Proceedings of ICGPSH 2026 Symposium: EdTech & AI in Learning: Large Language Models in Business, Politics, and Humanities
DOI: 10.54254/2753-7048/2026.LD33562

Neurolinguistic Mechanisms of Assimilation, Accommodation, and Cognitive Reorganization: Exploring Pedagogical Implications for Promoting Positive L1 Transfer

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Abstract. This article challenges the traditional teaching perspective which views learner's first language (L1) as a negative interference. By reviewing the neuroimaging studies, this research finds that bilingual processing relies on highly overlapping neural representations. In this process, the first language (L1) is not an isolated system but can serve as a cognitive scaffold for second language (L2) learning through assimilation and accommodation mechanisms. When the features between L1 and L2 are similar, the brain makes use of existing neural pathways to achieve efficient assimilation; when there are great differences, the brain initiates adaptation and long-term cognitive restructuring. The review also shows that self-efficacy and positive emotions associated with L1 can positively transfer to second language learning. Based on these findings, this article suggests a shift from default exclusion of L1 to a principled multilingual method in teaching. The pedagogical implications which treat L1 as a strategic scaffold for comprehension, cross-linguistic noticing, and affective support through practices such as translanguaging and CLIL are encouraged by this study. Through the connection between neurolinguistic findings and classroom practice, the positive L1 transfer in L2 language teaching gets theoretical support from this research.

Keywords: Positive L1 Transfer, Neurolinguistic Mechanisms, Assimilation and Accommodation, Second Language Acquisition

1. Introduction

For years, monolingual perspective has been a popular voice in the field of second language (L2) teaching, particularly in language teacher training programs. This perspective typically treats the learner' s first language (L1) as a source of "negative interference" that must be suppressed to facilitate successful immersion [1]. However, with the development of neurolinguistic, this monolingual belief has begun to be challenged. From the research of neuroimaging studies, scholars find that the bilingual brain does not maintain isolated neural networks for different languages; instead, L1 and L2 rely on highly overlapping neural representations for semantic processing across both visual and auditory modalities [2]. These findings show that it may be a mistake to see L1 as an obstacle, it could be a foundational cognitive scaffold for L2 development.

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The mechanisms of assimilation and accommodation play an important role in the interaction between these linguistic systems. In the process of assimilation, learners use their L1 neural pathways to process new L2 input while accommodation requires the functional reorganization of cortical networks to adapt to novel linguistic features [3]. The data from neuroimaging analysis further confirms that though L1 and L2 processing involve common brain regions, the degree of neural recruitment is often affected by the proficiency level and the language distance between the two systems [4]. Therefore, it is possible that L1 can facilitate a more efficient cognitive reorganization if used strategically.

The specific value of this research is to build a bridge between cognitive neurolinguistic studies and classroom practice. Although traditional teaching perspectives value L1 exclusion, this study introduces a study-based shift toward a cross-linguistic paradigm. With understanding the neurobiological principle of positive transfer in theory, language teachers can implement teaching strategies such as translanguaging or Content and Language Integrated Learning (CLIL) that are more suitable for the brain's natural architecture. The related study that happened in the Chinese context also found that the positive attitudes and self-efficacy from the use of L1 can greatly help to improve learner' s emotional resilience and motivation [5].

The neurolinguistic mechanisms of assimilation and accommodation and their role in cognitive reorganization are the heart of this study. How do neuroimaging findings about assimilation and accommodation prove and support the mechanisms of positive L1 transfer? And how can these neurolinguistic findings improve L2 teaching interventions? These two research questions are set to fill the gap between neurolinguistic study and classroom practice. To answer these questions, this study is going to reveal how the positive L1 transfer helps to improve L2 language teaching with the theory of natural architecture of the bilingual brain.

2. Literature review

2.1. The monolingual approach in L2 teaching: evolution and controversies

For much of the last century, L2 teaching was strongly shaped by what Gallagher and Geraghty [1] call monolingual principle which is the belief that learners' first language (L1) should be neglected in the L2 classroom and may even interfere with successful acquisition. In this tradition, maximum exposure to the target language was included in effective L2 language class, and the use of L1 was often treated as a flaw rather than as a possible learning resource. Gallagher and Geraghty [1] further mention that this belief became almost axiomatic in language teaching, to the point that many scholars of language teaching discussed L1 mainly in terms of how to avoid it.

