

# The Evolution of Chinese/Mandarin as a Second Language Acquisition: A Scientometric Analysis Using CiteSpace and VOSviewer Based on Web of Science Literature (1994–2024)

Yale Wu

School of Languages, Literacies and Translation, Universiti Sains Malaysia, Penang, George Town, Malaysia

Malini Ganapathy\*

School of Languages, Literacies and Translation, Universiti Sains Malaysia, Penang, George Town, Malaysia

**Abstract**—With the growing international influence of China and the increasing interest in Chinese/Mandarin as a second language acquisition (CSLA), there is a notable absence of scoping reviews in this field. This paper presents a scientometric analysis of 746 documents published between 1994 and 2024, aiming to provide insights into the overall development trends of CSLA research. Using CiteSpace and VOSviewer for document visualization, the analysis examines authors' institutions co-occurrence, keywords co-occurrence, and the strongest citation bursts to highlight the key research hotspots, emerging frontiers, and persistent challenges in CSLA research. By offering a comprehensive analysis, this study contributes to a deeper understanding of the global trends and thematic developments in CSLA, and provides a clear perspective on CSLA research evolution over the past three decades.

**Index Terms**—CSLA, SLA, L2 Mandarin, CiteSpace, VOSviewer

## I. INTRODUCTION

The field of second language acquisition (SLA) has historically been dominated by research on English as a second language (L2), reflecting its status as a global lingua franca. While Chinese as a Second Language Acquisition (CSLA) has witnessed considerable growth in recent years (Chan et al., 2022; Neal, 2025, p. 1), the field remains conspicuously understudied in terms of comprehensive scoping reviews. To bridge this gap, the present study employs two bibliometric tools—CiteSpace and VOSviewer—to systematically map the evolving research landscape of CSLA.

As established visualization and analysis tools for bibliometric research (Markscheffel & Schröter, 2021), CiteSpace and VOSviewer enable the construction of knowledge maps and scientometric examination of academic literature. The current investigation analyzes Web of Science (WoS)-indexed publications from 1994 to 2024, utilizing three primary analytical approaches: (1) authors' institutions co-occurrence, (2) keywords co-occurrence analysis, and (3) citation burst detection. Through this multidimensional scientometric approach, the study aims to: (a) identify core research foci, (b) trace emerging trends, and (c) highlight persistent challenges in CSLA research.

## II. LITERATURE REVIEW

Second language acquisition (SLA) generally refers to the process of learning a language subsequent to the acquisition of a first language (or native language). In some contexts, the term is also used to describe the learning of additional languages, such as a third or fourth language (Gass et al., 2020, p. 4). SLA is a multidisciplinary field of study that engages scholars from various academic disciplines, including linguistics, phonetics, psychology, psycholinguistics, sociology, sociolinguistics, discourse analysis, conversation analysis, and education, among others. Theories of SLA are often developed through empirical research conducted across these diverse fields. In the context of English as a Lingua Franca, the majority of SLA research has focused on second language (L2) English acquisition. As Ma et al. (2017, p. 815) observed, “research on language learning has long been dominated by studies of the English language”.

Chinese, as one of the six official languages of the United Nations (UN), has gained increasing global significance in recent years. With China's growing prominence on the international stage, there has been a rising scholarly and linguistic interest in the teaching and learning of Mandarin as a second language (L2) worldwide. For instance, the UK government launched the “Mandarin Excellence Programme” in 2016, aiming to have 5,000 students on track to fluency in Mandarin by 2020. This target was surpassed by January 2021, with approximately 8,000 students now enrolled in the program and progressing toward fluency (UCL, 2024). Furthermore, according to [people.cn](http://people.cn), Chinese had been integrated into the

\* Corresponding Author. Email: [malinik@usm.my](mailto:malinik@usm.my)

national education systems of 76 countries by the end of 2021 (MOE, 2022).

However, research in the field of Chinese as a second language acquisition (CSLA) has historically faced slow and challenging progress. Initially, the term “Chinese” was used to refer to the language spoken by all Chinese people. As research in L2 Chinese has advanced, many scholars have shifted to using “Mandarin” also known as Pǔtōnghuà, as the standard form of Chinese. Mandarin is also the most learned and spread Chinese language all over the world. In China, Mandarin is also referred to as guānhuà in some dialects and is understood by over 90% of the population (Yang, 2016). In other words, nearly all Chinese people are able to communicate in Mandarin, that is why Chinese speakers have limited proficiency in English. In this study, the terms “Chinese” and “Mandarin” are used interchangeably to refer to the standardized language promulgated in China.

Given the growing interest in CSLA, the current study aims to provide a comprehensive overview of the evolution of CSLA over the past three decades.

### III. METHODOLOGY

#### A. Research Questions

As far as the present research concerned, the following three research questions are objective to answer in this paper:

1. What is the overall development trend of CSLA research?
2. What are the hotspots and frontier areas in the field of CSLA?
3. What are the current issues in the field of CSLA?

#### B. Research Tools

In this paper, two bibliometric tools, CiteSpace and VOSviewer, will be used to generate scientific knowledge maps about the CSLA research.

CiteSpace is a free Java-based application designed for visualizing and analyzing trends and patterns in scientific literature. Initially developed as a bibliometric tool, CiteSpace helps researchers in identifying critical points in a research field, such as intellectual turning points and pivotal moments (Chen, 2006). This software supports researchers in gaining an understanding of the foundational knowledge within a discipline, identifying rapidly growing research areas, locating seminal works, uncovering emerging research frontiers, and clarifying the context of research evolution (Chen, 2016). Additionally, CiteSpace can analyze collaboration networks, author co-citation networks, and document co-citation networks. Furthermore, it provides bibliometric analyses of literature and visually presents the results. Currently, CiteSpace is used by researchers in over 100 countries, and more than 15,000 papers have been published utilizing this tool.

