

Teacher Mediation Strategies for Cognitive Load Reduction in L2 Content-based Instruction

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Abstract

In culture-oriented Content-Based Instruction (CBI), L2 learners face dual challenges of language and cultural acquisition, where teacher mediation plays a critical role in regulating cognitive load. However, existing research inadequately addresses how teachers reduce cognitive load in such classrooms through mediational instruments. This study employs the course “The Society and Culture of Major English-speaking Countries (Britain)” within a Chinese university English major program as a case, analyzing teacher’s mediation strategies via unstructured observation. Findings reveal that teacher primarily utilized three types of mediation: (1) Linguistic mediation activated memory and concretized abstract concepts through tri-phase scaffolding (review-outline-summary), relatable analogies/cross-cultural comparisons, and sandwich-style strategy, thereby reducing intrinsic and germane cognitive load; (2) Multimodal mediation captured student attention via visual-gestural coordination, diminishing extraneous cognitive load; (3) Social mediation facilitated meaning negotiation through scaffolded questioning and collective responses, alleviating metacognitive load. These mediational strategies operated synergistically, enabling students to attain their potential developmental level within the Zone of Proximal Development (ZPD) (e.g., mastering cultural concepts like parliamentary systems and applying relevant terminology). The study provides actionable pedagogical implications for designing high cognitive-load cultural CBI courses.

Keywords: Mediation Theory; Zone of Proximal Development (ZPD); Content-Based L2 Instruction; Mediational Instruments; Cognitive Load

1. Introduction

Within the field of second language acquisition (SLA), Content-Based Instruction (CBI), which promotes language proficiency development through the teaching of subject matter, has emerged as a significant paradigm shift beyond traditional form-focused instruction. Culture-oriented CBI simultaneously emphasizes language learning and cultural understanding, presenting dual challenges for L2 learners. Consequently, the teacher’s role as a mediator in regulating students’ cognitive load through mediational instruments becomes particularly critical. However, existing research predominantly concentrates on fostering linguistic skills such as grammar and writing (e.g., Xu & Li, 2018), leaving the mechanisms by which teachers utilize mediational instruments to achieve cognitive load reduction in culture-oriented CBI courses underexplored. Such courses require students to comprehend complex cultural concepts, where the inherently high intrinsic cognitive load readily impedes progress within the Zone of Proximal Development (ZPD). Mediation theory underscores the teacher’s role in employing tools like language and symbols to scaffold learners across the ZPD (Vygotsky, 1978). Complementing this, cognitive load theory posits that effectively managing the three types of cognitive load (intrinsic, extraneous, and germane) is essential for more efficiently reaching potential developmental levels (Sweller, 2008). Conducting empirical research can illuminate how teachers synergistically deploy various mediational instruments and social interactions to optimize cognitive resource allocation in cultural CBI classrooms. Using the course “The Society and Culture of Major English-speaking Countries (Britain)” as a case study, this research aims to address this theoretical gap and provide actionable scaffolding strategies for high cognitive load cultural instruction.

To investigate teachers’ deployment strategies and functions of applying mediational instruments in CBI classrooms, this study conducts a case study with unstructured observation to document classroom interactions and conduct an in-depth analysis. By coordinately integrating a multidimensional theoretical framework encompassing mediation theory, ZPD mechanisms, and cognitive load theory, the research systematically draws three applicable mediation strategies, including linguistic mediation, multimodal mediation, and social mediation, to provide teachers with a scientific reference for designing cognitively friendly cultural instruction

2. Literature Review

Content-Based Instruction (CBI) has gained increasing scholarly attention in recent years, with the research focus in China shifting from theoretical investigations of foreign models to the localization of CBI pedagogy within the Chinese context. CBI was first proposed abroad in the 1980s (Sun et al., 2021). Mohan (1986) introduced CBI for language teaching in SLA and bilingual contexts, aiming to enhance students' second language proficiency while imparting subject knowledge. Research on CBI in China began in the early 21st century (e.g., Yu & Han, 2003). Subsequently, scholars conducted further research on CBI implementation for both non-English major and English major students at the university level (Yuan & Yu, 2008; Chang & Dong, 2008). Compared to traditional form-focused instruction, CBI promotes second language acquisition through subject matter learning (Yu & Han, 2003), shifting the focus from solely building students' language foundations to also emphasizing their understanding of subject knowledge while teaching the second language. CBI classrooms in China are often characterized by "teacher-dominated lectures with students participating passively when questioned by the teacher." Enhancing student participation is thus an important pedagogical approach for this type of classroom (Sun et al., 2021).

