms and functions.

Taken collectively, these studies demonstrate that VP development extends beyond morphology to encompass distributional, functional, and frequency-based dimensions. This cumulative evidence underscores the VP domain as a productive site for examining how L2 users expand their grammatical range and achieve more target-appropriate usage patterns over time.

Processability Theory: Core Assumptions and Theoretical Developments

Processability Theory (PT), developed by Pienemann (1998, 2005), offers a psycholinguistic account of second language (L2) development by proposing that learners can only produce linguistic forms that their current level of grammatical processing can handle. The theory conceptualizes language development as a series of processing procedures that are incrementally added to the learner's developing interlanguage system, leading to a universal implicational hierarchy of emergence (Di Biase & Kawaguchi, 2002). In this hierarchy, the acquisition of a more complex structure presupposes the ability to process all preceding ones, thus defining a universal order of grammatical development across typologically diverse languages (Pienemann, 1998; Pienemann & Johnston, 1985).

Pienemann and Johnston (1985) laid the groundwork for what later became Processability Theory. Drawing on learner production data, they argued that grammatical structures can emerge only when the underlying processing procedures are developmentally available. This early model established the key premise that language acquisition is constrained not merely by exposure or instruction, but by the learner's readiness to handle specific grammatical operations.

Di Biase et al. (2015), drawing on longitudinal learner data, refined the original PT hierarchy by tracing the morphological and syntactic development of key structures. In particular, they reexamined four core morphemes—verbal *-ing*, past *-ed*, plural *-s*, and possessive *'s*—and located the unification of auxiliaries (*be*, *have*, and modals) with lexical verbs at the phrasal stage, highlighting the role of VP-internal processing. They also introduced the concept of soft barriers to explain variation within developmental stages, noting that some forms, such as *-ed*, tend to appear later than others at the same level. Together, these refinements expanded PT's explanatory scope for English and clarified how morphological and phrasal procedures

unfold in learner production.

Subsequent theoretical work, most notably Bettoni and Di Biase (2015), restated the processing hierarchy that underlies grammatical development in PT. Within this framework, language production unfolds through four core procedures that become available in a fixed order as the learner's processing capacity expands: (i) the lemma procedure, which involves lexical retrieval and the specification of semantic and syntactic features before they are unified with other elements; (ii) the category procedure, which enables morphological operations within a single word—such as adding plural -s or past -ed—without requiring agreement outside the word; (iii) the phrasal procedure, which manages feature exchange within phrases, allowing dependencies between elements such as determiners and nouns or auxiliaries and lexical verbs; and (iv) the sentence procedure, which coordinates features across phrases and supports clause-level reorganization, including subject–verb agreement and passivization. Each successive procedure presupposes the activation of the previous one, defining the learner's current level of grammatical processing. By formalizing this stepwise progression, their work strengthened the theoretical foundation of PT and its claim that L2 grammatical development reflects the architecture of the human language processor rather than exposure or instruction alone.

Expanding and Reframing PT

Building on these theoretical foundations, subsequent studies have tested Processability Theory (PT) across diverse learner populations and target languages, providing extensive empirical support for its developmental hierarchy. Bardovi-Harlig's (2000) Aspectual Hypothesis, which proposes that learners acquire aspectual forms in an order reflecting their semantic complexity, helps explain the predicted order among multi-verb constructions. The progressive (*be* + V-*ing*) precedes the perfect (*have* + V-*en*) because the former involves feature agreement within the verb phrase (the phrasal procedure), whereas the latter requires feature mapping across phrase boundaries (the interphrasal procedure) (see Bettoni & Di Biase, 2015). In other words, producing the perfect form demands a higher level of grammatical encoding, as it links auxiliary and main verb information across distinct processing domains. The passive (*be* + V-*en*) typically emerges last, as it entails a reorganization of the argument structure—specifically, the promotion of the patient to subject position and the demotion of the agent to an optional *by*-phrase. This restructuring imposes the greatest syntactic processing demand in the VP domain.

Håkansson (2013) reviewed cross-linguistic studies showing that, while accuracy rates may vary depending on learners' first language, the developmental order predicted by Processability Theory remains consistent. These studies collectively demonstrated that grammatical development proceeds through hierarchically constrained stages, as determined by processing availability.

Another line of research has approached PT from a different perspective—examining L2 development in relation to L1 transfer. Håkansson et al. (2002) explored how structural similarity between Swedish (L1) and German (L2) shaped learners' acquisition of word order, asking whether such similarity leads to early transfer. Within the PT framework, they argued that L1 effects are developmentally moderated—that is, transfer becomes possible only after the corresponding processing procedures are in place. Their findings revealed that Swedish learners did not reproduce the verb-second (V2) pattern from their L1 at the outset, despite the formal equivalence between the two languages. Instead, they began with canonical SVO sequences and progressed through an intermediate stage before eventually producing target-like V2 order, indicating a stepwise developmental trajectory constrained by processing availability. Their results also support the universal sequence predicted by PT.

Tang and Zhang (2015) investigated Chinese EFL undergraduates' oral and written English using the PT hierarchy as an assessment instrument. Drawing on classroom-based speaking and writing tasks, they coded learners' production by PT stages and compared performance across modalities. The study reported two main outcomes: (i) learners' written production outperformed their oral production on PT-indexed measures, and (ii) oral and written performance were positively correlated. Taken together, these results add empirical support for a staged, processing-based trajectory in this cohort, while underscoring that the evidence derives from elicited, instructional settings.

Collectively, these studies reinforced the robustness of PT's developmental predictions but, whether through empirical analysis or review, shared a focus on data derived from elicited or pedagogically controlled context, leaving the question of how similar patterns might emerge in more naturalistic, meaning-oriented communication. In other words, despite the vigorous support provided by those studies, PT research on L2 development has relied heavily on elicited production or classroom-based tasks—a methodological limitation also noted more broadly in L2 processing research (Keating & Jegerski, 2015). While such methods are effective in identifying developmental stages, they examine language that is produced under experimental control rather than through self-initiated communication. As Granena (2013) and Ellis (2006) observed, such data may underestimate the role of attention, discourse planning, and interactional intent in shaping grammatical

performance (see also DeKeyser, 2015).

