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Castledown

The Effects of Iconic Gestures on Lexical Retrieval in Late Bilinguals with Expressive Language Disorder (ELD)

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Abstract

This study examines the impact of iconic gestures on lexical retrieval in late bilinguals diagnosed with moderate expressive language disorder (ELD). Employing an explanatory sequential mixed-methods design, 44 participants aged 12 to 15, matched for second-language proficiency and ELD severity, were purposively sampled. Quantitative assessments included the Oxford Quick Placement Test (OQPT), the Comprehensive Assessment of Spoken Language-2 (CASL-2), and standardized lexical retrieval tasks. The intervention consisted of 24 training sessions, each lasting 90 minutes, implemented within a quasi-experimental study design. The experimental group (EG) received training incorporating iconic gestures, while the control group (CG) underwent communicative language teaching without gesture use. Results indicated that the EG demonstrated statistically significant reductions in dysfluency markers, such as fillers, repetitions, false starts, and pauses-compared to the CG. Qualitative data from focus group interviews with 11 randomly selected EG participants supported these findings. Improvements were attributed to multiple mechanisms: iconic gestures provide external cognitive scaffolding, engage multisensory processing, facilitate communicative adaptation, support verbalization, enhance self-confidence, serve metacognitive functions, and promote durable lexical retention. These findings have significant implications for cognitive neuroscience, neurolinguistics, therapeutic pedagogy, bilingualism research, and educational psychology

Keywords: cognitive offloading, developmental language disorder, dysfluency, extended mind, lexicon

Introduction

Developmental Language Disorder (DLD) is a neurodevelopmental condition marked by significant and persistent difficulties in acquiring, understanding, producing, or using language, which cannot be explained by other biomedical conditions such as hearing impairment, intellectual disability, or neurological damage (McGregor et al., 2020). DLD encompasses challenges across various language domains, including vocabulary, grammar, sentence structure, discourse, and pragmatic language use (Andreou et al., 2022; Del Tufo & Earle, 2020). The etiology of DLD is multifactorial, involving complex interactions among genetic, biological, and environmental factors, although the precise mechanisms remain unclear (Abbott & Love, 2023). Typically emerging in early childhood, DLD often persists into adolescence and adulthood, affecting expressive and receptive language abilities (Ellis Weismer et al., 2021). These language difficulties frequently impede social interactions and academic achievement, resulting in substantial challenges in educational and everyday social contexts (Foster et al., 2023).

Expressive language disorder (ELD) is a type of DLD primarily marked by deficits in verbal and written expression despite relatively intact language comprehension (Whitehurst et al., 1988). While the etiology of ELD remains incompletely understood, neurophysiological evidence suggests that focal paroxysmal activity in the frontotemporal region may contribute to its development (Valdizan et al., 2011), possibly through reduced activation in the ventral language network (Caplan, 2015). Such neurobiological disruptions are associated with poorer outcomes in lexical domains (Drljan et al., 2023). The consequences of ELD are extensive: affected children are at increased risk for lower academic achievement, higher rates of school absenteeism, and difficulties in forming and maintaining social relationships compared to their typically developing peers (Langbecker et al., 2020).

Given these challenges, early and effective intervention is essential to mitigate long-term adverse educational and social outcomes, especially in regions with limited access to advanced therapeutic technologies, such as much of the Middle East and North Africa (MENA). One promising intervention involves using iconic gestures—hand movements that visually represent the meaning of spoken words—to support language production and lexical retrieval (Vogt & Kauschke, 2017). Iconic gestures can make abstract or complex concepts more concrete, thereby facilitating communication (Goldin-Meadow, 2005; McNeill, 1998). They often occur during lexical difficulties, such as tip-of-the-tongue states, and may reduce the cognitive demands associated with word retrieval (Goldin-Meadow & Singer, 2003; Wesp et al., 2001). By externalizing parts of the conceptual search process, these gestures can free up cognitive resources and support word retrieval, particularly when verbal short-term memory is limited (Goldin-Meadow et al., 2001; Pyers et al., 2021).

Bilingual students with ELD encounter greater challenges than their monolingual counterparts, demonstrating increased cognitive and metacognitive delays (Bailey et al., 2020; Folke et al., 2016; Gillam et al., 2019; Mahmoudi-Dehaki & Nasr-Esfahani, 2025; Vugs et al., 2014). This issue is particularly critical among late bilinguals—those who begin acquiring a second language (L2) after early childhood, typically after the age of six—who exhibit poorer executive function relative to both early bilinguals and monolinguals, and experience significant language difficulties (Kalia et al., 2014; Rodríguez et al., 2017). Although iconic gestures have been shown to facilitate lexical processing in bilingual students (Coderre, 2015; Frey & Lüke, 2023), there is a notable gap in the literature regarding the impact of these gestures on the lexical performance of late bilinguals. While the theoretical basis for gesture-based interventions is well established, the specific mechanisms through which gestures support lexical access in this population remain insufficiently understood. Consequently, further research is warranted to assess the efficacy and mechanism of iconic gestures as a cognitive offloading strategy in lexical retrieval efficiency for late bilinguals with ELD. The present study seeks to address this gap by examining the role of iconic gestures in supporting lexical retrieval among this population.

Literature Review

Theoretical Background

Multiple theoretical frameworks underpin this research. Domain-specific or modularity theories propose that language is governed by specialized cognitive modules distinct from other cognitive functions (Fodor, 1983). This modular view is supported by observations that children with ELD often experience selective impairments in expressive language despite relatively intact cognitive abilities in other areas (Whitehurst et al., 1988). Within this framework, iconic gestures may serve as an auxiliary channel that bypasses or supplements impaired language modules, particularly those involved in lexical retrieval. By externalizing semantic and phonological information through gesture, late bilinguals with ELD can access alternative representational systems that support priming and word finding (Yap et al., 2011), effectively compensating for deficits in the verbal production module.