Socio-cultural theory is a key framework to SLA, of which its application to CBI classrooms can be a new analytical dimension. Since Soviet psychologist Vygotsky and his colleagues proposed and systematized the socio-cultural theory in the 1920s and 1930s, it has become a common practice (Gao, 2008). More and more language educators began to pay attention to this theory and apply it to second language acquisition. Socio-cultural theory was first proposed and explained by Vygotsky in 1987. Human mental functions are divided into lower and higher mental functions. Higher mental activities, such as logical memory and rational thinking, are processes that develop under the influence of the socio-cultural environment, mediated through the role of regulation. According to this concept, knowledge needs to be meaningful in the context of individual roles and interactions (Gao, 2008). Certain significant contributions have been made by socio-cultural theory in language teaching. The contributions lie in two areas: first, it emphasizes that language development occurs in interaction and that teachers should help learners learn through dialogue; second, language and other symbols can be used as a tool for learning a new language and help students internalize their linguistic knowledge (Gao, 2008).

ZPD theory is the key developmental mechanism for socio-cultural theory. ZPD serves as a developmental potential. It identifies two levels of individual development: the existing actual level, which refers to the level that an individual demonstrates when solving problems independently; and the potential level, which refers to the level of problem-solving that can be achieved at a higher stage with guidance from others. The gap between them is called ZPD (Vygotsky, 1978). ZPD has two main characteristics. Firstly, students must be given tasks that are slightly above their current level of personal competence. The tasks assigned should be enough to enhance their competence, but do not exceed it. Secondly, there must be a teacher or a more capable peer who plays a guiding role in the learner's approach to the problem (Wang, 2000). In language teaching based on ZPD theory, teachers, in order to help students bridge the gap between their ZPD, should provide learners with appropriate language materials and help them learn how to study through the construction of meaning (Gao, 2008). Regarding the practical application of ZPD theory, Lan (2010) suggested that when applying the ZPD theory, teachers should pay attention to the following tips: design the appropriate difficulty of the task and avoid locating the problem outside the ZPD; do not rely too much on other intermediaries and neglect their own role as guides; finally, apply as many teacher-student exchanges as they can. Besides, Xu et al. (2019) mentioned that teachers should give more specific feedback to improve the effectiveness of bridging ZPD. For example, "Start with a more direct statement to let the readers know the importance of the essay" rather than "start with a stronger opening statement".

Mediation theory is a pedagogical strategy that serves as an approach to bridge the ZPD. Its development has progressed unevenly globally, with earlier roots in international scholarship. Abroad, mediation theory took root earlier and has been continually enriched and refined. Evolving from psychological foundations, it originated in Vygotsky's concept of mediation for child cultivation and development, extended through Feuerstein's systematization of twelve features of mediated learning in education, and further advanced by Freeman's metaphorical conceptualization of teacher scaffolding (Feng, 2011). According to Vygotsky, a mediator is a cognitive tool. It can be a material tool, a symbolic system, or the behavior of others in social interaction. Mediators help learners to take ownership and control of their own learning processes; they also help them to learn to think and solve problems independently (Williams & Burden, 2000). Effective learning must be mediated to the ZPD (Vygotsky, 1978; Lantolf & Thorne, 2006) and depends on the quality of the interaction between the "mediator" and the learner (Zhu & Lu, 2020). Israeli psychologist and educator Feuerstein (1991) summarized twelve characteristics of mediation, corresponding to all learning tasks, learning processes, and social skills. Li (2007) detailed the application of the 12 mediating features in foreign language teaching in his paper and explained them with examples. The term "scaffold" is a metaphor for the mediating role of the teacher. In teaching, "scaffolding" is

used as a metaphor for the teacher's role in guiding students' learning through the construction of a conceptual framework to reach a target level, and then withdrawing from the framework so that students can learn to learn (Gao, 2008). Research on Mediation Theory in China commenced relatively late. Early studies in Chinese second language acquisition primarily focused on importing, introducing, or reviewing Western scholarship and emerging perspectives. Since the beginning of the 21st century, the field has gradually shifted from theoretical discussions to empirical investigations (Yang, 2005), with educators increasingly directing attention to Mediation Theory (Feng, 2011). In empirical research regarding mediational tools, scholarly inquiries have encompassed both traditional instruments and modern multimedia technologies. Zhu and Lu (2020) analyzed how teacher mediators can better use the theory of mediating role to regulate the relationship between students and textbooks in their paper, and selected mediating characteristics related to textbook use for specific analysis; in 2010, Lan suggested some approaches to better teach college English through multimedia network.; and Hu and Cao (2021) contrasted the roles of peer mediation in online and offline teaching and learning. Regarding classroom content in empirical studies, initial research prioritized linguistic competence development (Yang & Zhang, 2025), such as grammar instruction (Jiang, 1995; Dai & Chen, 2005; Dai & Ren, 2006; Wu & Zhang, 2010), later expanding to pragmatic competence cultivation. For example, Chen (2016) and Xu et al. (2019) studied the English for Academic Purposes (EAP). Chen (2016) studied the teacher's moderating role between essay writing and students. Teachers used questioning as a mediator to improve students' critical thinking and guided them to discover and work on their ZPD; Xu et al. (2019) investigated the moderating role of teachers in the academic English writing of graduate students. Teachers in this scenario use written feedback as a mediator and should pay attention to properly grasping the gap in the ZPD, reasonably presenting feedback, and expanding the content of feedback in detail. Current second language acquisition classrooms emphasize intercultural communicative competence, with research models increasingly adopting functionalist and interdisciplinary approaches (Yang & Zhang, 2025).