Beyond these methodological limitations, much PT research has examined inflectional morphology as evidence of developmental staging. When VP structures have been examined, attention has largely focused on inflectional forms such as the progressive, perfect, and passive, whereas auxiliary-based constructions like modal/*do* + verb have remained comparatively unexplored. However, such multi-verb combinations also reveal how learners manage processing demands in real communication, even though they do not involve inflectional morphology in the strict sense. Consequently, existing research leaves two important gaps: the need to examine PT's predicted hierarchy in naturalistic contexts and to extend it to a broader range of VP constructions beyond inflectional forms. The present study addresses both gaps by analyzing spontaneous learner production in Virtual Intercultural Exchange (VIE) interactions, exploring how both inflectional and auxiliary-based VPs distribute across sessions.

In considering how PT can be extended to account for patterns observed in authentic language use, it is useful to draw on complementary perspectives from usage-based research. While PT has been instrumental in explaining the sequence of morphosyntactic development, usage-based perspectives on language learning, in contrast, have long emphasized that frequency of use both shapes and reflects how strongly linguistic forms become routinized in memory and accessible for real-time processing (Bybee, 2006; Ellis, 2015). From this standpoint, repeated access and use of a structure lead to the proceduralization of its underlying representations, allowing the learner to retrieve and produce it with increasing ease and automaticity. In other words, as grammatical routines are practiced and automatized through use, they also tend to appear more frequently in spontaneous speech and writing.

This view can be integrated with the premise of PT to better reflect learner development. Although PT itself does not explicitly model frequency or distributional variation, its central claim, which holds that learners can only produce what they can process, can be extended to imply that once a form becomes processable, it also becomes more available for production. Several scholars have noted that integrating PT's processing hierarchy with usage-based insights could help account for not only categorical emergence but also frequency-related dimensions of development (Peker & Toprak-Celen, 2020). On this basis, the present study adopts a broader interpretation of PT, proposing that the implicational hierarchy it predicts may also be reflected in the relative frequency of VP patterns observed in learner production. The findings of this study will be discussed in light of this extended PT perspective.

VIE as a Bridge to Authentic, Developmentally Oriented Data

Digital communication has opened new avenues for examining L2 development in authentic communicative contexts. Virtual Intercultural Exchange (VIE)—also termed virtual exchange or telecollaboration—enables learners from different linguistic backgrounds to engage in sustained online collaboration integrated into academic courses (Dooly & Vinagre, 2022; Helm, 2015; O'Dowd, 2018). Unlike traditional classroom interaction, VIE offers reciprocal, audience-sensitive communication in which linguistic choices have direct pragmatic and social consequences. The written and multimodal records that such exchanges generate allow researchers to trace how form–function relationships evolve across iterative cycles of production and feedback, providing longitudinal depth even within relatively short instructional periods (Dooly & Vinagre, 2022; Hauck, 2019). Research on VIE has demonstrated gains in pragmatic competence (Chun, 2011), lexical expansion and discourse cohesion (Elola & Oskoz, 2010), and linguistic and interactional development (Pekarek Doehler & Berger, 2018), yet grammatical development remains comparatively underexplored. Asynchronous exchanges, in particular, allow learners more time for planning and reflection (Hauck, 2019), providing an ideal environment to observe how complex constructions emerge and stabilize over time. Because VIE combines authentic interaction with developmental continuity, it provides a unique bridge between controlled PT-based studies and real-world language use.

Overall, most PT research has focused on formally structured learning contexts, while VIE research has emphasized intercultural, pragmatic, and lexical outcomes over grammatical development. Bringing these two lines of inquiry together is therefore both methodologically and theoretically significant: VIE provides the naturalistic conditions that PT requires to test its processing-based predictions beyond elicited performance. To our knowledge, few studies have systematically examined L1–L2 convergence in VP development within sustained VIE interaction. The present study addresses this gap by analyzing how Korean learners' use of VP patterns—including simple verbs, modal or *do* + verb constructions, progressive, perfect, and passive forms—changes across two VIE sessions and by comparing them with their L1 counterparts. This study synthesizes PT and VIE perspectives to refine the understanding of how procedural skills develop when learners use language in authentic, meaning-driven communication.

METHOD

Participants and Data

The study draws on learner interaction data collected through two iterations of a university-level Virtual Intercultural Exchange (VIE) program, referred to as VIE1 and VIE2, each conducted over a six-week period. The dataset was provided by course instructors from a Korean university and a U.S. partner university, who coordinated the VIE as part of academic coursework in education. Each iteration involved twenty-two Korean undergraduates primarily majoring in education or related fields (L2 group) and twenty-seven American teacher education students (L1 group). Sessions were integrated into for-credit courses, with the aim of fostering intercultural exchange and shared disciplinary understanding among students from different cultural backgrounds who were enrolled in comparable educational psychology courses at both universities. All students gave informed consent for their anonymized contributions to be used in research. Detailed demographic data, such as year in program or age were not available, as the present study involved secondary analysis of texts compiled by the instructors. These materials have also been used in several other usage-based studies in the field of English language education, and the present research builds on this established line of inquiry. Each collection comprises naturally occurring texts from collaborative intercultural tasks, independently compiled to provide comparable samples of learner language.

The four collections (VIE1_L1, VIE1_L2, VIE2_L1, and VIE2_L2) contained roughly 1,000 to 1,500 sentences each (1,086, 1,460, 1,076, and 1,512, respectively). After excluding unclassifiable lines (72, 86, 94, and 120), the number of sentences examined was 1,014, 1,374, 982, and 1,392. The corresponding word counts—16,713, 13,041, 25,389, and 20,412—amounted to a total of approximately 75,000 words across the two sessions.

The unclassified lines consisted of elliptical utterances, phrasal fragments, or non-propositional expressions that did not constitute analyzable syntactic units, i.e., contained no identifiable VP structure for analysis. Representative examples from different datasets are shown below:

Glad to talk with you. (VIE1_L2_SN280)
Same to us, the overcrowded class. (VIE2_L2_SN470)
What a pity! (VIE2_L2_SN1116)
Sometimes also in the evening. (VIE2_L1_SN324)
But what about having more than one colleague to depend on? (VIE2_L1_SN580)

All interactional texts were anonymized prior to analysis, and each group's data were aggregated to capture overall developmental tendencies within and across the two VIE sessions.

