

Revisiting Nature and Nurture in Second Language Acquisition: A Comparative Analysis with an Environmental-Input Lens

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Abstract

The long-standing debate in second language acquisition (SLA) concerning whether language development is primarily driven by innate linguistic mechanisms or by postnatal experience has gained renewed relevance in contemporary foreign language learning contexts. With the global expansion of second language education, particularly in classroom-based and input-constrained environments, strong claims regarding the sufficiency of innate language ability face increasing empirical and pedagogical challenges. Against this backdrop, the present study conducts a comparative analysis of the roles of innate and acquired factors in SLA from the perspective of environmental input. Rather than treating these factors as isolated determinants, the study evaluates their explanatory strength under a unified analytical framework. Methodologically, the study adopts a qualitative comparative design that integrates a systematic literature review with theory-driven case analysis. Drawing on representative empirical studies and meta-analyses in SLA, three comparative criteria are constructed: explanatory coverage, empirical consistency, and pedagogical intervenability. These criteria are applied to examine how innate factors (such as Universal Grammar and language aptitude) and acquired environmental factors (including comprehensible input, interactive input, and output with feedback) account for observed acquisition patterns across different learning contexts. Case analyses are used not for statistical generalization but to illustrate how specific environmental input conditions activate, constrain, or amplify different factors in actual learning processes. The analysis demonstrates that acquired environmental factors exhibit clear explanatory advantages over innate factors under all three criteria. Environmental input accounts for a substantially larger proportion of variance in developmental sequences, shows more stable and convergent empirical effects across studies, and—most critically—can be directly manipulated through instructional design. By contrast, innate factors function primarily as background constraints or moderators whose effects emerge only under particular input, interaction, and feedback conditions and lack direct pedagogical operability. The findings suggest that while innate capacities delimit the boundaries of language learning, it is acquired environmental input that plays the central and actionable role in shaping second language development. This comparative perspective offers both theoretical clarification and practical implications for second language pedagogy in input-limited instructional contexts.

Keywords

second language acquisition, environmental input, innate and acquired factors

1. Introduction

1.1 Research Background

The field of second language acquisition has always revolved around a fundamental question: whether language ability mainly stems from innate mechanisms or is gradually shaped by experiences after birth. Since the mid-20th century, the two different perspectives of nativism and empiricism have gradually become the two main research directions in linguistics, psychology, and education. The theories of nativism and those related to general grammar hold that the language mechanisms innate to humans play a decisive role in language learning, while the empirical research approach believes that language ability is gradually developed through exposure to language input, social interaction with others, and actual language use [1]. Theories like the input hypothesis cover similar topics, as do the interaction hypothesis and the output hypothesis. Nowadays, globalization is developing at an increasingly rapid pace. English and other second languages are spreading more and more widely [2] in non-native language environments. British Council estimates indicate that there are currently approximately 1.5 billion English learners worldwide, and over 75% of them are learning English as a foreign language [2]. When learning a second language now, more and more cases do not occur as naturally immersed in a language environment as in childhood, but rather in a formal teaching setting where language input is limited and unbalanced. This poses a practical challenge to the strong belief that innate language talent is sufficient.

Under such circumstances, the role of environmental input in second language acquisition has become a particular focus of attention when conducting empirical and theoretical research. An increasing number of studies have found that different types of input - such as input that can be understood and input that has been adjusted during interaction and the output guided by feedback - all are closely related to the development process of learners in terms of language accuracy and fluency. The language environment can influence how learners pay attention to, process and reorganize their language knowledge. This has been mentioned in previous studies through interactive processes that promote meaningful and formal communication [3]. Moreover, from a cognitive perspective, input frequency, salience, attention, and transfer conditions shape how learners notice and process linguistic information [4]. However, nowadays people are paying more and more attention to environmental factors, but they cannot ignore the influence of innate individual differences, such as language ability, working memory ability and attention control. It is generally believed that these differences will affect the processing and absorption of input. From a cognitive perspective, these mechanisms do not operate solely by nature. Instead, it will dynamically interact with the distribution characteristics of the input. In addition, some studies have also mentioned this mechanism. However, current research and a persistent deficiency are that many studies either only look at innate mechanisms or only focus on environmental variables, without systematically comparing their explanatory scopes within a unified analytical framework. From this perspective, comparing and examining innate and acquired factors from the perspective of environmental input. It can play a comprehensive role in theory and also has a very crucial impact on the teaching methods of a second language.

1.2 Research Significance

1.2.1 Theoretical Significance

This study makes a theoretical contribution by systematically comparing the roles of innate and acquired factors in second language acquisition from the perspective of environmental input. Previous research on environmental input usually looked at different factors separately from a theoretical standpoint. There were few attempts to assess how well these factors could explain things when put together in a single analytical framework. This paper sets up a clear way to check the limits of what different factors can explain. It does this by introducing three clear criteria for comparison: how well they explain things, how consistent they are with real-world data, and how well they can be used in teaching.

Within this framework, innate factors are not regarded as abstract abilities independent of the learning background, but are examined based on specific input conditions. This method helps us understand precisely how innate factors' influence varies with different environmental inputs. It also provides a theoretical basis for analyzing their limitations in explaining things in later chapters. From this comparative perspective, the explanatory advantages of environmental factors can also be articulated more systematically.

1.2.2 Practical Significance

Practically speaking, the research can provide a clearer theoretical reference for second language teaching. By comparing the explanatory power of different factors under certain standards, we can analyze which aspects of language development are more susceptible to input conditions and which aspects reflect the moderating role of individual differences. This distinction can help form practical educational expectations for learners' abilities and teaching interventions.

Moreover, highlighting the manageability of environmental input offers theoretical backing for both instructional design and classroom activities. By concentrating on comprehensible input, interactive input, and feedback output, this essay links theoretical ideas with real-world teaching scenarios. This link will be explored further in the upcoming chapters when environmental factors are analyzed.