VOSviewer is also a free software tool designed for constructing and visualizing bibliometric networks. It utilizes text mining techniques to generate and display networks of significant terms found in scientific literature. By examining various relationships, such as co-authorship, co-citation, bibliographic coupling, and citation, VOSviewer generates network maps and offers three distinct types of visualizations: network visualization, overlay visualization, and density visualization (Bukar et al., 2023).

CiteSpace and VOSviewer are both software tools that researchers could use to visualize knowledge maps and conduct bibliometric analysis (Markscheffel & Schröter, 2021). Though they share many functionalities, they employ distinct algorithms for normalization, mapping, and clustering. In particular, clustering in VOSviewer is more effective and clearer compared to CiteSpace, and could be used directly.

#### C. Method

To conduct an accurate and scientific analysis of the literature in the field of CSLA, this study employed a bibliometric approach to perform a comprehensive research collaboration analysis on the retrieved documents. The analysis includes institutional collaboration and keyword collaboration. Additionally, cluster analysis was conducted on institutions and keywords, and further analyses were performed on author-institution co-occurrence, keyword co-occurrence, and the identification of the most significant citation bursts. The following sections provide a detailed explanation of the methods employed in this study:

##### (a). Author's Institution Co-Occurrence

The analysis of author's institution co-occurrence is an effective way to show institutions emerging trends over time and track the overall development trend in the specific field. The time zone visualization of the author's institution co-occurrence adds a time dimension on the basis of the knowledge graph of the co-occurrence network of the author's institution. In this way, the research overview and development trend of the discipline will be interpreted more clearly and intuitively.

##### (b). Keyword Co-Occurrence Analysis

Keywords serve as the most concise and accurate representation of a document's content. Keyword co-occurrence analysis is an effective method for identifying emerging research trends, monitoring evolving topics, and tracking the frontiers of research over time.

In CiteSpace, there are two primary procedures for conducting keyword co-occurrence analysis: the first involves extracting keywords, separating and classifying them to calculate their frequency; the second entails constructing a keyword co-occurrence matrix for further analysis (Chen, 2006; Fang et al., 2018). This study applied keyword co-occurrence analysis to examine the development trends, identify key issues, and project future research directions in the field of CSLA.

In contrast, keyword co-occurrence analysis in VOSviewer not only incorporates a temporal dimension but also offers more precise and intuitive clustering. It effectively illustrates the changing dynamics of research hotspots, with high similarity within clusters and significant dissimilarity between clusters (Bukar et al., 2023). In this study, clustering was derived from the collected documents and based on the extracted keywords. The clustering process in VOSviewer was found to be more effective and clearer than in CiteSpace, offering a more direct and accessible approach.

#### (c). *The Strongest Citation Bursts*

Citation burst refers to a significant increase in attention or focus within the scientific community toward a particular topic in a given research field (Chen, 2016), and it can only be generated using CiteSpace. According to Chen (2016), citation bursts can be categorized and sorted in two ways: by the starting time of the burst or by the strength of the burst. In this study, the top 10 keywords with the strongest citation bursts and the top 20 institutions with the strongest citation bursts were identified in order to explore the emerging frontiers and key issues in the field of CSLA.

#### D. *Data Collection Procedures*

This paper retrieves documents from Web of Science (WoS) literature index. As one of the most important literature indexes, the WOS is a bibliographic database that including academic articles from 22,000 peer-reviewed journals worldwide. The WOS provides access to multiple databases that spanning various disciplines and provides researchers with advanced academic search, citation analysis and bibliometrics.

There are three steps in retrieving documents from WOS in this paper. Firstly, this paper chooses WoS core collection and editions with Science Citation Index Expanded (SCI-EXPANDED: 1970-present), Social Sciences Citation Index (SSCI: 1970-present), Arts & Humanities Citation Index (AHCI: 1975-present). Secondly, search with TOPIC “L2 Chinese Acquisition” OR “L2 Mandarin Acquisition” OR “CSL research”, and refined by publication year 1994-2024, language limited only in English, and categories in Linguistics, Education Educational Research, and Language Linguistic. After filtering out document types like editorial material, news items, corrections, notes, etc., there are 746 documents left. Thirdly, export the documents in plain text file content with “Full Record and Cite References”.

Overall, there are 746 documents retrieved from WOS on November 5, 2024. The documents amount and format in accordance with the requirements of CiteSpace analysis (Chen, 2017) and VOSviewer analysis (Bukar et al., 2023).

### IV. RESULTS AND DISCUSSION

#### A. *The Overall Development Trend in CSLA Research*

The publications over time on CSLA research during the past 30 years (1994-2024) is shown in Figure 1. It can be observed that CSLA research obtains a clear up wards trend. Taking every two years as a time slice and the extraction node type is institutions, Figure 2 shows the time zone visualization of author’s institution co-occurrence in the field of CSLA (1994-2024). Time zone visualization can arrange the institutions over time and show the emerging time precisely. It clearly showed that more and more institutions conducting CSLA research, especially the institutions from mainland China. According to the growth publications and institutions over time, three development stages of CSLA research can be identified as follows:

##### (a). *Slow Development Period (1994-2007).*

The annual number of published papers during this period was below 10 and increased slowly. It also can be observed that the institutions are all overseas rather than mainland China, and centered in Hongkong. For a long time, only few scholars focus on the acquisition of CSLA. By the end of the year 2004, the very first Confucius Institute in the world was established in Seoul, South Korea, and the Confucius Institute shouldered the important function of acquisition of Chinese as a second language (Li, 2019). Then, there is a small peak of annual number of published papers in 2005, indicating the academic research began to focus on the acquisition of Chinese as a second language. Though slow development of CSLA, early research in CSLA laid the groundwork for understanding the issues and challenges faced by L2 Chinese learners (Hu, 2018).

##### (b). *Comprehensive Development Period (2008-2017).*

In 2008, the World Olympic Games were held in China. More and more Confucius Institutes were established overseas and the Chinese language learning boom around the world (Li, 2019). The number of published papers exceeded 10 in 2008, after that, it gradually increased. And approaching to 40 papers in 2016. Although there was a slight decline in 2017, it did not affect the overall rapid upward trend of CSLA research and development. In addition, there are many new research institutes emerging during this period, such as National Taiwan Normal University, Guangdong University of Foreign Studies, Beijing Normal University, Nanyang Technological University, and even University of Oxford (see

details in Figure 2). To sum up, it indicates that more and more institutions and scholars pay attention to CSLA research, and CSLA research has entered a period of comprehensive development.