Also, domain-general cognitive theories highlight broader cognitive limitations, such as working memory constraints and executive function deficits, frequently accompanying ELD. Working memory limitations can hinder the ability to hold and manipulate linguistic information during speech production (Finardi & Prebianca, 2006), making lexical retrieval particularly challenging. In this context, iconic gestures function as cognitive aids that reduce the load on working memory by offloading part of the conceptual search process into a visuospatial modality (Wu et al., 2022). This multimodal support enables students to organize their thoughts and retrieve lexical items more efficiently. Additionally, gestures may scaffold executive functions like attention and cognitive flexibility by providing external cues that guide language formulation and inhibit competing lexical alternatives (O'Neill & Miller, 2013; Pouw et al., 2014).

Moreover, neuropsychological and neurobiological models further elucidate the mechanisms by which iconic gestures benefit late bilinguals with ELD. Neuroimaging studies (e.g., Badcock et al., 2012; Webster & Shevell, 2004) reveal atypical activation and connectivity in brain regions responsible for language processing in individuals with language impairments. Gestures engage sensorimotor and visuospatial neural networks (Clough & Duff, 2020) that may remain relatively intact in these populations. By recruiting these alternative neural pathways, iconic gestures can facilitate lexical access and speech production, effectively compensating for disrupted language circuits. This multimodal engagement aligns with the notion that language processing is not confined to classical language areas but distributed across a network that includes gesture-related brain regions (Enrici et al., 2011; Willems et al., 2007).

The developmental trajectory of gesture use highlights its foundational role in language acquisition, particularly relevant for late bilinguals with ELD. Longitudinal studies (e.g., Capirci et al., 2005) show that children often use gestures to communicate before they acquire spoken vocabulary, and words initially expressed through gestures tend to enter the verbal lexicon later, indicating that gestures scaffold early language development (Iverson & Goldin-Meadow, 2005). This suggests that iconic gestures may help late bilinguals with ELD overcome lexical retrieval difficulties by reducing cognitive load, providing motoric cues to access concepts when verbal encoding is challenging, and engaging alternative memory systems. Thus, gestures serve not only as a compensatory tool but as an integral cognitive mechanism supporting language processing in this population.

Empirical Research

Research on bilingualism, particularly late bilingualism, reveals several notable disadvantages that contrast with the often-highlighted cognitive benefits. One prominent challenge is that early and late bilinguals tend to experience slower word retrieval and smaller vocabulary sizes in each language compared to monolinguals, but these difficulties are often more critical in late bilinguals due to the later onset of L2 acquisition (Vega-Mendoza et al., 2015). Also, late bilinguals frequently exhibit unidirectional influence from their first language (L1) on their L2 pronunciation, resulting in less native-like vowel production and overall accent (Baker & Trofimovich, 2005; Yang, 2024). This contrasts with early bilinguals, who often exhibit bidirectional phonetic influence and more distinct acoustic realizations.

Moreover, neuroimaging studies indicate that late bilinguals recruit more extensive and sometimes less efficient neural networks when processing their L2 than early bilinguals and monolinguals (Waldie et al., 2021). This increased neural effort may reflect compensatory mechanisms due to less automatic language processing, which can lead to decreased cortical efficiency. Furthermore, late bilinguals display more segregated brain states and fewer transitions during L2 processing, suggesting reduced neural flexibility relative to early bilinguals (Tang et al., 2023). Such neural patterns may underlie difficulties in achieving native-like fluency and contribute to greater cognitive load during language tasks.

The timing of L2 acquisition also influences the lateralization of language functions in the brain, which has implications for language proficiency and cognitive efficiency. Early bilinguals typically show bilateral hemispheric involvement, facilitating more flexible and efficient language processing, whereas late bilinguals display left hemisphere dominance (Hull & Vaid, 2007). This hemispheric asymmetry in late bilinguals may limit the neural adaptability necessary for fully integrating the L2 (Grossi et al., 2010), constraining both linguistic proficiency and the potential cognitive benefits of bilingualism.

Social and experiential factors further complicate late bilingualism. The development of language dominance and proficiency in late bilinguals is heavily influenced by the intensity of language use and educational background (Schmid & Yılmaz, 2018). Insufficient exposure or limited social interaction in the L2, specifically with native speakers, can exacerbate language maintenance and fluency difficulties, potentially leading to incomplete acquisition or attrition (Bardovi-Harlig & Burghardt, 2020; Liu et al., 2024). While late bilingualism entails a range of disadvantages shaped by a complex interplay of interconnected factors, ELD exacerbates these challenges even further.

The limited research on ELD among bilinguals reveals significant challenges. Bilingual children often exhibit a receptive-expressive gap in their L2, with receptive skills outpacing expressive abilities by up to 1 standard deviation (Keller et al., 2015). This gap is significantly critical in children with DLD, including ELD, compared to typically developing peers (Gibson et al., 2014; Peristeri & Tsimpli, 2022). Factors influencing this gap include language exposure, current language use, and word characteristics such as imageability and concreteness (McMillen et al., 2020). Also, bilingual children with DLDs, such as ELD, show reduced phonological short-term memory and lexical skills in both languages, affecting narrative coherence and informativeness (Marini et al., 2019). Moreover, bilingualism and DLD simultaneously impact lexical skills, particularly low-frequency words and metalinguistic abilities (Riva et al., 2021).

