

Effects of Integrating Metacognitive Strategies and Multimedia-Assisted Instruction for EFL Learners' Listening Comprehension: An Experimental Evaluation

Nai-Ying Chang

General Education Center

Hsiuping University of Science and Technology, Taiwan

doi: <https://doi.org/10.37745/ijelt.13/vol14n23476>

Published April 26, 2026

Citation: Chang N. (2026) Effects of Integrating Metacognitive Strategies and Multimedia-Assisted Instruction for EFL Learners' Listening Comprehension: An Experimental Evaluation, *International Journal of English Language Teaching*, 14 (2),34-76

Abstract: *This study investigated the effects of integrating metacognitive strategies with multimedia-assisted instruction on the listening comprehension of Taiwanese EFL learners enrolled in remedial TOEIC courses. A quasi-experimental pretest-posttest design was employed with 84 university students divided into an experimental group and a control group. The experimental group received instruction combining metacognitive strategies with multimedia resources, such as YouTube videos and podcasts, while the control group received traditional TOEIC-oriented instruction. Research instruments included TOEIC mock listening tests and the Metacognitive Awareness Listening Questionnaire (MALQ). The findings revealed that both groups improved in listening comprehension; however, the experimental group demonstrated greater gains in listening performance, strategic awareness, and learner confidence. Among the multimedia tools, podcast-based activities produced the most significant improvement, suggesting that audio-only input may reduce cognitive load and improve concentration. In addition, students in the experimental group more frequently applied strategies such as prediction, monitoring, and self-evaluation, which helped reduce listening anxiety and promote learner autonomy. The study concludes that integrating metacognitive strategies with multimedia-assisted instruction can effectively enhance EFL learners' listening comprehension and self-regulated learning. The findings also suggest that EFL listening courses should incorporate explicit strategy instruction and appropriate multimedia resources to improve learners' listening proficiency and confidence.*

Keywords: Metacognitive strategies; Multimedia-assisted instruction; EFL listening comprehension; Podcast learning

INTRODUCTION

With the rapid advancements in digital technology, multimedia has emerged as a cornerstone of modern education, particularly for English as a Foreign Language (EFL) learners (Alhazmi, 2024; Assadi, Murad, & Muhammad, 2025). Multimedia technology encompasses a diverse range of tools, including videos, podcasts, animations, and interactive platforms, providing learners with multimodal input that combines audio, visual, and textual elements. This integration facilitates a rich, immersive learning environment that supports language acquisition by catering to various learning styles and needs (Leveridge & Yang, 2014; Sejdiu, 2017). However, despite its potential, effectively using multimedia for listening comprehension is often hindered by challenges such as cognitive overload and learners' limited familiarity with complex cultural and linguistic contexts (Zhang & Zou, 2021; Mohsen, 2016). To address these challenges, incorporating structured metacognitive strategies has been suggested as an effective solution.

Metacognitive strategies refer to techniques that help learners plan, monitor, and evaluate their learning processes (Cross & Vandergrift, 2018; O'Malley & Chamot, 1990). These strategies empower learners to take an active role in their language acquisition journey by fostering self-awareness and self-regulation. For EFL learners, metacognitive strategies are particularly valuable in listening comprehension as they enable learners to overcome difficulties related to speech rate, unfamiliar vocabulary, and complex syntactic structures (Al-Alwan, Asassfeh, & Al-Shboul, 2013; Taheri & Hedayat Zade, 2018). Research has shown that learners who utilize metacognitive strategies demonstrate higher levels of listening proficiency, improved problem-solving skills, and reduced anxiety during listening tasks (Bozorgian et al., 2020; Taherkhani et al., 2022; Vandergrift, 1997; Vandergrift, 2003; Xu, 2023). However, while the role of metacognitive strategies has been widely acknowledged, there remains a need for comprehensive studies examining their impact in multimedia-supported learning contexts.

The interplay between multimedia and metacognitive strategies presents a promising avenue for enhancing EFL listening comprehension. Multimedia provides authentic and engaging materials that expose learners to diverse accents, speaking styles, and cultural contexts. When combined with metacognitive strategies, multimedia tools can help learners navigate these materials effectively, optimizing their listening performance. For instance, learners can use captions, annotations, and transcripts to support their understanding, while simultaneously employing metacognitive strategies to monitor their progress and address comprehension gaps (Mohsen, 2016; Sendag et al., 2018). Research

on multimedia and metacognitive strategies lacks empirical evidence regarding their impact on EFL learners' listening comprehension in university contexts in Taiwan.

Listening comprehension plays a pivotal role in second language acquisition as it serves as the foundation for effective communication and the development of other language skills, including speaking, reading, and writing. Listening proficiency is crucial for academic and professional success, as well as achieving a high level of language competence (Vandergrift & Goh, 2012). Moreover, listening comprehension tests are a core component of prominent English proficiency exams, such as TOEFL, TOEIC, IELTS, and CEFR-aligned assessments, emphasizing their significance in assessing learners' comprehensive language abilities. To enhance EFL learners' listening comprehension, multimedia has emerged as a transformative tool that offers authentic materials and multimodal resources catering to diverse learning styles. Tools such as YouTube, podcasts, and language learning apps provide rich and dynamic content, exposing learners to various accents, speech patterns, and real-life contexts. When integrated with structured metacognitive strategies, these multimedia resources could significantly enhance learners' listening skills by fostering active engagement and self-regulation. (Leveridge & Yang, 2014; Salaberry, 2001; Sejdiu, 2017).

Research Objectives

This study aims to bridge the gap in existing research by examining the effects of multimedia-supported instruction combined with metacognitive strategies on EFL learners' listening comprehension. It focuses on investigating how metacognitive strategies influence listening comprehension, evaluating the effectiveness of multimedia tools such as YouTube and podcasts, and exploring the interplay between metacognitive strategies and multimedia use in enhancing listening performance. Additionally, it seeks to identify challenges and benefits associated with implementing these approaches in remedial EFL contexts.

Research Questions

To achieve these objectives, the study addresses the following research questions:

1. How do metacognitive strategies impact the listening comprehension skills of EFL learners?
2. What are the comparative effects of multimedia tools (e.g., YouTube videos vs. podcasts) on EFL learners' listening performance?

3. How does the integration of multimedia and metacognitive strategies enhance learners' overall listening proficiency?
4. What factors influence the effectiveness of multimedia-assisted and strategy-based listening instruction in EFL settings?

LITERATURE REVIEW

Many language educators consider listening skills essential for achieving successful language learning outcomes and believe that listening comprehension can be enhanced through metacognitive intervention. The main concept of metacognition is defined as “one’s knowledge about one’s own cognitive processes and products or anything related to them” (Bozorgian, Yaqubi, & Muhammadpour, 2020). Metacognitive strategies involve managing, planning, and evaluating the use of cognitive strategies. To develop listening competence, learners are taught to plan their learning process and monitor their language production and comprehension. Ultimately, learners will be able to evaluate their self-learning progress (Zheng, 2018).

Metacognitive strategies and language learning

Metacognitive strategies are vital for facilitating language learning, as they allow learners to plan, monitor, and evaluate their cognitive processes (O’Malley & Chamot, 1990). These strategies are particularly beneficial in listening comprehension, which requires learners to process real-time auditory input while drawing upon their linguistic and contextual knowledge. Studies demonstrate that metacognitive strategies enable learners to navigate challenging listening tasks by promoting self-regulation and problem-solving skills (Taherkhani et al., 2022; Vandergrift, 2003).

Metacognitive strategies can be classified into three main components: planning, monitoring, and evaluating. Planning involves preparing for listening tasks by predicting content, setting goals, and activating prior knowledge (Chamot & O’Malley, 1994). Monitoring encompasses real-time awareness of comprehension issues, while evaluation focuses on reflecting on performance and identifying areas for improvement (Tham, 2018). Vandergrift's (1997) model highlights how skilled listeners use these strategies synergistically, enhancing their comprehension through active engagement.

Empirical research has demonstrated the efficacy of metacognitive strategy training. For instance, Vandergrift and Tafaghodtari (2010) demonstrated that learners receiving explicit metacognitive

strategy instruction significantly outperformed those in control groups in terms of listening proficiency and metacognitive awareness. Similarly, Hosseini et al. (2020) found that metacognitive training improved Iranian EFL learners' listening comprehension across different proficiency levels, suggesting that these strategies are adaptable and universally applicable.

The integration of metacognitive strategies with task-based language teaching has also yielded positive outcomes. Chou (2017) conducted task-based activities that incorporated metacognitive strategies, observing significant improvements in students' listening comprehension and cognitive awareness. Ko (2019) expanded this approach by integrating listening and reading tasks, revealing the interconnectedness of metacognitive strategies across modalities.