Although this position was long seen as common sense, it has increasingly been challenged. Gallagher and Geraghty [1] argue that second language teaching remains largely monolingual in orientation even after the wider multilingual turn happened in applied linguistics. They also address the fact that evidence suggests a strict monolingual approach is not necessarily the most effective way to support additional language learning, especially when compared with the actual linguistic practices of bilingual users. What's more, research indicates that many language trainers still struggle with the disconnect between monolingual policy and the practical necessity of multilingual practices in diverse classrooms [1].

A similar voice appears in CLIL and content-based education. Lin [6]. argues that monolingual immersion ideologies are still influential and are sustained by several traditional assumptions, especially the maximum input hypothesis and the idea of parallel monolingualisms In this view, bilingual development is seen as the separate growth of two languages, so learners are expected to

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build L2 mainly through L2 exposure while their existing L1 resources are kept outside the classroom. However, this persistence of the monolingual approach is not only theoretical, it is also ideological. Lin [6] explains that negative attitudes toward L1 are partly linked to the historical association between L1 use and grammar-translation methods. Under this perspective, even limited and purposeful uses of L1 are often judged as signs of poor teaching.

At the same time, both studies suggest that this view of language teaching is gradually changing. Gallagher and Geraghty [6]. argue that teachers need a clearer theoretical framework for making informed decisions about L1 use instead of simply following inherited assumptions [1]. On the other hand, Lin [6] calls for a more balanced and evidence-based understanding of the role of L1 in bilingual and content-based education These studies not only challenge the theoretical foundation of monolingual approach in L2 teaching but provide the starting point for reconsidering L1 through neurolinguistic evidence.

2.2. Neural mechanisms of bilingual language processing

Recent neurolinguistic research challenges the long-held assumption that L1 and L2 depend on entirely separate neural architectures. The findings now reveal a considerable neural overlap, particularly when it comes to semantic processing. Using multi-voxel pattern analysis (MVPA), Van de Putte et al. [2] found that neural activity in one language can decode the conceptual representations that the other language draws on. This cross-language decoding happens in both comprehension and production tasks. It shows that at least some semantic representations are shared across languages which, to a degree, extend across modalities as well.

The shared neural activity will not change into an identical anatomical layout. Van de Putte et al. [2] find that the regions recruited varied with the task. Picture naming, word listening, and word reading each happens in different areas. This shows that bilingual processing is shared in the brain, but it actually shaped by the order people give to the brain. The study of Hou et al. [7] mention that L1 and L2 involve overlapping networks. In their study, the distinct sensitivities to semantic and syntactic features arerevealed. When it comes to Chinese-English bilinguals, they find that L2 processing get strong engagement from the verbal working memory. This shows that bilingual processing involves common language representations and different cognitive demand.

This view is also supported by other neuroimaging evidence. Liu and Cao [4] believe that this great and long controversy about L1-L2 neural similarities begins with some interacting factors. It is not the single principle that happens in this bilingual process. Their analysis mainly reveals two key factors which are the age of acquisition and orthographic transparency. These two factors together shape whether L2 depends more on existing L1-based networks or asks for help on extra brain regions. What is important in their study is that late bilinguals recruit more extra regions for L2 processing than early bilinguals do. This means that the heavier processing demand is, the later acquisition begins. Their work also reveals that L2 can shape L1 processing. This finding makes it clear that bilingual language processing is dynamic and interactive, not one-directional.

Bilingual neural processing also shows sensitivity to the linguistic features of the languages around. Hou et al. [7] believe that L1-L2 similarities and differences can change from one component to another. Semantics, syntax, phonology, and orthography may each tell a different story. The popular generalizations about the bilingual brain often miss the point. Two languages can overlap heavily in one domain and at the same time stay quite distinct in another. This is why current neurolinguistic research now views bilingual processing as a distributed and adaptive system. In this system, shared conceptual meaning becomes side by side with language-specific patterns of form and structure. L1 and L2 networks are not fully separate or completely unified.

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They use overlapping neural resources. The precise configuration of these resources is shaped by task modality, cognitive demand, age of acquisition, and linguistic distance.

2.3. Assimilation, accommodation, and cognitive reorganization in bilingualism

When people learn a new language, the brain uses two mechanisms: assimilation and accommodation [8]. Assimilation is to reuse existing L1 neural networks in the brain. This process of reuse is quite useful for L2 processing. Accommodation is what happens when the L1 network cannot meet the demands of the new language. When accommodation happens, the brain will recruit extra brain regions. New processing routines are also put in place in this process. This dynamic balance tells why neuroimaging studies report varying degrees of L1-L2 neural overlap [4].