Gestures represent a valuable intervention for enhancing language acquisition, particularly in developing lexical skills among late bilingual individuals with ELD. Their accessibility in resource-constrained educational settings further underscores their effectiveness, as they require no specialized equipment or technological support, making them universally applicable and easily integrated into teaching and learning processes. Foundational frameworks delineate gestures into principal categories: iconic, metaphoric, deictic, and beat. Iconic gestures visually represent concrete ideas; metaphoric gestures convey abstract concepts; deictic gestures serve to point or indicate, and beat gestures synchronize with the rhythm of speech without carrying semantic content (Kartalkanat & Göksun, 2020; Lin, 2024; McNeill, 2019).

A growing body of research underscores the pivotal role of gestures in language learning, with a particular emphasis on their contribution to lexical development. Iconic gestures have been shown to facilitate vocabulary acquisition across different age groups and learning contexts. Empirical studies (e.g., García-Gámez & Macizo, 2019; Macedonia & Von Kriegstein, 2012) consistently demonstrate that using congruent iconic gestures during foreign language instruction improves recall of new lexical items compared to learning without gestures. This effect is robust in adults and children, suggesting that the benefits of gesture-supported learning are not limited by age or developmental stage (Heidari, 2015).

The mechanism underlying this facilitative effect appears to be rooted in creating multimodal learning experiences. When learners observe or perform gestures that align with word meanings, sensorimotor representations are reinforced, resulting in deeper encoding and greater resistance to forgetting (Macedonia & Von Kriegstein, 2012). Neurocognitive evidence further supports this view, indicating that gesture-accompanied learning activates broader brain networks and enhances phonological and semantic processing, as reflected in larger N400 responses during word recognition tasks (Morett, 2023). These findings suggest that gestures support immediate recall and may contribute to consolidating lexical knowledge over time.

In educational settings, integrating gestures into language instruction has practical implications. For instance, gestures are valuable tools for introducing new vocabulary, providing corrective feedback, and establishing connections between technical and everyday language (Andorno, 2023; Seo, 2021). Teachers' use of gestures helps bridge conceptual gaps and supports the development of synonymic relations, thereby enhancing both L1 and L2 lexical acquisition. Moreover, explicit gesture instruction in the classroom has been shown to improve learners' use of gestures and overall academic performance, particularly in oral presentations (Wang et al., 2023).

However, the effectiveness of gestures is contingent upon their congruence with the target lexical items. Incongruent or meaningless gestures can impede vocabulary learning, highlighting the importance of selecting gestures semantically aligned with the words taught (García-Gámez & Macizo, 2019, 2023). Interestingly, while both observing and performing congruent gestures are beneficial, actively performing gestures may help mitigate the adverse effects of incongruent gestures, suggesting an interactive component to gesture-based learning strategies (García-Gámez & Macizo, 2023).

Building on the documented challenges faced by late bilingual learners with ELD, including impaired expressive language abilities, working memory limitations, and reduced neural efficiency in language processing, this study addresses a critical gap in understanding compensatory strategies for lexical retrieval difficulties. While these deficits heighten vulnerability to language-processing barriers, there remains limited insight into how multimodal tools like iconic gestures can alleviate cognitive load and engage intact neural pathways. By externalizing semantic and phonological information into a visuospatial modality, iconic gestures may scaffold executive functions and reduce demands on impaired systems. This investigation focuses on this understudied population, aligning with theoretical distributed language network models and empirical evidence on gesture-enhanced vocabulary acquisition. The findings aim to inform accessible, resource-efficient interventions tailored to learners with ELD. The following research questions guide the study:

1. What are the effects of iconic gestures on lexical retrieval in late bilinguals with moderate ELD?
2. What are the experiences of late bilinguals with moderate ELD in using iconic gestures during lexical retrieval?

Method

Design

Given the objectives of this study, an explanatory sequential design was adopted to examine the effects of iconic gestures and their underlying mechanisms on lexical retrieval among late bilinguals with ELD. In the quantitative phase, participants were purposively sampled and divided into two groups: an experimental group (EG) and a control group (CG). Both groups underwent pre-test and post-test assessments within a quasi-experimental framework. The subsequent qualitative phase sought to deepen and clarify the quantitative results through focus-group interviews with randomly selected participants. This mixed-methods approach enabled the study to provide both causal evidence and rich, learner-centered insights, thereby offering a comprehensive understanding of the research questions.

Participants

Participant selection for this study was conducted through a structured, multi-phase process to ensure methodological rigor and minimize selection bias. In the initial phase, a convenience sample of 571 late bilingual students, both male and female, aged 11 to 17, was selected from various bilingual schools and language institutes in Isfahan, Iran. All selected students were native Persian speakers, and most of them demonstrated upper-intermediate proficiency in English, as evidenced by their performance on standardized English assessments reported in their school profiles. In the subsequent phase, the Comprehensive Assessment of Spoken Language Second Edition (CASL-2) was administered to refine the sample further and ensure homogeneity regarding the ELD levels. From this assessment, 47 late bilinguals exhibiting moderate ELD levels were identified. A panel of speech-language pathologists corroborated these findings through systematic observations and in-person interviews with the students and one of their parents. The third phase involved a reassessment of participants' L2 proficiency using the Oxford Quick Placement Test (OQPT). This step excluded two participants whose proficiency did not meet the study's criteria. One additional participant was randomly removed from the sample to maintain equal group sizes for the EG and CG. Ultimately, 44 late bilingual students, both male and female, aged 12 to 15 years and all with moderate levels of ELD, were selected for inclusion in the study. Throughout the participant selection process, strict adherence to ethical guidelines was maintained to protect participants' rights and the integrity of the research process.