1.3 Research Methods

1.3.1 Literature Review Method

This study uses the literature review method to build its theoretical framework and define its comparative focus. We systematically review relevant theories and empirical research on innate and acquired factors in second language acquisition (SLA), paying special attention to how different theories view the impact of environmental input. By analyzing key literature, we identify the main assumptions and explanatory patterns that shape our comparative criteria. This approach helps us integrate previous research in a structured way, rather than just summarizing it. It provides a theoretical basis for the framework presented in Chapter 2 and the comparative analyses in Chapters 3 and 4.

1.3.2 Case Analysis Method

Besides theoretical analysis, this research uses case analysis to explore how innate and acquired factors operate in second language acquisition when specific environmental inputs are present. Instead of viewing each case as a separate set of empirical data, the analysis relies on well-recorded instructional and learning situations from existing experimental and classroom studies. These cases are chosen to show systematic differences in input types, interaction patterns, and feedback conditions, which are key to the study's comparative approach. Each case is examined based on its learning environment, task design, input features, learner reactions, and observed learning results. The goal is to show how different factors are triggered, limited, or enhanced under certain environmental conditions. It's important to note that this case analysis is meant to be analytical and illustrative, not predictive or statistical. Its function is to ground theoretical claims in concrete scenarios and to clarify the mechanisms discussed in Chapters 3 and 4.

2. Theoretical Framework and Comparative Criteria

2.1 Basic Definitions of “Innate Factors” and “Acquired Factors” in Second Language Acquisition

Innate factors in second language acquisition are typically understood as the biological and cognitive capacities that learners possess prior to engaging in language learning. The conceptual origin of this view can be traced back to generative linguistics and the exploration of the essence of language ability by this discipline. In *Aspects of the Theory of Syntax*, Chomsky proposed in 1965 that humans possess an innate capacity for language, manifested as abstract mechanisms for constructing grammatical structure rather than as outcomes of stimulus–response learning [5]. Under the framework of this theory, language acquisition is regarded as a process in which the innate grammatical system gradually unfolds under the condition of limited input, and innate factors are defined as internal constraints that can define the possible forms of language knowledge.

Building on this line of reasoning, Pinker argued in 1994, in *The Language Instinct*, that language should be viewed as a biologically grounded instinct shaped by human evolution [6]. Although Pinker's discussion primarily addresses first language acquisition, his emphasis on the modularity and biological basis of language has exerted considerable influence on the definition of innate factors in SLA research. From this perspective, innate factors encompass not only abstract grammatical principles but also cognitive predispositions related to language processing, such as sensitivity to structural regularities and the capacity for rapid rule induction.

In contrast, acquired factors in SLA typically refer to the external conditions and experiential resources available to learners during language development, including linguistic input, social interaction, instructional settings, and contexts of language use. R. Ellis provided a systematic account of these influences in *The Study of Second Language Acquisition*, published in 2008, where he emphasized that language development is not the product of a single determinant but rather the result of continuous interaction between learners' cognitive resources and environmental experience [7]. In his formulation, acquired factors extend beyond the sheer quantity of input to include its comprehensibility, its interactional characteristics, and the feedback learners receive through language use. Together, these elements constitute the environmental foundation that enables second language development.

Overall, this essay finds that most current research regards innate factors as the internal conditions that enable language learning to occur, while acquired factors are seen as external resources that activate and shape the entire learning process. Although these two types of factors can be analyzed separately, in the actual language learning process, they are actually interdependent. This conceptual distinction has laid a necessary foundation for the subsequent research comparing their respective roles from the perspective of environmental input, enabling the subsequent analysis to proceed more smoothly.

As shown in Table 1, innate factors mainly refer to learners' biologically grounded linguistic and cognitive capacities, whereas acquired factors refer to the linguistic input, interaction, instruction, and feedback encountered during learning.

Table 1: Basic Definitions of Innate and Acquired Factors in Second Language Acquisition

Innate Factors	Acquired Factors
Inborn linguistic capacity and cognitive endowment	Linguistic input and experiential conditions encountered during learning
Abstract grammatical mechanisms and structural sensitivity	Comprehensible input and interactional input
Biologically evolved predispositions for language processing	Instructional settings, social interaction, and feedback
Internal conditions shaping how input is processed	External resources that trigger and support language development

Source: Author's compilation based on [5–7].

2.2 Theoretical Connotations of the Environmental Input Perspective

From an environmental input perspective, second language acquisition is concerned not simply with the quantity of linguistic exposure, but more critically with how learners interpret, process, and gradually internalize language under specific conditions. The theoretical origin of this view can generally be traced back to the input hypothesis proposed by Krashen in 1985. In *The Input Hypothesis: Issues and Implications*, Krashen argued that language acquisition occurs when learners are exposed to comprehensible input, defined as language input that is slightly beyond the learner's current level of competence ($i+1$) [1]. In this framework, environmental input is regarded as a necessary condition for language development. What is valued more is understanding the meaning rather than merely practicing the form of language.

This input-oriented view was subsequently extended by Long in 1996, who proposed the Interaction Hypothesis in his discussion of the linguistic environment in SLA. Long emphasized that the role of the environment lies not only in the provision of input itself, but also in the ways input is modified and negotiated through interaction [3]. Processes such as clarification requests, confirmation checks, and feedback during interaction enable learners to notice relationships between linguistic form and meaning more effectively. From this perspective, environmental input is understood as a dynamic and interactive experience rather than passive exposure to language forms.

Building on these ideas, Gass and Mackey offered a more integrated account of environmental input in 2007 by systematically linking input, interaction, and output. In *Input, Interaction, and Output in SLA*, they argued that input contributes to acquisition only when it is attended to, processed, and tested through opportunities for output and feedback [8]. This view broadens the environmental input perspective by incorporating learners' active engagement with language use, thereby highlighting the procedural nature of language development.

From a broader perspective, Ortega in 2018 called for renewed attention to the social and educational contexts in which second language learning takes place. She emphasized that environmental input should not be treated as an abstract variable, but as experience embedded in specific institutional settings, classroom structures, and social practices [9]. This contextualized understanding further enriches the theoretical connotations of the environmental input perspective and provides a conceptual foundation for later discussions of pedagogical intervenability.

As shown in Table 2, the environmental input perspective emphasizes comprehensibility, interactivity, output and feedback, and contextual embeddedness as core dimensions of second language development.