Beyond linguistic competence, metacognitive strategies help reduce listening anxiety and promote learner autonomy. Bandura's (1997) theory of self-efficacy indicates the importance of confidence in alleviating anxiety during listening tasks. Zeng and Zeng (2014) support the effectiveness of these strategies, revealing that learners with higher metacognitive awareness report experiencing lower anxiety levels and greater confidence in facing listening challenges.

While the benefits of metacognitive strategies are evident, effective instruction is crucial. Chamot and O'Malley's (1994) CALLA model provides a structured framework for integrating metacognitive strategies into classroom practice. This model emphasizes preparation, practice, evaluation, and expansion, ensuring learners internalize these strategies for autonomous use. Recent advancements, such as multimedia-assisted instruction, offer additional opportunities for enhancing metacognitive strategy application. Studies by Mohsen (2016) and Sejdiu (2017) demonstrate how multimedia tools, such as videos and podcasts, can support learners in planning, monitoring, and evaluating their listening performance. Therefore, metacognitive strategies are indispensable for language learners, particularly in listening comprehension. By fostering self-awareness, problem-solving skills, and confidence, these strategies empower learners to overcome linguistic challenges and develop lifelong learning habits.

Anderson's (2009) Cognitive Theory of Learning and Vandergrift's (2003) Metacognitive Listening Model provide essential theoretical underpinnings for understanding how learners process and regulate listening comprehension in multimedia-assisted environments. Anderson's theory conceptualizes learning as a transition through three stages: declarative, procedural, and automatic. In this model, learners initially acquire explicit knowledge, gradually refine their skills through practice, and ultimately achieve automaticity in processing auditory input (Anderson, 2009). In the context of

multimedia-assisted listening, learners first engage with listening strategies explicitly, such as predicting content and using transcripts, before progressively internalizing them for more efficient comprehension. (Rahimi & Katal, 2012). Vandergrift's model complements this by emphasizing metacognitive control in listening, where learners develop self-awareness through planning, monitoring, and evaluating their comprehension (Vandergrift & Goh, 2012). Research suggests that multimedia tools can enhance this metacognitive cycle by offering scaffolds such as captions, visual cues, and interactive transcripts, which help learners regulate their cognitive load and refine their listening strategies (Graham & Santos, 2015). Furthermore, studies indicate that explicit instruction in metacognitive listening strategies, combined with adaptive multimedia environments, fosters greater learner autonomy and listening proficiency (Goh, 2018). By integrating both theories, this study examines how multimedia-supported instruction can enhance cognitive processing and foster strategic listening behaviors to advance the listening comprehension of English as a Foreign Language (EFL) learners.

Listening comprehension process

Listening comprehension requires the engagement of individuals across a range of activities from complete comprehension to the discrimination of sounds of a speaker's utterances (Al-Azzemy & Al-Jamal, 2019). Furthermore, listening comprehension is widely acknowledged as a cognitive skill since it involves learners actively engaging in the processes of decoding, interpreting, and integrating auditory information with their prior knowledge and emotional responses (Podhajski, 2016; Vandergrift & Goh, 2012). Research has demonstrated that language learners' application of metacognitive and cognitive strategies, such as prediction, selective attention, monitoring, and evaluation, positively influences their listening comprehension results (Bozorgian et al., 2020; O'Malley & Chamot, 1990; Vandergrift, 2003). This, in turn, impacts learners' confidence and reduces their anxiety, as increased strategy use has been shown to enhance learners' self-efficacy and alleviate listening-related stress (Bandura, 1997; Zeng & Zeng, 2014). As the use of strategies could significantly influence learners' comprehension outcomes, less strategy-aware listeners may be at a disadvantage. Many language instructors pay more attention to the design and implementation of instructional programs to promote strategy development and use, particularly in listening comprehension tasks where metacognitive guidance is essential (Chamot & O'Malley, 1994; Vandergrift & Goh, 2012; Chou, 2017). Such programs focus on a range of strategies that are pertinent to the authentic use of listening situations or tasks to help learners develop top-down processes to extract meaning from contexts by applying educated inferences based on other available information

to compensate for comprehension gaps (Cross, 2009). In addition, effective EFL listeners can adopt various strategies for interpreting content. Research has shown that highly proficient EFL learners utilize additional and more sophisticated metacognitive strategies, such as comprehension monitoring, problem identification, and selective attention, beyond those employed by lower-proficiency learners (Vandergrift, 2003; Zeng & Zeng, 2014; Bozorgian, Yaqubi, & Muhammadpour, 2020).

Listening processes can be divided into three stages: pre-listening, listening order, and post-listening. However, listening materials on unfamiliar topics and with unfamiliar vocabulary could cause anxiety due to the learners' limited ability to recognize the meaning of the content they are confronted with (Yekeler & Ulusoy, 2021). Bandura (1997) reported that belief in one's own abilities, or self-efficacy, plays a vital role in relation to anxiety in this context. Increased student anxiety derives from a feeling of insufficiency with respect to particular course or subject. The anxiety that occurs during listening process is a negative self-conception, or a low level of self-confidence in listening (Yekeler & Ulusoy, 2021). A wide range of methods can relieve the anxiety caused by self-perceived incompetence to comprehend learning materials; one of these is the use of videos, which are often used to assist EFL learners (Yang, 2014). Videos provide visual and auditory inputs that can facilitate learners' cognitive development. These visual and auditory contents constitute the dual codes used in sensory reception. Dual codes can be further grouped into verbal codes, such as logogens, and non-verbal codes, such as imagens (Clark & Paivio, 1991). Thus, multimedia provides a learning environment that could support language learning process. Yang (2014) performed a study on vocabulary learning comparing visual-spatial and verbal learners. The results indicated no difference between learners with higher and lower visual spatial capabilities under pictorial aids with written annotations. Nevertheless, learners with high verbal competence outperformed those with low verbal competence on recalling vocabulary items in the pictorial annotations condition. Moreover, learners with high visual spatial abilities performed better than those with low spatial capabilities in dependent measures.

Theoretical framework of multimedia for listening comprehension

The effectiveness of multimedia-assisted listening comprehension is closely linked to Cognitive Load Theory (CLT), which emphasizes the importance of efficiently managing learners' cognitive resources to improve learning outcomes (Sweller, 1994). CLT asserts that working memory has a limited capacity, and excessive cognitive demands from processing simultaneous audio, visual, and textual inputs can result in cognitive overload, ultimately hindering comprehension (Mayer, 2009). In the context of multimedia listening, learners must decode spoken language while simultaneously processing subtitles, images, or animations, which can either enhance or hinder comprehension depending on how the

content is structured (Mayer & Moreno, 2003). Research indicates that dual-channel processing, where auditory and visual information are presented complementarily, boosts retention and understanding (Paivio, 1986). However, redundancy effects may occur if learners encounter identical information through multiple modalities, such as simultaneous narration and on-screen text, leading to ineffective cognitive processing (Kalyuga, 2007). To address these challenges, instructional design should incorporate segmenting techniques breaking down listening tasks into smaller parts to promote progressive cognitive engagement (Chandler & Sweller, 1991). Additionally, adaptive multimedia tools, such as interactive captions or keyword highlighting, can direct learners' attention to essential information without overloading their cognitive capacity (Mohsen, 2016). By aligning multimedia implementation with CLT principles, educators can enhance listening comprehension by minimizing extraneous load while boosting essential cognitive processing.

In addition to cognitive load considerations, another important theoretical perspective that supports multimedia-assisted listening comprehension is Dual Coding Theory (Paivio, 1986). This theory explains how learners process and retain information using both verbal and visual modalities. Dual Coding Theory (DCT) explains how learners process information through two cognitive channels: verbal and non-verbal (visual), which function together to improve comprehension and retention (Paivio, 2007). In multimedia-assisted listening comprehension, this theory suggests that combining auditory input (spoken language) with visual supports such as images, captions, and animations strengthens learners' ability to process and store information (Mayer, 2009). When learners interact with multimedia tools that offer both spoken and visual representations, they gain reinforcement between the two modalities, which reduces cognitive load and enhances meaning construction. (Plass & Jones, 2005). Research shows that dual coding improves listening comprehension by enabling learners to connect auditory stimuli with mental imagery, which is especially helpful for understanding unfamiliar vocabulary and complex sentence structures (Clark & Paivio, 1991). Moreover, studies show that dynamic visuals, such as video clips with synchronized captions, help EFL learners focus on key linguistic features while maintaining comprehension (Leveridge & Yang, 2014). To achieve the best results, multimedia content must be thoughtfully crafted to prevent cognitive overload, allowing visuals to support rather than hinder the listening experience (Sorden, 2012). By applying Dual Coding Theory, multimedia-assisted listening instruction can significantly enhance learners' ability to process, retain, and utilize linguistic input in real-world situations. Given the advantages of dual coding in listening comprehension, it is essential to design multimedia-assisted instruction that carefully integrates auditory and visual components while reducing distractions.