(c). *Rapid Development Period (2018-2024).*

In 2018, the number of published papers exceeded 40, and since then it has gradually increased year after year. It exceeded 80 in 2023, which is twice as many as in 2018, indicating the rapid development of CSLA. With the continuous introduction of CSLA research in foreign countries, great progress also has been made in this field in mainland China as there are many institutions emerged, such as Zhejiang University, Tsinghua University, Huazhong University of Science and Technology, Renmin University of China, Beijing Language and Culture University, and South China Normal University (see details in Figure 2). In the recent ten years, the CSLA research has been continuously broadened and achieved many commendable research results. For example, scholar Yang (2016, 2021) made a comprehensive study on L2 Mandarin prosodic acquisition, Neal (2018, 2020, 2022) made a great contribution on intelligibility of L2 Mandarin for L1 Anglophone beginner learners.

In summary, take both Figure 1 and Figure 2 into consideration, research in the field of CSLA has experienced slow and challenging development in the past 30 years. However, the overall development trend in the field of CSLA academic research is clearly up wards, booming and increasing.

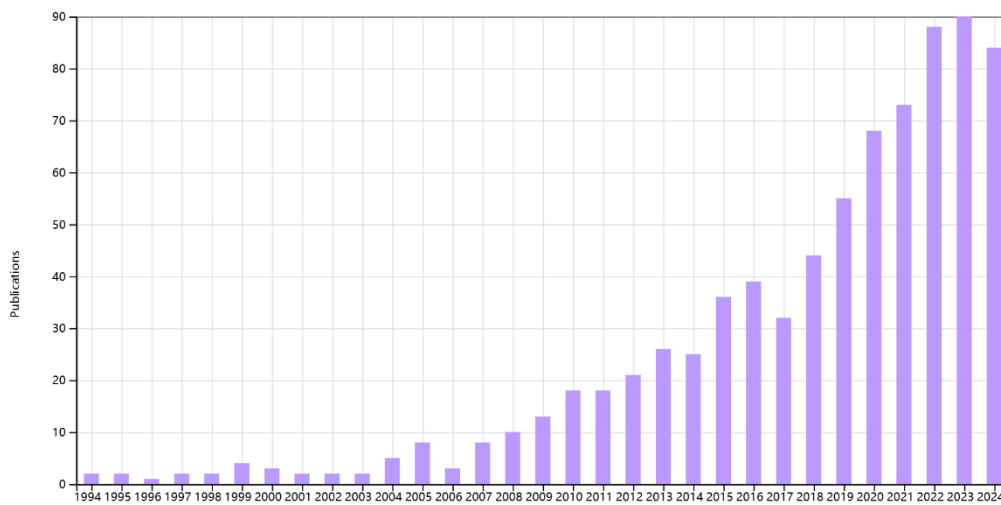


Figure 1. The Number of Published Documents on CSLA (1994–2024)

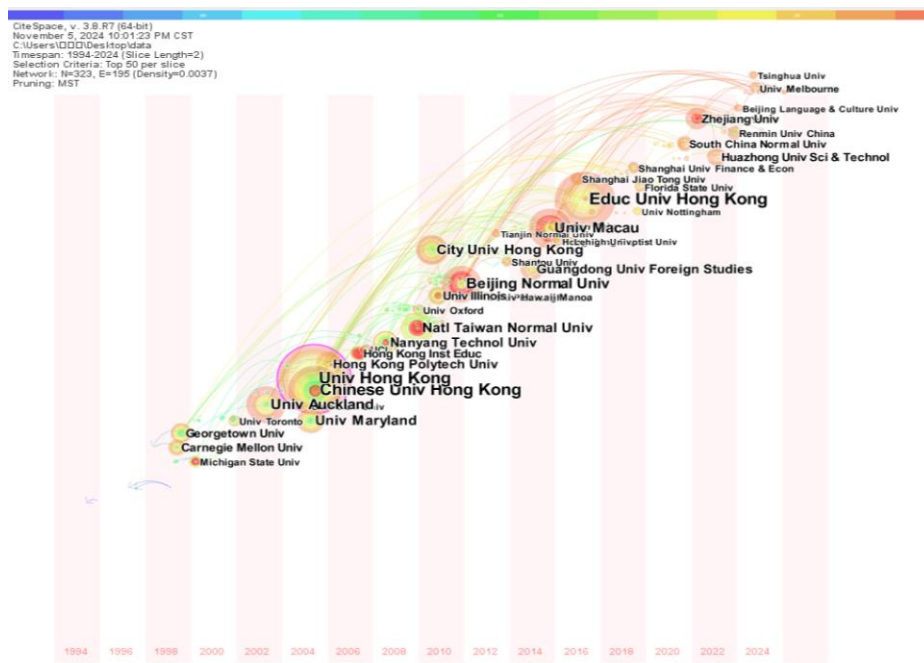


Figure 2. Time Zone Visualization of Author's Institution Co-Occurrence (1994-2024)

B. *The Hotspots and Frontier Areas in the Field of CSLA*

As mentioned previously, keywords in academic papers serve as a concise summary of the document's content, and keyword co-occurrence analysis is a commonly employed method in bibliometrics to identify the distribution of research hotspots (Fang et al., 2018). When applied to a large volume of literature, the keyword co-occurrence visualization with clustering in VOSviewer offers advantages over CiteSpace, including reduced label overlap, clearer clustering, and improved readability (Bukar et al., 2023). In this study, keyword co-occurrence visualization in VOSviewer is utilized to illustrate the distribution patterns of research hotspots in the field of CSLA.