Table 2: Core Theoretical Connotations of the Environmental Input Perspective

Theoretical Dimension	Core Connotation
Comprehensibility	Input must be meaningfully comprehensible to initiate acquisition
Interactivity	Input is modified and strengthened through interaction
Output and Feedback	Output enables learners to test and restructure interlanguage
Contextual Embeddedness	Input is situated within specific social and instructional contexts

Source: Author's compilation.

2.3 Construction of Comparative Criteria for Factors in Second Language Acquisition

2.3.1 Explanatory Coverage

In second language acquisition (SLA), explanatory coverage refers to the range of linguistic phenomena that a theoretical framework can effectively explain. This includes linguistic structures, different stages of language development, learning environments, and individual differences among learners. Instead of focusing on detailed explanations of single phenomena, explanatory coverage looks at whether a theory can offer a consistent explanation for the complexity and variety seen in real language learning processes. Therefore, explanatory coverage is often used to assess how well competing theories apply on a broader scale.

From a usage-based perspective on language acquisition, Tomasello proposed in 2003 that linguistic structure emerges from processes of pattern extraction and frequency-based generalization in language use, rather than from pre-specified abstract grammatical rules [10]. This framework is capable of accounting for a wide range of phenomena, including vocabulary growth, the development of constructions, and the gradual abstraction of grammatical patterns, thereby demonstrating relatively high explanatory coverage. For example, corpus-based studies have consistently shown that both child learners and second language learners acquire high-frequency constructions more rapidly than low-frequency ones, a pattern observed across multiple languages and learning contexts, which supports the broad explanatory power of input frequency.

Building on this approach, N. C. Ellis in 2008 provided a systematic account of how usage-based theories of SLA integrate form learning and meaning construction within a unified explanatory framework [11]. N. C. Ellis argued that general cognitive mechanisms such as attention, frequency sensitivity, and perceptual salience can account for acquisition phenomena across multiple linguistic levels, ranging from phonology and lexis to morphosyntax. Empirical studies in SLA have shown that input frequency alone can explain approximately 30%–50% of the variance in learning outcomes in a wide range of experimental settings, suggesting that input-based explanations possess substantial cross-phenomenon applicability.

In 2008, Larsen-Freeman and Cameron brought the complex systems perspective into second language acquisition (SLA) research. They highlighted that language development is not linear but dynamic [12]. According to this view, a good theory should be able to explain why learners' developmental paths vary, why their learning speeds differ, and why their learning results are unstable, all at the same time. For example, even when learners receive similar language input, they may still follow very different paths in language development. This is hard to explain with theories based on fixed rules, but the complex systems perspective offers a clear way to understand it.

2.3.2 Empirical Consistency

Empirical consistency in SLA refers to the degree to which a theoretical account is supported by stable and replicable empirical evidence across diverse research designs, learning environments, and learner populations. Rather than relying on isolated experimental findings, this criterion emphasizes the degree to which empirical results converge across studies, thereby serving as a key indicator of the reliability of a theoretical account. An

explanation that is repeatedly supported under varying conditions can be regarded as possessing higher empirical credibility.

Empirical studies on interactional input offer a clear example of this standard. In their 2007 extensive review of interaction research, Mackey and Goo found that a significant amount of experimental data supports the idea that interactional processes, like negotiating meaning, providing corrective feedback, and modifying interactions, help improve learners' grammar accuracy and understanding [13]. Notably, the studies they summarized included learners from various first-language backgrounds, learning multiple target languages, and taking place in both classroom and lab settings. Despite differences in research methods, the overall findings were quite consistent, indicating that interactional input reliably and generally contributes to second language development.

In terms of instructional intervention, Spada and Tomita carried out a meta-analysis in 2010 to explore the connection between different instruction types and various linguistic knowledge types [14]. Their research results showed that form-focused instruction had a notably strong impact on rule-based grammatical structures, whether the instruction was explicit or implicit. On average, the effect size was around 0.70. However, its influence on irregular structures was relatively weaker. The recurrence of this pattern across multiple studies highlights the empirical consistency of input- and instruction-based explanations in accounting for learning outcomes.

From a methodological perspective, Plonsky and Oswald argued in 2014 that meta-analytic synthesis has revealed relatively stable effect-size ranges in a wide array of SLA research [15]. Specifically, studies examining input, interaction, and feedback commonly report effect sizes clustering between 0.40 and 0.80, indicating moderate to strong effects. This convergence across independent studies provides further empirical grounding for explanations that emphasize environmental input and instructional conditions.

2.3.3 Pedagogical Intervenability

Pedagogical intervenability shows the extent to which a specific factor can be systematically adjusted through instructional design, classroom activities, or targeted teaching strategies to influence learning results. Unlike explanatory coverage and empirical consistency, this criterion has a more direct link to actual teaching practices. Thus, it is an important aspect for assessing how practical SLA theories are in real educational settings.

In 2005, Ellis conducted a thorough review of instructed second language acquisition. He pointed out that not all factors influencing language development can be equally influenced by teaching [16]. By analyzing numerous classroom-based and experimental studies, he found that teaching methods generally have a consistent impact on aspects like grammar rules, word selection, and where learners focus their attention. On the other hand, learner characteristics such as age and language aptitude, which are often seen as inherent traits, are much harder to change through teaching. This difference helps us distinguish between factors that can be taught and those that cannot when evaluating how effective teaching methods are.

Based on this viewpoint, in their 2013 summary of classroom research, Lightbown and Spada outlined the circumstances in which instructional intervention is most beneficial [17]. They pointed out that teaching doesn't simply pass linguistic rules on to learners. Instead, it affects language acquisition by making the input more understandable, facilitating interaction opportunities, and offering prompt and useful feedback. Numerous classroom studies have indicated that learners in instructional environments that include targeted feedback or form-focused tasks generally show more improvement in grammatical accuracy compared to those in settings with only exposure. In some instances, reported enhancements have reached 20% to 30%.

