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Research Article

Research on the Acquisition Sequence of the Multifunctional Word “ Lai ” Among Foreign Students

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Abstract

The multifunctional word “ *Lai* ” (来) [come] possesses complex semantic and part-of-speech diversity, presenting significant comprehension difficulties and resulting in frequent errors among foreign students. This study employs a combined methodology integrating single-criterion and multi-criteria standards. First, two acquisition sequences were established using a direct sorting method based on the relative frequency of correct usage and the output rate of “*Lai*.” Second, the third acquisition sequence was generated by using implicational scaling. Following this, correlation tests were conducted on these three sequences, followed by a pairwise combination approach to generate three additional sequences. Finally, a comprehensive scoring method was applied to determine the most statistically valid acquisition sequence for learners of Chinese, which is: *Lai* $_1$ > *Lai* $_4$ > *Lai* $_2$ > *Lai* $_3$ > *Lai* $_8$ > *Lai* $_7$ > *Lai* $_6$ > *Lai* $_5$. Among these, *Lai* $_1$, *Lai* $_4$, and *Lai* $_2$ are identified as the most easily acquired senses; *Lai* $_3$ and *Lai* $_8$ are moderately accessible; and *Lai* $_7$, *Lai* $_6$, and *Lai* $_5$ represent the most difficult senses to acquire. By analyzing the semantic acquisition of the multifunctional word “ *Lai* ” through the HSK Interlanguage Corpus, this study establishes a definitive acquisition order to facilitate Chinese language pedagogy and minimize learner errors.

Keywords

Multifunctional Words, LAI (来), Acquisition Sequence, Second Language Teaching

1. Introduction

A “ multifunctional word ” refers to a lexical item possessing two or more semantic and grammatical functions, in contrast to single-function words. An investigation of the HSK Interlanguage Corpus reveals that learners of Chinese frequently exhibit errors regarding the multifunctional word “ *Lai* ” including redundancy, misselection, omission, word order errors, and pragmatic failures. Examples of such errors include:

(1) **Na nage zai Zhongguo fasheng de shijian laishuo, wo renwei nawei xiansheng zhen kelian, weile ta qin'ai de qizi lai jueding bangzhu ta zisha, fan'er shoudaole falv de zhicai.* (拿那个在中国发生的事件来说，我认为那位先生真可怜，为了他亲爱的妻子来决定帮助她自杀，反而受到了法律的制裁。) [Take that incident in China as an example; I think that gentleman was truly pitiful. Out of love for his wife, he decided to assist in her suicide, yet he ended up being sanctioned by the law.]

(2) **Naci lvyou shi wo di-yi ci lai Zhongguo, suoyi nashihou wo shuo Hanyu hai shuo de jiejiebaba, zhi hui shuo jiandan de wenhouyu.* (那次旅游是我第一次来中国，所以那时候我说汉语还说得结结巴巴，只会说简单的问候语。)

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[That trip was my first time coming to China, so at that time my spoken Chinese was still very halting and I could only say simple greetings.]

(3) **Xue zhe pian wenzhang shi you xiangqilaile ninmen. Ta de nainai qushi shi, fuqin dui ta shuo "Tian wu jue ren zhi lu".* (学这篇文章时又想起来了您们。他的奶奶去世时，父亲对他说"天无绝人之路"。这样安慰自己的儿子。) [Studying this article reminded me of you all again. When his grandmother passed away, his father comforted him by saying, " Heaven never bars one's way."]

(4) **Women yinggai ziji maidaole lvse shipin hou xian xi ganjing ta cai chi, buyao luandiu lvse shipin lai wuran huanjing.* (我们应该自己买到了绿色食品后先洗干净它才吃，不要乱丢绿色食品来污染环境。) [We should wash the green food clean after buying it before eating, and should not litter green food to pollute the environment.]

(5) **Zhongguo liuxue zhe jian shi, dui wo laishuo, zai wo de rensheng zhong, zhanzhe hen zhongyao de weizhi.* (中国留学这件事，对我来说，在我的人生中，占着很重要的位置。) [Studying abroad in China holds a very important place in my life.]

(6) **You yi tian wanshang, shi Zhongqiuyue de shihou, cong yuanfang piao zhenzhen huaxiang, wo tang zai chuangshang zhunbei rumian, ta shuo: "Qianwan yao jizhu Jiuzaikai zhe yi tuanti mingzi!".* (有一天晚上，是中秋月的时候，从远方飘阵阵花香，我躺在床上准备入眠，她说："千万要记住救灾会这一团体名字！"。) [One night, during the Mid-Autumn Festival, bursts of floral fragrance drifted over from afar. As I lay in bed preparing to sleep, she said: "You must remember the name of this disaster relief organization! "]

(7) **Women de shenghuo fangshi, women sidiao de shijian didian yu fangshi zuihao shi lai women jueding.* (我们的生活方式、我们死掉的时间地点与方式最好是来我们决定。) [Our lifestyle, as well as the time, place, and manner of our death, had best be decided by ourselves.]

(8) **Wo yiqian zai Balidao gongzuoguo san ge yue lai.* (我以前在巴厘岛工作过三个月来。) [I once worked in Bali for three months.]

(9) **Buguo, daole women lvyou de zuihou yi tian, women zuida de yuanwang hai meiyou shixian, jiushi kan xiaxue, zhengzai shiwang de shihou, xiaxue zhongyu lai le!* (不过，到了我们旅游的最后一天，我们最大的愿望还没有实现，就是看下雪，正在失望的时候，下雪终于来了！) [However, by the last day of our trip, our biggest wish—to see snow—had not yet come true. Just as we were feeling disappointed, the snow finally came!]

(10) **Suiran nin shengqi, dui wo que meiyou biaoshi... Toufa ye bianchengle baise, shengyin ye xiao qilaile.* (虽然您生气，对我却没有表示。爸爸，以前您看这样的我，您非常生气，我很怕您，可是现在的爸爸呢，依我看好像衰弱多了。头发也变成了白色，声音也小起来了。) [Although you were angry, you didn't show it. Dad, in the past, seeing me like this would make you furious, and I was terrified of you. But now, Dad, you seem much frailer. Your hair has turned white, and your voice has grown faint.]