Data Analysis

Preprocessing and Sentence Structuring

Prior to the statistical analysis of VP patterns, the raw discussion transcripts from the Virtual Intercultural Exchange (VIE) dataset underwent a multi-stage preprocessing pipeline designed to ensure analytic reliability and consistency. All procedures were implemented in Python 3.9 using the libraries Stanza, re, and pathlib, and were automated through a batch-processing script that sequentially handled multiple text files. A pilot test on a subset of the data was first conducted by a collaborating computer science specialist and was refined based on the authors' feedback on the test results. Excluding the unclassified lines, which removed potentially problematic cases as noted previously, the final output was spot-checked by the authors on a randomly selected sample representing less than 5% of the data to confirm correct VP labeling.

The initial preprocessing stage involved the removal of non-linguistic metadata such as participant identifiers, session headers, and divider lines (--- … ---), using regular-expression filters to restrict the analytic scope to genuine learner production. A series of normalization rules were then applied to stabilize surface forms for sentence boundary detection: smart quotes (“ ”, ‘ ’) and long dashes (—, –) were converted to ASCII characters (“ and -), non-ASCII symbols and emojis were deleted, and redundant spaces or newlines were reduced to single blanks. This normalization minimized tokenization noise and ensured consistent input for subsequent parsing.

The cleaned text was segmented into individual sentences using the English tokenization pipeline of Stanza, a neural-network-based NLP library developed by the Stanford NLP Group. Unlike rule-based tokenizers, Stanza identifies sentence boundaries even in ambiguous contexts (e.g., abbreviations or missing periods) with high accuracy. Each sentence was

assigned a unique identifier (Sentence Number, SN) and exported in a tab-separated format (SN <tab> Sentence), producing structured TSV files. This structure allowed for efficient mapping between the original discussion context and the extracted VP tokens. To further reduce segmentation errors, post-processing heuristics were used to correct typical over-segmentation (e.g., *as if* mistakenly segmented as *as.* and *If*) and under-segmentation (e.g., clauses joined after semicolons). These adjustments, when applied, follow reproducible regular-expression rules that merge or separate clauses only when syntactic cues (e.g., explicit subjects or auxiliaries) are present.

VP Extraction, Classification, and Validation

From the sentence-level data, verb phrases were automatically identified and classified into normalized VP patterns (see Table 1) representing functional combinations of modality, perfect, progressive, and passive marking. Each VP's auxiliary chain was analyzed via dependency relations to extract the presence or absence of four functional flags: modal (M), perfect (P), progressive (Pr), and passive (Pa). Their Boolean combinations determined the canonical pattern label—for example, 2.1 Modal/*Do* + V, 2.2 *Have* + V-*en*, or 4.2 Modal + *have* + *been* + V-*en*. Semi-modals and multiword expressions (e.g., *be going to, have to, be supposed to, used to*) were treated as single auxiliary units, while marginal auxiliaries (*need, dare*) were recognized as modal only when functioning as auxiliaries. Infinitival complements (*to* V) functioning as secondary predicates (xcomp) were excluded from VP counts to prevent inflation of VP frequency per sentence.

The classification module was validated through pseudo-coded rules ensuring that (i) forced recognition of multiword expressions (MWE) precedes general VP extraction, (ii) duplicated counts are prevented by tracking the index of each head verb, ensuring that each VP was counted only once, and (iii) the auxiliary chain preserves surface order. The resulting output files contained, for each sentence, the extracted VP(s), assigned pattern label, lemma of the head verb, and verb-token count, serving as the primary dataset for the subsequent quantitative comparison of L1 and L2 VP distributions. The overall workflow from raw VIE data to structured VP output files is illustrated in Figure 1. The full pseudo code for the automated VP extraction process is provided in Appendix A.

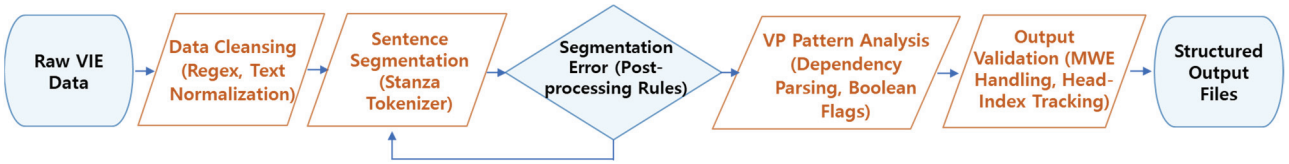

FIGURE 1
Overall Sequence of Data Processing and VP Extraction

Statistical Analysis

All VP tokens in the corpus were identified and classified according to the full range of theoretically possible auxiliary combinations (see Table 1). For analytic purposes, however, the present study concentrates on five focal patterns— Simple Verb, Modal/*Do* + V, Progressive (*Be* + V-*ing*), Perfect (*Have* + V-*en*), and Passive (*Be* + V-*en*). These categories have been widely discussed in previous L2 acquisition research as core stages in the development of the English auxiliary system (Andersen & Shirai, 1996; Bardovi-Harlig, 2000; Housen, 2008; Pienemann, 1998), and corpus-based descriptions also indicate that they represent the most recurrent VP configurations in actual English use (Biber et al., 1999). Importantly, these five categories also emerged as the most frequent VP patterns in the present dataset (see Results), which further justifies the analytical focus.

Group differences across VIE sessions were tested using standard frequency-based procedures. In addition to significance testing through Pearson's chi-square (χ^2) tests, Cramér's V was computed to capture the degree of convergence toward target-like L1 distributions for each VP pattern. This effect-size index offers a more interpretable measure of developmental change than significance values alone. Normalized frequencies (per 10,000 VP tokens) were also computed for visualization. Patterns that deviated from expected distributions—particularly the Passive, which showed an unexpectedly higher frequency in the L2 group—were further examined qualitatively to identify types of non-target or extended usage.

Hypotheses

While the research questions outlined earlier specify the overall goals of the study, formulating explicit hypotheses may allow the predictions of PT to be tested empirically, operationalizing the theoretical expectations of PT and its extended framework within the present dataset. Drawing on PT and its extension to distributional frequency patterns, the following hypotheses were formulated:

H1. VP pattern frequencies will align with the implicational hierarchy predicted by PT.
H2. L2 distributions will converge toward L1 patterns over time, following the same implicational order.