From a broader educational research perspective, Hattie reported in 2009 the results of a synthesis of more than 800 meta-analyses, proposing that effective instruction can be evaluated in terms of its measurable impact on learning outcomes [18]. In this framework, an average effect size of 0.40 is used as a hinge-point benchmark for judging educationally meaningful effects, while feedback is treated as a comparatively high-impact instructional influence. Although this work is not specific to SLA, its emphasis on measurable instructional effects provides an important empirical reference for conceptualizing pedagogical intervenability in language education.

As shown in Table 3, explanatory coverage, empirical consistency, and pedagogical intervenability provide the main criteria for comparing different factors in second language acquisition.

Table 3: Comparative Criteria for Evaluating Factors in Second Language Acquisition

Comparative Criterion	Core Definition	Key Focus	Representative Empirical Indicators
Explanatory Coverage	The extent to which a theory accounts for a wide range of SLA phenomena across linguistic domains, learning stages, contexts, and individual variation	Breadth and integrative power of explanation	Ability to explain vocabulary growth, construction development, grammatical abstraction, nonlinear learning paths; input frequency accounting for approx. 30%–50% of outcome variance
Empirical Consistency	The degree to which an explanation is supported by stable and replicable findings across studies, methods, and learner populations	Cross-study convergence and reliability	Recurrent positive effects of interaction and instruction; meta-analytic effect sizes typically ranging from 0.40 to 0.80
Pedagogical Intervenableity	The extent to which a factor can be systematically modified through instructional design and teaching practices	Practical malleability through instruction	Measurable gains from form-focused instruction and feedback; reported improvements of 20%–30%; instructional effect sizes above 0.40

Source: Author's compilation.

3. The Role of Innate Factors from the Perspective of Environmental Input and Their Explanatory Limits

3.1 Relevant Theories of Innate Language Ability in Second Language Acquisition

Theories of innate language ability originate from generative linguistics and its inquiry into the nature of human linguistic competence. In *Aspects of the Theory of Syntax*, Chomsky proposed in 1965 the concept of a Language Acquisition Device (LAD), arguing that the rapid and systematic acquisition of complex grammatical structures under conditions of limited and imperfect input can only be explained by an innate set of abstract grammatical principles, known as Universal Grammar (UG) [5]. Within this framework, linguistic input is assigned a triggering role, serving primarily to activate pre-specified parameters rather than to construct language knowledge itself.

As second language acquisition (SLA) research developed, increasing attention was paid to the question of whether and how UG remains available to second language learners. White addressed this issue systematically in *Second Language Acquisition and Universal Grammar*, published in 2003, where she reviewed competing hypotheses regarding learners' access to UG, including full access, partial access, and no access accounts [19]. Drawing on empirical evidence from syntactic acquisition, she argued that second language learners often exhibit sensitivity to UG-constrained properties, such as structure dependence and certain grammatical constraints, even when these properties are not transparently represented in the input. Such findings have been taken to suggest that innate linguistic principles may continue to influence second language development, albeit under conditions different from first language acquisition.

As shown in Table 4, theories of innate language ability in second language acquisition mainly draw on generative grammar, Universal Grammar, and debates over learners' access to Universal Grammar.

Table 4: Relevant Theories of Innate Language Ability in Second Language Acquisition

Theoretical Perspective	Representative Scholar(s)	Core Claims	Relevance to SLA
Generative Grammar / UG	Chomsky [5]	Language acquisition is guided by innate grammatical principles (UG); input triggers parameter setting	Explains rapid acquisition of abstract grammatical structure
UG Accessibility in SLA	White [19]	UG may be fully, partially, or not accessible in SLA; learners show sensitivity to UG constraints	Accounts for persistent grammatical patterns in L2 acquisition

Source: Author's compilation based on [5, 19].

3.2 The Role of Innate Factors under Different Environmental Input Conditions

3.2.1 Processing of Innate Language Ability under Constraints of Comprehensible Input

Innate language ability is limited by the extent to which the input supports the mapping of form and meaning. When learners can understand input without paying attention to grammatical form, they tend to rely on

semantic information; VanPatten and Cadierno's work on structured input and Spanish target forms [20] helps explain why grammatical sensitivity is not fully activated under such conditions. Learners who are only exposed to formally redundant input have a particularly small improvement in grammatical accuracy. However, if the input they are exposed to contains grammatical cues that are crucial for understanding meaning, even without clear grammatical rule guidance, their improvement in grammatical accuracy will be much greater [20]. These research results indicate that innate grammatical sensitivity is actually a potential resource. This resource will only come into play when the input conditions need to focus on the grammatical form, which means that the form and meaning in the input must be aligned.

3.2.2 Regulation of Innate Cognitive Mechanisms Dependent on Interactive Input Contexts

Innate cognitive mechanisms are influenced by the interactive context embedded in the input. This interaction can shape learners' attention and create conditions that require grammatical abstraction. Mackey and Goo's meta-analysis of interaction research [13] shows that learners who participate in negotiated interaction tend to outperform those who are only exposed to pre-modified input. The advantage of interaction lies in directing learners' attention to mismatches between their own output and target structures. Interaction selectively activates cognitive mechanisms rather than directly enabling learners to acquire new knowledge in isolation [21].

3.2.3 The Influence of Innate Individual Differences That Cannot Be Separated from Output and Feedback Conditions

The influence of inherent individual differences, such as the varying language abilities of each person, actually only becomes evident in learning environments that require content output and feedback. Research conducted by DeKeyser [22] found that language ability can clearly predict how much can be learned in feedback-based output-oriented learning. However, if one is merely exposed to a language environment, this predictive ability would be much weaker. This research finding indicates that only when output and feedback create opportunities for learners to analyze language and verify ideas can innate language talent truly help amplify learning outcomes.

As shown in Table 5, innate factors operate differently across input conditions and become more visible when interaction, output, and feedback direct learners' attention to language form.

Table 5: The Operation of Innate Factors under Different Environmental Input Conditions

Input Condition	Role of Innate Factors	Key Empirical Implication
Comprehensible but form-redundant input	Innate grammatical sensitivity remains inactive when form–meaning mapping is weak	Grammatical processing emerges only when input directs attention to form
Negotiated interaction with feedback	Innate cognitive mechanisms are selectively activated through interaction	Interaction regulates attention and enables structural abstraction
Production tasks with corrective feedback	Innate individual differences are amplified by output demands	Aptitude effects emerge only in output- and feedback-rich contexts

Source: Author's compilation based on [13, 20, 22].