Although "*Lai* " appears with high frequency in both spoken and written Modern Chinese, its complex classification and abstract usage pose significant challenges for international students. Current research (Cao, 1995; Ding, 1961; Fan, 1963; Hu, 1959; Lü, 1942, 1980; Wang, 1957; Zhang, 1953) [1-7] on "*Lai* " predominantly focuses on ontological studies of specific parts of speech. And research (Chen, 2011; Chi, 2014; Ying & Wang, 2014; Zhang, 2021) [8-11] on " *Lai* " focuses on its syntactic functions. Regarding Second Language Acquisition (SLA) research of "*Lai* ", studies have largely focused on error analysis and acquisition orders of single grammatical functions through a contrastive lens. For instance, studies (Ma & Peng, 2022; Su, 2013; Ye, 2022) [12-14] have investigated the natural acquisition order of the compound directional complement "V+X *Lai* (来) "among Korean learners, as well as errors in the "X+NP+*Lai shuo*（来说）"construction from the perspectives of syntax, semantics and pragmatics. While there is a substantial body of studies on error, acquisition and nationality-based classification, studies addressing the acquisition sequence and the errors generated from internal semantic variations of "*Lai* " from the perspective of multifunctional word remain scarce.

Existing methods for determining acquisition sequences primarily utilize direct sorting and implicational scaling. The former sorts items based on numerical values, assuming that items with higher rankings are acquired earlier; however, this method often overlooks individual differences across proficiency levels. This study adopts a methodology combining single and composite criteria: initially employing direct sorting based on output frequency and relative correct usage frequency of "*Lai* " to derive two sequences; subsequently employing implicational scaling for a third sequence; conducting correlation tests among the three; combining them pairwise to generate three additional sequences; and finally, applying a comprehensive scoring system to determine an acquisition sequence best suited for learners of Chinese.

2. Semantic Classification of the Multifunctional Word "Lai"

Both the *Xiandai hanyu cidian (7th Edition)* [Modern Chinese dictionary] [15] and *Xiandai hanyu babai ci* [800 Words of Modern Chinese] (hereafter *800 Words*) classify "*Lai* " into three parts of speech: verb, particle, and noun. 800 Words identifies 9 verbal senses and 2 particle senses. Compared to the *Modern Chinese Dictionary*, *800 Words* further categorizes the verb "*Lai* " denoting rapport/ability (or lack thereof) as a directional verb and provides detailed descriptions of fixed structures like "越来越" [more and more] and "动来动去" [moving around]. The two dictionaries differ in their syntactic description of "*Lai* " when indicating the intent to perform an action: *800 Words* notes that it appears before a verb,

whereas the *Modern Chinese Dictionary* imposes no such positional restriction. *800 Words* also includes pragmatic descriptions of "*Lai* " as an approximate number indicator and a sentence-final particle, serving as a supplement to the *Modern Chinese Dictionary*.

This study primarily adopts the definitions from the *Modern Chinese Dictionary*, supplemented by *800 Words*. Based on an investigation of high-frequency usage in the HSK Interlanguage Corpus, "*Lai* " is categorized into verbs, nouns (locative), and particles, with a total of 8 distinct semantic items (senses), as shown in Table 1.

Table 1. *Semantic Classification of "Lai" by Part of Speech.*

Part of Speech	Sense	Word meaning	Example Sentence
Verb	*Lai* 1	Directional meaning	Tamen *lai* xianggang le. They have come to Hong Kong.
	Lai 2	Indicating intention to do something	Ni qu dashui, wo *lai* shoushi wuzi. You go and fetch some water, and I'll tidy up the house.
	Lai 3	Replacing a more specific verb	Changde tai haole, zai *lai* yige. You sang so well. Let's do it again.
	Lai 4	Used between two verbs/verbal phrases; the former is method/direction/attitude, the latter is purpose	Ta huijia tanqin *lai*le. He came home to visit his relatives.
	Lai 5	(Events, problems, etc.) occur; arrive	Renwu *lai*le, yao nuli wancheng. The task has come. Let's work hard to complete it.
Locative Noun	*Lai* 6	From the past to the present	Sishi nian *lai*, tamen doushi zheyang zuozai fushouyi shang. For the past forty years, they have been sitting in the armchairs in this way.
Particle	*Lai* 7	Modal particle	Wode shouji nali qule *lai*zhe. Where did my phone go again?
	Lai 8	Approximate numeral	Duo ye bu suan duo, zhiduo ye buguo shi*lai*ge. It's not a lot, but at most there are no more than ten or so.

Through retrieval from the HSK Interlanguage Corpus, it was found that "*Lai"* indicating "ability/inability or possibility/impossibility" appeared only 15 times, and "*Lai"* indicating enumeration appeared sporadically. Due to these extremely low output probabilities, they are excluded from this study. When "*Lai* " functions as a compound directional verb, it often generates extended meanings via metaphorical mechanisms. For example, in the phrase "attributes displayed in cognitive processes," the directional meaning is not fully grammaticalized. Following Chen 's classification of metaphor types (2018) [16], this is analyzed as an entity metaphor—viewing the human body as a container from which abstract concepts like interest and ability "come out." In this paper, such extended meanings are consistently categorized under *Lai* 1. However, instances where the directional meaning is fully grammaticalized, such as "*qilai* (起来)" in " *kanqilai* (看起来)" (indicating evaluation), are excluded from the scope of this study.

The primary object of this study is "*Lai* " appearing as a monomorphemic word within a sentence (e.g., *"Jintian laile haoduo keren."* "今天来了好多客人。" [Many guests came today.] where it functions as *Lai* 5， indicating the arrival of guests). Compound words and fixed structures containing "*Lai* " are excluded and categorized as "Other" in the statistical data.

In summary, the acquisition sequence examined in this paper includes the extended meanings of the not-fully-grammaticalized directional verb *Lai* 1 and the simple word "*Lai*." It excludes the fully grammaticalized evaluative "*Lai*," fixed structures, potential meanings, and enumerative meanings.

3. Output Analysis of Semantic Items of "Lai"

Using the HSK Interlanguage Corpus, we examined the output and accuracy of each semantic item of "*Lai*." The keyword retrieval yielded 6,529 entries, with "*Lai* " appearing a total of 8,331 times across different sentences. The output distribution is presented in Table 2.