The analysis was conducted using keyword co-occurrence as the unit of analysis, with full counting as the counting method and a minimum word frequency threshold of 5. As a result, 281 high-frequency keywords were selected to create a keyword co-occurrence label view for CSLA research from 1994 to 2024 (see Figure 3). In this visualization, each circle represents a keyword node, with the size of the circle corresponding to the frequency of the word. Larger nodes indicate higher word frequencies, signifying their greater representativeness in the research domain and the research hotspots. Notably, the term "acquisition" has the largest node and highest frequency, followed by "Chinese," "English," and "learners." Furthermore, the overlap of nodes in Figure 3 illustrates the co-occurrence relationships among the keywords in the research documents; the greater the number of node connections, the stronger the relevance of the associated research topics. The color of each keyword is determined by its assigned cluster, and the keywords are arranged from left to right to reflect a timeline from 1994 to 2024, with red representing the earlier period (1994) and yellow indicating more recent keywords (2024).

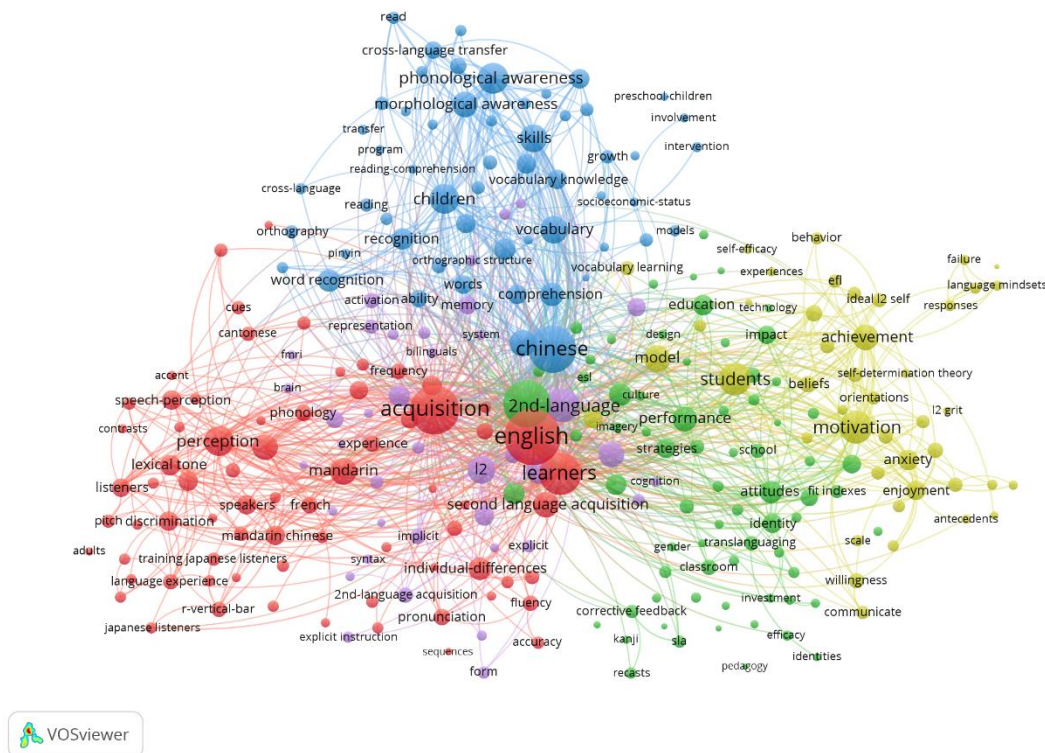


Figure 3. Keywords Co-Occurrence Visualization of CSLA Research (1994-2024)

Focusing on the research topic of CSLA, the high-frequency keywords based on co-occurrence relationships reveal five distinct clusters, which are visually represented by different colors (red, blue, yellow, green, and purple). The four primary research clusters, displayed in Tables 1 to 4 (including their links, total link strength, and frequency), are utilized to analyze the key research domains, perspectives, topics, and methodologies within the scope of CSLA. The cluster in purple is scattered and small, and mostly related to other four clusters, which is without laying out.

#### (a). Cluster 1 (72 Items)

In this cluster, high-frequency words centered “perception” and “mandarin” in red color, following with “identification”, “discrimination”, “speakers”, “listeners”, “experience”, “lexical stress”, and “tone”, “lexical tones”, indicates the research methods in the field of CSLA.

CSLA research is situated within the broader framework of second language acquisition (SLA). Early developments in the acquisition of a second or foreign language were grounded in Contrastive Analysis (CA, Lado, 1957) and Error Analysis (EA, Corder, 1974). During this initial phase, much of the research focused on learners, with methodologies primarily involving the descriptive analysis of learner errors based on CA and EA theories. Subsequently, Best (1995) and Best and Tyler (2007) introduced the Perceptual Assimilation Model (PAM) and PAM-L2 within the context of SLA.

This model suggests that adults perceive the speech sounds of a non-native language by comparing the differences and similarities between their native language and the target language. Following this, researchers began to design perceptual tasks—typically involving identification and discrimination tasks—and conduct perception and production experiments, such as Yang and Chan (2010) and Yang et al. (2021).

Moreover, distinguishing and accurately pronouncing Chinese tones remains a significant challenge for many L2 Mandarin learners. As Ma et al. (2017) noted, “the uniqueness and complexity of Chinese language acquisition” (p. 823), particularly regarding lexical tones and characters, poses considerable difficulties. Consequently, tone, lexical tone, and lexical stress have been key issues of focus in CSLA research, as demonstrated by studies such as those by Zhang (2016) and Shen (2018).

In summary, the high-frequency words in Cluster 1 reflect predominant methodological approaches in CSLA research, with particular emphasis on the acquisition of Chinese tones, lexical tones, and lexical stress as persistent research foci. The current literature demonstrates a strong perceptual orientation, as evidenced by the predominance of listener-based studies discussed previously. Motivations, emotions, and experience are all with high relevance to a second language learning (Satio et al., 2018). Contemporary CSLA investigations increasingly incorporate both listener and speaker experiential dimensions.