Regardless of evolving research paradigms and technologies, scholars unanimously recognize both the teacher's pivotal role as a mediator and language's essential function as a mediational tool. Teachers play a significant role in language learning courses. According to Gao (2008), teachers are often regarded as the most common mediators in language acquisition, using language as a mediating tool to help learners, who in turn use it to comprehend and internalize new knowledge, and through internalization to gain personal cognitive and linguistic development. The mediating role of the teacher can be threefold: first, to help students learn to learn on their own; second, to create interactions and reciprocity; and third, to provide students with appropriate and easily self-managed materials (Zhu & Lu, 2020). Scholars in education have persistently explored the mediating role of language. As Vygotsky (1987) posited, "language functions as the most potent mediational tool for human cognitive development." Grounded in this principle, research on teacher discourse in classroom interactions has long constituted a prominent research focus (Chen, 2016). Gao (2009) studied the interactive discourse in a second language acquisition classroom from cognitive and socio-cultural perspectives. The study centered on the amount of teacher-student discourse, teacher discourse strategies, negotiation of form and negotiation of meaning in the interaction, and concluded that the ideal development trend is the organic integration of the two.

Teachers' instructional strategies can reduce learners' cognitive load and facilitate knowledge comprehension and integration. Cognitive Load Theory (CLT) posits that the human memory system comprises sensory memory, working memory (also known as short-term memory), and long-term memory (Kalyuga & Singh, 2016; Sweller, 2016). Sensory memory processes external stimuli; working memory handles information selected by learners' attentional focus; long-term memory stores knowledge that has been internalized and retained permanently (Zhang et al., 2018). Learners' cognitive load derives from three dimensions: intrinsic cognitive load, extraneous cognitive load, and germane cognitive load (Sweller, 2008). Intrinsic cognitive load correlates positively with the inherent complexity of the knowledge content. Extraneous cognitive load correlates positively with the degree of interference caused by instructional design and methods. Germane cognitive load encompasses processing cognitive load and metacognitive load: the former refers to the load generated when learners internalize new knowledge and integrate or restructure it with existing cognitive schemata, while the latter denotes the load expended in extracting strategic patterns and general principles during knowledge acquisition. Current research includes advancing theoretical modeling of cognitive load, developing measurement methodologies, and integrating these frameworks into pedagogical contexts (Zhang et al., 2018).

Nevertheless, existing studies in China often focus on form-focused interaction or task-based scaffolding in grammar and composition classes (Xu & Li, 2018; Mifka-Profozic et al., 2023), while there are merely a few studies on content-based instruction. Few current studies concentrate on second language professional learners' courses about the cultures of second language countries. These courses focus more on comprehension and also expand second language expression. This paper investigates how teachers can use language as a mediation in the classroom of L2 countries' cultures to reduce students' cognitive load through interaction and explanation.

Although mediation and ZPD have been extensively examined in the context of developing core language skills such as writing and speaking, far less research has investigated how these constructions apply to content-based cultural instruction. Such courses require learners to interpret complex sociocultural concepts, negotiate meaning across cultural frameworks, and express nuanced perspectives—tasks that heavily rely on effective teacher mediation. Moreover, the lack of empirical evidence on how language functions as a mediational tool to reduce cognitive load in these contexts represents a critical gap in current SLA literature. Addressing this gap is essential for designing pedagogical strategies that support learners in navigating cross-cultural content and deepening their intercultural competence.

3. Method

3.1 Research Questions

This study examines the following questions in L2 content-based instruction:

- (1) What types of instructional and social mediation do teachers employ to facilitate students' cognitive development?
- (2) How do these mediations enhance learners' cognitive progression and social competence?

3.2 Research Design

This study adopts a qualitative research paradigm utilizing a case study as the primary strategy, with unstructured observation as the data collection technique to investigate teacher mediation in L2 content-based instruction.

A case study enables in-depth examination of a specific instance (e.g., one lesson) to holistically capture complex phenomena (Yin, 2017). The research questions focus on “what types of mediation do teachers employ” and “how do these mediations alleviate learners' cognitive load”—such complex social interactions require deep contextualized analysis (Denzin, 2017) to uncover their essence. Thus, one prototypical lesson is selected as the case unit to intensively analyze teacher-student interactions and address the research questions.