Table 2. *Output Rates of Semantic Items of "Lai".*

Sense	Output Count	Output Rate (%)
Lai 1	3,275	39.38%
Lai 2	1,456	17.51%
Lai 3	93	1.12%
Lai 4	1,342	16.14%
Lai 5	41	0.50%
Lai 6	42	0.50%
Lai 7	88	1.10%
Lai 8	79	0.90%
Other	1,900	23.75%
Total	8,316	100.00%

Note. Output Rate = Output count of each sense / Total occurrences of *"Lai ".*

Table 2 illustrates the usage of "*Lai* " by international students directly. The "Other" category refers to compound words, fixed collocations, and meanings not listed in this study. For instance, the enumerative "*Lai* " (e.g., *"Yilai nashi wo waipo juzhu de difang, erlai women dou meiyou dao jianada youlan guo."* "一来那是我外婆居住的地方，二来我们都没有到加拿大游览过" [Firstly, it is where my grandma lives; secondly, we have not been to Canada.]) appeared only 19 times, and the potential/ability meaning appeared only 13 times; thus, they were not statistically analyzed.

Data from Table 2 indicate:

1) *Lai* 1 (directional meaning) has the highest frequency (39.38%), followed by *Lai* 2 (intention, 17.51%) and *Lai* 4 (purpose, 16.14%).
2) *Lai* 6 and *Lai* 5 have the lowest usage (0.50%)， at 42 and 41 occurrences respectively. The remaining items rank as *Lai* 3, *Lai* 7, and *Lai* 8.
3) Learners most frequently use "Lai "for directional, occurrence, and purposive meanings, while rarely using it for temporal or specific occurrence meanings.

While corpus-based studies of the "*Lai* " in the HSK Interlanguage Corpus can describe its usage in interlanguage, they cannot definitively ascertain whether international students exhibit systematic overgeneralization or avoidance of this item.

To better understand learner performance across proficiency levels, the HSK corpus data were divided into Beginner (A), Intermediate (B), and Advanced (C) levels and compared with native speaker data from the CCL Corpus (Center for Chinese Linguistics Corpus). After removing entries without proficiency certification, the total valid occurrences were 4,615 (Beginner: 3116; Intermediate: 1280; Advanced: 219). A sample of 8,331 entries from the CCL corpus served as the native speaker baseline. For the purpose of comparative analysis, the sample was determined based on the frequency of "*Lai* " in the HSK Interlanguage Corpus, with the first 8,331 tokens retrieved from the CCL designated as the reference dataset.

3.1. Comparison of "Lai" Output: Beginner Learners vs. Native Speakers

Based on a comparison between the HSK Interlanguage Corpus and CCL corpus, Table 3 illustrates the usage distribution of "*Lai* " senses among beginner learners and native speakers.

Table 3. *Distribution Comparison of"Lai"Senses: Beginner Learners vs. Native Speakers.*

Sense	L2 Frequency	L2 Percentage (%)	L1 Frequency	L1 Percentage (%)
Lai 1	1,175	37.70	4,939	59.28
Lai 2	535	17.17	474	5.70
Lai 3	28	0.90	189	2.20
Lai 4	551	17.68	434	5.20
Lai 5	16	0.50	53	0.60
Lai 6	15	0.50	1,731	20.78
Lai 7	42	1.30	43	0.50

Sense	L2 Frequency	L2 Percentage (%)	L1 Frequency	L1 Percentage (%)
Lai 8	26	0.80	19	0.20
Other	728	23.45	469	5.55
Total	3,116	100.00	8,331	100.00

Note. L2 = Beginner-level L2 learners from the HSK Interlanguage Corpus; L1 = Native speakers from the CCL Corpus. Frequency refers to the raw count of occurrences. Percentage indicates the distribution of each sense within the respective group.

Data from Table 3 indicate:

1) Lai 1 is the dominant output for both groups. Abundant comprehensible input is crucial for language acquisition, occurring in both instructional and naturalistic settings. The high output frequency of Lai 1 among native speakers indirectly suggests that learners receive significant input for this sense outside the classroom. Consequently, the output rate of "Lai 1" among L2 learners is markedly higher than that of other senses. For native speakers, following the high-frequency items Lai 1 and Lai 6, the sequence proceeds with "Lai 2, Lai 4, and Lai 3." A similar distributional pattern is observed in learner output, further evidencing the strong influence of extramural input.
2) Among native speakers, Lai 2 and Lai 4 rank third and fourth in output frequency respectively, and are commonly used in daily communication. While both groups show relatively high usage of these senses compared to others, the output rate among L2 learners is more than three times that of native speakers. Liu (2000) [17] posits that learners often inappropriately apply limited or incomplete knowledge to new linguistic items. Consequently, the significantly higher output rate among learners can be attributed to the overuse of Lai 2 and Lai 4 resulting from such overgeneralization.
3) Native speakers use Lai 3 and Lai 6 far more frequently than learners. These senses appear in Developing Chinese (Elementary Comprehensive I, Lesson 20; Elementary Comprehensive II, Lesson 24) but are taught as fixed collocations rather than distinct semantic items. Although the grammar is simple, the lack of explicit explanation makes the usage opaque to learners. As a result, learners often employ avoidance strategies, eschewing grammatical items they lack confidence in.

3.2. Comparison of "Lai" Output: Intermediate L2 Learners vs. Native Speakers

Based on a comparison between the HSK Interlanguage Corpus and CCL corpus, Table 4 illustrates the usage distribution of "*Lai* " senses among intermediate learners and native speakers.

Table 4. *Distribution Comparison of "Lai" Senses: Intermediate Learners vs. Native Speakers.*

Sense	L2 Frequency	L2 Percentage (%)	L1 Frequency	L1 Percentage (%)
Lai 1	413	32.27	4,939	59.28
Lai 2	223	17.42	474	5.70
Lai 3	22	1.70	189	2.20
Lai 4	242	18.90	434	5.20
Lai 5	6	0.50	53	0.60
Lai 6	5	0.40	1,731	20.78
Lai 7	13	1.00	43	0.50
Lai 8	21	1.60	19	0.20
Other	332	26.21	469	5.55
Total	1,280	100.00	8,331	100.00

Note. L2 = Intermediate-level L2 learners from the HSK Interlanguage Corpus; L1 = Native speakers from the CCL Corpus. Frequency refers to the raw count of occurrences. Percentage indicates the distribution of each sense within the respective group.