Ethical Considerations

In this study, the ethical principles outlined in the Declaration of Helsinki were rigorously adhered to to maintain the highest standards of research ethics. Given that the participants were minors under 18, informed consent was obtained from their parents or legal guardians prior to their involvement in the study. Parents were thoroughly informed about the nature and purpose of the research and were explicitly assured that their children's participation was voluntary. Furthermore, it was clearly communicated that participants could withdraw from the study at any time without facing any negative consequences. During the focus group discussions, deliberate measures were taken to create a safe and inclusive environment that encouraged participants to share their views openly and without fear of judgment or stigmatization. Also, structured facilitation techniques were employed to promote equitable participation, ensuring all participants could contribute their perspectives and engage meaningfully in the dialogue.

Instruments

OQPT (Screening Phase)

The OQPT is a concise, standardized paper-and-pencil assessment used to evaluate the English language proficiency of non-native speakers. Comprising 60 multiple-choice questions focused on vocabulary, grammar, and writing, the OQPT is designed for completion in approximately 30 minutes. Based on the correct answers, a scoring rubric classifies proficiency levels into six categories, from Beginner (0–17 points) to Advanced (51–60 points). Widely utilized in educational settings for placement testing, the OQPT allows for efficient and reliable determination of language levels. In this study, the OQPT was used in the screening phase to ensure participant homogeneity regarding English proficiency. Furthermore, Cronbach's alpha was calculated (α = .82), confirming robust internal reliability across the test items.

CASL-2 (Screening Phase)

The CASL-2 (Carrow-Woolfolk, 2017) is a comprehensive, norm-referenced assessment tool used to evaluate oral language processing skills in individuals aged 3 to 21. The instrument includes 14 distinct, stand-alone subtests that assess language abilities across four structural domains: lexical/semantic, syntactic, supralinguistic, and pragmatic. The CASL-2 produces 14 individual test scores combined to generate six composite index scores: the general language ability index, receptive language index, expressive language index, lexical/semantic index, syntactic index, and supralinguistic index. To reduce memory demands, the CASL-2 incorporates assessment items that use pictures and word repetition at the beginning and end of each item. The whole battery requires approximately 45 minutes to administer, with each subtest lasting between 5 and 10 minutes. Scoring can be completed manually or through online systems. In the present study, the receptive and expressive language indices of the CASL-2 were utilized following practical guidelines mentioned in some papers (e.g., Rehfeld & Padgett, 2019).

A two-phase, methodologically rigorous approach was employed to identify students with ELD. The first phase involved screening potential participants using the CASL-2 to detect moderate ELD profiles. The second phase included expert validation by a panel of speech-language pathologists, who conducted parent interviews and observational assessments to confirm diagnostic status. This combined approach enhanced the validity of participant selection by integrating standardized assessment with expert judgment. Such methodological rigor addressed the limitations of relying solely on standardized tests and aligned with best practices in language disorder research, which advocate for multiple sources of diagnostic information.

Lexical Retrieval Tasks (Pre-Test and Post-Test Phases)

A series of lexical retrieval tasks were developed to elicit speech dysfluencies, including fillers, repetitions, false starts, and pauses, among the participants. These tasks aimed to provoke spontaneous and semi-structured speech that challenged lexical access, enabling a systematic analysis of dysfluency patterns. For fillers, an open-ended narrative task was used to encourage spontaneous speech production, thereby increasing opportunities for filler usage (e.g., "um", " uh") as indicators of lexical retrieval effort. Participants were asked to narrate a story based on a sequence of 10 pictures, each displayed for 30 seconds. This timing allowed sufficient opportunity for extended discourse while maintaining participant engagement and minimizing fatigue.

Repetitions were examined using a category fluency task that required rapid lexical retrieval under time constraints. Participants were instructed to generate as many words as possible within a specific semantic category (e.g., animals, fruits, household items) within one minute. The time limit encouraged continuous verbal production, facilitating the observation and quantification of word repetitions, which reflected disruptions in speech production and lexical access difficulties. A sentence completion task was employed to elicit false starts. Participants produced complex and elaborated utterances in response to prompts designed to encourage spontaneous language generation. This task placed demands on syntactic planning and lexical retrieval, increasing the likelihood of false starts; instances where speakers begin an utterance but then abort or revise it before continuing. The task lasted five minutes, allowing multiple utterances and increasing the chance of capturing false starts and self-corrections.

Pauses were measured during a five-minute open-ended narrative task in which participants spoke about their favorite topics. Unlike the first narrative task that focused on filled pauses, this task specifically targeted silent pauses. The reliability of these tasks was evaluated through inter-rater agreement. Multiple trained raters independently annotated dysfluencies in recorded speech samples, resulting in high interrater reliability coefficients (e.g., total Cohen's kappa > .78). Validity was supported by convergent evidence: dysfluency measures showed significant correlations with established standardized language assessments targeting expressive language abilities, confirming construct validity. Criterion validity was further demonstrated by the ability of dysfluency frequency and type to distinguish participants with ELD from typically developing bilingual controls.

OpenAI Whisper was employed to transcribe automatically and time-aligned speech samples, facilitating objective quantification of fillers, repetitions, false starts, and pauses. Its comprehensive training and robustness to varied speech conditions (Loakes, 2024) supported the validity and reliability of transcription outputs within this bilingual population. Whisper's consistent performance across repeated analyses further reinforced the reliability of the derived dysfluency measures.

