

Modelling the Mediating Role of Cognitive Load Overload on Listening Anxiety and Mandarin Phonetic Perception among Non-Native Mandarin Learners

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ABSTRACT

Learning Mandarin as a foreign language has become essential for career and academic progress due to rapid economic development of China, international trade dominance, and important strategic framework like the Belt and Road Initiative. However, phonetic often considered as the arduous task for non-native Mandarin learners, especially when interpreting the distinct tonal variations and consonantal contrasts. While existing literature emphasise on pedagogical model, the exact cognitive-affective mechanisms that obstruct auditory processing are still underexplored. For that reason, this concept paper suggests a mediation framework to examine how Cognitive Load Overload mediates the association between Foreign Language Listening Anxiety (FLLA) and Mandarin phonetic perception. Based on Affective Filter Hypothesis (AFH) and Cognitive Load Theory (CLT), this study proposes that increased listening anxiety causes distracting, unrelated thoughts. Consequently, learners encounter greater difficulty in differentiating between Mandarin tones and consonantal contrasts when phonetic processing. A quantitative research design is proposed, utilising an adapted Foreign Language Listening Anxiety Scale (FLLAS), Leppink's Cognitive Load Scale to evaluate mental effort post-task, and a computerised Mandarin Phonetic Perception Task. This study attempts to provide Mandarin language educators a practical insight by identifying learners' cognitive barriers in phonetic learning and enable them to design curricular that reduce anxiety and cognitive load while enhancing oral-aural competency.

Keywords: Listening Anxiety, Cognitive Load Overload, Mandarin phonetic perception, non-native Mandarin learners

INTRODUCTION

Mandarin phonetics presents unique challenges due to its tonal nature and the distinction between aspirated and unaspirated consonants (Ting & Ye, 2023). The four lexical tones (T1: high-flat, T2: rising, T3: falling-rising, T4: falling) are essential for distinguishing meanings, however they are often misperceived or mis produced by non-native speakers due to interference from their native phonological systems (Tu, 2023). Additionally, aspirated and unaspirated consonants lack direct equivalents in many languages, making auditory discrimination and pronunciation more challenging (Feng & Meng 2009).

Cognitive factors such as language proficiency and strategy use are frequently studied in second language acquisition. Nonetheless, affective barriers, especially listening anxiety remain insufficiently investigated limitations that impede auditory comprehension. As mentioned by Li (2022), listening anxiety considered as a widespread problem in foreign language learning which negatively correlated with listening comprehension and performance. Gu (2021) further found that listening anxiety arises from factors such as unfamiliar phonetic features, lack of confidence, and the stress of monitoring one's listening process. Song et al., (2026) claimed that

the tonal system increases listening anxiety of Mandarin learners as they need to perceive the precise pitch which is cognitively challenging and emotionally draining (Song et al., 2026).

Phenomenon that parallel with Yerkes-Dodson Law, listening anxiety interferes with stable attention in its inverted V-shaped relationship with cognitive performance. Zheng (2018) explained that high anxiety hinder concentration, while moderate levels of anxiety enhance learning performance. Moreover, learners perceive authentic listening materials are more challenging and thus increase anxiety. Tonal errors and mispronunciations in Mandarin further increase anxiety. Tu (2023) explained anxiety serves as a feedback loop which hinders auditory processing and learning outcomes. Liu and Lin (2025) claimed that while extensive studies on cognitive elements have been conducted, the emotional impact of listening anxiety require greater focus to enhance learning strategies and performance. Thus, this concept paper aims to develop and validate a theory-driven mediation model that clarifies the process of cognitive load affects the relationship between listening anxiety and Mandarin speech sound perception among non-native Mandarin learners.

This study examines the following research questions: (RQ1) Is there a significant relationship between listening anxiety levels and the accuracy of Mandarin speech perception (including tones and consonants)? (RQ2) Does a high level of listening anxiety significantly increase the cognitive load of listeners during speech perception tasks? (RQ3) Does the direct negative effect of listening anxiety on speech perception decrease significantly when the mediating role of cognitive load is taken into consideration?

Significance of the study

Educators can better understand and address the challenges encountered by Mandarin of non-native learners by implementing cognitive load theory, affective psychology, and phonetic linguistics. This interdisciplinary method promotes efficient teaching strategies, alleviates anxiety, and enhances phonetic awareness and thus, bridging the gap between emotional and linguistic domains.

LITERATURE REVIEW

Theoretical framework: Cognitive Load Overload and Affective Filter Hypothesis

Cognitive Load Theory (CLT) developed by Sweller (2011), emphasizes the limitation working memory and impact of instructional design on effectiveness of learning. Three types of cognitive load included intrinsic load (difficulty of content), extraneous load (inefficient instructional design), and germane load (cognitive effort directed toward learning). Working memory becomes overwhelmed when overload occurs. Consequently, hindering learning and retention (Lewis, 2022). For example, excessive information or irrelevant details can contribute to cognitive overload and consequently reduce learning effectiveness (Lewis, 2022).