Data from Table 4 indicate:

Relative to beginners, intermediate learners show significantly higher output for "*Lai* $_3$, *Lai* $_4$, and *Lai* $_8$" and lower output for *Lai* $_1$, which nevertheless remains the top item. This trend supports Karl (1983) "Natural Order Hypothesis," illustrating a progression from basic to complex structures. Although all are early-introduced items, "*Lai* $_3$, *Lai* $_4$, and *Lai* $_8$" impose stricter syntactic constraints on arguments (e.g., subjects and objects) compared to *Lai* $_1$. Therefore, their use increases with proficiency. Meanwhile, *Lai* $_1$, having been mastered early, sees a reduction in output rate driven by diminishing instructional input and a shift in learner attention.

Consistent with the pattern observed at the beginner level, intermediate learners exhibit significantly higher output rates for *"Lai* $_2$, *Lai* $_4$, and *Lai* $_8$" compared to native speakers, whereas their usage of *Lai* $_1$ and *Lai* $_6$ remains substantially lower. These discrepancies suggest that phenomena of overgeneralization and avoidance persist in learner interlanguage.

The proportion of the "Other" category shows an increase compared to the beginner stage. Intermediate learners primarily encounter "*Lai* " in the form of fixed collocations and compound words. Taking *Developing Chinese: Intermediate Comprehensive Course* as an example, the textbooks frequently feature fixed patterns such as " *(jiu) na... laishuo (ba)* （就）拿...来说（吧）[taking... as an example] ", " *cong...laikan* 从...来看[from the perspective of...] ", and " *zai...kanlai* 在... 看来 [in the view of...]. Since these fixed forms are excluded from the analysis of specific senses in this study, the output rate of "Other" category consequently rises.

3.3. Comparison of "Lai" Output: Advanced L2 Learners vs. Native Speakers

Based on a comparison between the HSK Interlanguage Corpus and CCL corpus, Table 5 illustrates the usage distribution of "*Lai* " senses among advanced learners and native speakers.

Table 5. *Distribution Comparison of "Lai" Senses: Advanced Learners vs. Native Speakers.*

Sense	L2 Frequency	L2 Percentage (%)	L1 Frequency	L1 Percentage (%)
Lai $_1$	71	32.42	4,939	59.28
Lai $_2$	44	20.09	474	5.70
Lai $_3$	2	0.90	189	2.20
Lai $_4$	36	16.44	434	5.20
Lai $_5$	3	1.37	53	0.60
Lai $_6$	0	0.00	1,731	20.78
Lai $_7$	0	0.00	43	0.50
Lai $_8$	5	2.30	19	0.20
Other	98	26.48	469	5.55
Total	219	100.00	8,331	100.00

Note. L2 = Advanced-level L2 learners from the HSK Interlanguage Corpus; L1 = Native speakers from the CCL Corpus. Frequency refers to the raw count of occurrences. Percentage indicates the distribution of each sense within the respective group. "0" indicates no occurrences were found in the corpus.

Data from Table 5 indicate:

1) Across all proficiency levels and native speakers, *Lai* $_1$ is the most frequently produced sense, yet native speaker output far exceeds that of learners. As the primary directional sense, *Lai* $_1$ is acquired and activated first, leading to its high usage among learners. Nevertheless, according to the "Interface Hypothesis" proposed by Sorace and Filiaci (2006) [18], it is challenging for learners to attain native-like competence at external interfaces (e.g., the syntax-pragmatics interface). The extended meanings of *Lai* $_1$ involve pragmatic nuances such as register distinctions. Consequently, learners' struggle with these interface properties results in a lower output rate compared to native speakers.
2) Relative to the intermediate stage, advanced learners exhibit a decline in the output rates of "*Lai* $_3$, *Lai* $_4$, and *Lai* $_7$," while showing an increase in "*Lai* $_2$, *Lai* $_5$, and *Lai* $_8$." Notably, the usage frequency of "*Lai* $_2$, *Lai* $_5$, and *Lai* $_8$" among advanced learners more closely approximates native speaker norms, whereas other senses show minimal fluctuation. For advanced learners, the expansion of their vocabulary allows for the use of synonyms to replace the

functions of "*Lai*." For instance, *Lai* 4 (indicating purpose) can be substituted by terms such as " *weile* (为了) [in order to], *yi* (以) [to], *yibian* (以便) [so that]."Conversely, *Lai* 7, which serves as a modal particle, is syntactically optional and often omitted, contributing to its reduced output rate.

4. Investigation of the Acquisition of the Senses of the Multifunctional Word "Lai"

To investigate the acquisition sequence of the various senses of "*Lai*," this study adopts a comprehensive approach combining three methods: output rate ranking, relative frequency of correct usage ranking, and implicational scaling. These analyses are based on statistics derived from the HSK corpus, specifically focusing on output rates, accuracy, and the relative frequency of correct usage.

4.1. Acquisition Sequence Based on the Output Rate of the Senses of "Lai"

Table 6. *Output Rates of the Different Senses of "Lai".*

Sense	Frequency	Percentage (%)
Lai 1	3,275	51.04
Lai 2	1,456	22.69
Lai 3	93	1.45
Lai 4	1,342	20.91
Lai 5	41	0.60
Lai 6	42	0.65
Lai 7	88	1.37
Lai 8	79	1.34
Total	6,416	100.00

Note. Data is derived from the HSK Interlanguage Corpus. Frequency refers to the raw count of each sense. Percentage is calculated based on the total output frequency (N=6,416).

Swain (1995), Stephen, D. & Krashen (1982) [19, 20] proposed the renowned "Output Hypothesis." Her research demonstrates that input alone does not suffice for second language learners to attain native-like competence, arguing instead that output plays a more pivotal role in second language acquisition. Output rate is positively correlated with acquisition sequence: a lack of output, or minimal output volume, indicates that a grammatical point has not been acquired or is poorly mastered. Conversely, a higher output rate suggests that the grammatical rules of a specific sense are relatively simple and that the sense is frequently employed in daily communication. Based on the output data for the various senses of "*Lai*," the output rates are summarized in Table 6.