3.3 Explanatory Limitations of Innate Factors under the Established Comparative Criteria

3.3.1 Limitations in Explanatory Coverage

A major limitation of innate-factor explanations lies in their restricted explanatory coverage with respect to the diversity of developmental outcomes observed in second language acquisition. While nativist accounts emphasize universal grammatical constraints, they often fail to explain why certain linguistic features are acquired earlier, more reliably, or more consistently than others across learner populations [23].

This limitation was clearly illustrated in the large-scale quantitative research carried out by Goldschneider and DeKeyser [24], regarding the morpheme acquisition order in second language learners of English. Through reanalyzing data from numerous morpheme-order studies, the researchers explored whether inborn grammatical intricacy alone might predict the acquisition order. Their findings indicated that innate grammatical considerations accounted for just a tiny fraction of the observed differences. However, a group of distributional and perceptual elements such as input frequency, perceptual salience, semantic complexity, and regularity—together elucidated around 60% of the variance in the acquisition order across different studies [24].

A number of morphemes completely authorized within Universal Grammar, like the third person singulars, were consistently acquired late and exhibited great optionality in learners' output. This pattern could not be adequately explained by inborn grammatical rules alone, since these rules don't distinguish between surface frequency or perceptual significance [24]. The results indicate that inborn explanations had restricted coverage when it comes to clarifying cross-feature and cross-learner variability, emphasizing a structural divide between nativist predictions and empirical growth patterns.

3.3.2 Insufficiencies in Empirical Consistency

Innate-factor explanations also face limitations in terms of empirical consistency, particularly when evaluated across different tasks and measurement methods. A theory which ascribes language development mainly to inborn mechanisms would be anticipated to provide steady empirical support across experimental situations. However, empirical results in second-language acquisition frequently exhibit considerable inconsistency in this matter.

A typical instance is Johnson and Newport's [25] study on age effects in second language acquisition. Using a grammaticality judgment test with 46 Chinese and Korean learners of English, they found a strong negative correlation ($r \approx -0.77$) between age of arrival and grammatical accuracy for those who arrived before puberty; for those who arrived after puberty, performance varied widely and showed no consistent relationship with age.

Later studies that used similar grammaticality judgment tasks have not always reached the same conclusion. Some studies do reproduce the strong correlation between age of arrival and performance reported for early learners, but others find that the pattern depends heavily on the task, or that the relationship is much weaker when production data are examined. Notably, even the original study showed wide variation among late learners: accuracy ranged from near native to almost chance level [25]. Taken together, this spread makes it difficult to treat innate biological constraints as a sufficient explanation that should yield stable predictions across learner groups and task types, and it therefore weakens the empirical consistency of innateness based accounts.

3.3.3 Lack of Pedagogical Intervenability

Another shortcoming of innate factor explanations lies in their unpedagogical intervenability. If a factor cannot be directly interfered with via teaching, its explanatory power in educational contexts would be inevitably restricted. Research on language aptitude offered a clear illustration of this drawback.

In DeKeyser's [22] study of critical-period effects in second language acquisition, 57 adult Hungarian-speaking immigrants completed a grammaticality judgment test. The study found that only a small number of adult arrivals reached the range of child arrivals, and those adults tended to have high verbal analytical ability; by contrast, verbal analytical ability was not a significant predictor for childhood arrivals.

This finding is more cautious than the original wording here: it supports the view that learner-internal abilities can moderate adult second-language outcomes, but it does not show that instruction changes aptitude itself. For this reason, innate-factor accounts still have limited pedagogical leverage: they identify constraints on learning rather than variables that teachers can directly manipulate.

As shown in Table 6, innate-factor explanations face limitations in explanatory coverage, empirical consistency, and pedagogical intervenability.

Table 6: Empirically Identified Limitations of Innate-Factor Explanations in Second Language Acquisition

Analytical Dimension	Representative Study	Key Empirical Evidence	Implication for Innate-Factor Explanations
Limited Explanatory Coverage	Goldschneider & DeKeyser [24]	Distributional and perceptual variables jointly explained ~60% of variance in morpheme acquisition order	Innate grammatical principles alone cannot account for cross-feature and cross-learner variability
Insufficient Empirical Consistency	Johnson & Newport [25]	Strong age-accuracy correlation ($r \approx -0.77$) before puberty; high variability and weak patterns after puberty	Innate constraints yield inconsistent predictions across learner groups and task types
Lack of Pedagogical Intervenability	DeKeyser [22]	Verbal analytical ability was associated with near-native adult attainment but was not a significant predictor for childhood arrivals	Innate individual differences function as moderators rather than pedagogically adjustable variables

Source: Author's compilation based on [22–25].

4. The Core Role and Explanatory Advantages of Acquired Environmental Factors from the Perspective of Environmental Input

4.1 Theoretical Foundations of Environmental Input in Second Language Acquisition

The environmental input approach constitutes an important theoretical orientation in second language acquisition (SLA) research, emphasizing that language development does not occur in isolation, but is gradually constructed through learners' exposure to and processing of linguistic experience in specific environments. The foundational formulation of this approach is commonly attributed to Krashen's Input Hypothesis, proposed in 1985. In *The Input Hypothesis: Issues and Implications*, Krashen argued that a necessary condition for language acquisition is sustained exposure to comprehensible input, defined as language that learners can understand in terms of meaning while being slightly more advanced than their current level of competence ($i+1$) [1]. Within this framework, environmental input is conceptualized as a crucial external condition for language development, with primary emphasis placed on meaning comprehension rather than on explicit formal practice.