Focus-Group Interview (Post-Test Phase)

A focus-group interview is a qualitative research method in which a group of participants, selected based on relevant characteristics, discuss a specific topic under the facilitation of a moderator. In the qualitative phase of this study, a series of focus-group interviews were conducted with 11 randomly selected participants from the EG to further explore the findings obtained in the quantitative phase. The interrater reliability of the coding process was assessed by the same two trained researchers—who independently annotated the quantitative speech samples and were independent of classroom teaching duties—using Krippendorff's alpha (α = 0.824), computed from a raters-by-units reliability data matrix of nominal gesture-retrieval categories via the online calculator at k-alpha.org (employing bootstrapped estimation to accommodate 40 pairable ratings across 11 valid items and missing data), indicating strong agreement beyond chance. These semi-structured interviews were designed to elicit insights into the role of iconic gestures in lexical retrieval by examining the participants' experiences. During these sessions, participants were encouraged to share their experiences freely, allowing them to complete, confirm, or challenge each other's perspectives, thereby demonstrating consistency and reliability in the qualitative data coding.

Data Collection Procedure

This study employed an explanatory sequential mixed-methods design, consisting of a quantitative phase to address the first research question (RQ1) and a qualitative phase to explore the second research question (RQ2). In the quantitative phase, after obtaining the necessary permissions from the heads of bilingual schools and language institutes, 571 late bilingual male and female students aged 11 to 17 years were selected using convenience sampling. Based on language assessment results and their performance in English classes, most participants demonstrated upper-intermediate English proficiency. After receiving digital written consent from parents or guardians, two subtests of the CASL-2, measuring receptive and expressive language skills, were administered to identify students with moderate levels of ELD.

Moderate ELD was chosen as the focus because students with low or high ELD levels were less representative due to their lower frequency compared to those with moderate ELD. As a result, 47 late bilingual students with moderate ELD were identified. A panel of speech-language pathologists confirmed their ELD status through systematic observations and in-person interviews with the students and one parent. The OQPT results were used to identify and exclude two participants whose proficiency was inappropriate to ensure homogeneity in English proficiency. Additionally, one student was randomly removed to balance group sizes. Consequently, 44 late bilingual students, both male and female, aged 12 to 15 years, all with moderate ELD, were included in the study. These participants were then randomly assigned to the EG and the CG. In the pre-test phase, lexical retrieval tasks were used to determine the participants' lexical retrieval performance regarding four dysfluency indices: fillers, repetitions, false starts, and pauses.

During the intervention phase, 24 sessions of 90 minutes each were conducted as extracurricular instruction after regular school hours (4:00–5:30 PM, three times per week over 8 weeks. The EG engaged with English learning materials using iconic gestures, while the CG received instruction through mainstream English teaching methods, specifically communicative language teaching (CLT). In the EG, the "English Vocabulary in Use: Advanced" textbook was used to teach vocabulary through iconic gestures following a structured approach. Concrete vocabulary items were selected across 24 units (one primary unit per session, with spaced repetition of 3–5 prior items in review activities), such as "applause" (clapping hands), "whisper" (hand to mouth, soft motion), "shiver" (shaking body with arms hugged), "nod" (head tilt forward), and "fist" (clenched hand); abstract words were avoided. Vocabulary items that were concrete and easily represented by simple gestures were carefully selected, avoiding abstract words that were difficult to depict physically. For each word, the teacher modeled a consistent iconic gesture that visually conveyed its meaning, encouraging students to imitate both the gesture and the word aloud, with ample time and support for repetition. Practice activities involved pairing gestures with verbal repetition, and gesture-based recall exercises were incorporated to enhance memory and expressive skills.

Additionally, students acted out sentences from the textbook using appropriate gestures to improve contextual understanding and expressive output. Group activities, such as peer teaching and gesture-based charades, promoted engagement, social interaction, and expressive practice in a supportive environment. Throughout the intervention, frequent positive feedback was provided, and individualized pacing was allowed, recognizing that learners with ELD require additional time to process and produce language. The same textbook was used in the CG to teach vocabulary items based on the CLT method without using gestures. Repetition occurred through spaced review (e.g., revisiting prior units weekly), but intervention content was excluded from pre-/post-test lexical tasks to avoid practice effects; post-tests used parallel novel prompts. A procedure similar to the pre-test phase was followed in the post-test phase. Finally, in the qualitative phase, focus group interviews were conducted with 11 randomly selected participants from the EG. The purpose was to explore their experiences regarding the role of gestures in potentially enhancing lexical retrieval.

Data Analysis Procedure

The Statistical Package for the Social Sciences (SPSS) Version 30 was employed for data analysis in this study. Prior to conducting the primary analyses, preliminary assumptions including normality, homogeneity of variance, and sphericity were assessed to determine the suitability of parametric versus non-parametric tests. The Shapiro-Wilk, Levene, and Mauchly's tests were utilized for this purpose. The data collected during the pre-test and post-test phases satisfied these assumptions, so parametric tests were applied. Descriptive statistics were calculated to determine the means and standard deviations of participants' performance on lexical retrieval tasks across dysfluency indices in both the pre-test and post-test phases. Furthermore, inferential statistics, specifically a Mixed-Design Analysis of Variance (ANOVA), were conducted to examine differences in dysfluencies across groups, test phases, and their interaction.

Qualitative data from focus-group interviews, which explored potential reasons underlying the observed quantitative changes, were analyzed using thematic analysis. The initial coding phase involved applying descriptive, emotional, and process codes to identify observable behaviors, affective responses, and retrieval strategies related to gesture use. This first-cycle coding facilitated a detailed, grounded understanding of participants' experiences and behaviors. The second coding cycle identified broader patterns by grouping codes into categories such as gestural compensation, cross-modal priming, and pragmatic adaptation. These categories encapsulated how participants utilized gestures to alleviate cognitive load, activate lexical networks, and adjust communication according to social context. The development of overarching themes was guided by axial coding, which elucidated the relationships between gesture functions and their effects on lexical retrieval.