Affective Filter Hypothesis (AFH) proposed by Krashen (1981) emphasizes the role of emotional factors, including motivation, anxiety, and self-esteem in the process of acquiring a language was another theoretical framework of this concept paper. Affective factors have a direct impact on learners' capability to interact with and remember new information (Prodanovska-Poposka & Todorova, 2022). Study by Prodanovska-Poposka and Todorova (2022) depicted that negative affective filter like anxiety can blocks language input from being processed properly, while positive filter improves learning outcomes.

A comprehensive framework that combines CLT and AFH contribute to the understanding of learning blocks. Both theories emphasize the overloaded cognitive or negative emotional hinder one's capability to process and remember information which further impacts on learning performance. This indicating that emotional stress may elevate the impacts of cognitive load (Lewis, 2022; Prodanovska-Poposka & Todorova, 2022). Effective instructional design (CLT) can reduce unnecessary cognitive load, while considering emotional factors (AFH) can decrease the affective filter. For instance, cognitive load can be reduced through a clear and relevant materials, while fostering a supportive, low-anxiety learning context that enhance motivation and engagement (Gärtner et al., 2025). Emotional states influence cognitive capacity. Anxiety or lack of self-confidence (AFH) may lower working memory effectiveness, increasing learners are more susceptible to cognitive overload (CLT).

Conversely, cognitive overload may elevate frustration and anxiety, boost the affective filter and further obstruct learning (Lewis, 2022; Prodanovska-Poposka & Todorova, 2022).

Foreign language listening anxiety (FLLA)

Foreign Language Listening Anxiety (FLLA) is a type of general language anxiety that occurs specifically during listening activities in a foreign language. It is characterised by feelings of inadequacy, helplessness, and anxiety when learners are required to interpret and understand spoken language instantly (Serraj & Noordin, 2013). According to Serraj and Noordin (2013), FLLA is different from general Foreign Language Anxiety (FLA) as it specifically related to the listening skill which requires the instant processing of auditory input.

Listening in a foreign language is frequently cause more anxiety than speaking due to various distinct challenges. This real-time nature of listening heightens anxiety, as learners fear missing important information or failing to understand the message (Serraj & Noordin, 2013). Listening is irreversible which is distinct from speaking. Learners can pause, rephrase, or seek clarification when speaking. Meanwhile, when a spoken word or phrase is overlooked during listening, it cannot be replayed unless the audio is replayed, which is frequently not possible during real-time interactions or exams (Kiliç & Uçkun, 2013). Anxiety can be increased by the authenticity of listening resources including native accents or colloquial expressions. Learners often struggle with unfamiliar sounds, which makes them more anxious of being misunderstood or failing. Listening comprises simultaneous processes, such as decoding sounds, understanding meaning, and remembering information. This cognitive demand can overwhelm learners, especially when they feel uncertain about their listening abilities (Kiliç & Uçkun, 2013; Serraj & Noordin, 2013).

Previous studies indicate that listening anxiety arises from the nature of the skill, which is real-time, irreversible, and cognitively challenging. These factors make listening to a unique challenging aspect of foreign language learning, combines with fear of negative evaluation and unfamiliar auditory input.

Mandarin phonetic perception

Mandarin phonological perception requires substantial working memory resources because the complexity and novelty of auditory data for speakers of non-tonal language. Learners need to analyse process segmental (consonants and vowels) while simultaneously understanding suprasegmental pitch contours (tones) to accurately determine lexical meanings. The lack of pre-existing native auditory and motor templates is a significant disadvantage for non-native learners whose first language (L1) is non-tonal. Pitch acuity and universal phonological principles are inadequate, domain-general auditory processing skills and individual pitch sensitivity significantly contribute to tone identification.

Listening anxiety and phonetic decoding

When learner is encounters real-time Mandarin speech, decoding unfamiliar phonetic contours requires complete and uninterrupted attention from their working memory. Nevertheless, if the learner experiences high listening anxiety, their cognitive resources are preoccupied by emotional pressure (Huiyong & Xinping, 2025). Because anxiety increases total cognitive load, it leaves fewer cognitive resources available for the processing of novel auditory information. Faced with this cognitive deficit, the learners' acoustic-phonetic processing breaks down entirely. They are no longer execute the fine-grained auditory discrimination needed to separate a rising Tone 2 contour from a falling-rising Tone 3 contour, resulting in immediate tonal substitutions and phonetic misinterpretations (Peelle, 2018). This complex input is prevented from entering the language acquisition device by the elevated affective filter, which leads to comprehension failure, increase learning frustration, and reinforcing the cycle of language anxiety. Prior studies do not specifically address the Affective Filter Hypothesis or the way elevated anxiety functions as an invisible barrier, blocking input from reaching the language acquisition device. Nevertheless, the relationship between anxiety and cognitive load depletion indicates that high level of anxiety could indirectly hinder language learning by reducing the cognitive resources required for processing linguistic information. To bridge the gap, it is essential to investigate the mediating impact of cognitive load overload on listening anxiety and Mandarin phonetic perception to offer a foundational reference for Mandarin language instructors and curriculum developers.