Methodologically, unstructured observation is implemented without predetermined checklists or standardized procedures, centering only on overarching goals. Empirical studies confirm that task presets distort natural behaviors, such as shifted attention or performative responses (Li, 2015; Granwald et al., 2025). In order not to interfere with the natural interactive behaviors in the classroom, unstructured observation avoids preset tasks and records classes via non-intrusive methods (e.g., audio recordings, field notes), preserving data authenticity.

3.3 Participants

This study utilized purposeful sampling to select an L2 content-based instruction based on three criteria: (1) instructional focus prioritizing content comprehension over language expression; (2) observational accessibility for data collection; (3) consistently positive student evaluations. The target course was “The Society and Culture of Major English-speaking Countries (Britain)”. The instructor, Mary, an Associate Professor of the School of Foreign Languages at a high-level specialized university in China, taught this curriculum. Participants consisted of 33 sophomore English majors (6 males and 27 females; mean age=19), averaging TEM-4 proficiency, and most of them were not familiar with English history. Among four parallel classes (approximately 35 students each), we randomly chose Class C. The course systematically explores British history and culture, including linguistic evolution, political development, pivotal historical events, and economic progression. The recorded 45-minute session comprised: reviewing the previous class; instructing new content on parliamentary composition, electoral systems, operational procedures, and legislative functions; and concluding with a summary.

3.4 Data Collection Methods

This study employed unstructured observation for data collection, with the researcher conducting non-participant observation. During the 45-minute instructional session, the entire class was audio-recorded to document the teacher's use of mediational tools and students' in-class responses. Post-class, audio recordings were transcribed verbatim and subjected to iterative reviewing and analysis to extract salient patterns. Upon organization, the recorded classroom content was categorized into the following sections: the original classroom transcripts, interaction perspectives, overview of Mary's actions, Mary's aims, characteristics of Mary's lecturing, and the pedagogical theories manifested in these lecturing characteristics.

4. Results and Discussion

This case study exemplifies a Content-Based Instruction (CBI) classroom designed to enable learners to comprehend the composition, functions, and operational mechanisms of the British Parliament while mastering relevant English expressions. Its primary distinction from traditional form-based instruction lies in its emphasis on comprehension, the non-systematic nature of vocabulary acquisition, and the grounding of lexical items in established facts and domain-specific terminology.

According to the Zone of Proximal Development (ZPD) theory, students' potential developmental level in this lesson encompasses both understanding the institutional knowledge of the British Parliament and acquiring its associated English terminology. For learners encountering British history for the first time, the specialized nature of this subject matter induces high intrinsic cognitive load. To bridge the gap between their current level and potential developmental level (ZPD) while mitigating intrinsic cognitive load, the mediator—Teacher Mary—employed multiple effective mediational tools, including comprehension-facilitating linguistic mediation and multimodal mediation, and internalization-oriented social mediation.

4.1 Linguistic Mediation for Comprehension

4.1.1 Optimizing Memory Processing

During the class, Mary implemented linguistic mediation to achieve a tri-phase guidance which significantly reduced learners' intrinsic and germane cognitive load, thus helping to bridge the ZPD gap. At the commencement phase, she facilitated knowledge reactivation through keyword prompts and questioning to review the acquired content from the last class.

Okay, we finished last class with this point, composition, right? So, do you still remember how many parts are there in British Parliament has?

Following this review, Mary executed transitional bridging to introduce lesson focal points, simultaneously heightening learners' attentional engagement for the new phase.

Since we have discussed something about monarch, and then we just looked at some details of these two houses.

At the end of the class, she briefly summarized core concepts and delivered revision reminders.

The three-phase design aligns with human memory processing mechanisms (Figure 1), including information intake, selective attention, short-term memory storage and long-term memory encoding. Specifically, short-term memory can transform into long-term storage through automatization (e.g., repetitive reinforcement or rule internalization), while long-term memory can be retrieved into working memory for output. In the review phase of the class, Mary's questioning "How many parts are there in British Parliament?" activated students' long-term memory, triggering knowledge retrieval into working memory for output, which consolidates prior knowledge and targets current developmental levels while establishing cognitive foundations for ZPD bridging. This consolidates prior knowledge and builds conceptual connections, echoing Luo's (2023) Spreading Activation Model, where keywords trigger schematic recall for efficient review. In the outline phase, explicit lesson goals "details of these two houses" directed students' selective attention to parliamentary details while implying the content's examination relevance, thereby defining potential developmental levels to narrow ZPD gaps. This enhanced "attention" and "detection" efficiency of the memory mechanism, corroborating Robinson's (1995) attentional resource allocation hypothesis. In the summary phase, Mary reapplied spreading activation to facilitate knowledge recall. Crucially, concrete directives rather than vague "review" commands scaffolded students' acquisition of revision strategies, thereby reducing learners' metacognitive load to accelerate knowledge internalization and ultimately transform potential developmental levels into updated current developmental levels.