TABLE 1  
CLUSTER 1 BASED ON KEYWORDS CO-OCCURRENCE OF CSLA RESEARCH

Cluster 1 (72 items)	links	total link strength	word frequency
perception	104	287	47
mandarin	123	240	41
identification	69	129	19
discrimination	63	125	18
speakers	66	121	21
listeners	51	119	19
experience	64	88	17
lexical stress	37	57	8
tone	31	55	7
lexical tones	27	42	7

(b). *Cluster 2 (71 Items)*

In this cluster, high-frequency words centered “attitudes” and “instruction” in green color, also including “identity”, “strategies”, “classroom”, “teachers”, “school”, “corrective feedback”, “international students”, and “culture”. Keywords in this cluster indicate the current research hotspots in CSLA research, as we mentioned above that the time line from left to right shows the time from 1994 to 2024.

Since 2008, the global trend of learning Chinese has gained significant momentum, with the majority of learners studying at Confucius Institutes. According to a recent report, there are over 550 Confucius Institutes worldwide, operating in 162 countries and offering Chinese language programs in 1,172 "Confucius Classrooms" at primary and secondary schools (Chan et al., 2022). Additionally, some countries have made Chinese language learning a mandatory part of their curricula. For example, in the United Kingdom, students enrolled in the Mandarin Excellence Programme are required to study Mandarin for an average of 8 hours per week, including at least 4 hours of face-to-face instruction, with a minimum of 2 hours designated for scheduled classroom teaching (British Council, 2024). Concurrently, an increasing number of scholars have focused on L2 Chinese acquisition, with international students often serving as the subjects of research. The research topics primarily revolve around teaching methodologies, pedagogical strategies, and corrective feedback (e.g., Li, 2014; Gu & Cheung, 2016; Xu & Peng, 2017; Bryfonski & Ma, 2020).

Additionally, Yu (2010) argued that integrative motivation has a positive impact, while language anxiety has a negative effect on both sociocultural and academic adaptation. Furthermore, it has been observed that academic adaptation is closely and positively associated with sociocultural adaptation. Recently, an increasing number of scholars have shown interest in the study of language attitudes. Language attitudes refer to an individual's perceptions or evaluations of languages (Baker, 1992; Garrett, 2010; González-Riaño et al., 2017; Dragojevic et al., 2021). A positive language attitude is conducive to language learning, whereas a negative language attitude can hinder learning outcomes (Xu et al., 2010; Pei & Wei, 2021).

To sum up, high-frequency words in cluster 2 indicate the recent research trend in the field of CSLA centered on language attitudes, and the research objectives are mainly international students, research domain are mostly concentrated on language education, teaching instructions and strategies.

TABLE 2  
CLUSTER 2 BASED ON KEYWORDS CO-OCCURRENCE OF CSLA RESEARCH

Cluster 2 (71 items)	links	total link strength	word frequency
attitudes	73	174	25
instruction	92	170	28
identity	68	129	26
strategies	76	123	23
classroom	60	84	19
teachers	51	77	18
school	49	73	9
corrective feedback	36	58	11
international students	29	36	8
culture	28	35	9

(c). *Cluster 3 (55 Items)*

In this cluster, high-frequency words centered “phonological awareness” and “children” in blue color, also including “vocabulary”, “morphological awareness”, “word recognition”, “cross-language transfer”, “reading comprehension”, “speaking”, “orthography”, and “pinyin”. During this period, keyword analysis in this cluster reveals that research in CSLA primarily focused on child learners, with cross-language transfer emerging as the predominant methodological approach.

The study of cross-language transfer initially emphasized spoken language acquisition. However, beginning in the 1990s, scholarly attention expanded to encompass literacy-related transfer, including reading, spelling, and writing. Cross-language transfer plays a crucial role in bilingual reading development, as language researchers and educators seek to identify the conditions under which learning in one language can facilitate learning in another (Perkins & Salomon, 1992; Chung et al., 2019).

Research on phonological awareness and morphological awareness also falls within the scope of cross-language transfer. Ziegler and Goswami (2005) argued that phonological awareness is a key component of metalinguistic awareness, crucial for the development of literacy skills across various languages. Zhang and Roberts (2019) suggested that phonological awareness plays an essential role in language acquisition for young learners of morpho-syllabic writing systems, such as Chinese, but is less significant for learners of alphabetic systems, such as English. Morphological awareness is linked to word reading, vocabulary development, spelling, and reading comprehension in both monolingual and bilingual learners (Chung et al., 2019). Additionally, numerous studies have focused on the acquisition of Chinese vocabulary, word recognition, reading comprehension, speaking, and orthographic skills (Hao, 2018; Han, 2020; Neal, 2022; Hao, 2023).

Chinese Pinyin Program is currently used and recognized by the UN, which is the best Phonetic Systems designed for Chinese learning, and always applied as the best tool for foreigners to learn Chinese phonetics. The program also has been accompanied by international Chinese teaching, which has shown its scientific and practical value for decades and is an indispensable tool for the beginners of Chinese language learning (Yang, 2016). Thus, most of the CSLA research related to pinyin.

In summary, high-frequency words in cluster 3 predominantly reflect research conducted within the theoretical framework of cross-language transfer, with child learners representing the primary population under investigation. The analysis also reveals diverse aspects of CSLA research - including morphological awareness, word recognition, reading comprehension, speaking, and orthographic processing - have been systematically examined through this theoretical lens.

TABLE 3  
CLUSTER 3 BASED ON KEYWORDS CO-OCCURRENCE OF CSLA RESEARCH

Cluster 3 (55 items)	links	total link strength	word frequency
phonological awareness	100	306	38
children	116	251	36
vocabulary	118	248	42
morphological awareness	84	216	28
word recognition	99	175	28
cross-language transfer	51	101	12
reading comprehension	47	70	10
speaking	57	70	10
orthography	44	64	11
pinyin	28	40	6

(d). Cluster 4 (44 Items)

In this cluster, high-frequency words centered “motivation” and “students” in yellow color, also including “model”, “achievement”, “anxiety”, “enjoyment”, “orientations”, “communicate”, “language proficiency”, and “self-determination system”. Keywords in this cluster present the newest research trend in CSLA research, that is, learners’ motivations, individual differences, and emotional development. While, the research objects are still concentrated on students/international students.