There are five elements to multimedia inputs, including texts, audio, images, animations, and subtitles. The instructional content can be arranged through a single-element mode or a combination of two or three elements, such as in the double or triple-element mode. In addition, the theoretical framework of multimedia applications involves the modality principle, which contains the development of cognition through visual and auditory input (Zhang & Zou, 2022). The effect of multimedia applications in foreign language learning could be more significant if learners' metacognitive awareness could be enhanced (Bozorgian, Yaqubi, & Muhammadpour, 2020). Alamdari and Bozorgian (2022) examined the impact of dialogic interaction and metacognitive intervention on multimedia listening comprehension among Iranian EFL learners. In their study, learners engaged in dialogic recall activities, reflecting on their strategic approaches to comprehending videotexts. Their findings revealed that structured dialogic interaction not only enhanced learners' multimedia listening comprehension but also significantly promoted metacognitive awareness. While the study highlighted the pedagogical potential of dialogic recalls as a reflective tool, it also noted challenges such as the variability in learners' engagement levels during dialogic tasks. Moreover, although immediate gains in metacognitive awareness and listening comprehension were reported, the study called for further longitudinal research to determine the sustainability of these improvements over time and across varying multimedia task complexities. These insights highlight the importance of systematically integrating dialogic strategy instruction within multimedia-assisted language learning curricula.

There are also certain limitations to the effectiveness of the integration of technology in language learning. Despite the recognized benefits of technology integration in language learning, several limitations persist. While multimedia tools offer distinct advantages, such as interactivity, accessibility, authenticity, and integrating text, sound, and visuals (Leveridge & Yang, 2014; Sejdiu, 2017), external and learner-related factors hinder their effectiveness. A lack of digital literacy and familiarity with technology use among learners continues to impede optimal outcomes (Sejdiu, 2017; Ng, 2012). Cultural attitudes toward technology adoption also play a mediating role, influencing learners' acceptance and willingness to engage with digital tools (Alammary, 2019; Zhao & Frank, 2003). Furthermore, Zhang and Zou (2022) emphasized that multimedia input can, under certain conditions, contribute to cognitive overload, distracting learners and leading to superficial processing rather than deep comprehension. Learners with lower working memory capacity, for instance, may struggle to integrate multiple streams of multimodal input simultaneously, ultimately reducing the effectiveness of multimedia instruction. Consequently, although multimedia technologies hold significant pedagogical promise, their success depends largely on learners' technological preparedness, cognitive processing abilities, and culturally influenced attitudes toward technology. To maximize the benefits

of multimedia-assisted instruction, educators must address these challenges by providing preparatory digital literacy training and carefully scaffolding multimedia inputs to avoid cognitive overload (Mayer & Moreno, 2003; Chandler & Sweller, 1991).

According to Zhang and Zou (2022), it was observed that under specific conditions, multimedia input does not enhance learning efficacy. First, cognitive overload resulting from the excessive information presented by multimedia resources may diminish its overall effectiveness. Second, multimedia could distract students and shift their attention away. Under this condition, it is difficult for students to stay properly focused on different inputs, and this could result in shallow processing of the information presented through the different multimedia elements. For instance, students with a relatively lower capacity for working memory could have better reading comprehension while reading picture books without narration because the additional audio would be redundant and distracting. In other words, students may overlook crucial multimedia input that delivers the target knowledge and focus instead on extraneous, irrelevant, or unnecessary information. All of these conditions could lead to low learning efficiency and unsatisfactory learning outcomes. Thus, appropriate instructional methodologies and guidance must be implemented to avoid the above-mentioned situation. (Juan & Yahaya, 2019).

METHODOLOGY

This research employed an experimental pretest-posttest design with a comparison between the experimental and control groups to analyze the impact of metacognitive strategies combined with multimedia-assisted instruction on the listening comprehension of EFL learners. A pre-test established a baseline, while a post-test evaluated outcomes, given to both groups to measure improvements in listening comprehension throughout the semester. By comparing improvements in the experimental class with those in the control class, this study inferred the potential benefits of the metacognitive strategy and multimedia intervention. Two current TOEIC remedial classes were designated as two different types of groups: the experimental group, which received training in metacognitive strategies combined with multimedia-supported instruction, and the control group, which continued with a traditional TOEIC test preparation curriculum without any metacognitive training. Due to the necessity for these students to attend remedial classes following their inability to achieve the TOEIC 550 graduation requirement, the students were randomly assigned based on the arrangement of the Language Center. This pretest and posttest framework enabled the evaluation of students' improvements in listening comprehension over the course of one academic semester, spanning 18

weeks. To minimize individual differences and ensure homogeneity between the two groups, both the experimental group and the control group received identical instructions based on the same curriculum design and requirements, which were administered over 8 weeks prior to their pretest. This consistency was crucial for ensuring the reliability of the pretest. Following the pretest, the experimental group underwent an intervention that incorporated metacognitive strategies alongside multimedia-assisted instruction. During this period, four YouTube and four podcast assessments were administered to the experimental group, and the participants were explicitly instructed in metacognitive strategies. Meanwhile, the control group received the original test-oriented curriculum, which focused heavily on test strategies and drills. After the intervention, both groups completed the Metacognitive Awareness Listening Questionnaire (MALQ), which included open-ended questions. The purpose was to investigate the quantified data for the learners' referred strategies across these two groups and the qualitative data for the participants' opinions. Additionally, the pretest and posttest were administered in the format of TOEIC mock tests, which are used in all TOEIC remedial courses to measure students' improvement in language proficiency, with the goal of achieving a score of 550 on the TOEIC as the graduation threshold.

Participants

This study involved third- and fourth-year undergraduate students enrolled in a remedial English course aimed at TOEIC preparation at a technological university in Taiwan. A total of 84 students participated, with 51 in the experimental group and 33 in the control group. All participants had previously faced challenges in English listening proficiency, having been placed in this remedial course due to not achieving the TOEIC score of 550, the minimum needed for graduation. Consequently, at the beginning of the study, all participants had similarly low TOEIC listening abilities, remaining below the 550 threshold. As third or fourth-year students, they have completed the standard freshman English courses; however, they did not meet the language proficiency requirement, indicating the necessity for this additional training. Participants typically ranged in age from their early 20s and included both male and female students.

The experimental and control groups were randomly assigned based on the arrangement of the Language Center office and the instructors' willingness to participate in this study. One existing class was chosen as the experimental group to receive the new instructional method, while another similar class acted as the control group, continuing with the traditional approach. Therefore, group membership was based on course enrollment, a naturally occurring division, rather than being assigned by the researchers. Although this method maintained the standard class structure, it also raised the

chance of pre-existing differences between the groups. To mitigate this issue, the researchers ensured that all students had comparable entry qualifications, which all required remedial instruction due to TOEIC scores of less than 550, and used pre-test scores to verify that there were no significant initial differences in listening comprehension between the two groups.

Intervention

The Experimental Group, which received metacognitive strategies and multimedia-assisted instruction, participated in the explicit teaching of metacognitive listening strategies integrated with multimedia-supported activities. The instructor systematically taught the students how to approach EFL listening tasks using metacognitive techniques. This instruction was based on established models of metacognitive strategy training, encompassing key components such as planning and goal-setting prior to listening, directed attention and monitoring during listening, problem-solving when comprehension falters, and self-evaluation after listening. In practice, this involved the teacher introducing and explaining particular listening strategies in designated sessions. These strategies included predicting content from context, identifying keywords, monitoring comprehension, and reflecting on performance. Students received guidance on when and how to use these strategies to enhance comprehension. After the strategy instruction, the class participated in a listening activity utilizing authentic multimedia materials, which included a selected YouTube video or a podcast segment. This approach enabled learners to apply the strategies to real-world listening experiences immediately. Each session typically lasted around 20 to 30 minutes of strategy instruction and discussion, followed by a multimedia listening task and a brief comprehension quiz or discussion. Throughout the semester, the experimental group consistently engaged with these multimedia materials. Eight multimedia listening tasks and quizzes were conducted every week after the pretest so that the students could practice and reinforce the strategies taught. These tasks included four video-based activities using YouTube clips and four audio-only activities using podcasts, covering topics such as workplace conversations, business news, and common TOEIC scenarios. During these activities, students practiced their metacognitive strategies, such as planning by reviewing questions beforehand, monitoring their understanding during playback, and evaluating their performance afterward. The instructor also provided feedback and facilitated reflection, helping students become more aware of their listening processes and how to improve them.