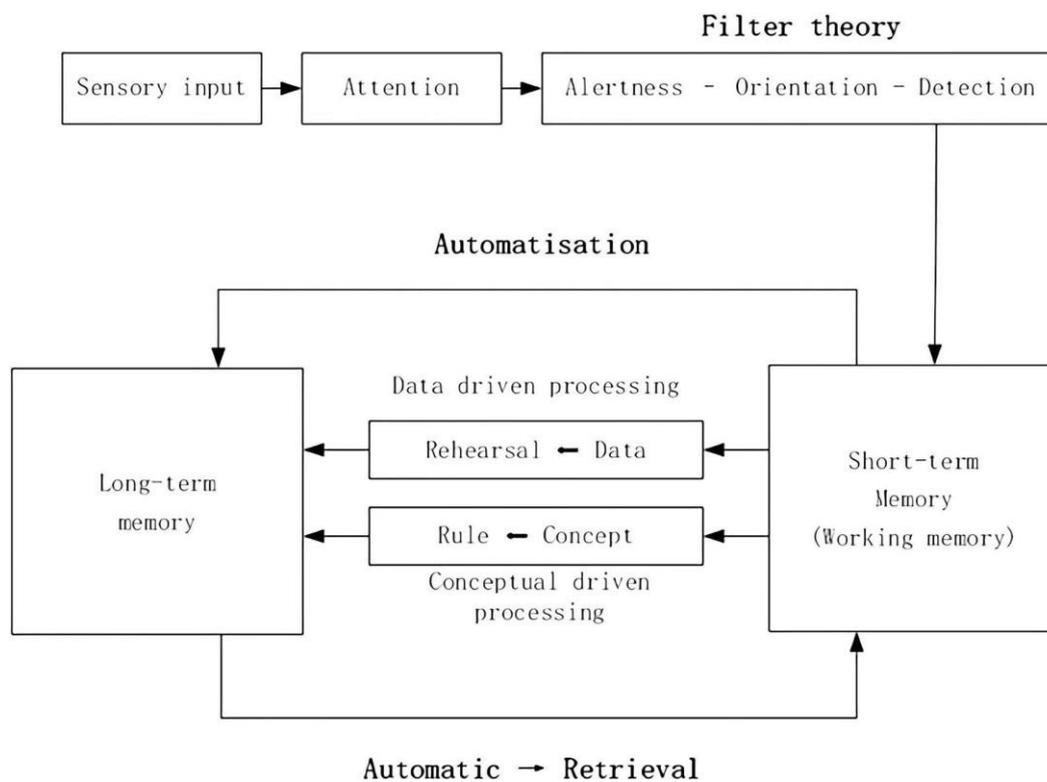


Figure 1 Memory Mechanism

Inspiringly, this strategy shows that teachers can raise targeted questions to optimize working memory, capture students’ effective attention through the “review-outline-summary” sequence, and provide explicit learning pathways to effectively mitigate high intrinsic load induced by complex materials (e.g., parliamentary intricacies) and systematically bridge ZPD gaps through this tri-phase progressive cognitive scaffolding.

4.1.2 Contextualization and Embodiment

Mary employed linguistic mediation to embody abstract political concepts through real-world analogies, cross-cultural comparisons and humorous descriptions, effectively reducing intrinsic cognitive load while optimizing extraneous cognitive load in instructional design. In this way, the ZPD gap can be well bridged. Key practices included: Anchoring complex concepts (e.g., parliamentary elections, pocket boroughs) to daily experiences, analogizing “MP elections” to “class monitor elections” and exemplifying the “objects in a student’s pocket” to explain “pocket boroughs”.

Comparing the complex UK political concepts with those of China to facilitate students’ understanding. For instance, contracting British parliamentary debates with Chinese “round-table” consultation, elucidating cultural differences while extracting the objective of debates.

Exaggerated depictions of parliamentary chaos (e.g., “throwing shoes”) to highlight British procedural rigor, activating emotional memory encoding.

Using humorous language to attract students’ attention. For instance, describe parliamentary chaos in a more exaggerated and humorous way (e.g., “throwing shoes”) to highlight British procedural rigor and their gentlemanly demeanor, activating the class’s atmosphere.