For a long period of time, language learning motivation has been regarded as a critical factor influencing second language acquisition. Motivated learners are more likely to exert greater effort in overcoming challenges and achieving high levels of proficiency in the target language (Al-Hoorie, 2017; Dörnyei & Ushioda, 2011; Wong et al., 2024). According to MacIntyre and Gardner (1994), foreign language anxiety refers to "the feeling of uneasiness, worry, nervousness, and apprehension experienced when learning or using a second or foreign language." It is a common phenomenon in foreign language classrooms. Anxiety can significantly impact students' confidence, self-esteem, and participation levels, and it serves as a distinct indicator of students' learning outcomes (Dewey et al., 2018).

In the field of CSLA, learning anxiety directly impairs language learners' oral complexity and fluency (Gong et al., 2024). Language contact influences oral proficiency, with verbal interactions having a particularly significant effect on oral fluency, while, language contact does not mediate the relationship between learning anxiety and oral proficiency (Gong et al., 2024). This investigation makes a significant contribution to the existing theories of foreign language anxiety within the domain of CSLA and emphasizes the important role that anxiety plays in the language learning process.

In summary, high-frequency words in cluster 4 centered on students’ learning motivation, learning anxiety, learning achievement and enjoyment. In addition, CSLA research paid more attention to learners’ individual differences, communicative orientations rather than theoretical descriptions. The research results and conclusions are more practical and beneficial for language learners and language teachers.

TABLE 4  
CLUSTER 4 BASED ON KEYWORDS CO-OCCURRENCE OF CSLA RESEARCH

Cluster 4 (44 items)	links	total link strength	word frequency
motivation	123	358	58
students	120	234	41
model	120	234	41
achievement	99	218	36
anxiety	72	146	26
enjoyment	60	130	21
orientations	43	65	9
communicate	38	57	8
language proficiency	42	50	8
self-determination system	23	29	5

In summary, the four clusters identified in the research reflect the key hotspots in CSLA studies over the past 30 years, including topics such as “perception”, “experience”, “lexical stress”, “tone”, “lexical tones”, “attitudes”, “instruction”, “identity”, “strategies”, “international students”, “phonological awareness”, “children”, “cross-language transfer”, “pinyin”, “motivation”, “students”, “anxiety”, “self-determination system”. Regarding research methodologies, early studies primarily focused on theoretical frameworks and descriptive analyses of language learning phenomena. Over time, attention shifted towards the development of cross-language transfer theory. The subjects of these studies have predominantly been children, students, and international students, with findings often generalized to all language learners. Currently, the field has moved towards a focus on language anxiety, exploring individual learner differences and the emotional aspects of language learning. This shift indicates a growing emphasis on understanding learners themselves rather than solely on linguistic theories. The outcomes of these studies are increasingly practical and evidence-based, contributing to the development of language learners’ skills and offering valuable pedagogical insights for educators and researchers in the field of language education.

Additionally, the strongest citation bursts identified in CiteSpace provide a direct indication of the emerging research frontiers in a given field. This feature is a key aspect of the analysis based on citation bursts, which can only be obtained through CiteSpace. Figure 4 illustrates the top 10 keywords with the strongest citation bursts, sorted by their starting time, with the red bars indicating the duration of the bursts. Notably, all citation bursts began after 2003. The term “anxiety” exhibits the strongest citation burst, while “awareness” (both phonological and morphological) has the longest citation duration. Cross-language transfer, a topic long emphasized in second language acquisition (SLA) research (Chung et al., 2019), also continues to be a focal point in CSLA studies, as highlighted earlier. “Cross-language transfer” ranks second in terms of citation duration. Furthermore, “computer-mediated communication”, which emerged in 2013 and persisted for four years, is another notable hotspot. During this period, the development of computer-assisted and mobile-assisted language learning technologies provided significant corrective feedback, enhancing language learners’ abilities (Bryfonski & Ma, 2020; Xu & Peng, 2017). From 2021 onwards, the research frontiers in CSLA have increasingly focused on “achievement”, “anxiety”, “positive psychology”, and “motivation”, all of which show strong citation bursts. These emerging topics reflect the current research frontier in CSLA. Overall, the research hotspots and frontiers identified in the citation burst analysis align with the findings from the earlier cluster analysis.

**Top 10 keywords with Strongest Citation Bursts**

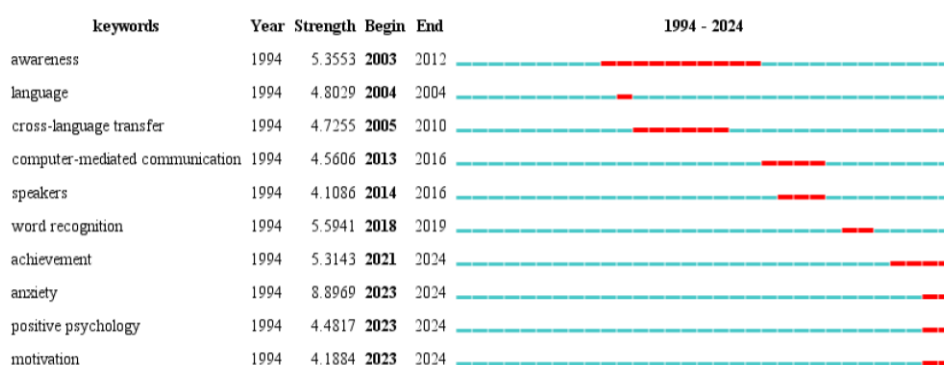


Figure 4. Top 10 Keywords With the Strongest Citation Bursts (1994-2024)

### C. The Current Issues in the Field of CSLA

As mentioned above, research in the field of CSLA has experienced a slow and challenging development in the past 30 years. Although the overall development trend in the field of CSLA academic research is clearly up wards, booming and increasing, there are still some issues.