Although the Input Hypothesis emphasizes the primacy of input, subsequent studies have provided evidence that impure exposure to input cannot fully account for the diversity in developmental outcomes among learners. In Long's [3] Interaction Hypothesis, Long extended the environmental input perspective by arguing that the effectiveness of input relies not just on its comprehensibility but also on how the input is altered, negotiated and refined in the process of interaction [3]. Interactional mechanisms such as meaning negotiation, clarification requests, and feedback enable learners to pay closer attention to the relationship between language form and meaning, thus facilitating deeper processing. For example, in classroom activities, instant responses from teachers or peers to what learners say typically stimulate them to re-analyze target language patterns, which illustrates the regulatory role of interactional input in language development.

As shown in Table 7, the Input Hypothesis and the Interaction Hypothesis provide key theoretical foundations for understanding the role of environmental input in second language acquisition.

Table 7: Theoretical Foundations of Environmental Input in Second Language Acquisition

Theoretical Perspective	Representative Scholar(s)	Core Claims	Implications for SLA
Input Hypothesis	Krashen [1]	Language acquisition requires sustained exposure to comprehensible input ($i+1$), with emphasis on meaning	Establishes input as a necessary condition for language development
Interaction Hypothesis	Long [3]	Input becomes effective when modified and negotiated through interaction	Highlights the role of interaction in facilitating form-meaning mapping

Source: Author's compilation based on [1, 3].

4.2 The Role of Different Types of Environmental Input in Second Language Acquisition

4.2.1 The Direct Supporting Role of Comprehensible Input in the Acquisition of L2 Linguistic Forms

The comprehensible input is a direct and central contribution in second language linguistic form learning. In the area of acquiring the second language, especially in foreign language situations, the exposure of the learners to the target language tends to be ineffective in quantity and breadth. Then, only pre-existing input with a meaning can be used as an evidence of the progressive attainment of the lexicons, grammatical morphemes, and repetitive forms [26]. When the learners are able to make sense out of the input, one can apply gradual development of stable form-meaning associations by exposing them to the linguistic forms in significant contexts.

Large-scale studies have supported separately extensive reading as a form of input on a meaning basis. In a meta-analysis of 34 empirical studies involving 3,942 learners, Nakanishi [27] examined the effects of extensive reading programs on second language development. The effect was moderate when comparing the experimental and control groups ($d = 0.46$), but it was stronger from pre test to post test ($d = 0.71$). These findings would indicate that language acquisition can be improved dramatically just because of exposure to comprehensible information on an extensive level. Interestingly, in such studies learning environments

involved more by way of textual understanding than explicit grammar coaching, which suggests that the progress in linguistic knowledge became secondary with the sustained use of meaningful input.

This direct facilitative position is further expressed particularly through the learning of vocabulary and high-frequency constructions in the classroom. Given an input-rich environment, such as using graded readers or listening materials, learners were more likely to hear the same forms of a language in a variety of contexts [28]. Thus, linguistic varieties are consolidated due to frequency and exposure to context even without being taught. These kinds of patterns indicate that not only does comprehensible input aid the comprehension process, but also that comprehensible input promotes or at least leads to the stability of the linguistic forms in a second language.

4.2.2 The Key Guiding Role of Interactive Input in L2 Meaning Construction and Adjustment

Unlike comprehensible input which is the point of entrance into the language learning process, interactive input has a direct didactic role in the process of acquiring second language which consists of constructing and manipulating meaning. Interaction differs from simple exposure in that it actively shapes learners' attention, directing it toward mismatches between intended meaning and linguistic expression. Interaction assists learners to perfect their interpretations and revise their suppositions about the manner in which meaning is coded in the target language [29].

The empirical evidence on this dominant role is high as it is supported by research on meaning negotiation and interaction. In a massive meta-analysis review, Mackey and Goo [13] combined the findings of 27 experimental studies (that were carried out on interactional effects in SLA). The review indicated moderate-to-strong overall effects of the interactional input in grammatical development in learners, where conclusions were mostly positive when the researchers took into account the possibility of negotiation process and feedback given to the learners. In a range of classrooms and learner groups, interaction tends to make a clear difference: learners doing interactive tasks usually outperform peers who only work with pre modified input. One likely reason is that interaction pushes learners to tie what they mean to how they express it.

This guiding role is common in task-based interaction in the instructional context such as in information-gap tasks, collaborative problem solving activities as well as inquiry between the teacher and the student. When faced with communication challenges, learners are motivated to ask questions, verify in order to gain a clear understanding or paraphrase learning. Such interactional actions do not only help in uptaking the inputs, they also tend to actively lead the focus of the learners towards the pertinent linguistic variations. Such an explicitly focused attention, in the long term, assists in sharpening the representations of meaning and allowing more accurate applications of linguistic expressions, especially in those cases, where meaning is contingent upon grammatical encoding.

4.2.3 The Triggering Role of Output and Feedback in the Restructuring of L2 Interlanguage

The interlanguage system of a second language is strongly triggered by output and feedback. In comparison with input, which mostly provides linguistic evidence, output enables learners to encode meaning on their own based on existing linguistic resources [30]. This process usually reveals gaps or discrepancies in learners' interlanguage, thereby creating contexts where feedback can allow for the reorganization and refinement of linguistic knowledge [31].

There is empirical evidence for corrective feedback that substantiates this triggering effect. In a review of 15 classroom studies involving 827 learners, Lyster and Saito [32] assessed the impact of oral corrective feedback on second language development. Their comparison showed that corrective feedback elicited strong learning effects, with its delayed effects also being robust. It is noteworthy that feedback types requiring learners to make self-repairs—including prompts and elicitation—were found to have larger effects compared to feedback that simply provided the correct form. This tendency implies that output combined with feedback induces more cognitive processes and achieves lasting modifications in interlanguage representations.

This triggering mechanism is typical of classroom practices in speaking and writing activities, which involve feedback and subsequent revision [33]. When students attempt to convey meaning and receive feedback pointing out linguistic inaccuracies or imprecision, they are prompted to re-evaluate their linguistic hypotheses and revise their output. These re-encodings can frequently lead to restructuring rather than surface-

level correction, particularly in situations where learning requires the learner to generate a revised form. Output and feedback, accordingly, are not merely supportive but critical events and stimuli that drive interlanguage development at specific stages in the learning process.