RESULTS

Distribution of VP Patterns

Table 1 summarizes the distribution of VP patterns across the two VIE sessions. While English theoretically allows for up to sixteen auxiliary combinations, only fourteen were actually attested in the present dataset. Notably, the two marked forms—Modal + *be* + *being* + V-*en* and Modal + *have* + *been* + *being* + V-*en*—were not observed in either group. Their absence is consistent with earlier observations that such forms are highly infrequent even in native discourse, reflecting their marginal status in actual language use (Bardovi-Harlig, 2000: Biber et al., 1999).

TABLE 1
Frequency of VP Patterns by VIE Sessions and Groups

VP Pattern	VIE1		VIE2	
	L1	L2	L1	L2
1.1 Simple Verb	1,856 (7,679)	1,439 (7,898)	2,620 (7,450)	2,058 (7,656)
2.1 Modal/*Do* + V	284 (1,175)	215 (1,180)	472 (1,342)	358 (1,332)
2.2 *Have* + V-*en*	73 (302)	36 (198)	97 (276)	63 (234)
2.3 *Be* + V -*en*	40 (165)	47 (258)	101 (287)	90 (335)
2.4 *Be* + V -*ing*	121 (501)	54 (296)	168 (478)	79 (294)
3.1 Modal + *have* + V-*en*	4 (17)	5 (27)	13 (36)	2 (7)
3.2 Modal + *be* + V-*en*	14 (58)	12 (66)	11 (30)	23 (86)
3.3 Modal + *be* + V-*ing*	8 (33)	1 (5)	7 (20)	2 (7)
3.4 *Have* + *been* + V-*ing*	3 (12)	8 (44)	8 (23)	9 (33)
3.5 *Have* + *been* + V-en	8 (33)	2 (11)	7 (20)	1 (4)
3.6 *Be* + *being* + V-*en*	6 (25)	3 (16)	11 (30)	1 (4)
4.1 Modal + *have* + *been* + V-*ing*	- (-)	- (-)	1 (4)	1 (4)
4.2 Modal + *have* + *been* + V-*en*	- (-)	- (-)	1 (4)	- (-)
4.3 *Have* + *been* + *being* + V-*en*	- (-)	- (-)	- (-)	1 (4)
Total Number of VPs	2,417 (10,000)	1,822 (10,000)	3,517 (10,000)	2,688 (10,000)
Examined Sentences (with VP)	1,014	1,374	982	1,392

Note. Normalized frequencies (per 10,000 VP tokens) are shown in parentheses for descriptive comparison.

The distribution is heavily skewed toward the Simple Verb, which consistently accounts for over 70% of all VP tokens. Beyond this unmarked category, Modal/*Do* + *V* emerged as the second most frequent pattern, followed by the Progressive (*Be* + V-*ing*), the Perfect (*Have* + V-*en*), and the Passive (*Be* + V-*en*).

When ranked by normalized frequency, L1 overall followed the order Simple Verb > Modal/*Do* + V > Progressive >

Perfect > Passive, whereas L2 showed Simple Verb > Modal/*Do* + V > Passive > Progressive > Perfect. The two highest-frequency categories were shared across groups, but the relative positions of the aspect and voice patterns diverged slightly, with L2 showing a higher proportion of passives. Beyond the two most frequent categories, more complex combinations occurred only sporadically, with normalized frequencies under 100 per 10,000 VP tokens.

The bottom row of Table 1 provides additional information about the number of sentences examined for VP analysis. In VIE1, 1,014 sentences from the L1 group and 1,374 from the L2 group were analyzed, while in VIE2 the corresponding numbers were 982 and 1,392. Although the L2 participants produced more sentences overall, their VP totals were lower than those of L1 participants. Consequently, the average number of VPs per sentence was consistently higher in the L1 group (VIE1: 2.38; VIE2: 3.58) than in the L2 group (VIE1: 1.33; VIE2: 1.93).

While Table 1 offers a comprehensive overview of all VP types and sentence counts, the following section narrows the analysis to the five most frequent patterns. Table 2 presents these categories together with chi-square results and effect-size measures, allowing for a more precise assessment of group contrasts.

Top-5 VP Patterns

To enable more focused comparisons, Table 2 narrows the analysis to the five most frequent VP patterns: Simple Verb, Modal/Do + V, Progressive, Perfect, and Passive. These five focal patterns were ranked by their overall normalized frequencies across groups (1.1 Simple Verb: 7,973 tokens; 2.1 Modal/Do + V: 1,329; 2.4 Progressive: 422; 2.3 Passive: 278; 2.2 Perfect: 269). Together, these categories account for the vast majority of VP tokens across both groups and sessions. Raw frequencies, which serve as the basis for the inferential tests (χ^2, V), are presented together with normalized values (per 10,000 VP tokens) in parentheses for descriptive comparison.

Table 2 shows that the Simple Verb overwhelmingly dominates in both groups and sessions, yet the chi-square tests reveal no significant group differences for this category. Similarly, the distribution of Modal/*Do* + V was balanced across groups, with negligible effect sizes. More revealing contrasts emerge in the less frequent but structurally important categories. For the Progressive, L1 speakers used the form significantly more often than L2 learners in both sessions (VIE1: $\chi^2 = 10.949$, $V = .051$; VIE2: $\chi^2 = 13.463$, $V = .047$). The Perfect also showed a significant difference in VIE1 ($\chi^2 = 4.523$, $V = .033$) but not in VIE2, suggesting variability in its use across contexts. Conversely, the Passive appeared more frequently in the L2 group in VIE1 ($\chi^2 = 4.418$, $V = .032$), though this difference weakened and became non-significant in VIE2. The consistent L2 preference for passives motivates a closer qualitative examination of how these forms were used.

TABLE 2

Top-5 VP Patterns Across Groups With χ^2, and Cramér's V

Rank	VP Pattern	VIE1				VIE2			
		L1	L2	χ^2	V	L1	L2	χ^2	V
1	1.1 Simple Verb	1,856 (7,679)	1,439 (7,898)	2.878	.026	2,620 (7,450)	2,058 (7,656)	3.509	.024
2	2.1 Modal/*Do* + V	284 (1,175)	215 (1,180)	.003	.001	472 (1,342)	358 (1,332)	.014	.001
3	2.4 *Be* + V *-ing*	121 (501)	54 (296)	10.949*	.051	168 (478)	79 (294)	13.463*	.047
4	2.3 *Be* + V *-en*	40 (165)	47 (258)	4.418*	.032	101 (287)	90 (335)	1.159	.014
5	2.2 *Have* + V-*en*	73 (302)	36 (198)	4.523*	.033	97 (276)	63 (234)	1.041	.013
	Others	43	31			59	40		
	Total	2,417	1,822			3,517	2,688		

Note. 1. Ranked by overall frequency for each VP pattern.