As for the control group, it was conducted through traditional test-oriented instruction. The control class was taught using a traditional grammar-translation and test-preparation approach without any explicit metacognitive strategy training or specialized multimedia integration beyond the standard

course resources. These students followed the regular remedial TOEIC curriculum as outlined by the language center. Instructions for the control group focused on traditional methods where the teacher emphasized grammar explanations, vocabulary development, and translation of listening passages, aligning with a teacher-centered approach. Lessons often involved reviewing TOEIC practice questions and mock test drills. For instance, students would listen to audio passages from the TOEIC preparation textbook or an online practice platform and subsequently answer multiple-choice questions, after which the teacher would explain the answers, often translating or dissecting the passages to ensure understanding. While the control group utilized audio materials from the TOEIC textbook and the accompanying online resources, including the Easy Test mock test platform, they did not receive training in metacognitive listening strategies and lacked additional authentic multimedia content compared to the experimental group. Essentially, their practice focused more on rote learning and test preparation, aiming to familiarize students with TOEIC question types and enhance listening skills through repetition and translation instead of emphasizing strategic awareness.

The experimental intervention covered eight class sessions during the semester. During those sessions, the instructor spent approximately the first 20 minutes on metacognitive strategy instruction and utilized the remaining time for multimedia listening practice and other course activities. The eight authentic listening tasks were spread across these sessions to offer continuous practice. Outside of these strategy sessions, the experimental group also completed the standard coursework, including textbook exercises and online assignments. Therefore, the students did not miss any of the required material. The control group's schedule aligned with the experimental group regarding assessments and textbook coverage. However, while the experimental class focused on strategies and authentic media, the control class typically engaged in additional TOEIC practice exercises, teacher lectures, or translations according to the standard curriculum. The midterm functioned as a checkpoint and a preliminary assessment of listening skills in the analysis, while the final exam served as a follow-up test. After the midterm exam, which served as a pretest, the experimental group started learning metacognitive strategies along with multimedia-assisted instruction. Instructors closely monitored attendance and participation to maintain comparable engagement levels in both groups. To maintain consistency, the instructional procedures were largely similar for both classes, differing only in the inclusion of metacognitive strategy training and multimedia activities for the experimental group. This organized method aimed to evaluate the influence of the metacognitive multimedia intervention on listening outcomes.

Materials & instruments

A key feature of this study was the use of authentic multimedia resources to support listening instruction in the experimental group. The materials included carefully chosen YouTube videos and podcasts that reflect authentic English usage and are thematically connected to workplace, business, and TOEIC contexts. For instance, YouTube segments can include workplace conversations, short lectures on business topics, or news clips relevant to TOEIC subjects. Conversely, podcasts often include interviews or conversations focused on professional growth and everyday workplace interactions. These materials were chosen to align with TOEIC content areas so that they would be relevant to the students' test preparation needs while also providing richer, more engaging input than standard textbook audio. All multimedia selections were authentic, exposing students to natural language with normal speech rates and accents, which can enhance listening skill development. To ensure appropriateness, the instructor previewed each video/audio to verify that it was at a comprehensible level for lower-intermediate learners. When needed, multimedia content was enhanced with visuals, transcripts, or explanations to avoid overwhelming the students. These resources acted not only as teaching aids during class but also as the foundation for assessment in the eight listening quizzes for the experimental group.

To measure listening comprehension improvement, the study utilized TOEIC-format listening tests as the pre-test and post-test instruments for both groups. In practice, the listening section of the midterm exam functioned as a preliminary benchmark for the pre-test, whereas the final exam's listening section served as the post-test assessment. Both tests were formal and proctored, encompassing various TOEIC listening tasks such as photograph descriptions, question-response activities, short conversations, and brief talks. The listening assessments featured multiple-choice queries and adhered to the conventional TOEIC scoring system. These assessments are recognized as validated and dependable tools for evaluating English listening skills. TOEIC, a globally recognized standardized test, has demonstrated content validity in both workplace and everyday scenarios, consistently achieving high reliability with published reliability coefficients typically exceeding 0.85–0.90 for TOEIC listening. By utilizing TOEIC-based measures, the study ensured that the testing instruments aligned with the course's learning objectives and generated scores that were meaningfully comparable across students and over time. It is important to note that the pre- and post-test versions were parallel forms but did not contain the exact same questions to prevent any recall advantages; they were sourced from official TOEIC preparation materials on the Easy Test TOEIC item bank, which was published by a Taiwanese test publisher and obtained credentials by many universities in Taiwan. The online platform offers a wide

range of TOEIC-style questions. This helped maintain test reliability and prevented practice effects from skewing the results.

In addition to the performance assessment in both groups, this study also collected data on students' metacognitive awareness of listening through the Metacognitive Awareness Listening Questionnaire (MALQ). The MALQ, created by Vandergrift et al. (2006), serves as a self-report tool to evaluate language learners' awareness of and engagement with listening comprehension strategies. It includes various statements regarding listening processes and provides insights into multiple aspects of listeners' metacognition. The questionnaire addresses five key factors of metacognitive listening: problem-solving (strategies for guessing meaning and overcoming difficulties), planning/evaluation (pre-planning for listening and evaluating performance afterward), mental translation (tendency to translate into one's native language while listening), person knowledge (beliefs about one's own listening ability and anxiety), and directed attention (ability to concentrate and stay on task during listening). In this study, the MALQ was administered in its original English version with Chinese translation, while the instructor provided clear explanations to ensure all participants understood the statements. The MALQ was given at the end of the semester, immediately after the posttest, and it was administered to the experimental and the control group for further comparison. The rationale for administering the MALQ to the experimental group was to evaluate how the intervention may have affected their metacognitive awareness. The MALQ has been extensively utilized in second language (L2) listening research due to its demonstrated reliability and validity. For instance, Vandergrift et al. (2006) reported reliability coefficients ranging from 0.70 to 0.80 across its subscales, indicating a consistent internal structure and accurate measurement of learners' metacognitive listening strategies. In this study, the MALQ was employed not only to quantitatively assess participants' use of metacognitive strategies but also to capture qualitative insights into their strategic development through open-ended questions. Thus, the MALQ's strong psychometric properties ensure the credibility of the collected data, effectively complementing and enriching the analysis of participants' listening test performance

Data Collection

Data were collected at three critical time points: before the intervention, during the intervention, and after the intervention. At the mid-point of the semester, participants from both groups took the midterm exam as their pretest. This was conducted in a classroom setting by the course instructors under standardized exam conditions. The scores were recorded for use as baseline data. During the intervention, the instructor of the experimental group monitored performance on the eight in-class listening tests derived from the multimedia materials. These tests served as formative assessments to

track progress in the experimental group, although the main focus of analysis was on comparing the pretest and posttest across these two groups. The post-test data were collected during the last week of the semester when both groups took the listening section of the final exam. This final listening test was conducted in the same manner as the pre-test, under exam conditions, ensuring consistency. Immediately after the final exam, students in both the experimental and control groups were asked to complete the MALQ. They were given clear instructions and assured that the questionnaire was not graded and would be used only for research purposes. The researcher was present to clarify any items that a student was confused about. All data, including pre-test scores, post-test scores, and MALQ responses, were collected confidentially. To protect privacy, each participant's data was identified by a code instead of their name.

Data Analysis

The collected data were analyzed quantitatively using statistical tests appropriate for a pre-/post-test two-group design. First, basic descriptive statistics, including means and standard deviations, were computed for the listening scores in each group at the pre-test and post-test. To compare within-group improvement, this study employed paired-sample t-tests. For the experimental group, the pre-test listening score was compared to the post-test score using a paired t-test to determine if there was a statistically significant gain after the intervention. Similarly, a paired t-test was conducted for the control group's pre-test and post-test listening scores to determine if the control group also showed significant improvement from regular instruction. These within-group analyses indicate whether each instructional approach led to progress over time. Subsequently, independent-sample t-tests were employed to analyze the differences between groups. An independent t-test was conducted on the pre-test scores of the two groups to verify that there was no significant initial difference in listening ability between the experimental and control classes. Furthermore, an independent-sample t-test was performed on the post-test scores to determine whether the experimental group outperformed the control group following the intervention. This tested the primary hypothesis that the metacognitive strategy with multimedia instruction would result in higher listening scores than the traditional method. Additionally, the gain scores, calculated as post-test minus pre-test for each student, were compared between groups as another way to check for differences in improvement. This can be performed using an independent t-test on the gain scores. In simpler terms, this study examined whether the average improvement in the experimental group was significantly greater than that in the control group.