These strategies establish language as an effective mediational instrument, of which contextualization reduced intrinsic load while humor optimized extraneous load. The Embodied Cognition Theory proposed by Skulmowski and Rey (2017) can also explain Mary’s analogies. These analogies activated students’ lived experiences (e.g., monitoring elections and real pockets), triggering situational simulation via the mirror neuron system to convert intrinsic load into productive cognitive load that facilitates ZPD bridging. In terms of cultural contrasts, it can also be explained by Kovecses’ (2005) Conceptual Metaphor Theory. Cross-cultural analogies (e.g., meeting formats) can help decode cultural metaphors (e.g., British parliament debate) from dual perspectives. Mary’s humorous language also reflects Krashen’s Affective Filter

Hypothesis and Schmitt's Humor Modulation. Humor lowered students' anxiety, reducing conceptual resistance and strengthening their information filtering, creating a low-affective-resistance environment conducive to attaining potential developmental levels.

These approaches demonstrate that teachers can enhance comprehension of complex knowledge through life-based analogies and cultural contrasts during content-based instruction, while using judicious humor to regulate affective states for efficient attentional allocation, thereby systematically narrowing ZPD gaps. Nevertheless, over-relying on life-based analogies is inadvisable, as it may cause oversimplification (e.g., ignoring the power-balancing context in the candidates' elections to the British parliament if merely analogizing parliament elections to class monitor elections).

4.1.3 Translanguaging and Deliberate Reiteration

During instruction, Mary enhanced students' comprehension and knowledge internalization through L1-L2 alternation and key term repetition. She consistently employed a sandwich-style structure (e.g., "Hereditary? Hereditary") to explain critical terminology, enabling rapid concept mastery while reducing intrinsic and germane cognitive load.

Remember these words? Hereditary? Hereditary.

Concurrently, Mary implemented high-frequency reiteration for core concepts (e.g., "Lord Speaker"), extending working memory processing duration and accelerating knowledge transfer from working to long-term memory. Lord speaker

This strategy reflects Mary's integration of translanguaging theory and memory mechanisms. Translanguaging denotes the strategic deployment of multilingual resources by teachers and students in multilingual settings (Canagarajah, 2011), where L1-mediated cognitive bridging significantly facilitates conceptual decoding and reduces intrinsic cognitive load, laying linguistic mediational foundations for ZPD gap reduction. The classroom recording "Hereditary? Hereditary" demonstrates code-switching where Chinese serves as a cognitive bridge, aiding decoding of the English term "hereditary" and accelerating its integration with pre-existing schemata in long-term memory. This translanguaging strategy transforms abstract terminology into cognitively accessible units, effectively lowering the linguistic-cognitive threshold for ZPD bridging. Mary's lexical repetition (e.g., "Lord Speaker") aligns with Baddeley's (2000) memory mechanism (Figure 1), of which multi-phase input activates the phonological loop, establishing sensory memory, reinforcing auditory encoding, and consolidating semantic networks. This helps extend the processing time of working memory to accelerate knowledge automatization, thereby facilitating the transformation of potential developmental levels into actualized levels.

Consequently, content-based L2 instruction should systematically adopt this sandwich-style translanguaging strategy (e.g., "L2 term → L1 gloss → L2 term"), particularly for high intrinsic cognitive-load concepts, positioning L1 mediation as cognitive scaffolding for ZPD advancement. Teachers require training to identify intervention moments (e.g., when concepts are over-complex, students feel confused or attentional drift). Furthermore, structured reiteration for core terminology is essential. Teachers can repeat 2–3 times immediately upon initial input, and reinforce within 3–5 minutes, to optimize working memory retention by ensuring stable internalization of potential developmental levels through memory consolidation.

4.2 Multimodal Mediation: Visual-Gestural Synergy

Mary implemented multimodal input via PPT images, structured knowledge tables, and gestural guidance to bridge the ZPD gap. Pedagogically, visual stimuli facilitated intuitive comprehension of complex concepts, reducing extraneous cognitive load; content-wise, multisensory explanations alleviated conceptual processing difficulties, diminishing intrinsic cognitive load. She displayed color-contrasted parliamentary hall images annotated with seating positions, directing students' gaze to specific areas through gestures. This sequence elucidated spatial and symbolic distinctions between the Houses of Lords and Commons, with image-gesture integration clarifying members' positions, behaviors, and roles to introduce parliamentary functions and legislative processes. Political signifies You can find the shape of the meeting board is rectangular.