2. Raw counts are used for statistical testing (χ^2, V).

3. Normalized frequencies (per 10,000 VP tokens) are shown in parentheses for descriptive comparison.

*: $p < .05$

To complement the statistical summary, Figure 2 presents normalized frequencies for the four non-dominant categories (Modal/*Do* + V, Progressive, Perfect, Passive). The Simple Verb was excluded from the visualization because of its overwhelming frequency, which would otherwise obscure contrasts among the other categories.

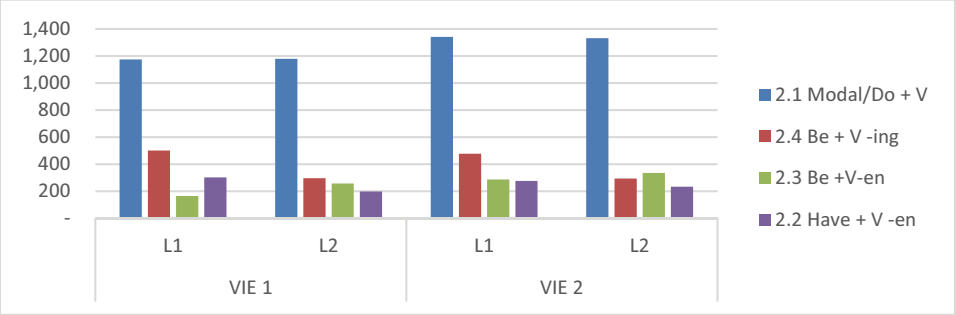

FIGURE 2
Normalized Frequencies (Per 10,000 VP Tokens) of Two-Verb VP Patterns (Rank 2–5) across L1 and L2 in VIE1 and VIE2

As shown in Figure 2, visualizing the normalized frequencies brings out contrasts that are less evident in the raw counts. Modal/*Do* + V retained its position as the second most common category, with relatively stable distributions across groups and sessions. The Progressive stands out more clearly in this visualization, with L1 speakers showing consistently higher normalized frequencies than L2 learners. In contrast, the Perfect remained peripheral in both groups, while the Passive revealed a temporary predominance of L2 usage in VIE 1 that aligned more closely with L1 usage in VIE 2. Taken together, the figure complements the statistical results in Table 2 by highlighting how differences among the less frequent categories become more visible once the overwhelming Simple Verb is excluded.

Figure 3 further contextualizes these contrasts by displaying effect size measures (Cramér's *V*) for the top-5 VP patterns across sessions. Cramér's *V* indicates the degree of difference in frequency distributions between two groups (L1 vs. L2), with lower values signifying greater similarity between distributions. To examine the difference in the frequency of 1.1 Simple Verb use between the L1 and L2 groups in VIE1, the data were reorganized into a 2 × 2 contingency table as follows: frequency of 1.1 in L1, frequency of patterns other than 1.1 in L1, frequency of 1.1 in L2, and frequency of patterns other than 1.1 in L2 — specifically, (1, 1, 1,856), (1, 0, 561), (2, 1, 1,439), and (2, 0, 383). A crosstabs analysis was then conducted to obtain the Pearson Chi-square and Cramér's *V* values, yielding $\chi^2 = 2.878$ and $V = .026$. Similarly, Cramér's *V* values were also calculated for the remaining VP patterns (2.1, 2.2, 2.3, and 2.4) to examine the distributional differences between the L1 and L2 groups in VIE1, and the same procedure was applied to VIE2.

Three patterns emerge. First, Modal/*Do* + V remains essentially null (*V* = .001 in both sessions), and the Simple Verb shows only a very small association that further declines from VIE 1 to VIE 2 (.026 → .024), aligning with the non-significant χ^2 results and indicating no meaningful group contrast for the two most frequent categories. Second, among the aspect/voice-marking patterns, the Progressive consistently yields the largest effect sizes in both sessions (VIE 1: .051; VIE 2: .047), suggesting a stable—albeit small—L1 > L2 difference over time. Third, the Perfect and the Passive displayed small effects in VIE 1 (Perfect: .033; Passive: .032), which weakened slightly in VIE 2 (Perfect: .013; Passive: .014), echoing the non-significant results and suggesting convergence between the two groups.

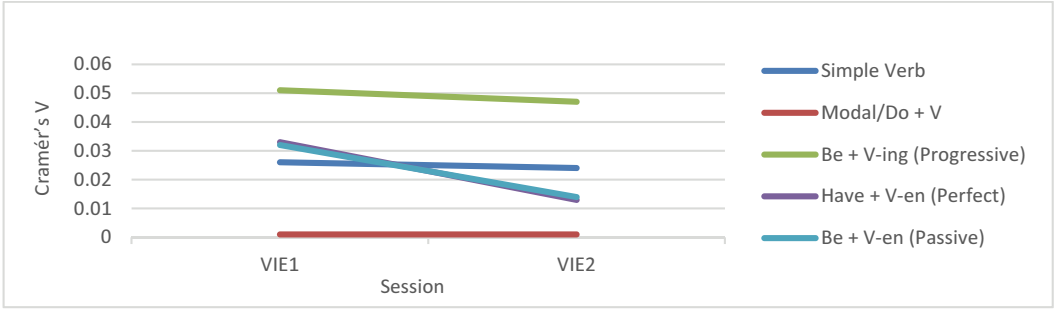

FIGURE 3
Cramér's V for Top-5 VP Patterns (VIE1 → VIE2)

Overall, the effect-size trajectories reinforce two points that are less obvious from raw or normalized counts alone. Group contrasts are concentrated in aspect/voice morphology rather than in operator-like categories (Simple Verb, Modal/*Do* + V), and time moderates those contrasts: differences in the Perfect and Passive weakened toward VIE2, whereas the Progressive gap persists at a small but comparatively largest level. In short, the strength of L1–L2 divergence is generally small across the board—most pronounced, albeit still small, for the Progressive—and diminishes for the Passive and Perfect from VIE1 to VIE2.