4.3 Explanatory Advantages of Acquired Environmental Factors under the Established Comparative Criteria

4.3.1 Greater Explanatory Coverage

If we look at explanatory coverage, environmental factors simply explain more of the outcomes we see in second language learning than innate based accounts do. This advantage can be illustrated by a quantitative study by Goldschneider and DeKeyser [24] on the acquisition sequence of English grammatical morphemes.

Goldschneider and DeKeyser re-examined the outcomes of several studies featuring multiple morpheme orders and tested different predictors of acquisition order. They reported that input-related variables such as frequency, perceptual salience, semantic complexity, and regularity explained approximately 60 percent of the variance in morpheme acquisition order. In comparison, predictors based on inherent grammatical complexity explained only a small percentage of observed patterns, and could not account for both the consistent optionality and slow acquisition of particular morphemes. Once evaluated by the same explanatory criterion, acquired environmental factors thus have strikingly wider coverage than innate factors. Innate constraints may well set the outer limits of what counts as grammatical, yet that boundary alone rarely tells us why development unfolds the way it does. In studies that track learners over time—whether in classrooms, in tutoring settings, or in longitudinal corpora—some forms become stable quickly, while others remain optional for months (and sometimes years), even when the underlying rule is not controversial. The timing of emergence, the reliability of use, and the degree of variation across learners are precisely where an “innateness only” account tends to lose explanatory traction, because it has little to say about differences in exposure, perceptual salience, attention, or the kind of feedback learners receive. Environmental factors, by contrast, allow these influences to be modeled together: frequency and distribution in input, opportunities for interaction, corrective feedback, and task demands can jointly explain why one feature consolidates early while another lags, and why two learners following the same syllabus still diverge.

4.3.2 Stronger Empirical Consistency

In terms of empirical consistency, acquired environmental factors provide better and more stable empirical support across studies than innate-factor explanations. This advantage is supported by the meta-analysis by Spada and Tomita [14] of form-focused training in second language learning.

Spada and Tomita examined 41 experimental and quasi-experimental studies that varied instructional input circumstances and measured learning results using comparable methods. Their meta-analysis found a mean impact size of around 0.70 for the acquisition of rule-governed grammatical structures, with positive effects consistently detected across learner demographics, instructional environments, and research types. Importantly, the magnitude and direction of these effects were consistent regardless of whether the instruction was explicit or implicit.

Evidence commonly invoked for innate factors, such as age effects or language aptitude, also shows weaker convergence across studies. Reported relationships often change with the task and the measurement: results from grammaticality judgment tests do not always align with patterns in spontaneous production, and effect sizes can vary with scoring decisions and sampling. On the criterion of empirical consistency, environmental explanations are therefore better supported by findings that tend to be more stable and replicable than accounts centered on innate factors.

4.3.3 Higher Pedagogical Intervenability

From the standpoint of pedagogical intervenability, environmental factors have a clear edge over innate ones because teachers can change them through instructional design. The large-scale synthesis by Hattie [18] offers a useful illustration.

Drawing on evidence from more than 800 meta-analyses, Hattie compared the influence of different variables on learning outcomes. He reported that instructional levers tied to environmental manipulation, especially feedback, showed strong effects, with an average effect size around 0.70. This comfortably exceeded

his benchmark for educational significance (0.40). These effects appeared across subject areas and learner populations, suggesting that classroom conditions can be adjusted to produce reliable learning gains.

By contrast, learner-internal characteristics often linked to innate factors, such as relatively stable cognitive traits, are not directly alterable through instruction and typically affect learning only indirectly.

On this criterion, innate factors function more as boundary conditions than as variables teachers can actively work on. Environmental factors therefore show higher pedagogical intervenability and are more practically useful for instructional explanation and decision making.

As shown in Table 8, acquired environmental factors show stronger explanatory coverage, empirical consistency, and pedagogical intervenability than innate factors under the established criteria.

Table 8: Comparative Advantages of Acquired Environmental Factors under the Established Criteria

Comparative Criterion	Empirical Basis	Performance of Innate Factors	Performance of Acquired Environmental Factors
Explanatory Coverage	Goldschneider & DeKeyser [24]	Explain limited variance; cannot account for timing and optionality	Explain ~60% of variance in acquisition order across forms
Empirical Consistency	Spada & Tomita [14]	Effects vary across tasks and studies	Stable mean effect size (~0.70) across 41 studies
Pedagogical Intervenability	Hattie [18]	Not directly modifiable through instruction	Directly manipulable; instructional effects > 0.40

Source: Author's compilation based on [14, 18, 24].

5. Conclusion

This study compared innate and acquired factors in second language acquisition through an environmental-input lens, using three shared criteria—explanatory coverage, empirical consistency, and pedagogical intervenability. Overall, the evidence synthesized across the selected cases and meta-analytic findings indicates that acquired environmental factors (comprehensible input, interactive input, and output with feedback) provide broader and more operational explanations of observed learning patterns than innateness-based accounts: they explain substantial variance in developmental sequences (e.g., morpheme acquisition order), show stable effects across studies (e.g., form-focused instruction with moderate-to-strong effect sizes), and—most importantly—are directly manipulable in instructional settings. By contrast, innate factors (e.g., UG-related constraints and aptitude) are best characterized as background conditions that delimit possibilities and modulate responsiveness to input, with their observable influence emerging most clearly under particular input/interaction/feedback configurations rather than operating as stand-alone determinants.

References

- [1] Krashen, S. D. The input hypothesis: Issues and implications. Longman; 1985.
- [2] British Council. The Future of English Report 2023. Available from: <https://www.britishcouncil.org/english/future-of-english> (accessed 7 June 2026).
- [3] Long, M. H. The role of the linguistic environment in second language acquisition. In Handbook of Second Language Acquisition, Ritchie, W. C., Bhatia, T. K., Eds. Academic Press; 1996, pp. 413-468. <https://doi.org/10.1016/b978-012589042-7/50015-3>
- [4] Ellis, N. C. Selective attention and transfer phenomena in SLA: Contingency, cue competition, salience, interference, overshadowing, blocking, and perceptual learning. Applied Linguistics. 2006, 27(2), 164-194. <https://doi.org/10.1093/applin/aml015>
- [5] Chomsky, N. Aspects of the theory of syntax. MIT Press; 1965.
- [6] Pinker, S. The language instinct. HarperCollins; 1994.
- [7] Ellis, R. The study of second language acquisition. 2nd ed. Oxford University Press; 2008.