According to Second Language Acquisition (SLA) theory, pedagogy should align with the developmental patterns of language learning, progressing from simple usages to more complex lexical and grammatical structures. By employing the direct ranking method to sort the output rates in Table 6 in descending order, Acquisition Sequence (A) for the senses of "*Lai* " was derived as follows: *Lai* 1 > *Lai* 2 > *Lai* 4 > *Lai* 3 > *Lai* 7 > *Lai* 8 > *Lai* 6 > *Lai* 5.

4.2. Acquisition Sequence Based on the Relative Frequency of Correct Usage of the Senses of "Lai"

Shi (1998) [21] points out that the "relative frequency of correct usage" method is designed to address issues of uneven corpus distribution and small sample sizes for certain items, where equal random sampling is unfeasible, thereby ensuring data comparability. Given the uneven distribution of the senses of "*Lai* " in the HSK Interlanguage Corpus—where some senses appear frequently while others are rare—this study adopts this method to examine the acquisition sequence. By counting the number of errors for each sense of "*Lai* " in the corpus, the relative frequency of correct usage was calculated, as presented in Table 7.

Table 7. *Relative Frequency of Correct Usage for the Senses of "Lai" Based on the HSK Corpus.*

Sense	Correct Frequency	Relative Frequency (%)
Lai 1	3,019	47.05
Lai 2	1,294	20.17
Lai 3	87	1.40
Lai 4	1,301	20.28
Lai 5	27	0.40
Lai 6	24	0.30
Lai 7	58	0.90
Lai 8	73	1.10
Total	6,416	100.00

Note. Correct Frequency = Total output frequency of the sense minus error frequency. Relative Frequency = Correct frequency of the specific sense divided by the total output frequency of all senses (N=6,416).

Shi (1998) states that within corpus data, a higher relative frequency of correct usage for a linguistic item indicates that

its grammatical rules are easier to master, implying earlier acquisition. Consequently, based on Table 7, Acquisition Sequence (B) for the senses of "*Lai* "—derived from the relative frequency of correct usage—is established as follows: *Lai* $_1$ > *Lai* $_4$ > *Lai* $_2$ > *Lai* $_3$ > *Lai* $_8$ > *Lai* $_7$ > *Lai* $_5$ > *Lai* $_6$. When compared with Acquisition Sequence (A), which is based on output rates, the two sequences exhibit slight variations in the ranking of all senses, with the exception of *Lai* $_1$, which retains the same position in both.

4.3. Acquisition Sequence Based on Implicational Scaling

In the field of Second Language Acquisition (SLA), implicational scaling serves as a pivotal tool for investigating acquisition sequences. Utilizing implicational scales allows researchers to mitigate the impact of individual learner differences on analysis results. As a first step, the accuracy rates for the senses of "*Lai* " were calculated across beginner, intermediate, and advanced levels, as presented in Tables 8, 9, 10, and 11.

Table 8. *Accuracy Rates of "Lai" Senses: Beginner Level.*

Sense	Correct Frequency	Total Frequency	Accuracy (%)
Lai $_1$	1,025	1,175	87.23
Lai $_2$	424	535	79.25
Lai $_3$	23	28	82.14
Lai $_4$	537	551	97.46
Lai $_5$	8	16	50.00
Lai $_6$	10	15	66.67
Lai $_7$	18	42	57.41
Lai $_8$	24	26	92.30

It can be derived from Table 8 that the total accuracy rate of "*Lai* " usage by beginner-level Chinese learners (total accuracy rate at the beginner stage = total correct frequency of all senses at the beginner stage / total output frequency of all senses at the beginner stage) is 86.64%.

Table 9. *Accuracy Rates of "Lai" Senses: Intermediate Level.*

Sense	Correct Frequency	Total Frequency	Accuracy (%)
Lai $_1$	373	413	90.31
Lai $_2$	200	223	89.67
Lai $_3$	18	22	81.82
Lai $_4$	238	242	98.35
Lai $_5$	5	6	83.33
Lai $_6$	3	5	60.00
Lai $_7$	10	13	76.92
Lai $_8$	20	21	95.23

It can be derived from Table 9 that the total accuracy rate of "*Lai* " usage by intermediate-level Chinese learners (total accuracy rate at the intermediate stage = total correct frequency of all senses at the intermediate stage / total output frequency of all senses at the intermediate stage) is 91.75%.

Table 10. *Accuracy Rates of "Lai" Senses: Advanced Level.*

Sense	Correct Frequency	Total Frequency	Accuracy (%)
Lai $_1$	70	71	98.59
Lai $_2$	42	44	95.45
Lai $_3$	2	2	100.00
Lai $_4$	34	36	94.44
Lai $_5$	3	3	100.00
Lai $_6$	0	0	—
Lai $_7$	0	0	—
Lai $_8$	5	5	100.00

The senses *Lai* $_5$ and *Lai* $_6$ did not appear at this stage, making it impossible to determine their acquisition status. This situation is regarded as "missing data"; therefore, they are treated as unacquired and converted to 0. It can be derived from Table 10 that the total accuracy rate of "*Lai* " usage by advanced-level Chinese learners (total accuracy rate at the advanced stage = total correct frequency of all senses at the advanced stage / total output frequency of all senses at the advanced stage) is 96.89%.

The overall accuracy rate for beginner learners is below 90%, whereas it exceeds 90% for intermediate and advanced learners. Based on a synthesis of these three stages, a 90% accuracy rate was selected as the cutoff threshold. Consequently, the accuracy rates were converted into binary categorical data (0 and 1), where 0 represents "unacquired" and 1 represents "acquired." Specifically, a sense is determined as acquired and coded as 1 in the implicational scale if its accuracy is ≥ 90%; conversely, if the accuracy is < 90%, it

is deemed unacquired and coded as 0. With learner proficiency levels (S) on the vertical axis and the senses (Q) on the horizontal axis, the collected data were converted into binary values (0, 1) to construct the following implicational scaling matrix:

Table 11. Implicational Scale Analysis of "Lai" Acquisition.