Passive Constructions

Since the passive was the only construction in which L2 usage exceeded that of L1 speakers—showing a significant predominance in VIE1 and a smaller, non-significant difference in VIE2—it warrants closer qualitative examination. A closer look at the L2 data reveals three recurrent types: (i) active-preferable contexts, i.e., agentive contexts where English typically favors the active voice (e.g., I was graduated → I graduated, VIE1_L2_316); (ii) over-formal/impersonal framing, i.e., grammatically well-formed passives that render the discourse unnecessarily bureaucratic (e.g., are required, VIE2_L2_463); and (iii) argument-structure/lexical mismatches, where passivization clashes with verb subcategorization or typical collocations (e.g., should be listened by vs. listen to, VIE2_L2_1271). Representative examples, along with suggested target-like alternatives, are presented below; the pattern indicates that L2 speakers not only use passives more often but also extend them into contexts where L1 speakers tend to opt for simpler active formulations or different lexical packages.

(i) Active-Preferable Meanings (agentive/experiential content)

- *Last Month this February, I was graduated from university. (VIE1_L2_316) → I graduated from university.*
- *Of course, I'm not yet experienced in teaching at school. (VIE1_L2_320) → I don't have much experience teaching at a school yet.*
- *...they are common in that both of them are started with the genuine interest and concern. (VIE1_L2_457) → ...both of them started with genuine interest and concern.*
- *They are developed with encouragement. (VIE2_L2_9) → They develop with encouragement.*

(ii) Over-formal / Impersonal Framing (register-driven passives)

- *Establishing personal relationships is concerned with knowing and respecting the student… (VIE1_L2_76) → …is about knowing and respecting the student…*
- *We need to digest that the fidelity is established and nurtured through caring. (VIE1_L2_707) → …fidelity develops (is fostered) through caring.*
- *Those types of conversations are based on the students' intentional thinking… (VIE2_L2_1240) → …build on the students' intentional thinking…*
- *That's why we are required to make out lesson plan. (VIE2_L2_463) → That's why we have to make a lesson plan.*

(iii) Argument-Structure / Lexical Mismatch in Passives

- *Most of their topics were related to books and movies which they were touched the most… (VIE2_L2_388) → …books and movies that moved them the most.*
- *…some students with better speaking fluency are intended to get involved actively, others aren't. (VIE2_L2_1192) → …are supposed to get involved actively, others aren't.*
- *So … what teachers want to say should be listened by the administrators. (VIE2_L2_1271) → …the administrators should listen to teachers…*
- *Education is dealt with a person. (VIE2_L2_1383) → Education deals with individuals.*

In summary, the results reveal distinct patterns across the five focal VP constructions: the Progressive favored by L1 speakers, the Perfect showing variable differences, and the Passive with an L2 predominance in VIE1 that diminished in VIE2. These outcomes partly align with PT-based predictions, such as the relatively early stabilization of the Progressive. However, the unexpected L2 preference for the Passive depart from the developmental sequence proposed by the theory. A fuller discussion of these theoretical implications follows in the next section.

DISCUSSION

Building on these results, the following section interprets them in light of the research questions and hypotheses. The discussion first examines the overall distribution and developmental paths of VP patterns (H1), then considers the extent to which L2 usage converged toward L1 norms over time (H2), and finally discusses broader implications for Processability Theory (PT) and authentic L2 development.

Overall Distribution of VP Use

Across both sessions, the overall distribution of VP patterns was clearly base-dominant: the Simple Verb accounted for more than two thirds of all VP tokens in every data set, while auxiliary-based patterns collectively occupy the remaining space (Table 1). This pattern underscores the dominance of unmarked predicate structures in authentic discourse, where simple lexical verbs serve as the primary vehicles of propositional meaning. In addition, L1 texts consistently contained more VPs per sentence than L2 texts, indicating structurally denser clause-combining and modification in L1 discourse. Such density reflects greater syntactic embedding and functional layering—features often linked to higher fluency and discourse sophistication. These two baselines—base-dominant inventories and L1 structural density—thus establish a reference frame for interpreting the smaller yet theoretically meaningful contrasts observed among the more marked, non-dominant VP patterns in what follows.

In authentic VIE interaction, auxiliary-based patterns unfolded in ways that partly align with PT's implicational expectations, yet displayed subtle distributional patterns not typically captured in elicited tasks. The Progressive surfaced more frequently in L1 than in L2 across sessions (VIE 1 and 2: small yet largest *V* among focal categories), consistent with PT's view of the progressive as an early-stabilizing construction, but revealed a persistent L1 > L2 usage gap. The Perfect remained peripherally distributed overall; a modest L1 > L2 difference in VIE1 narrowed by VIE2, suggesting context-sensitive employment rather than steady growth. The Passive showed the most conspicuous deviation from classic PT expectations: it was overrepresented in L2 in VIE1 and then converged toward L1 levels in VIE2, though it still occurred more frequently than the aspectual patterns overall. Taken together, these patterns indicated that the emergence order broadly followed PT predictions (progressive → perfect → passive), thus lending overall support to H1. Yet, Pienemann (1998, 2005) argued that actual production is also conditioned by task demands and communicative context, and accordingly, frequency patterns in the VIE appeared to be further shaped by discourse mode, planning time, and register management—dimensions typically suppressed in elicited contexts. Some residual differences, however, may also reflect L1-based tendencies or instruction-driven habits.

Of these developmental patterns, the progressive presents the clearest case of divergence, prompting a closer look at the factors underlying its persistence. The progressive's discourse-organizational load (Bardovi-Harlig, 2000; Shirai & Andersen, 1995) appeared to increase the processing demands for its regular use in reflective, asynchronous writing. Although PT predicts early processability of the progressive, the pragmatic workload of this form in meaning-focused writing is non-trivial: writers must manage viewpoint continuity, event foregrounding, and information packaging (Bardovi-Harlig, 2000) simultaneously. L1 writers typically use the progressive to shape this stance and rhetorical framing—for instance, to present ongoing projects or to soften commitments—whereas L2 writers tend to default to the simple aspect for efficiency. The outcome can be viewed as a usage rather than a competence gap: while L2 participants likely possess procedural control of the progressive, they appear to use it less frequently when balancing fluency, content density, and monitoring demands in authentic tasks.