Finally, the data from the MALQ questionnaire were analyzed by calculating the mean score for each of the five metacognitive factors and determining the overall average metacognitive awareness score

for the experimental and control groups. These results were used descriptively to understand which strategies students reported using most and least often. No inferential statistical test was applied to the MALQ data in this study. The results of these analyses are presented in the next section, with tables summarizing the test scores and statistical comparisons.

The data collection and analysis processes were designed to thoroughly assess the research questions: whether the metacognitive strategy and multimedia intervention led to significant enhancements in listening comprehension for the experimental group, how those improvements compared to those seen in the control group, and whether the experimental group surpassed the control group in listening comprehension after the intervention.

Multimedia-assisted listening comprehension performance

To examine the effects of multimedia-assisted instruction integrated with metacognitive strategies on EFL learners' listening comprehension, descriptive statistics, and paired samples t-tests were conducted separately for the YouTube and podcast listening tasks given to the experimental group. These tests facilitated the evaluation of both performance trends and statistical significance across repeated measures.

Table 1. Descriptive statistics analysis for the YouTube assessment

	N	Min.	Max.	Mean	SD
1 st test	51	20	90	61.37	17.552
2 nd test	51	30	90	66.08	15.631
3 rd test	51	30	90	66.27	14.137
4 th test	51	30	90	70.39	14.417

The mean scores of the four YouTube listening comprehension tests were 61.37, 66.08, 66.27, and 70.39, showing an upward trend. The standard deviations gradually shrank, indicating that the students' scores were converging on a mean and becoming more stable.

Table 2. Paired sample t -test for YouTube assessment

		mean	SD	Std. error mean	Confidence interval		t	df	Sig.
					Lower limit	Upper limit			
Pair 1	1 st & 2 nd test	-4.076	21.941	3.072	-10.877	1.465	-1.532	50	.132
Pair 2	1 st & 3 rd test	-4.902	23.270	3.258	-11.447	1.643	-1.504	50	.139
Pair 3	1 st & 4 th test	-9.020	24.270	3.398	-15.846	-2.194	-2.654	50	.011
Pair 4	2 nd & 3 rd test	-.196	20.148	2.821	-5.863	5.471	-.069	50	.945
Pair 5	2 nd & 4 th test	-4.314	20.905	2.927	-10.193	1.566	-1.474	50	.147
Pair 6	3 rd & 4 th test	-4.118	15.515	2.172	-8.481	.246	-1.895	50	.064

A paired sample t-test was conducted to analyze data from the first test to the fourth test to identify any significant differences between the two tests. Only significant differences with $p < .05$ between the two tests are shown in the paired comparisons. As shown in Table 2, only pair 3 (the first test and the fourth test) indicated a significant difference ($.011 < 0.05$). The mean score between the first test and the fourth test improved from 61.34 to 70.39, resulting in an improvement rate of approximately 14.7%. However, other pairwise comparisons did not reach statistical significance (all $p > .05$), indicating limited immediate impact between adjacent tests.

Podcast-based listening assessments

Descriptive statistics for the podcast-based listening assessments are shown in Table 3. A significant and consistent improvement was noted across the four assessments, with mean scores rising from 56.96 to 85.29 and standard deviations falling from 19.98 to 10.17.

Table 3. The descriptive statistics analysis for podcast assessments

	N	Min.	Max.	Mean	SD
1 st test	51	15	100	56.96	19.977
2 nd test	51	20	100	65.78	18.121
3 rd test	51	50	95	75.10	12.668
4 th test	51	60	100	85.29	10.169

The data in Table 3 for the podcast assessments indicate that the mean scores progressively improved in each test. Additionally, the standard deviations decreased progressively, suggesting that the students' performances were trending toward stability.

Table 4. Paired sample t-test for podcast assessment

		mean	S D	Std. error mean	Confidence interval		t	df	Sig .	
					Lower limit	Upper limit				
Pair 1	1 st & 2 nd test	-8.82 4	21.739		3.0 44	-14.9 38	-2.709	-2.899	50	.006
Pair 2	1 st & 3 rd test	-18.1 37	19.848		2.7 79	-23.7 20	-12.55	-6.256	50	.000
Pair 3	1 st & 4 th test	-28.3 33	19.562		2.7 39	-33.8 35	-22.83	-10.34	50	.000
Pair 4	2 nd & 4	-9.31 4	10.818		1.5 15	-12.3 56	-6.271	-6.149	50	.000

	3 rd test								
Pair 5	2 nd & 4 th test	-19.5 10	12.500	1.7 50	-23.0 26	-15.99 4	-11.14 6	50	.000
Pair 6	3 rd & 4 th test	-10.1 96	8.364	1.1 71	-12.5 49	-7.844	-8.705	50	.000

A paired sample t-test was conducted to analyze the data from the first test to the fourth test, determining whether any significant differences existed between the two tests. Only significant differences with $p < .05$ between the two tests are reported among the six pairs compared. The analysis of the paired sample t-test for these six pairs in Table 4 revealed that each pair exhibited a significant difference ($.000 < .05$). Descriptive statistics indicated a consistent progressive increase in test scores with each iteration. The mean score climbed from 56.96 in the first test to 85.29 in the fourth test, representing an improvement rate of approximately 49.7% and indicating substantial progress in listening comprehension with audio-only materials.

Analysis of the midterm exam and the final exam in the control group

The purpose of this t-test was to analyze data in the listening comprehension tests from the midterm exam to the final exam in the control group to identify any significant differences.

Table 5. Paired sample statistical analysis for listening comprehension tests in the control group

	Mean scores	N	SD	Std. error mean
Midterm listening test	160.50	33	42.279	7.360
Final listening test	211.00	33	57.682	10.041

Table 6. Correlated sample test in the control group

	N	Correlation	Sig.
Listening test scores from midterm to final exam	33	.685	.000

Table 7. Paired sample t-test in the control group

	Mean	SD	Std. error mean	Confidence interval		t	df	Sig.
				Lower limit	Upper limit			
Listening test scores from midterm to final exam	-50.500	42.122	7.333	-65.436	-35.564	-6.887	32	.000

The mean score for the listening test in the midterm exam from the control group was 160.50, with a standard deviation of 42.279. In addition, the mean score for the listening test in the final exam from the control group was 211.00, with a standard deviation of 57.682. The mean scores progressed from 160.50 to 211.00, with an improvement rate of 31.46%.

Table 6 presents a correlation of 0.685 and $p = .000 < .05$, which indicates a significant correlation. Furthermore, the paired sample t-test compared the listening scores between the midterm exam and the final exam in the control group, as shown in Table 7), which indicated a t value -6.887 and a two-tailed p value of $.000 < .05$, which indicated significance. Thus, the results showed a significant difference.

Analysis of the midterm exam and the final exam in the experimental group**Table 8. Paired sample statistical analysis for listening comprehension tests in the experimental group**

	Mean scores	N	SD	Std. error mean
Midterm listening test	185.57	50	36.174	5.116
Final listening test	244.53	50	61.749	8.733

Table 9. Correlated sample test in the experimental group

	N	Correlation	Sig.
Listening test scores from midterm to final exam	50	.565	.000

Table 10. Paired sample t-test in the experimental group

	Mean	SD	Std. error mean	Confidence interval		t	df	Sig.
				Lower limit	Upper limit			
Listening test scores from midterm to final exam	-58.960	50.945	7.205	-73.438	-44.482	-8.184	49	.000

From the descriptive statistical analysis, the mean score of the listening test in the midterm exam from the experimental group was 185.57, with a standard deviation of 36.174. In addition, the mean score

of the listening test in the final exam in the experimental group was 244.53, with a standard deviation of 61.749. The mean scores progressed from 185.57 to 244.53, with an improvement rate of 31.77 %.

Table 9 showed a correlation coefficient of 0.565 and $p = .000 < .05$, which indicated a significant correlation. Furthermore, a paired sample t-test was conducted to compare the listening scores between the midterm exam and the final exam in the experimental group in Table 10, which revealed the t value -8.184 and two-tailed significant $p = .000 < .05$. Therefore, the result showed a significant value.