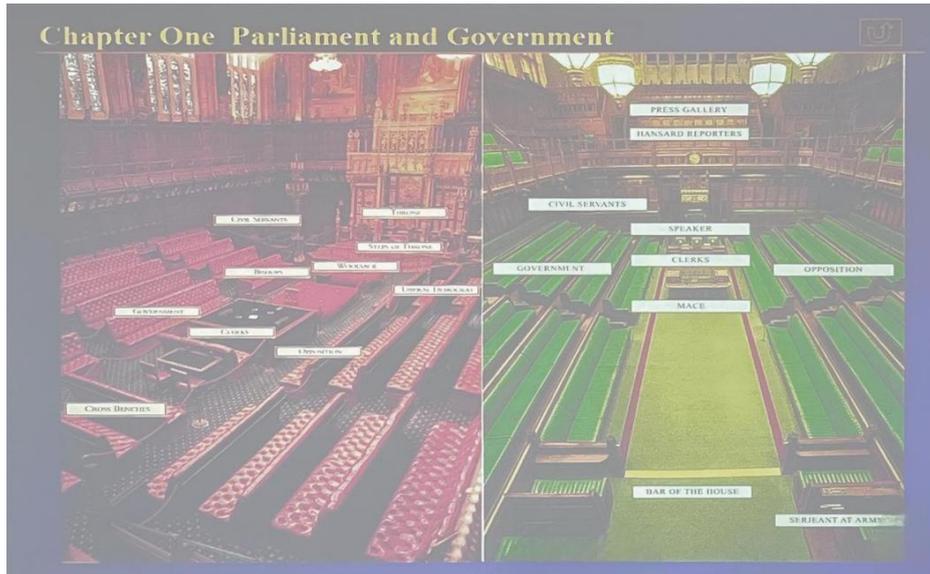


Figure 2 Mary’s PPT for Explaining Two Houses

After detailing every part of the British parliament, Mary presented a comparative knowledge table for systematic review. Contrasting five dimensions (members composition, number, represented groups, leadership, and payment), the table prompted marked engagement with almost all students photographed it with mobile devices.

	House of Lords	House of Commons
Members	Lords Spiritual Lords Temporal	not appointed, be elected
Number	about 1100	650
Represent	themselves	voters of constituency
Leader	Lord Speaker	Mr. Speaker
Payment	no salary	£ 65,000 a year

Table 1 Mary’s Summary of the Class

This multimodal approach embodies Baddeley’s (2000) working memory mechanisms (Figure 1) and oculomotor control theory (Chen & Deng, 2006). Mary’s gestural targeting activated spatial indexing in working memory, synchronizing the visuospatial sketchpad and episodic buffer. Gestures aided spatial anchoring of knowledge in images, narrowing visual searches and constructing embodied cognitive scaffolding, which reduces extraneous load and cognitive barriers to ZPD bridging. Simultaneously, gestures also enhanced exogenous oculomotor control to steer eye movements toward critical information, avoiding ineffective fixation. The knowledge table leveraged spatial structuring to categorize complex concepts for internalization, which provided a clear cognitive roadmap for potential developmental levels, operationalizing the ZPD bridging process and optimizing extraneous load while reducing intrinsic load.

This practice suggests teachers should master multimedia techniques to engage multisensory channels and sustain attention. Gestural elaboration must be integrated by using deictic gestures for physical references and metaphoric gestures for abstract notions. However, excessive gestures are inadvisable as the fragmented visual inputs can obscure potential developmental levels, impede effective ZPD bridging and increase extraneous load.

4.3 Social Mediation: Enhancing Interaction and Knowledge Application

Mary created interactive opportunities through frequent questioning and strategic pauses. She employed interrogatives during review and instruction and used rising intonation plus pauses to elicit answers. Besides, she also actively adopted a hierarchical questioning guidance (e.g., “voter→ “candidates) . After interaction, she provided affirmative feedback (e.g., “Yes/Great”) to strengthen students’ confidence and willingness to answer.

Mary : So here we should make clear the three kinds of people. First, the voter, you know that right? Mary :
Yes. The first is voter, the last is
Students & Mary : candidates.

This interaction reflects memory mechanisms (Figure 1), the Interaction Hypothesis (Long, 1996), and cultural dimensions (Hofstede, 2005). Mary's sustained interaction facilitated knowledge retrieval from long-term memory to working memory for output, with feedback enabling long-term memory to adjust or restructure. Such retrieval-rehearsal cycles dynamically narrow cognitive distances between current and potential levels through social negotiation, aligning with meaning negotiation in the Interaction Hypothesis to enhance retention while reducing metacognitive load. Mary's tiered questioning corroborates Gao's (2009) finding that scaffolded queries improve term memorability. Collective responses by both teacher and students significantly reduced students' anxiety, as Chinese learners exhibit high uncertainty avoidance and collectivism. Chinese students tend to avoid individual prominence (e.g., solo responses) and prioritize answer accuracy.