Firstly, English remains the predominant focus of SLA research, while Chinese is less frequently studied compared to other languages, particularly English. Table 5 presents 11 keywords with a centrality greater than 0.1. As noted by Su et al. (2019, p. 8), centrality is “a metric of a node that indicates its contribution to connections with other nodes in a network; it measures the likelihood that an arbitrary shortest path in the network will pass through the node”. Therefore, centrality is independent of word frequency.

It is evident that “acquisition” holds the highest centrality, followed by “students”, indicating that students have long been the primary focus of research in CSLA. Additionally, after “Chinese”, the centrality of “English” is 0.11, which is even higher than that of “Mandarin”. This highlights the dominant role of English in SLA research. English, as a global lingua franca, is widely spoken across many countries, and it is common to use English as an interlanguage when learning Mandarin. Furthermore, the current study primarily collects documents in English, with much of the research being conducted by scholars from English-speaking countries and institutions. Nevertheless, Chinese and Chinese characters

are typologically distinct from many other languages, and CSLA remains an area of significant theoretical interest within the broader field of SLA (Chan et al., 2022).

TABLE 5  
KEYWORDS LIST WITH A CENTRALITY HIGHER THAN 0.1

Number	Word frequency	centrality	keyword
1	134	0.3	acquisition
2	64	0.24	students
3	142	0.17	language
4	36	0.13	achievement
5	30	0.13	performance
6	165	0.12	Chinese
7	41	0.11	English
8	40	0.1	speech
9	39	0.1	mandarin
10	27	0.1	perception
11	23	0.1	word recognition

Secondly, while there are identifiable hotspots in the field of CSLA, there is a noticeable lack of innovation. Figure 5 presents a time-zone visualization of keyword co-occurrence in CSLA research, as retrieved from CiteSpace. The round circles represent keyword nodes, with larger nodes indicating higher word frequency and greater representation of the research domain and its hotspots. Additionally, shifts in research topics serve as valuable indicators, helping researchers gain deeper insights into the evolution of a particular research field. From Figure 5, it is clear that since the year of 2014, many small nodes appear, indicating the emergence of new research topics. However, there is an absence of relatively larger, more focused topics, suggesting that most research is still in an exploratory phase. In other words, much of the CSLA research has centered on theoretical frameworks and empirical descriptions, with scientific investigations and experimental studies being relatively rare.

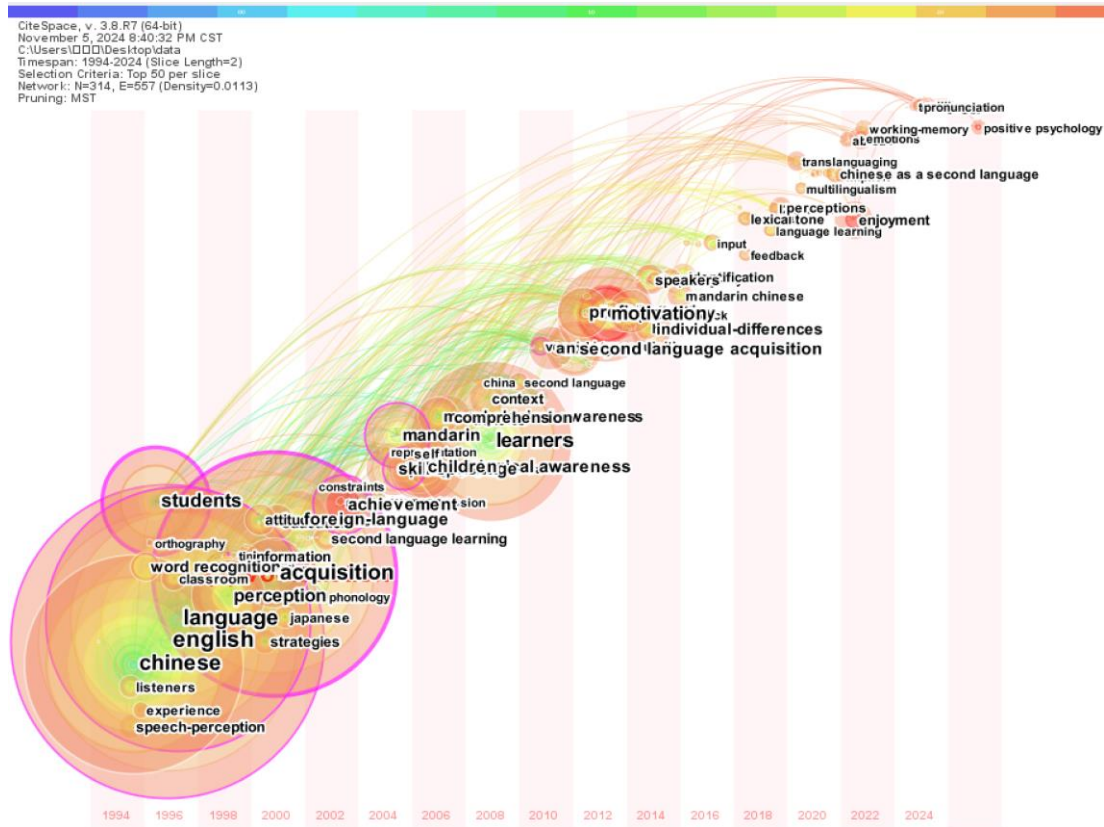


Figure 5. Time Zone Visualization of Keywords Co-Occurrence of CSLA Research (1994-2024)

Thirdly, a substantial proportion of CSLA scholars have historically been affiliated with international institutions, while Chinese academic entities and researchers have gained prominence only in recent years. Figure 6 illustrates the top 20 institutions with the strongest citation bursts over the past 30 years. When sorted by the starting time of citation bursts, it is evident that the majority of these institutions are based outside mainland China. Notably, three of the top four institutions with the longest citation burst periods are located abroad, including the University of Saskatchewan (Canada), California State University, Long Beach (USA), and Nanyang Technological University (Singapore). One possible explanation for this trend is that many Chinese researchers have conducted their studies abroad and published papers during their time overseas.