Analysis of the metacognitive awareness listening questionnaire

The MALQ measures five factors, namely, problem-solving, planning and evaluation, mental translation, individual prior knowledge, and directed attention. The reliability of the Likert scales has been identified to have Cronbach's alpha coefficients of .74 for problem-solving, 0.75 for planning and evaluation, 0.78 for translation, 0.74 for individual prior knowledge, and 0.68 for directed attention, respectively (Rahimi & Katal, 2012).

The participants in the experimental group completed a MALQ at the end of the study to identify the most and least frequently used strategies in the multimedia listening comprehension test and the TOEIC mocking listening test. Descriptive statistics for the questionnaire indicate that the most frequently used strategy was "I use the words I understand to guess the meaning of the words I do not understand" (question 5). The mean score for this item on the questionnaire was 4 out of 5, and the second most frequently used strategies were "I use my experience and knowledge to help me understand" (question 9) and "I focus harder on the text when I have trouble understanding" (question 2). The mean scores for these two questions were respectively 3.923 and 3.897.

The analysis also revealed that the least frequently used strategy was "I do not feel nervous when I listen to English" (question 15). The mean score for the question was 2.923. Therefore, the score indicated that the students could be anxious and tense when taking the comprehension tests. The second-least-used skills were "After listening, I think back to how I listened, and about what I might do differently next time" (question 14) and "I find that listening in English is more difficult than reading, speaking, or writing in English" (question 3). The mean scores for these two items were 2.974 and 3.128, respectively.

In the questionnaire, items 1 to 6 describe problem-solving strategies. Items 7 to 11 relate to planning and evaluation strategies. Items 12 to 14 relate to mental translation strategies, and items 15 to 17 cover

individual prior knowledge strategies. Finally, items 18 to 21 describe the directed attention strategy. The results of the analysis show that the students were more influenced by the problem-solving, planning, and evaluation strategies. Furthermore, they were less influenced by the mental translation and the individual prior knowledge strategies when coping with the listening comprehension test.

The analysis of the MALQ responses from the control group offers insights into learners' natural tendencies in metacognitive listening awareness without formal strategy instruction. Among all categories, the control group scored highest in problem-solving ($M = 3.68$), suggesting that students often engaged in guessing the meanings of unfamiliar words using contextual cues and attempted to make sense of difficult segments through active inference. This indicates the presence of some intuitive or test-driven strategy use, possibly influenced by prior exposure to TOEIC-style training.

The second-highest score was found in directed attention ($M = 3.63$), reflecting a relatively strong tendency to focus and recover concentration during listening tasks. This indicates that students had some level of attentional control, although it was probably influenced more by external motivation than by internalized strategy use.

In contrast, Planning and Evaluation received the lowest mean score ($M = 3.24$), indicating limited use of strategies such as goal-setting, predicting content, or evaluating performance after listening tasks. These findings imply that learners from the control group were less likely to prepare for or reflect on their listening processes, a skillset generally nurtured through explicit metacognitive instruction.

Moreover, Mental Translation yielded a moderate mean ($M = 3.46$), suggesting that students often relied on translating the input into their first language, which is a compensatory habit that may hinder real-time comprehension. Similarly, Person Knowledge ($M = 3.27$) indicated only a modest level of confidence and self-efficacy in listening, consistent with literature noting that learners in remedial programs often struggle with anxiety and low listening confidence.

Qualitative analysis of MALQ open-ended questions

At the end of the questionnaire, there are three open-ended questions designed to understand the differences between the experimental and control groups. A deductive framework-based analysis was conducted on the open-ended MALQ responses, guided by the five metacognitive domains outlined in Vandergrift et al. (2006). Responses were categorized under the domains of problem-solving, planning and evaluation, mental translation, person knowledge, and directed attention. This theory-driven

coding approach allowed for a structured comparison of metacognitive strategy use between the experimental and control groups. The questions are as follows.

Q1. What strategies did you find most helpful when trying to understand the listening materials.

Q2. When you had difficulty understanding the listening content, what did you do to help yourself?

Q3. How did using these listening strategies affect your confidence or feelings during listening tasks?

Experimental group analysis

Table 11. Experimental group feedback categories

Question	Strategy Mentioned	Example Responses
Q1: Most helpful strategies	Problem-solving, Planning, Evaluation	"I learned to predict the content and use my common sense to grasp the main idea." "I identified locations and job positions to understand the overall context." "I evaluated my weaknesses, such as vocabulary and pronunciation, and worked to improve them after class." "I identified the main idea first, then noted related details." "Identifying accents helped me focus more effectively." "Podcasts helped me concentrate better because there was no visual distraction."
Q2: Difficulties and solutions	Directed Attention, Mental Translation, Self-regulation	"I tried to catch familiar words and filled in comprehension gaps." "I focused on familiar words and guessed the overall meaning from context."
Q3: Affective reactions	Person Knowledge (anxiety, self-efficacy)	"Even with strategies, I still felt nervous, but if strategies improved my comprehension, I became calmer and more confident." "Understanding the conversation's context through strategies made me feel more confident; otherwise, I felt anxious and resorted to guessing."

The qualitative analysis of the experimental group's responses revealed significant advantages gained from explicit metacognitive strategy training integrated with multimedia instruction. Participants

consistently demonstrated enhanced strategic depth by employing sophisticated strategies such as content prediction, contextual analysis, and proactive self-evaluation to address their comprehension weaknesses. For instance, responses such as "predicting content and using common sense" and "evaluating weaknesses to improve vocabulary and pronunciation" clearly indicate active cognitive engagement fostered by the intervention.

Moreover, the experimental group effectively utilized multimedia elements, particularly podcasts, to enhance listening focus and reduce cognitive distractions. Learners reported that the audio-only format of podcasts facilitated better concentration and comprehension, as exemplified by responses like "Podcasts helped me concentrate better because there was no visual distraction."

When encountering comprehension difficulties, students effectively applied strategies like directed attention and context-driven inference to maintain comprehension, demonstrating improved self-regulation and proactive problem-solving abilities.

Additionally, the intervention positively impacted learners' affective experiences. Participants frequently mentioned increased confidence and reduced anxiety when strategies effectively facilitated their comprehension. Although anxiety persisted for some learners, the explicit strategy instruction notably enhanced their emotional management capabilities, helping them maintain composure and confidence during challenging listening tasks.

Overall, the experimental group's qualitative responses indicate the substantial benefits of integrating explicit metacognitive strategies with multimedia instruction, including enhanced cognitive engagement, improved listening focus, effective self-regulation, and increased emotional resilience.

Control group analysis

Table 12. Control group feedback categories

Questions	Strategies Mentioned	Example Responses
Q1: Most helpful strategies	Problem-solving, Planning, Evaluation	"I was taught to catch the keywords and sometimes read the comprehension questions first to get some clues for the listening." "I was taught to find clues from the photos, graphs, and questions provided in the exam to aid my listening."

Q2: Difficulties and solutions	Directed Attention, Mental Translation, Self- regulation	"I would give up on the questions that are too hard for me." "I would simply guess the answers." "I have no idea."
Q3: Affective reactions	Person Knowledge (anxiety, self- efficacy)	"I practiced only mock tests and was not very familiar with the strategies." "I don't have much confidence in the TOEIC tests. But I hope I can still pass the requirements of this class." "I mostly practiced mock tests and learned something from my mistakes. Overall, I don't have much vocabulary in my brain."

The qualitative analysis of responses from the control group revealed insights into the natural strategic tendencies and emotional states of learners who did not receive explicit metacognitive strategy training. Participants predominantly relied on basic problem-solving and planning strategies, such as keyword identification and contextual clues from accompanying visuals or test questions, indicating some level of test-oriented preparation but limited strategic depth. For example, responses demonstrated a superficial engagement with strategies like "catching keywords" or "reading comprehension questions first," suggesting their strategy use was primarily geared towards immediate comprehension rather than deeper cognitive engagement.

When faced with comprehension difficulties, students frequently resorted to passive or non-strategic behaviors such as guessing or completely abandoning challenging questions, reflecting a deficiency in self-regulatory and attentional control strategies. Responses such as "I would simply guess the answers" and "I have no idea" highlighted the absence of active monitoring or problem-solving strategies that might otherwise support ongoing comprehension.

Regarding affective reactions, the control group expressed notable levels of anxiety and low self-efficacy in listening tasks. The statements "I don't have much confidence" and the recognition of inadequate vocabulary implied a lack of belief in their ability to manage listening comprehension challenges effectively. This finding indicates the potential value of explicit metacognitive and affective strategy instruction in enhancing confidence and reducing anxiety, thereby facilitating more effective language learning outcomes.