Consequently, CBI requires robust classroom interaction for good comprehension. Teachers should frequently question core concepts and recycle terminology systematically, distributing individual cognitive loads of ZPD advancement through collective scaffolding. Moreover, teachers are advised to implement collective queries, group-negotiated tasks and co-responding, or anonymous digital responses (in/after class). Avoid targeting specific students (e.g., high-achievers) to prevent misperceptions and increased affective load. In addition, in response to students' anxiety about answering questions, teachers should pose collective questioning, answer jointly with students, and call students after the group discussion. Teachers can also actively utilize multimedia equipment and make good use of the functions like anonymous questions and feedback from students and choose appropriate times (in class or after class) to answer their questions.

4.4 Bridging ZPD through Coordinated Mediation

Linguistic mediation, multimodal mediation, and social mediation in Mary's classroom did not operate independently but complemented one another through coordinated interactions, collectively reducing students' cognitive load and facilitating learners' transformation toward potential developmental levels within the Zone of Proximal Development (ZPD).

In the process of bridging ZPD gaps, linguistic, multimodal, and social mediation formed an interconnected "concept establishment-concretization-internalization" chain. For example, when teaching the "British parliamentary electoral system," Mary first established preliminary concepts through life analogies (linguistic mediation), supplemented by images and gestural positioning of parliamentary chambers (multimodal mediation), and finally completed term internalization via collective responses (social mediation)—achieving the transformation to ZPD potential levels (comprehension + application). The core synergy of this process lies in linguistic mediation providing conceptual frameworks, multimodal mediation reinforcing associative memory, and social mediation optimizing interaction efficiency, collectively facilitating ZPD transformation.

The three types of mediation also formed an interconnected system for reducing the three cognitive load types through coordination. Linguistic and multimodal mediation reduced intrinsic cognitive load by concretizing abstract concepts through coordinated life analogies, cross-cultural comparisons, and visual scaffolds; Multimodal and social mediation diminished extraneous cognitive load by leveraging rich multimedia images, gestural guidance, and supportive interactive environments to help students rapidly comprehend information via external media; Social and linguistic mediation optimized students' attentional allocation through coordinated collective responses and streamlined directives, thereby reducing germane cognitive load.

The synergistic effect of the three mediations suggests that culture-oriented CBI classrooms should coordinately apply multiple pedagogical strategies across linguistic, multimodal, and social dimensions. By synergistically addressing auditory, visual, and interactive aspects, teachers can bridge students' cultural-cognitive gaps and L2 lexical-cognitive disparities while reducing the difficulty of high-load tasks. Over-reliance on a single pedagogical strategy may impede ZPD progression toward advanced cultural analysis competencies.

5. Conclusion

This study employs a cultural CBI classroom in a Chinese university English major program as a case, investigating how the teacher utilized mediational instruments (linguistic/multimodal/social) to reduce cognitive load and bridge ZPD gaps. The findings reveal that: (1) Teacher Mary activated memory processing through a three-phase linguistic mediation strategy (review-outline-summary), effectively reducing intrinsic and germane cognitive load; she concretized abstract concepts by employing relatable analogies and cross-cultural comparisons (e.g., likening "parliamentary elections" to "class monitor elections"), thereby diminishing intrinsic cognitive load; and she optimized working memory transformation using sandwich-style translanguaging repetition strategies (e.g., reinforcing terminology through "Chinese-

English-Chinese” or “English-Chinese-English” reinforcement); (2) Regarding the multimodal mediation, visual-gestural coordination (e.g., providing images and knowledge integration tables alongside deictic gestures) reduced extraneous cognitive load through spatial indexing; (3) According to social interaction, scaffolded questioning and collective responses alleviated metacognitive load via meaning negotiation, a strategy particularly well-suited to the collectivist orientation of Chinese students. These strategies synergistically facilitated the attainment of students’ potential developmental levels within the ZPD (e.g., understanding parliamentary systems and applying relevant terminology).

Despite these contributions, the study is limited by its reliance on a single classroom case and the constraints of an observational methodology that lacked advanced technological tools for quantifying cognitive load. Future research could (1) incorporate control groups or conduct comparative analyses across multiple classroom cases; (2) integrate specialized equipment such as eye-tracking or functional near-infrared spectroscopy (fNIRS) to monitor cognitive load; (3) explore the applicability of AI-driven mediational instruments in CBI classrooms.

This study theoretically and practically offers some applicable findings and strategies for cultural-oriented CBI classes. It integrates sociocultural theory (mediation theory, ZPD mechanism) with cognitive load theory, exploring their combined feasibility within cultural CBI classrooms and revealing that mediational instruments can scaffold developmental bridges by regulating the three types of cognitive load (intrinsic/extraneous/germane). Practically, it provides reusable pedagogical strategies for high cognitive load L2 CBI cultural instruction, specifically distilling operational methods such as the “sandwich-style strategy”, “visual-gestural coordination”, and “collective response”, thereby addressing the operational void in strategy implementation for content-based cultural teaching.

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