Difficult ⟵								⟶ Easy	
Proficiency Level	***Lai* 7**	***Lai* 6**	***Lai* 5**	***Lai* 3**	***Lai* 2**	***Lai* 1**	***Lai* 8**	***Lai* 4**	**Total Score**
Advanced	0	0	1	1	1	1	1	1	
Intermediate	0	0	0	0	0	1	1	1	
Beginner	0	0	0	0	0	0	1	1	
Correct	3	3	3	3	3	3	3	3	24
Errors	0	0	0	0	0	0	0	0	0
Total	3 0	3 0	2 1	2 1	2 1	1 2	0 3	0 3	

As noted by Wu and Wang (2014) [22], creating an implicational scale is insufficient on its own to demonstrate rank differences. It is necessary to conduct statistical tests to verify the validity of the constructed scale. This involves calculating the following coefficients: Coefficient of Reproducibility, Minimum Marginal Reproducibility, Percent Improvement in Reproducibility, and Coefficient of Scalability.

4.3.1. Coefficient of Reproducibility

The value of the Coefficient of Reproducibility (C_{rep}) indicates the degree of confidence with which students' performance can be predicted based on their positions or arrangements within the matrix, and this value should exceed a critical threshold of 0.90 (Wu & Wang, 2014) [22]. The closer the obtained coefficient is to 1, the greater the confidence in predicting student positions or performance. The formula for the Coefficient of Reproducibility is:

$$C_{rep}=1-\frac{\text{Number of Errors}}{\text{Number of Students}\times\text{Number of Items}}$$

According to Table 11, the number of errors is 0, the number of students is 3, and the number of items is 8. The calculation is as follows:

$$C_{rep}=1-\frac{0}{3\times 8}=1$$

Thus, the coefficient is 1 > 0.90, leading to the conclusion that there is sufficient confidence to predict the students' performance.

4.3.2. Minimum Marginal Reproducibility

The Minimum Marginal Reproducibility (MMrep) indicates the extent to which student performance can be predicted without considering the errors in the matrix, and this value should be lower than the Coefficient of Reproducibility (C_{rep}) calculated above. The formula for Minimum Marginal Reproducibility is:

$$MM_{rep}=\frac{\text{Maximum Marginal Sum}}{\text{Number of Students}\times\text{Number of Items}}$$

Here, the "Maximum Marginal Sum" is obtained by summing the largest frequency (whether of 0s or 1s) for each column. Based on the table above, the Maximum Marginal Sum is 20. Therefore, the calculation is:

$$MM_{rep}=\frac{20}{3\times 8}\approx 0.83$$

Thus, MMrep= 0.83 < C_{rep}, satisfying the statistical requirement.

4.3.3. Percent Improvement in Reproducibility

The formula for Percent Improvement is defined as the Coefficient of Reproducibility minus the Minimum Marginal Reproducibility. The calculation is as follows:

$$\text{Percent Improvement}=C_{rep}-MM_{rep}=1-0.83=0.17$$

4.3.4. Coefficient of Scalability

Statistical conventions dictate that the Coefficient of Scalability (C_{rep}) must exceed 0.60 for an implicational scale to be considered scalable. The formula for this coefficient is:

$$C_{scal}=\frac{\text{Percent Improvement}}{1-MM_{rep}}=\frac{0.17}{1-0.83}=1$$

Since 1 > 0.60, the data derived from this scale demonstrate sufficient reliability. In summary, the result C_{rep}= 1 > 0.60 confirms the validity of the implicational scale, while C_{rep}= 1 indicates high predictability. Based on the implicational scale, Acquisition Sequence (C) for the senses of "*Lai* " is established as: *Lai* $_4$—*Lai* $_8$—*Lai* $_1$—*Lai* $_2$—*Lai* $_3$—*Lai* $_5$—*Lai* $_6$ — *Lai* $_7$. Furthermore, items located within the same horizontal tier in the scale are considered to be at the same acquisition stage. Thus, the acquisition of "*Lai* " can be categorized into four distinct stages:

Stage 1: *Lai* $_4$/*Lai* $_8$ Stage 2: *Lai* $_1$ Stage 3: *Lai* $_2$/*Lai* $_3$/*Lai* $_5$ Stage 4: *Lai* $_6$ / *Lai* $_7$.

5. Integrated Acquisition Sequence Derived from the Synthesis of the Three Orders

The three acquisition sequences derived from the Output Rate Ranking Method, the Relative Frequency of Correct Usage Method, and the Implicational Scaling Method are not entirely consistent. Relying solely on a single method to determine the acquisition order is insufficient and potentially biased. Furthermore, items situated within the same acquisition stage possess comparable difficulty levels, making it challenging to discern their specific chronological order of acquisition. Therefore, to ensure a more scientifically robust and valid outcome, it is necessary to synthesize the findings from all three sequences to definitively establish the precise ranking of items within the same acquisition stage.

5.1. Correlation Test

Table 12. *Spearman Rank Correlations Among the Three Acquisition Sequences.*

			Output Rate	Relative Frequency	Accuracy
Spearman's rho	Output Rate	Correlation Coefficient	1.000	.929**	.619
		Sig. (2-tailed)	.	.001	.102
		N	8	8	8
	Relative Frequency	Correlation Coefficient	.929**	1.000	.810*
		Sig. (2-tailed)	.001	.	.015
		N	8	8	8
	Implicational Scale	Correlation Coefficient	.619	.810*	1.000
		Sig. (2-tailed)	.102	.015	.
		N	8	8	8

Note. Correlation is significant at the 0.01 level (2-tailed).. Correlation is significant at the 0.05 level (2-tailed).

To establish an integrated acquisition sequence by synthesizing the three individual orders, it is first necessary to determine whether significant correlations exist among them. For this purpose, correlation analysis was conducted using SPSS software, employing Spearman's rank correlation coefficient. The results are presented in Table 12.

The results indicate that the correlation coefficient between the acquisition sequence derived from output rates and that derived from the relative frequency of correct usage is 0.929. The coefficient between the relative frequency sequence and the implicational scale sequence is 0.810. While the correlation between the output rate sequence and the implicational scale sequence is 0.619, the overall pattern suggests a substantial degree of consistency among the three sequences, justifying a synthesized analysis.

5.2. The Integrated Acquisition Sequence

The Spearman rank correlation coefficient was employed to examine the relationships among the three acquisition sequences (A, B, and C), revealing strong inter-correlations. Consequently, a pairwise combination approach was adopted to process these sequences. The final acquisition order for the senses of "*Lai* " was determined by assigning points to each item and ranking them based on their cumulative scores.