Language distance also plays a major role in affecting this balance. It largely controls whether the brain takes the path of assimilation or accommodation. The study of Kim et al. [8] offer a specific example. Because English shares some orthographic transparency with Korean, they find that Korean speakers will activate their L1 network in their brain when they read English. That is assimilation. It is quite different when it comes to Chinese context. When Chinese speakers read English, their neural patterns move away from their L1 and come to get together. That is where accommodation happens. Therefore, when a new language sits close to L1 in structure, the brain leans on familiar resources. And when the distance widens, more extensive neural adaptation is called for [4].

These immediate adjustments are only part of the process. Continuous interaction between L1 and L2 produces "cognitive reorganization", which are fundamental reshaping of the bilingual language system. The study of Lee et al. [3] reveal this neuroplasticity. They find that even if there is only little training in Mandarin, beginners would use their left-hemisphere activation patterns typical of native speakers. Early functional reorganization in the reading network was found by Kuper et al. [9] in a longitudinal fMRI study. During their research, native and foreign language processing quickly began to converge. These findings prove that bilingual learning is not a temporary adjustment. It physically restructures the brain's language architecture. And this reorganization works both ways. The neural organization of L1 can be greatly changed by L2 learning. In the study of Zou et al. [10] , they find that the functional brain network supporting L1 production actively reorganizes to meet L2 demands in bimodal bilinguals. This kind of bilingual processing is not a one-way transfer from a static L1 baseline. It is a dynamic, interactive system [4]. Cognitive reorganization can be seen as the broader outcome of ongoing assimilation and accommodation across time.

Assimilation shows how existing L1 resources scaffold L2 processing. Accommodation shows how the brain adapts when those resources prove insufficient. Cognitive reorganization refers to something broader. This framework clarifies exactly when and how L1 supports L2 acquisition.

2.4. Positive L1 transfer: theoretical basis and empirical findings

The brain uses assimilation and accommodation to deal with a new language. Because of that, modern neurolinguistic research has largely abandoned the idea of L1 interference. The focus of relative study has become positive L1 transfer. L1 is now seen as a powerful cognitive and emotional scaffold. This scaffold accelerates L2 acquisition.

Positive transfer happens at the foundational morphosyntactic level. The empirical study of Banasik-Jemielniak et al. [11] support this perspective. They find that intentional bilingual exposure does not harm a child's L1 morphosyntactic development. If two linguistic systems are managed,

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metalinguistic awareness will increase. This awareness benefits both languages. The cognitive transfer can extend to grammatical structures. Kim et al. [12] have proved this point. Their study of Korean-English and Chinese-English bilinguals showed that key brain regions for L1 reading were also recruited for L2 reading. L1 processing tendencies can affect L2. In another context, Kush and Dahl [13] investigated how Norwegian learners of English learn complex sentence structures, specifically island insensitivity. Learners do not build new parsing rules from the beginning. They directly apply L1 learning strategies when dealing with difficult grammar in the L2. In this process, deep-level L1 grammatical routines are adjusted in the brain. This adjustment makes L2 comprehension faster and more efficient.

Positive transfer is not restricted to cognitive and structural rules. Recent study shows it also happens in the psychological and emotional domains. Zhu et al. [5] find that attitudes, self-efficacy, and emotional resilience are actively carried over from a learner's L1 background into the L2 learning. When L1 is valued in the classroom rather than suppressed, learners tend to report lower anxiety and higher motivation. A confident L1 user is more likely to become a confident L2 learner. L1 supplies a structural framework. It also offers an emotional scaffold for the learner. This perspective greatly challenges the traditional monolingual teaching approach.

3. Discussion: pedagogical implications for positive L1 transfer

3.1. L1 as a dual scaffold: cognitive network and affective efficacy

The literature review above suggests that L1 should not be treated only as interference, but as a potential scaffold for L2 learning. At the cognitive level, this view is supported by evidence that bilinguals do not process meaning in two fully isolated systems. Cross-language semantic overlap mentioned above indicates that L2 learning could be built, to some extent, on already established L1-based representations where some degree of assimilation is possible. Moreover, neuroimaging research shows the similarities between L1 and L2 processing, even though the amount of overlap depends on factors such as age of acquisition, task type, and orthographic transparency. This makes it difficult to justify a strict monolingual position that excludes L1 by default.