L1–L2 Convergence and Functional Interpretation

Building on the overall distributional tendencies discussed above, the next pattern concerns the extent to which L2 writers' VP use approximated L1 norms over time. As shown in Figure 2, Cramér's *V* values indicated small but consistent decreases for most auxiliary-based categories, suggesting gradual convergence between L1 and L2 distributions across sessions. The Passive and Perfect both showed clear narrowing of the gap between L1 and L2 patterns, whereas the Progressive maintained the largest but stable gap between groups as discussed previously. Operator-like patterns such as the Simple Verb and Modal/*Do* + V remained virtually unchanged, consistent with early routinization of the operator layer. Taken together, these tendencies lend overall support to H2, which predicted that authentic interaction would promote movement toward L1-like distributions.

Functional interpretation helps clarify these tendencies. The Passive and Perfect both illustrate gradual functional

realignment with L1 usage over time: in VIE 1, the differences between groups were statistically significant, but by VIE 2 they no longer reached significance, indicating that the initially displaced patterns moved closer to L1 norms. These shifts underscore the possibility that authentic, sustained interaction can prompt learners to attune their grammatical choices more closely to communicative function rather than mere form. Unlike the Passive and Perfect, the Progressive, as noted earlier, retained a stable gap largely due to its heavier discourse-organizational load.

Overall, these results suggest that convergence is selective rather than uniform. L2 users improved most in categories that were initially most divergent from L1 norms, particularly the Passive, while the Progressive gap persisted due to its heavier pragmatic and discourse demands. In sum, H2 is supported: authentic peer communication facilitates convergence overall, though VP categories differ in how readily they adapt to input-driven adjustment. The following sections elaborate on these two key areas of change—the Perfect and the Passive—where alignment with L1 usage was most evident.

The Perfect at the Periphery

The perfect aspect was relatively infrequent for both groups, probably reflecting task-related constraints rather than lack of grammatical competence. For L2 writers, however, use of the perfect was further limited by cross-linguistic mapping challenges between English aspect and Korean temporal expressions (Noh & Song, 2023; Park, 2009). For example, learners may often rely on the simple past instead of present perfect as a pragmatically safer alternative, a tendency also noted in earlier studies (Hong, 2022; Kim & Kim, 2020). This low frequency is also consistent with PT predictions, as the perfect occupies a higher position in the implicational hierarchy and thus emerges later in development. Despite this, the perfect showed clear convergence over time: the initial L1–L2 difference observed in VIE 1 was no longer significant in VIE 2, suggesting that even less frequent constructions can realign toward target-like usage through sustained, meaning-oriented interaction.

The Passive Overuse and Its Retraction

The passive pattern showed partial but meaningful adjustment across sessions. In VIE 1, L2 writers used passives more frequently than L1 peers, reflecting functional and lexical overextension rather than grammatical advancement. Three main types of overuses were observed: (a) active-preferable meanings, where verbs normally occurring in active constructions were passivized; (b) impersonal or bureaucratic framing, used to create distance or formality, though often resulting in stylistically awkward or overly formal expressions; and (c) argument-structure mismatches, for example, involving non-idiomatic restructuring of verb–argument relations. These patterns suggest that learners extended the passive beyond its communicative scope, a tendency consistent with the form-focused salience induced by grammar instruction, as reported in prior studies of Korean learners (Jung, 1996; Shin, 2011).

By the second session, these non-target uses had decreased, and overall passive frequency moved closer to L1 levels, though it still remained higher. This moderation points to interaction-driven recalibration: sustained exposure to L1 partners' more actives and straightforward verb–argument patterns appeared to heighten learners' sensitivity to functional appropriateness. The shift thus represents not a categorical reduction but a qualitative adjustment—from a broadly applied formal strategy to more contextually guided deployment.

Extending PT to Frequency and Authentic Communication

The present findings provide an empirical basis for extending PT from categorical emergence to frequency-based usage. In the present data, the relative frequencies among the Progressive, Perfect, and Passive—ranked as Progressive > Perfect > Passive in L1 but Passive > Progressive > Perfect in L2—indicate that while the overall sequence broadly aligns with PT's implicational hierarchy, actual frequency patterns are further shaped by pragmatic and stylistic choices, as well as by the learning conditions and communicative demands characteristic of the L2 environment. Once a structure becomes processable, it becomes available for production, but its realized frequency is conditioned by the discourse ecology—the pragmatic, stylistic, and planning constraints that shape authentic communication (van Lier, 2004). The VIE data highlight these conditions: processability permits use, yet genre and stance requirements determine how often and for what purposes forms are deployed. In this light, the progressive's selective underuse and the passive's pragmatic readjustment in L2 illustrate that frequency reflects functional choice as well as developmental factors.

Beyond individual processing, the convergence patterns also point to the social grounding of grammatical development. Learners' procedural growth was supported by incidental learning and mutual adjustment, as they aligned their VP use with

L1 partners through sustained exchange. At the same time, L1 speakers appeared to accommodate their L2 partners by slightly increasing their use of aspectual and passive forms, a pattern consistent with the view that convergence involves mutual influence in communicative behavior (Giles et al., 1991; Kim & Choi, 2019). These dynamics suggest that grammatical development in VIE interaction is not unidirectional but co-constructed through reciprocal participation.

Finally, the consistently small effect sizes observed across categories confirm that the differences, while systematic, reflect genuine developmental tendencies rather than procedural or sampling effects. The data thus lend qualified support to both H1 and H2: L2 distributions broadly followed PT's implicational hierarchy while showing gradual convergence toward L1 norms under authentic interaction. Taken together, these tendencies point toward an ecologically grounded view of frequency, in which grammatical development appears to unfold as a socially mediated, usage-driven process.

CONCLUSION

This study examined how English VP constructions develop among Korean L2 learners engaged in VIE, focusing on the frequency and distribution of five core VP patterns—Simple Verb, Modal/*Do* + V, Progressive, Perfect, and Passive—across two sessions of sustained interaction. By analyzing naturally occurring learner–native exchanges, the study sought to capture how morphosyntactic development unfolds under authentic communicative conditions rather than elicited tasks.