- [8] Gass, S. M., Mackey, A. Input, interaction, and output in second language acquisition. In *Theories in Second Language Acquisition: An Introduction*, VanPatten, B., Williams, J., Eds. Lawrence Erlbaum Associates; 2007, pp. 175-199.
- [9] Ortega, L. SLA in uncertain times: Disciplinary constraints, transdisciplinary hopes. *Working Papers in Educational Linguistics*. 2018, 33(1), 1-30.
- [10] Tomasello, M. *Constructing a language: A usage-based theory of language acquisition*. Harvard University Press; 2003. <https://doi.org/10.2307/j.ctv26070v8>
- [11] Ellis, N. C. Usage-based and form-focused language acquisition: The associative learning of constructions, learned attention, and the limited L2 endstate. In *Handbook of Cognitive Linguistics and Second Language Acquisition*, Robinson, P., Ellis, N. C., Eds. Routledge; 2008, pp. 372-405.
- [12] Larsen-Freeman, D., Cameron, L. *Complex systems and second language development*. Oxford University Press; 2008.
- [13] Mackey, A., Goo, J. Interaction research in SLA: A meta-analysis and research synthesis. In *Conversational Interaction in Second Language Acquisition: A Series of Empirical Studies*, Mackey, A., Ed. Oxford University Press; 2007, pp. 407-453.
- [14] Spada, N., Tomita, Y. Interactions between type of instruction and type of language feature: A meta-analysis. *Language Learning*. 2010, 60(2), 263-308. <https://doi.org/10.1111/j.1467-9922.2010.00562.x>
- [15] Plonsky, L., Oswald, F. L. How big is "big"? Interpreting effect sizes in L2 research. *Language Learning*. 2014, 64(4), 878-912. <https://doi.org/10.1111/lang.12079>
- [16] Ellis, R. *Instructed second language acquisition: A literature review*. Auckland Uniservices Limited for the New Zealand Ministry of Education; 2005. ISBN 0-478-13285-9.
- [17] Lightbown, P. M., Spada, N. *How languages are learned*. 4th ed. Oxford University Press; 2013.
- [18] Hattie, J. *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. Routledge; 2009.
- [19] White, L. *Second language acquisition and universal grammar*. Cambridge University Press; 2003.
- [20] VanPatten, B., Cadierno, T. Input processing and second language acquisition: A role for instruction. *The Modern Language Journal*. 1993, 77(1), 45-57. <https://doi.org/10.1111/j.1540-4781.1993.tb01944.x>
- [21] Xu, J. F., Yang, L. Transdisciplinarity of Second Language Acquisition and Its Implications for Foreign Language Teaching in China. *Journal of Shanghai Jiao Tong University (Philosophy and Social Sciences)*. 2021, 29(3), 137-144. <https://doi.org/10.13806/j.cnki.issn1008-7095.2021.03.014> (in Chinese)
- [22] DeKeyser, R. M. The robustness of critical period effects in second language acquisition. *Studies in Second Language Acquisition*. 2000, 22(4), 499-533. <https://doi.org/10.1017/S0272263100004022>
- [23] Wang, T. T. Clarifying second language acquisition theories and looking ahead to research on key issues: A review of Key Issues in Second Language Acquisition. *Journal of Shanxi University of Finance and Economics*. 2021, 43(1), 132. (in Chinese)
- [24] Goldschneider, J. M., DeKeyser, R. M. Explaining the natural order of L2 morpheme acquisition in English: A meta-analysis of multiple determinants. *Language Learning*. 2001, 51(1), 1-50. <https://doi.org/10.1111/1467-9922.00147>
- [25] Johnson, J. S., Newport, E. L. Critical period effects in second language learning: The influence of maturational state on the acquisition of English as a second language. *Cognitive Psychology*. 1989, 21(1), 60-99. [https://doi.org/10.1016/0010-0285\(89\)90003-0](https://doi.org/10.1016/0010-0285(89)90003-0)
- [26] Sun, L. P. A review of Second Language Acquisition from the Perspectives of Neurolinguistics and Psycholinguistics. *Jiangxi Social Sciences*. 2018, (8), 30-36. (in Chinese)
- [27] Nakanishi, T. A meta-analysis of extensive reading research. *TESOL Quarterly*. 2015, 49(1), 6-37. <https://doi.org/10.1002/tesq.157>

- [28] Li, H. Q. Foreign language teaching and second language acquisition: A review of Second Language Acquisition and Foreign Language Teaching. Higher Education Development and Evaluation. 2018, (3), 122. (in Chinese)
- [29] Aihemaitijiang T., Yasen N. A study on the characteristics of language input and cognitive language intuition in second language acquisition: A review of Second Language Acquisition and Learner's Dictionary Research. Language Planning. 2017, (30), 81. <https://doi.org/10.16412/j.cnki.1001-8476.2017.30.041> (in Chinese)
- [30] Swain, M. Communicative competence: Some roles of comprehensible input and comprehensible output in its development. In Input in Second Language Acquisition, Gass, S., Madden, C., Eds. Newbury House: Rowley, MA; 1985, pp. 235-253.
- [31] Wang, L. Interface research on second language acquisition and language teaching: A review of Explorations in Language Teaching from the Perspective of Second Language Acquisition. Research in Educational Development. 2017, 37(Z2), 128. <https://doi.org/10.14121/j.cnki.1008-3855.2017.z2.024> (in Chinese)
- [32] Lyster, R., Saito, K. Oral feedback in classroom SLA: A meta-analysis. Studies in Second Language Acquisition. 2010, 32(2), 265-302. <https://doi.org/10.1017/S0272263109990520>
- [33] Gao, H. A Construction Grammar Perspective on the Relevance of Chunks to Second Language Acquisition. Journal of PLA University of Foreign Languages. 2017, (2), 86-94. (in Chinese)

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