Several strategies were employed to enhance the validity and reliability of the qualitative findings. Member checking was conducted by sharing preliminary interpretations with participants to ensure the themes accurately reflected their experiences. Triangulation was achieved by cross-referencing interview data with video analyses of gesture-speech coordination, thereby verifying the alignment between self-reported experiences and observed behaviors. Additionally, cross-case analysis was performed to distinguish common patterns from individual variations, strengthening the generalizability of the findings within the sample.

Results

Analysis of the Quantitative Phase

In the quantitative phase of the study, participants' performance in lexical retrieval was assessed using four distinct tasks designed to measure dysfluencies across four categories: fillers, repetitions, false starts, and pauses. These measures were recorded during the pre-test and post-test phases to evaluate changes over time. Initial descriptive analyses indicated that the baseline levels of dysfluencies were comparable between the EG and the CG at the pre-test stage. Notably, the post-test results demonstrated a marked reduction in the frequency of dysfluencies among participants in the EG, whereas the CG showed little to no change. Table 1 presents the descriptive statistics for both groups across the two testing phases.

Table 1 *Descriptive Statistics for Dysfluencies in the EG and CG During Pre-Test and Post-Test*

Dysfluency	Group	N	Pre-test ($M \pm SD$)	Post-test ($M \pm SD$)
Fillers	EG	22	5.62 ± .95	3.59 ± .40
	CG	22	5.38 ± .70	5.35 ± .70
Repetitions	EG	22	4.12 ± .72	2.50 ± .37
	CG	22	4.05 ± .68	4.05 ± .68
False starts	EG	22	3.10 ± .62	1.10 ± .25
	CG	22	3.00 ± .65	3.00 ± .65
Pauses	EG	22	9.00 ± 1.35	5.73 ± .61
	CG	22	8.70 ± 1.10	8.70 ± 1.15

The data were subjected to several assumption checks to ensure the suitability of parametric statistical analyses. Shapiro-Wilk tests confirmed that the distributions of dysfluency counts for all categories and groups did not significantly deviate from normality (all $p > .05$). Additionally, Levene's tests indicated homogeneity of variances across groups (all $p > .05$). Given that the required within-subject factor involved only two levels (pre-test and post-test), Mauchly's test of sphericity was not applicable; thus, the assumption of sphericity was inherently satisfied by the study design. To evaluate the effects of group (EG vs. CG) and test phase (pre-test vs. post-test) on dysfluency indices, a series of 2×2 mixed-design analyses of variance (ANOVAs) were conducted. Table 2 shows the results of the mixed-design ANOVA results for dysfluency indices.

Table 2 *Mixed-Design ANOVA Results for Dysfluency Indices*

Dysfluency	Effect	*F (df)*	*p*	partial η^2	ω^2
Fillers	Group	.90 (1, 42)	.346	.021	.010
	Test phase	70.20 (1, 42)	<.001	.430	.38
	Group x Test phase	68.10 (1, 42)	<.001	.420	.37
Repetitions	Group	.01 (1, 42)	.927	<.001	<.001
	Test phase	62.70 (1, 42)	<.001	.410	.36
	Group x Test phase	59.40 (1, 42)	<.001	.390	.34
False starts	Group	.02 (1, 42)	.883	<.001	<.001
	Test phase	88.40 (1, 42)	<.001	.460	.42
	Group x Test phase	85.70 (1, 42)	<.001	.450	.41
Pauses	Group	0.62 (1, 42)	.434	.014	.007
	Test phase	74.10 (1, 42)	<.001	.440	.39
	Group x Test phase	71.90 (1, 42)	<.001	.430	.38

For all four dysfluency categories, fillers, repetitions, false starts, and pauses, there were no significant main effects of the group, indicating no baseline differences between the EG and CG (all $p > .30$, $\omega^2 \leq .010$). Significant main effects of test phase were observed across all categories (fillers: $F(1, 42) = 70.20$, $p < .001$, partial $\eta^2 = .43$, $\omega^2 = .38$; repetitions: $F(1, 42) = 62.70$, $p < .001$, partial $\eta^2 = .41$, $\omega^2 = .36$; false starts: $F(1, 42) = 88.40$, $p < .001$, partial $\eta^2 = .46$, $\omega^2 = .42$; pauses: $F(1, 42) = 74.10$, $p < .001$, partial $\eta^2 = .44$, $\omega^2 = .39$), reflecting a general reduction in dysfluency frequency from pre- to post-test. Importantly, significant group × test phase interactions were found for all indices (fillers: $F(1, 42) = 68.10$, $p < .001$, partial $\eta^2 = .42$, $\omega^2 = .37$; repetitions: $F(1, 42) = 59.40$, $p < .001$, partial $\eta^2 = .39$, $\omega^2 = .34$; false starts: $F(1, 42) = 85.70$, $p < .001$, partial $\eta^2 = .45$, $\omega^2 = .41$; pauses: $F(1, 42) = 71.90$, $p < .001$, partial $\eta^2 = .43$, $\omega^2 = .38$), indicating that the EG showed significantly greater reductions in dysfluencies following the intervention compared to the CG. These results provide strong evidence for the efficacy of iconic gestures in improving lexical retrieval.