Overall, the responses from the control group indicate the critical need for explicit, structured instruction in metacognitive strategies to enhance both cognitive and affective outcomes in listening comprehension tasks within remedial EFL contexts.

FINDINGS

Effects of metacognitive strategies on listening comprehension

Although the experimental group obtained slightly higher mean scores than the control group on the pretest, it is important to clarify that neither group had received any differentiated instruction at that stage. Prior to the midterm examination, which functioned as the pretest in this study, all participants were exposed to the same traditional TOEIC-based instruction, following the standardized remedial English curriculum implemented by the university. The metacognitive strategy training and multimedia-assisted instruction were introduced exclusively to the experimental group only after the midterm. Therefore, any observed differences in pretest performance likely reflect natural individual variation rather than instructional effects.

Furthermore, both groups consisted of students who had not yet achieved the TOEIC 550 benchmark required for graduation and were randomly assigned to their respective classes through the university's standard enrollment procedures. Additionally, an independent-samples t-test revealed that the difference in pretest scores between the two groups was not statistically significant ($p > .05$), thereby reinforcing the internal validity of subsequent group comparisons.

The experimental group that received explicit instruction in metacognitive strategies combined with multimedia-supported activities showed a significant improvement in listening comprehension. A paired-sample t-test comparing their midterm and final TOEIC listening scores indicated a statistically significant gain ($M = 58.96$, $SD = 50.95$, $t(49) = -8.18$, $p < .001$), with the mean score increasing from 185.57 to 244.53, representing a 31.77% improvement. This gain surpassed the 31.46% increase noted in the control group ($t(32) = -6.88$, $p < .001$), whose mean score rose from 160.50 to 211.00.

Although the quantitative statistical analysis revealed significant improvement from pretest to posttest in both groups, with the experimental group showing a greater improvement rate than the control group, there was no statistically significant difference between the experimental and control groups in terms of pretest-posttest improvements. However, qualitative analysis from the MALQ open-ended questions provided critical insights into the advantages of the intervention. Participants from the

experimental group, who received explicit training in metacognitive strategies integrated with multimedia-assisted instruction, demonstrated notable qualitative benefits.

Firstly, learners in the experimental group consistently reported higher engagement with advanced problem-solving, planning, and evaluation strategies. Responses indicated that these learners actively predicted content, effectively used contextual cues, and systematically evaluated their performance. For instance, students stated, "I learned to predict the content and use my common sense to grasp the main idea," and "I evaluated my weaknesses, such as vocabulary and pronunciation, and worked to improve them after class." Such feedback emphasized the intervention's effectiveness in fostering deeper cognitive engagement and strategic self-regulation.

Secondly, multimedia-assisted instruction, particularly through podcast-based activities, contributed significantly to enhancing learners' concentration and comprehension. Students specifically highlighted the advantage of podcasts, noting reduced cognitive load and increased attentional focus due to the absence of visual distractions. As one participant mentioned, "Podcasts helped me concentrate better because there was no visual distraction." This aligns with Cognitive Load Theory (Sweller, 1994; Mayer, 2009), suggesting that minimizing extraneous input can optimize learners' cognitive resources for better listening performance.

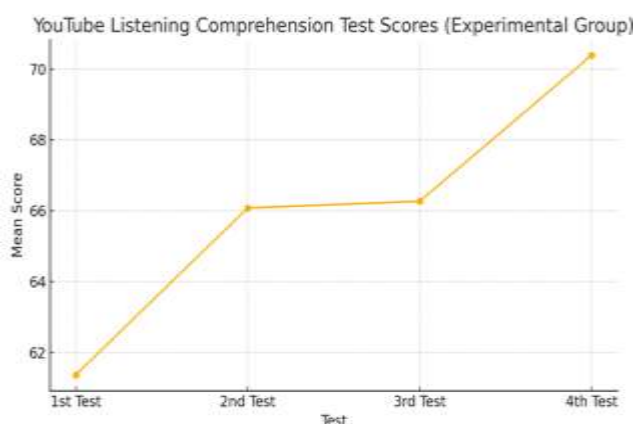
Furthermore, the qualitative responses also revealed enhanced emotional resilience among experimental group participants. Although anxiety persisted for some, the explicit metacognitive instruction helped students manage their anxiety more effectively, resulting in increased confidence during listening tasks. Statements such as "Even with strategies, I still felt nervous, but if strategies improved my comprehension, I became calmer and more confident," clearly indicate the affective advantages provided by metacognitive training.

In contrast, the control group's responses reflected limited strategic depth, reliance on basic test-oriented approaches, and higher levels of reported anxiety and low self-efficacy. This qualitative differentiation further highlights the effectiveness of explicit metacognitive instruction combined with multimedia-assisted instruction in improving not only cognitive but also emotional aspects of language learning.

Comparative effects of YouTube and Podcast multimedia tools

Analysis of the multimedia quiz scores from the experimental group revealed distinct patterns in learner performance between YouTube video and podcast tasks. For the YouTube-based assessments, only the comparison between the first and fourth tests yielded a statistically significant improvement ($M = 9.02$, $t(50) = -2.65$, $p = .011$), corresponding to a modest improvement rate of 14.7%. Although there was a general upward trend in mean scores (from 61.37 to 70.39), the other paired comparisons did not reach statistical significance (all $p > .05$), suggesting limited gains over time.

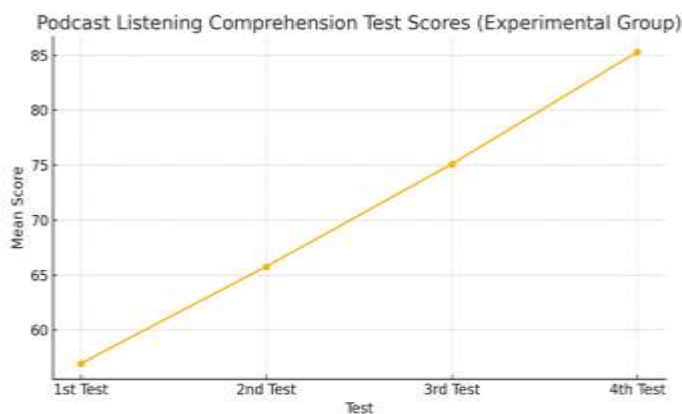
Figure 1. YouTube Listening Comprehension Test Scores



This linear graph shows the mean scores across four YouTube-based listening tasks, reflecting a gradual upward trend and improved performance over time.

In contrast, podcast assessments demonstrated consistently significant improvements across all test pairs (all $p < .01$), with mean scores rising from 56.96 to 85.29, reflecting an overall improvement rate of 49.7%. These results suggest that audio-only materials produced greater gains in listening comprehension than video-based materials. One interpretation is that the learners, many of whom are auditory learners, benefited more from focused listening experiences without the potential distractions of visual input.

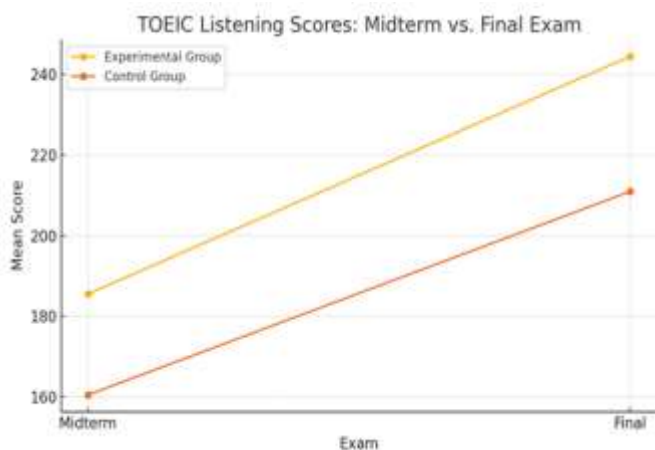
Figure 2. Podcast Listening Comprehension Test Scores (Experimental Group)



This linear graph illustrates a steady and significant increase in mean scores across four podcast-based assessments, highlighting the greater effectiveness of audio-only input.

Integration of multimedia and metacognitive strategies for enhancing listening proficiency

Figure 3. TOEIC Listening Scores: Midterm vs. Final Exam



The linear graphs compared the midterm and final exam scores for both the experimental and control groups, showing a statistically significant increase following the intervention.

The integration of metacognitive strategies with multimedia-assisted instruction demonstrated notable pedagogical value in enhancing learners' listening proficiency, as evidenced by the considerable improvement of the experimental group's performance. While both the experimental and control

groups showed statistically significant within-group improvements on their respective posttests (experimental: $M = 244.53$, control: $M = 211.00$), it must be acknowledged that the difference in posttest scores between the two groups did not reach statistical significance ($p > .05$). And this could indicate limited comparative efficacy of the multimedia-assisted metacognitive approach over traditional test-oriented instruction.