Overall, the results revealed a base-dominant distribution in which unmarked simple verbs accounted for the majority of VP tokens. Among auxiliary-based constructions that occupied a smaller space, the operator-like category Modal/*Do* + V remained highly stable across groups and sessions. The more theoretically revealing contrasts appeared within the remaining auxiliary patterns: the Progressive showed a persistent L1 > L2 gap, the Perfect remained relatively infrequent but showed gradual convergence toward L1 levels, and the Passive—initially overused by L2 writers—retracted toward more balanced use in the second session. When examining the aggregated frequency distribution, the relative proportions among these VP patterns broadly reflected the implicational hierarchy predicted by PT (progressive → perfect → passive). At the same time, the dynamics of L1–L2 convergence and frequency distribution also highlight that actual usage frequencies are further shaped by discourse mode, planning time, and communicative intent.

The developmental patterns also suggest selective convergence between L1 and L2 groups. Cramér's *V* values indicated that group differences in the Perfect and Passive diminished across sessions. Although no comparable convergence was observed for the Progressive, the overall pattern nevertheless points to a gradual functional alignment in how learners deploy aspect and voice, especially when authentic peer communication affords repeated exposure to contextually appropriate models. Taken together, these results partially support the view that sustained intercultural interaction promotes not only lexical and pragmatic growth but also subtle restructuring of morphosyntactic routines.

Theoretically, the study attempted to extend PT toward a frequency-based interpretation of development. The VIE context made this extension visible: learners maintained procedural readiness for complex VP forms, yet their frequency of use appeared to reflect genre, stance, and planning constraints typical of reflective online writing. In this way, the study bridges PT's psycholinguistic account of form emergence with usage-based perspectives that highlight the role of authentic use and contextual factors in shaping grammatical development.

Pedagogically, the findings suggest that explicit attention to the discourse functions of auxiliary forms may help close remaining gaps. Despite sustained exposure to native models in VIE, learners continued to underuse the Progressive; instructional approaches should address not only formal properties but also the pragmatic workload and communicative functions associated with this aspect—specifically how the Progressive organizes viewpoint and stance. Likewise, teaching about the Passive should move beyond treating it as a mere structural alternative to the active. The tendency of L2 learners to overuse Passive forms—contrary to implicational hierarchy expectations—may reflect a lack of emphasis on its true discourse functions, such as information packaging and formality in traditional grammar instruction. Effective pedagogy should address these discourse-pragmatic distinctions, which can conceal, deemphasize, or background agency, to support contextually appropriate use. Instruction can also clarify how Perfect forms connect past events with present or past reference points, helping learners navigate cross-linguistic mapping challenges. Task design that elicits these functions in meaningful contexts—rather than isolating morphological drills—may foster more balanced, context-sensitive use.

As with any study, several limitations should be noted. The analysis focused on asynchronous, course-integrated writing over two sessions (approximately 75,000 words) and on the five most frequent VP types. Automated parsing, while validated, may have missed edge cases, and findings generalize primarily to similar interactional settings rather than to spoken or synchronous modes. Future research could extend this approach to longer longitudinal spans, incorporate mixed-effects modeling to capture lemma- and speaker-level variation, and add qualitative coding of functional appropriateness to

complement frequency measures. Examining aspectual tendencies by verb type may also help clarify why the Progressive gap persists.

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Appendix

Simplified Pseudo Code for Automated VP Extraction

```
START
  // 1. Preprocessing: Cleaning and Sentence Segmentation
  FOR each file IN input_folder:
      READ raw_text
      REMOVE metadata (IDs, dividers)
      NORMALIZE quotes, dashes, spaces via regex
      SEGMENT text INTO sentences USING Stanza tokenizer
      SAVE as TSV file: (SN, Sentence)

  // 2. Define modal sets and helper functions
  STRICT_MODALS = {can, could, may, might, shall, should, will, would, must}
  SEMI_MODAL_MWES = {have to, be going to, be supposed to, used to, ought to, be used to, dare to}
  MARGINAL_AUX = {need, dare}

  FUNCTION compute_flags(aux_chain, head):
      modal = any(aux in STRICT_MODALS or is_MWE(aux) or is_marginal(aux))
      perfect = 'have' in aux_chain
      progressive = ('be' in aux_chain and head.TAG == VBG)
      passive = ('be' in aux_chain and head.TAG == VBN)
      RETURN (modal, perfect, progressive, passive)

  FUNCTION classify_pattern(m,p,pr,pa):
      IF m+p+pr+pa: RETURN "5.1 Modal + have + been + being + V-en"
      ELSE IF m+p+pr: RETURN "4.1 Modal + have + been + V-ing"
      ELSE IF m+p+pa: RETURN "4.2 Modal + have + been + V-en"
      ELSE IF p+pr+pa: RETURN "4.3 have + been + being + V-en"
      ELSE IF m+pr+pa: RETURN "4.4 Modal + be + being + V-en"
      ELSE IF m+p: RETURN "3.1 Modal + have + V-en"
      ELSE IF m+pa: RETURN "3.2 Modal + be + V-en"
      ELSE IF m+pr: RETURN "3.3 Modal + be + V-ing"
      ELSE IF p+pr: RETURN "3.4 have + been + V-ing"
      ELSE IF p+pa: RETURN "3.5 have + been + V-en"
      ELSE IF pr+pa: RETURN "3.6 be + being + V-en"
      ELSE IF m: RETURN "2.1 Modal/Do + V"
      ELSE IF p: RETURN "2.2 have + V-en"
      ELSE IF pa: RETURN "2.3 be + V-en"
      ELSE IF pr: RETURN "2.4 be + V-ing"
      ELSE: RETURN "1.1 simple verb"

  // 3. VP Detection and Classification
  FOR each sentence IN TSV:
      doc = parse(sentence)     // via spaCy dependency parser
      FOR each token IN doc:
          IF token.POS in {VERB, AUX} and token.DEP in {ROOT,ccomp,advcl,relcl,conj}:
              aux_chain = children(token) with DEP in {aux, auxpass}
              (m,p,pr,pa) = compute_flags(aux_chain, token)
              label = classify_pattern(m,p,pr,pa)
              WRITE (SN, token.text, label, token.lemma) TO result_table

  // 4. Output Validation
  REMOVE duplicates via head-index tracking
  ENSURE auxiliary chain preserves surface order
  SAVE result_table AS "<filename>_result.tsv"
END
```

Note. All modules were implemented in Python 3.9 using Stanza and spaCy. This pseudo code summarizes the automated pipeline from preprocessing to VP classification.