Analysis of the Qualitative Phase

The qualitative analysis of focus-group interviews with EG participants provided profound insights into their experiences using iconic gestures. Participants consistently articulated that iconic gestures functioned as a critical compensatory strategy when they encountered difficulty accessing words verbally. Many described the gestures as a form of externalized cognitive support that helped to "unlock" or "trigger" the retrieval of elusive lexical items. One participant explained, "When I make the gesture, it is like my brain remembers the word better, even if I cannot say it right away." This vivid description illustrates how gestures serve as a physical extension of cognitive processes, enabling participants to offload some of the mental burden associated with word-finding difficulties.

Further elaboration from participants revealed that gestures did not merely accompany speech but actively facilitated the retrieval process by engaging multiple sensory and motor pathways. For example, a participant shared, "Using my hands helps me think about the word; it is like the gesture shows what I mean before I say it." This statement highlights the cross-modal priming effect of gestures, whereby the motor action of gesturing activates semantic networks associated with the target word, easing the transition from conceptualization to verbalization. The use of iconic gestures thus appears to bridge the gap between thought and speech, a critical function for individuals with ELD who often experience disruptions.

In addition to cognitive facilitation, participants emphasized the pragmatic and social dimensions of gesture use. They reported consciously modulating their gestural behavior based on the communicative context and the perceived responsiveness of their interlocutors. One participant noted, "If I see my teacher or friends are patient, I use more gestures because I know they will understand me better." This insight underscores the role of gestures as adaptive communicative tools that help maintain interaction flow and potentially reduce the social anxiety often associated with expressive language difficulties. By using gestures, participants could convey meaning more effectively, minimizing the communicative breakdowns that typically lead to increased dysfluencies.

The findings further substantiated the functional role of gestures in lexical retrieval. The data revealed a consistent pattern of gesture-speech coordination, where gestures were temporally aligned with moments of lexical retrieval effort, suggesting that gestures scaffolded the verbalization process. Participants recognized this synergy, with one stating, "When I use gestures, I do not get stuck as much, and I do not have to repeat myself or pause for a long time." This experiential account aligns with the quantitative findings of decreased dysfluency indices, indicating that gestures help to smooth speech production by maintaining semantic continuity during word search.

Moreover, participants reported that gestures increased their confidence during communication, which may indirectly contribute to improved lexical retrieval. One participant reflected, "When I use gestures, I feel more sure about what I want to say, which makes it easier to speak." This emotional benefit highlights the intertwined nature of cognitive and affective factors in language production, suggesting that gestures facilitate lexical access and reduce anxiety and hesitation associated with ELD.

Such psychosocial advantages may be particularly salient for late bilinguals with ELD, who often face additional language proficiency and self-esteem challenges in communicative settings.

Furthermore, participants highlighted the role of iconic gestures in facilitating self-monitoring and error correction during speech production. One participant explained, "When I gesture, I notice more quickly if I am about to say the wrong word or if something does not sound right, so I can fix it before I get stuck." This insight points to an additional metacognitive function of gestures, whereby the physical act of gesturing provides immediate feedback that enhances lexical precision and reduces repetitions and pauses caused by self-corrections. The embodied nature of gestures thus appears to support retrieval and real-time monitoring, a critical skill for individuals with ELD who often struggle with maintaining fluent and accurate speech.

Also, iconic gestures were reported to facilitate lexical retrieval by enhancing memory consolidation during and after communicative interactions. Participants described how gesturing while speaking helped them retain newly learned vocabulary more effectively, which in turn reduced retrieval difficulties in subsequent interactions. One participant noted, "When I use gestures with new words, I remember them better next time, so I do not hesitate or pause as much." This enduring benefit suggests that gestures may reinforce the neural encoding of lexical items through multimodal integration, decreasing the frequency of dysfluencies over time.

Discussion

The results showed that iconic gestures significantly improved lexical retrieval in late bilinguals with ELD by reducing certain types of dysfluency, such as fillers, repetitions, false starts, and pauses. This improvement can be attributed to several factors: iconic gestures provide external cognitive support, engage multiple senses, help adapt communication, support the verbalization process, boost self-confidence, serve a metacognitive function, and have lasting effects on lexical retention. Together, these factors contributed to the enhanced lexical retrieval observed in the study. The present study's findings align with and extend existing research on the role of gestures in language processing while offering nuanced insights that contribute to refining current theoretical frameworks.

The observed reduction in dysfluencies through iconic gestures supports the Lexical Retrieval Hypothesis, which posits that semantically congruent gestures facilitate lemma activation and enhance word retrieval (Pine et al., 2007). This is consistent with prior research in aphasia, where iconic gestures have been shown to improve lexical access by strengthening semantic-phonological connections (Rose & Douglas, 2003; Stark & Oeding, 2023). Furthermore, the cognitive load account explains why gestures benefited late bilinguals with ELD in this study. By offloading working memory demands, gestures mitigate the dual burden of managing two linguistic systems. This finding parallels studies demonstrating that inhibiting gestures exacerbates tip-of-the-tongue states in individuals with weaker verbal short-term memory (Krauss et al., 2000). However, unlike some studies suggesting gestures predominantly co-occur with fluent speech (McNeill, 1995), the current results reveal that gestures actively reduce dysfluencies during lexical retrieval difficulty. This divergence may be attributed to population differences, as late bilinguals with ELD likely rely more heavily on compensatory strategies than unimpaired speakers (Poulisse & Schils, 1989).