The pedagogical value of L1 is also effective. Zhu et al. [5] found evidence that L1 self-efficacy, enjoyment, and anxiety are related to corresponding L2 attitudes, and that L1 self-efficacy can positively predict L2 self-efficacy while indirectly shaping L2 emotions. This suggests that L1 may support not only comprehension but also confidence and emotional stability in demanding L2 tasks. In terms of classroom practice, introducing L1 in the L2 language class to the learners may therefore reduce their unnecessary anxiety and help them to preserve motivation. More cautious supporting evidence comes from Banasik-Jemielniak et al. [11], who found that intentional bilingualism was not associated with disadvantages in L1 morphosyntax and that the intentional bilingual group performed similarly to monolinguals. Although this study is not classroom-based, it weakens the common fear that bilingual support necessarily harms the first language.

3.2. Teaching through assimilation and accommodation

If bilingual learning involves both assimilation and accommodation, then pedagogy should not treat all L2 features in the same way. When L2 features are relatively close to learners' L1, teachers can use cross-linguistic comparison to support assimilation. Selective reference to L1 may help learners notice similarities in meaning, structure, or vocabulary and connect new input to existing knowledge more efficiently. For example, the Japanese teachers in a Chinese teaching context can take good use

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of the Kanji knowledge of learners. This idea is consistent with calls for a clearer framework that allows teachers to make informed pedagogic decisions about L1 use, rather than simply following monolingual assumptions.

On the other hand, when L2 features differ greatly from L1, teaching needs to focus more on accommodation and longer-term reorganization. In such cases, learners may need repeated, explicit, and well-supported practice in order to build new processing routines. Here, L1 may still serve as an initial bridge for explanation, but it cannot replace the sustained practice needed for L2-specific development. The pedagogical implication is therefore not that L1 should always be used, but that it should be used strategically, such as using L1 to explain the definition of the new vocabulary or to introduce the complex grammar rules.

3.3. From monolingual exclusion to principled multilingual pedagogy

Translanguaging and CLIL also show a promising picture on the possibility of positive L1 transfer. Gallagher and Geraghty [1] argue that there is little evidence that the monolingual principle is the most effective route to language learning and call for more explicit, theoretically informed treatment of L1 use in teacher education. What's more, Lin [6] believes that CLIL has the potential to move beyond traditional immersion models by adopting a more flexible and balanced view of L1, and that future work should focus on the systematic and functional use of both L1 and L2 rather than exclusion from the outset.

However, the strongest pedagogical implication is not that more L1 is always better, but that L1 should no longer be excluded by default. A principled multilingual pedagogy would treat L1 as a scaffold for comprehension, cross-linguistic noticing, and affective support, while still maintaining the long-term goal of stronger and more autonomous L2 processing. In this sense, the value of neurolinguistic evidence lies less in offering fixed classroom techniques and more in providing a stronger rationale for moving beyond the monolingual myth.

4. Conclusion

This paper has discussed that neurolinguistic research offers a valuable basis for rethinking the role of L1 in L2 teaching. Rather than supporting the traditional monolingual view that L1 is mainly a source of interference, this paper suggests that bilingual language processing involves both shared and adaptive neural systems. Research on semantic overlap, bilingual processing, and neuroplasticity shows that L1 and L2 are connected through dynamic mechanisms rather than strict separation [2,4]. Therefore, L1 should be understood not only as a possible constraint, but also as a potential cognitive resource for L2 learning.

The literature review showed that the concepts of assimilation, accommodation, and cognitive reorganization provide a useful framework for explaining positive L1 transfer. When L1 and L2 share important features, learners may rely on existing neural routines to support L2 processing. When the differences are greater, however, more explicit accommodation and longer-term reorganization are needed [3,8]. This means that positive transfer should not be treated as automatic or universal. Its value depends on language distance, linguistic domain, and the type of learning task involved.

In terms of pedagogical practice, the main implication is that L1 should no longer be excluded by default, rather than always used. L1 is expected to be seen as a scaffold for comprehension, comparison, and affective support, while still aiming at stronger and more independent L2 processing in practice. Therefore, the contribution of this review study lies in bridging

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neurolinguistic evidence and classroom practice. It offers a more balanced foundation for moving beyond the monolingual myth and toward language teaching that is better aligned with the natural architecture of the bilingual brain.

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