Concurrently, against the backdrop of rising global interest in Chinese language acquisition and expanding scholarly engagement with CSLA, the thematic and demographic breadth of research has begun to diversify. This evolving landscape is reflected in Figure 6, where three Chinese institutions—South China Normal University, Guangdong University of Foreign Studies, and Beijing Language and Culture University—demonstrate the strongest citation bursts since 2020. Of particular significance, South China Normal University has sustained prolonged citation burst activity over the past five years, signaling its growing influence in the field.

### Top 20 institutions with Strongest Citation Bursts

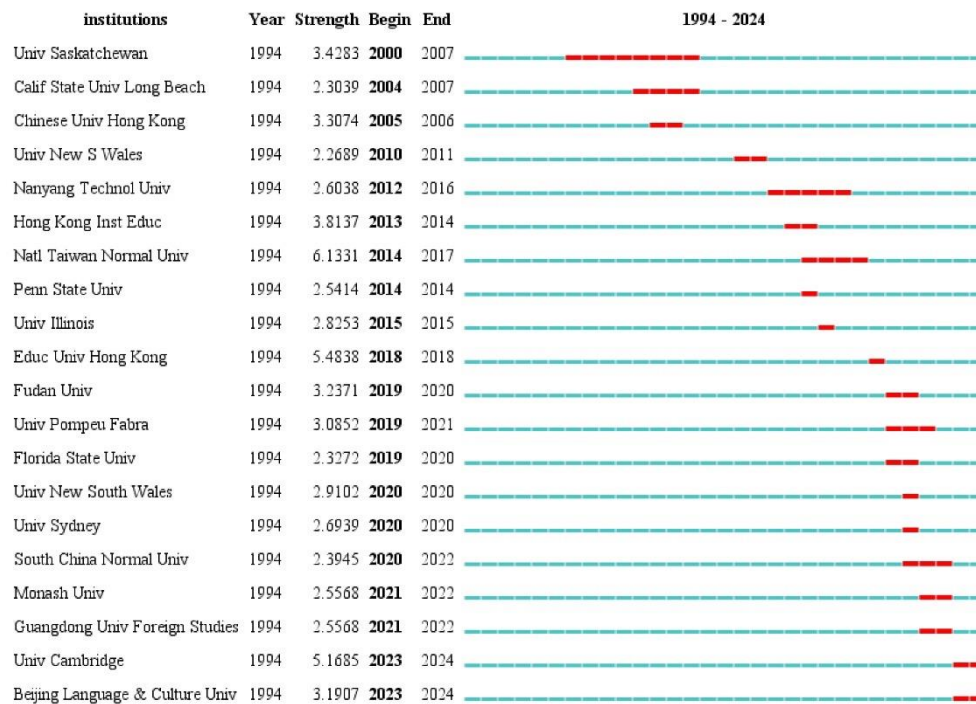


Figure 6. Top 20 Institutions With the Strongest Citation Bursts (1994-2024)

In summary, while English has traditionally dominated SLA research, CSLA has emerged as a growing area of scholarly interest. However, current trends in CSLA research reveal a notable lack of theoretical and methodological innovation, with the majority of studies confined to framework-based analyses and descriptive empirical work. Furthermore, the field has long been shaped by international scholars and institutions, while Chinese researchers and academic entities have only recently begun to play a more substantial role. Despite these limitations, CSLA research exhibits a clear upward trajectory, demonstrating consistent growth and increasing academic momentum.

### V. CONCLUSION

On the basis of the documents retrieved from WOS core collection, this paper presents an analysis of the evolution of Chinese/Mandarin as a second language acquisition (CSLA), utilizing scientific knowledge maps generated through CiteSpace and VOSviewer. To address the research questions, the following key findings are reported:

First of all, over the past 30 years, research in CSLA has progressed slowly but steadily, evolving through three distinct phases: the slow development period (1994-2007), the comprehensive development period (2008-2017), and the rapid development period (2018-2024). As the global number of Chinese learners has increased sharply, academic attention to CSLA research has gradually intensified. The overall development trend of CSLA is distinctly upward, showing clear growth and expansion.

Secondly, while many research hotspots have emerged within CSLA, the primary focus remains on cross-language transfer. Related studies in this field are empirical research, concentrating on the perception and production of L2 Mandarin speech. The research subjects are predominantly students, including international students and children. Currently, the frontier of CSLA research revolves around issues of language anxiety, as well as individual differences and emotional experiences among language learners. Furthermore, much of the research emphasizes the practical application of language and its pedagogical implications. Language achievement, language anxiety, positive psychology, and language motivation are the current frontiers and hotspots in the field of CSLA.

Finally, despite the growing global attention to CSLA research, there are still notable challenges. Future research in CSLA should prioritize empirical investigations. In addition to building on established studies in language acquisition, CSLA research should aim for innovation through empirical studies rather than merely describing language phenomena or offering theoretical explanations.

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**Yale Wu** is now a PhD candidate majoring in Applied Linguistics at the School of Languages, Literacies and Translation, Universiti Sains Malaysia, Penang. She received her M.A. degree in Foreign Languages and Literatures from Henan University of Technology, Zhengzhou, China. She is interested in applied linguistics, phonetics, and sociolinguistics, especially in the field of second language acquisition. The present article pertains to throw a brief introduction of research on Chinese as a second language acquisition, and particularly to evoke research interests in the field of Chinese as a second language acquisition.



**Malini Ganapathy** is now an associate professor at the School of Languages, Literacies and Translation, Universiti Sains Malaysia, Penang. She has a Certificate of Education (TESL), B.A. (Hons.) in English Language and Literature Studies, M.A. and Ph.D in Applied Linguistics from Universiti Sains Malaysia. She has 18 years of teaching experience at secondary schools, prior to joining Universiti Sains Malaysia in 2014. Her research interests include English Language Teaching (ELT), Literacy (Multiliteracies, Multimodality, New Literacies) and Writing. She has published numerous research articles focusing on her area of research, both in international and local journals.