DISCUSSION

Conceptual framework

The conceptual framework is illustrated in Figure 1. This concept paper presents a comprehensive empirical framework to illustrate the relationships between the emotional inputs, cognitive processing mediators, and language outputs among non-native Mandarin learners. Proposed mediation model depicting the hypothesized pathways. Path a represents the impact of listening anxiety on cognitive load, Path b demonstrates the effect of cognitive load on perception while controlling for anxiety, and Path c' indicates the direct effect of anxiety on perception after taking the mediator into consideration. The indirect effect ($a \times b$) represents the pathway by which anxiety influences perception via cognitive load.

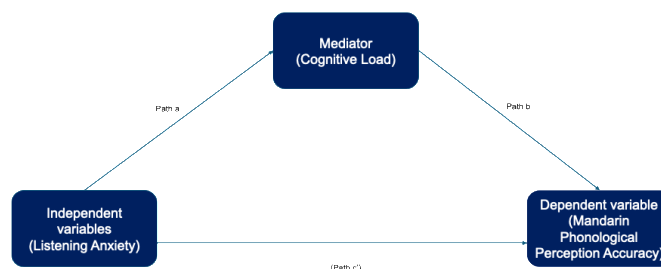


Figure 1 Mediation model

Proposed Methodology

A quantitative research design is proposed for the implementation of this framework. The target population will consist of non-native Mandarin learners who currently studying Mandarin as a foreign language either in their home countries or in China. All participants should be a native speaker of non-tonal languages such as English, Malay language, German or French. Additionally, they should not have had any exposed to Mandarin or any other tonal language to create an accurate non-tonal L1 baseline.

Three instruments utilised in this study which consist of Foreign Language Listening Anxiety (FLLA), Cognitive Load, and phonological perception. The FLLA developed Kim (2002) which consists of 33 items scale employing a 5-point Likert Scale will be administrated. The Leppink Cognitive Load Scale by Leppink et al. (2013) consisting of 10 items scale will serve as the mediating instrument. The scale of 10 items includes three sub-dimensions which are Intrinsic load (3 items), Extraneous Load (3 items), and Germane Load (4 items).

All statistical analyses will be performed with SPSS utilising the PROCESS macro (Hayes, 2018) for mediation testing. The analysis will proceed on two tiers, encompassing overall cognitive load analysis and three-dimensional detailed analysis. The indirect impact of listening anxiety on phonological perception via cognitive load will be assessed using Bootstrapping with 5,000 resamples and 95% bias-corrected confidence intervals. An indirect effect is deemed statistically significant when the confidence interval excludes zero.

Expected findings

Based on the outlined framework of independent variables affecting Foreign Language Listening Anxiety (FLLA) and the dependent variable of phonetic perception accuracy, several hypotheses can be formulated regarding the expected findings:

H1: There is a negative correlation between FLLA and tone perception accuracy.

H2: There is a negative correlation between FLLA and minimal pairs accuracy.

H3: The relationship between FLLA and accuracy of phonetic perception will be mediate by cognitive load overload.

The expected findings suggest a significant negative relationship between FLLA and accuracy in phonetic perception, especially for non-tonal L1 speakers. This relationship is expected to be further clarified by the mediating role of cognitive load overload, emphasizing the complexities of language learning in the context of anxiety.

CONCLUSION

This concept paper establishes an important connection between emotional states and speech processing in Mandarin foreign language classrooms. Integrating the Affective Filter Hypothesis with Cognitive Load Theory demonstrates that listening anxiety poses a notable, though frequently neglected, obstacle to mastering Mandarin phonetics efficiently. When non-native learners experience elevated listening anxiety, the stress overload their limited working memory. This emotional burden greatly hinders their capacity to recognise real-time pitch changes and minor consonant boundaries, leading to frequent phonetic mistakes. Moving forward, education must acknowledge that addressing both linguistic and emotional needs are necessary to resolving phonetic errors. Learners would experience less anxiety and have more mental capacity to interpret sounds if they switch from high-pressure listening drills to low-stakes, visually supported auditory training. To sum, applying this conceptual framework in future research and instructional methods will assist non-native learners in overcoming the tonal challenge, improving their listening confidence and oral competency.

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