Specifically, the items in the three sequences (A, B, and C) were ranked in descending order. A scoring metric was applied wherein the highest-ranked item received 8 points, the second received 7 points, and so on, sequentially decreasing to 1 point for the lowest-ranked item. Items identified as

belonging to the same acquisition stage were assigned identical scores. The resulting score distributions for each acquisition sequence are presented in Tables 13 and 14.

Table 13. Score Results of the Three Acquisition Sequences.

	Lai 1	*Lai* 2	*Lai* 3	*Lai* 4	*Lai* 5	*Lai* 6	*Lai* 7	*Lai* 8
Sequence A	8	7	5	6	1	2	4	3
Sequence B	8	6	5	7	2	1	3	4
Sequence C	7	6	6	8	6	5	5	8

Based on Table 13, three new acquisition sequences (D, E, and F) were derived by performing a pairwise summation of the scores from Sequence A (Output Rate), Sequence B (Relative Frequency), and Sequence C (Implicational Scale):

Table 14. Scores of the Combined Acquisition Sequences.

	Lai 1	*Lai* 2	*Lai* 3	*Lai* 4	*Lai* 5	*Lai* 6	*Lai* 7	*Lai* 8
Sequence D	16	13	10	13	3	3	7	7
Sequence E	15	12	11	15	8	6	8	12
Sequence F	15	13	11	14	7	7	9	11

Note. Sequence D = Sequence A + Sequence B; Sequence E = Sequence B + Sequence C; Sequence F = Sequence A + Sequence C.

A higher cumulative score indicates a lower level of acquisition difficulty, whereas a lower score implies a higher level of difficulty. By aggregating the statistics from the derived sequences, the Final Acquisition Sequence (G) is determined as follows: *Lai* 1 > *Lai* 4 > *Lai* 2 > *Lai* 3 > *Lai* 8 > *Lai* 7 > *Lai* 6 > *Lai* 5.

Specifically, "*Lai* 1, *Lai* 4, and *Lai* 2" are identified as the three easiest senses to acquire; "*Lai* 3 and *Lai* 8" are categorized as moderately easy; and "*Lai* 7, *Lai* 6, and *Lai* 5" represent the three most difficult senses to acquire.

5.3. Acquisition Characteristics of the Senses of "Lai"

Drawing upon Second Language Acquisition (SLA) theory, this section analyzes the acquisition characteristics of each sense of "*Lai* " by synthesizing the established acquisition sequence with data on output rates and accuracy rates.

Based on the derived sequence, *Lai* 1, *Lai* 4, and *Lai* 2 represent the three easiest senses to acquire; notably, all three function as verbs. Previous statistics indicate that *Lai* 1 and *Lai* 4 rank first and second, respectively, in interlanguage output rates, surpassing the rates observed in native speaker data. However, with accuracy rates reaching 92% and 97%, their usage patterns in interlanguage closely mirror those of native speakers. This high accuracy suggests that the higher output frequency does not constitute "overuse" but rather reflects solid acquisition. *Lai* 2 ranks third in interlanguage output, exceeding the native frequency by 19%. Its accuracy is 88.87%, which, while slightly lower than that of *Lai* 1 and *Lai* 4, remains relatively high. This indicates that *Lai* 2 is slightly more difficult but is still acquired well. Furthermore, an analysis across proficiency stages reveals a positive correlation: the higher the learners' proficiency, the better their mastery of *Lai* 2.

Lai 3 and *Lai* 8 are categorized as moderately easy to acquire. The low output rates in both interlanguage and native language corpora suggest that *Lai* 3 is a low-frequency item for both groups. However, the high accuracy rate of 93.55% implies that while L2 learners rarely use this sense, they have effectively mastered its usage when required. *Lai* 8 denotes an approximate number, which is classified as a Level 3 grammar point in the *Chinese Proficiency Grading Standards and Grammar Syllabus* (hereinafter referred to as the Syllabus). Its median position in our acquisition sequence aligns with this syllabus classification. Despite low output rates in both corpora, its accuracy stands at 92.4%—exceeding the acquisition criterion set in this study—indicating satisfactory mastery.

Lai 7, *Lai* 6, and *Lai* 5 are identified as the three most difficult senses to acquire. *Lai* 7 functions as a sentence-final modal particle indicating a past occurrence, restricted to affirmative contexts. Its uniformly low output rates in both interlanguage and native corpora can be attributed to its nature as a colloquial

auxiliary element, primarily used in spoken language. Regarding *Lai* $_6$, neither the *Syllabus* nor the *Developing Chinese* textbooks provide a dedicated introduction. *Lai* $_5$ appears in Level 4 of the *Syllabus* but also lacks specific coverage in the *Developing Chinese* textbooks. Both senses exhibit the lowest output rates in the interlanguage—even lower than in the native corpus. Coupled with significantly low accuracy rates of 57% and 65%, this data strongly suggests that learners are employing avoidance strategies due to the lack of pedagogical input and the inherent difficulty of these items.

6. Conclusion

Drawing upon authoritative references *Xiandai hanyu babai ci* [800 words of Modern Chinese] and *Xiandai hanyu cidian* [Modern Chinese Dictionary] to define the semantic categories of "*Lai*,"this study analyzes the usage of "*Lai* " by international students in the HSK interlanguage corpus. By synthesizing the results from the Output Rate Ranking, the Relative Frequency of Correct Usage Ranking, and the Implicational Scale Ranking, the study establishes an integrated acquisition sequence for the senses of "*Lai* ": Directional Meaning > Purpose > Future Intent > Pro-verb > Approximate Number > Modal Particle > Temporal > Occurrence (i.e., *Lai* $_1$ > *Lai* $_4$ > *Lai* $_2$ > *Lai* $_3$ > *Lai* $_8$ > *Lai* $_7$ > *Lai* $_6$ > *Lai* $_5$).