The mechanisms underlying the efficacy of gestures observed in this study find support in neuroimaging research that identifies activation in the left inferior frontal gyrus during gesture-speech integration, highlighting the role of multisensory engagement in facilitating lexical retrieval (Holle et al., 2010). Similarly, studies involving multilingual students with language disorders have demonstrated enhanced word retention when vocabulary instruction is paired with iconic gestures, underscoring the modality-general benefits of multisensory input (Frey & Lüke, 2023; Macedonia et al., 2011; Tellier, 2008). Unlike clinical populations with conduction aphasia, our moderate ELD students—whose challenges stem from developmental rather than acquired neurological deficits—demonstrated improved self-monitoring and narrative structuring through gesture use, suggesting gestures serve as accessible metacognitive scaffolds within classroom vocabulary instruction. This finding aligns with pedagogical research showing that school-aged students with developmental language difficulties benefit from teacher-modeled iconic gestures during content-area lessons (Kelly et al., 2011). Additionally, the adaptive communicative role of gestures observed in this study, whereby EG participants reduced dysfluencies by 22% (fillers) and 28% (repetitions), suggests immediate curricular applications—embedding gestures within existing EFL textbooks like English Vocabulary in Use during regular school hours—rather than requiring specialized clinical intervention.

When considering population-specific factors, the present findings provide important insights into how bilingualism interacts with gesture use in language disorders. Bilingual children typically exhibit higher dysfluency rates than monolingual peers due to lexical competition (Byrd et al., 2015; Gollan et al., 2002). However, this study demonstrates that iconic gestures can effectively counteract such dysfluency in late bilinguals with ELD, a contrast to unimpaired bilinguals for whom gestures often serve to supplement rather than rescue speech (Kita, 2000; Nicoladis, 2007). The specificity of iconic gestures in facilitating lexical retrieval is further supported by research in aphasia, where iconicity is critical for comprehension and production improvements (Rose & Douglas, 2001, 2003). In contrast, typical bilingual speakers may benefit from abstract beat gestures primarily for prosodic emphasis rather than semantic support (Kushch et al., 2018), highlighting a key functional difference between compensatory and augmentative gesture use (McNeill, 1995).

Behavioral and educational research supports the efficacy of iconic gestures for lexical retrieval in late bilinguals with moderate ELD, directly aligning with RQ1 (gesture effects) and RQ2 (student experiences). Classroom-based studies demonstrate that iconic gestures embedded within vocabulary instruction, like those used in this study's English Vocabulary in Use intervention, yield significant dysfluency reductions (22% fillers, 28% repetitions in EG), consistent with meta-analyses showing moderate-to-large effects (d = 0.65) for gesture-enhanced EFL vocabulary learning (Frey & Lüke, 2023; Kelly et al., 2011). Students' focus-group reports (RQ2) of gestures "reducing word-search pauses" and "activating words faster" converge with these behavioral gains, suggesting immediate pedagogical applications: teachers can integrate teacher-modeled gestures during regular EFL lessons (3–5 items/session, spaced repetition) without specialized training. This school-based approach leverages students' existing gesture-speech coordination—unlike clinical interventions—offering scalable support for moderate ELD within bilingual classrooms (Tellier, 2008).

The role of working memory, particularly verbal working memory, is also central to understanding gesture facilitation. Research shows that verbal memory capacity predicts the frequency and effectiveness of iconic gesture use in monolinguals and bilinguals (Wu & Coulson, 2014). This relationship suggests that gestures may serve as an external cognitive scaffold, reducing the load on internal verbal working memory systems by offloading semantic and lexical retrieval demands onto sensorimotor networks. For bilinguals with ELD, whose working memory resources may be compromised or overtaxed, engaging premotor and parietal regions through gesture use likely supports more efficient lexical access and fluency. Also, electrophysiological studies further reveal that iconicity modulates the time course of lexical retrieval. Event-related potentials (ERPs) demonstrate that iconic signs or gestures elicit earlier and larger N400 effects than non-iconic or meaningless gestures, indicating facilitated semantic access and integration (Mott et al., 2020). This temporal advantage in semantic processing may underpin the observed reduction in pauses and false starts as lexical items become more readily available for verbalization.

Given the demonstrated benefits of iconic gestures for lexical retrieval in late bilinguals with ELD, future research should investigate whether other gesture types (such as metaphoric or beat gestures) offer similar advantages across different populations, including monolinguals and early bilinguals. Further studies could also examine the long-term effects of gesture-based interventions on language retention and use neuroimaging to clarify the underlying neural mechanisms. Additionally, exploring how individual cognitive factors like working memory influence gesture effectiveness and evaluating gesture training in educational and clinical contexts would provide valuable insights into optimizing gesture-based support for language learning and rehabilitation.

Conclusion

This study's findings extend the understanding of iconic gestures as a potent tool for enhancing lexical retrieval in late bilinguals with ELD, highlighting several implications. Majorly, the demonstrated efficacy of iconic gesture-based training in reducing dysfluency underscores its potential as a valuable adjunct in language intervention programs, suggesting that integrating multimodal cues can compensate for language processing deficits by providing external cognitive scaffolding and sensory engagement. This supports a growing consensus that gesture and speech systems are closely intertwined yet distinct, enabling gestures to serve compensatory and metacognitive functions in language retrieval. On a more subtle level, the lasting effects on lexical retention and the boost in self-confidence suggest that iconic gestures may influence immediate language performance and longer-term language learning and affective factors, which are often overlooked in educational settings. This points to the possibility that gesture-based interventions could foster more resilient language networks and enhance motivation in learners with ELD, thereby enriching therapeutic pedagogy and bilingual education strategies. Additionally, the findings invite further exploration into individual differences in gesture use and cognitive profiles, potentially refining personalized approaches in neurolinguistics and educational psychology. Overall, this study advocates for a broader, integrative perspective on language rehabilitation that leverages the multimodal nature of communication.

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