Based on this acquisition sequence and the observed acquisition characteristics, this paper proposes a three-tiered pedagogical classification system to guide students, teachers, and textbook compilation: (1) Communicative Essentials (*Lai* $_1$, *Lai* $_4$, *Lai* $_2$), (2) Expression Enhancement (*Lai* $_7$, *Lai* $_3$, *Lai* $_8$), and (3) Low Priority Items (*Lai* $_5$, *Lai* $_6$). It is recommended that textbooks and instruction align with this hierarchy: Communicative Essentials should be reinforced through extensive exercises; Expression Enhancement items should be taught through contextualized scenarios; and Low Priority items should be allocated minimal instructional time, with a focus on brief introductions rather than intensive mastery.

Abbreviations

SLA	Second Language Acquisition
C_{rep}	The Coefficient of Reproducibility
MM_{rep}	The Minium Marginal Reproducibility
C_{scal}	The Coefficient of Scalability
Sequence A	Output Rate
Sequence B	Relative Frequency
Sequence C	Implication Scale
Sequence D	Sequence A+Sequence B
Sequence E	Sequence B+Sequence C
Sequence F	Sequence A+Sequence C
G	Final Acquisition Sequence
A	Beginner
B	Intermediate
C	Advanced
CCL	Center for Chinese Linguistics Corpus
HSK	Chinese Proficiency Test (Hanyu Shuiping Kaoshi)
L1	Native Speakers from the CCL Corpus
L2	Beginner-level from the HSK Interlanguage Corpus

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Author Contributions

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Conflicts of Interest

We have no conflicts of interests to disclose.

References

[1] Cao, G. (1995). Jindai hanyu zhuci [Particles in Early Mandarin]. Yuwen Chubanshe.

[2] Ding, S. (1961). Xiandai hanyu yufa jianghua [Lectures on modern Chinese grammar]. The Commercial Press.

[3] Fan, J. (1963). Dongci he quxiangxing houzhi chengfen de jiegou fenxi [Structural analysis of verbs and directional post-components], Journal of Chinese Language and Literature, (2), 136–160. https://doi.org/CNKI:SUN:HYXX.0.1985-05-009

[4] Hu, Z. (1959). Gaishuci " Lai" de chuxian jiqi youlai [The appearance and origin of the approximate number word "Lai"], Journal of Chinese Language and Literature, (5), 222–224.

[5] Lü, S. (1942). Zhongguo wenfa yaolue [Outline of Chinese grammar]. The Commercial Press.

[6] Wang, L. (1957). Zhongguo xiandai yufa [Modern Chinese grammar]. Zhonghua Book Company.

[7] Zhang, Z. (1953). Hanyu yufa changshi [Common knowledge of Chinese grammar]. China Youth Publishing House.

[8] Chen, C. (2011). You daidongci " Lai" goucheng de shubin duuanyu ji shuliangci de gongneng [The Functions of Verb-Object Phrases Formed by the Pro-verb "Lái" and Quantifiers]. Journal of Henan University (Social Science Edition), 51(1), 118–124. https://doi.org/10.15991/j.cnki.411028.2011.01.014

[9] Chi, C., & Wang, Y. (2014). Xiandai hanyu daidongci " Lai" xinlun [A new theory on the modern Chinese pro-verb "Lai"], Journal of Anhui University (Philosophy and Social Sciences Edition), (6), 58–66. https://doi.org/10.13796/j.cnki.1001-5019.2014.06.012

[10] Ying, X., & Wang, X. (2014). The distribution of approximate number words "Lai" and "Duo" in quantitative structures, Chinese Language Acquisition, (4), 45–52.

[11] Zhang, C. (2021). Houqi jindai hanyu shitai zhuci " Lai" de gongneng ji yanbian [Function and evolution of the aspectual particle "Lai" in late early mandarin], Journal of Chinese Language and Literature, (6), 723–734.

[12] Ma, Z., & Peng, S. (2022). Hanguo xuexizhe fuhe quxiang buyu " V+ X Lai" xide qingkuang diaocha ji jiaoxue duice [Investigation on the acquisition of compound directional complement "V+X Lai" by Korean learners and teaching strategies], Dongjiang Journal, (3), 108–115. https://doi.org/10.19410/j.cnki.cn22-5016/c.2022.03.010

[13] Su, C. (2013). Comparative analysis and teaching research on approximate number expressions in Chinese and Vietnamese [Master's thesis, Fujian Normal University].

[14] Ye, Z. (2022). Acquisition errors and teaching research of the Chinese "X+NP+Laishuo" structure [Master's thesis, Nanchang University]. https://doi.org/10.27232/d.cnki.gnchu.2022.003453

[15] Dictionary Editing Office of the Institute of Linguistics, CASS. (2016). Xiandai hanyu cidian [Modern Chinese dictionary] (7th ed.). The Commercial Press.

[16] Chen, K. (2018). Metaphorical usage and error analysis of "Lai" and "Qu", [Master's thesis, Nanjing Normal University]. https://doi.org/10.27245/d.cnki.gnjsu.2018.000087

[17] Liu, X. (2000). Duiwai hanyu jiaoxue yinlun [Introduction to teaching Chinese as a foreign language]. Beijing Language and Culture University Press.

[18] Sorace, A., & Filiaci, F. (2006). Anaphora resolution in near-native speakers of Italian. Second Language Research, 22(3), 339–368. https://doi.org/10.1191/0267658306sr271oa

[19] Swain, M. (1995). Three functions of output in second language learning. In G. Cook & B. Seidlhofer (Eds.), Principles and practice in applied linguistics, Oxford University Press. https://xueshu.baidu.com/ndscholar/browse/search

[20] Stephen, D. & Krashen (1982). Principles and practice in second language acquisition. Pergamon press. http://doi.org/10.2307/3586656

[21] Shi, J. (1998). Waiguo liuxuesheng 22 lei xiandai hanyu jushi de xide shunxu yanjiu [Study on the acquisition order of 22 types of modern Chinese sentence patterns by foreign students], World Chinese Language Teaching, (4), 77–90. https://doi.org/10.13724/j.cnki.ctiw.1998.04.008

[22] Wu, J., & Wang, Y. (2014). Dier yuyan xide shunxu yanjiu gongju—yunhan liangbiao pingjie, [Review of implicational scaling as a tool for second language acquisition order research]. Journal of Yunnan Normal University (Teaching and Research on Chinese as a Foreign Language), (1), 85–92. https://doi.org/10.16802/j.cnki.ynsddw.2014.01.008