However, this finding requires careful contextual interpretation. First, the lack of statistical significance in between-group differences might partially reflect constraints associated with the limited duration of the intervention, which spanned approximately half a semester. Given that the development and effective application of metacognitive strategies typically require extended periods of practice and internalization (Vandergrift & Goh, 2012), longer-term interventions might yield clearer statistical distinctions.

Secondly, despite rigorous test-focused practice integrated into the control group's curriculum, which primarily consisted of repetitive drills and frequent exposure to TOEIC formats, the experimental group still achieved higher final mean scores. This indicates that explicit metacognitive training, when combined with multimedia-supported learning, provided additional benefits beyond mere familiarity with test formats. Such training fosters deeper cognitive engagement and promotes strategic listening behaviors, which are critical for sustained and transferable language proficiency (Vandergrift & Tafaghodtari, 2010).

Moreover, the consistently higher improvement rate observed in multimedia-based assessments, especially with podcasts, where students demonstrated significant and sustained performance gains, demonstrates the practical significance of metacognitive multimedia integration. This finding aligns with Cognitive Load Theory (Sweller, 1994; Mayer, 2009), suggesting that the optimal cognitive engagement elicited by podcasts likely enhanced learners' ability to focus effectively on linguistic input without extraneous cognitive demands from visual stimuli.

In addition, the experimental group's increased metacognitive awareness, as evidenced by MALQ data, highlighted another practical dimension of instructional effectiveness. Students explicitly reported higher usage of metacognitive strategies, particularly related to problem-solving and evaluation. This strategic competence is vital not only for immediate performance on standardized tests but also for developing broader autonomous learning skills and managing language-learning anxiety (Bandura, 1997; Zeng & Zeng, 2014).

Therefore, while the posttest statistical differentiation between groups was limited, the comprehensive evidence from performance trends, strategic awareness assessments, and theoretical alignment strongly supports the practical effectiveness of integrating metacognitive strategies with multimedia-assisted instruction. Future research employing longer intervention durations and larger sample sizes could further elucidate the long-term impacts and nuanced benefits of this combined instructional approach.

Factors influencing the effectiveness of multimedia-assisted, strategy-based instruction

The effectiveness of multimedia-assisted listening instruction is influenced by several key factors, including individual learner differences, modality preference, and anxiety. The MALQ responses indicated relatively low usage of anxiety-reducing strategies in the experimental group, such as maintaining calm during listening tasks ($M = 2.92$), suggesting that test anxiety may have hindered optimal performance for some students. Additionally, the difference in effectiveness between YouTube and podcast tasks may reflect modality preferences; students appeared to process auditory input more efficiently than multimodal (audio-visual) input, possibly due to a lower cognitive load.

Furthermore, prior knowledge and linguistic competence contributed to successful comprehension. Learners who utilized contextual clues and personal experiences tended to achieve higher scores, indicating the importance of developing background knowledge and vocabulary in conjunction with strategy training.

DISCUSSION

This study investigated the effects of metacognitive strategy instruction and multimedia-assisted learning on EFL learners' listening comprehension in a Taiwanese remedial English program. The findings demonstrated that while both the experimental and control groups improved their listening performance, students exposed to podcasts and strategy instruction showed significantly greater gains than those who relied solely on visual-based multimedia or traditional methods. These findings are consistent with prior studies (Vandergrift & Goh, 2012; Bozorgian et al., 2020) that emphasize the importance of strategy awareness and modality selection in L2 listening comprehension.

Although quantitative analysis indicated significant improvements from pretest to posttest within both experimental and control groups, no statistically significant difference emerged between the two groups. Nevertheless, framework-based analysis from open-ended MALQ responses provided

valuable insights into the benefits experienced by the experimental group, underscoring the efficacy of metacognitive strategy instruction supported by multimedia.

Framework-based analysis highlighted several key advantages for the experimental group. First, participants explicitly noted the strategic depth they gained through the intervention. Learners in the experimental group reported effectively employing advanced metacognitive strategies such as content prediction, contextual inference, and proactive self-evaluation. Statements like "I learned to predict the content and use my common sense to grasp the main idea" and "I evaluated my weaknesses, such as vocabulary and pronunciation, and worked to improve them after class" illustrate the participants' enhanced cognitive engagement and active self-regulation. These findings align with existing research emphasizing the crucial role of metacognitive awareness and strategy use in facilitating deeper language comprehension (Vandergrift & Goh, 2012; Taherkhani et al., 2022).

Second, the qualitative responses from the experimental group revealed that multimedia-assisted instruction, especially through podcasts, significantly improved learners' attentional focus and reduced cognitive distractions. Students specifically highlighted the effectiveness of the audio-only format, stating, "Podcasts helped me concentrate better because there was no visual distraction." This finding aligns with Cognitive Load Theory (Sweller, 1994; Mayer, 2009), indicating that the elimination of extraneous cognitive load enables participants to optimize their cognitive resources, resulting in improved listening performance.

Third, qualitative findings also suggested a substantial impact on participants' emotional resilience. Although anxiety persisted, the explicit metacognitive instruction equipped students with strategies to manage anxiety effectively, resulting in increased confidence during listening tasks. Statements such as "Even with strategies, I still felt nervous, but if strategies improved my comprehension, I became calmer and more confident" exemplify the beneficial affective influence of structured strategy training. These insights affirm the importance of addressing learners' emotional factors, such as anxiety and self-efficacy, as critical components of language proficiency development (Bandura, 1997; Zeng & Zeng, 2014).

Comparative efficacy of multimedia modalities

The differences in outcomes between YouTube and podcast interventions can be elucidated through the lens of Cognitive Load Theory (Sweller, 1994) and the Modality Principle (Mayer, 2009). The podcast group demonstrated an improvement rate of 49.7%, significantly surpassing the 14.7%

improvement seen in the YouTube group. This suggests that podcast-based instruction, which is free from extraneous visual stimuli, may have allowed learners to allocate cognitive resources more efficiently toward auditory processing. In contrast, the dual-input nature of YouTube (audio + visual) may have resulted in cognitive overload, especially for learners with limited working memory, which diminishes comprehension effectiveness. (Zhang & Zou, 2022).

Learner preferences and learning styles may also play a mediating role. Since most participants seemed to favor auditory input, aligning instructional design with these preferences likely enhanced their engagement and comprehension. These findings align with those of Teng and Zhang (2021, 2023), who noted that individual differences in working memory and learning style significantly impact the efficacy of multimedia formats.

Impact of metacognitive strategies on listening comprehension

The implementation of metacognitive strategy instruction, which focused on planning, problem-solving, and evaluation, resulted in enhanced learner autonomy and listening awareness, particularly for the experimental group. MALQ responses revealed a frequent use of inferencing and background knowledge from the experimental group to resolve comprehension gaps, reinforcing the importance of top-down processing strategies in L2 listening (Li , Zhang & Goh, 2022; Vandergrift et al., 2006). However, the quantitative data showed an insufficient rate of engaging in post-task reflection, indicating underdeveloped self-evaluation skills. This gap indicates the need to explicitly emphasize the complete cycle of metacognitive regulation, encompassing post-listening reflection and strategy transfer. (Tham, 2018; Zheng, 2018).

Influential factors in multimedia and the integration of strategies

Alongside multimedia modality and instruction in metacognitive strategies, other contextual variables also emerged as significant in influencing listening outcomes. First, anxiety was identified as a critical factor. The MALQ quantitative and qualitative data from the experimental group indicated certain levels of listening-related nervousness among students, which is consistent with Yekeler and Ulusoy's (2021) findings on the negative impact of affective variables on listening comprehension. Incorporating self-efficacy training (Bandura, 1997) and stress-reduction techniques may help learners manage anxiety and improve focus.

Second, the reliance on prior linguistic knowledge during listening tasks suggests that schema activation plays a vital role in comprehension (Carrell & Eisterhold, 1983). Students who connected new information to their prior knowledge showed greater levels of comprehension, reinforcing the necessity of pre-listening activities that activate background knowledge.

Finally, while digital literacy and technological readiness were not directly measured in this study, they likely influenced learners' ability to engage with multimedia tools. Prior studies (Sejdiu, 2017; Zhao & Frank, 2003) have indicated that a lack of familiarity with digital platforms can obstruct effective strategy implementation, highlighting the necessity of preparatory training on tool usage.

Pedagogical Implications

The findings of this study offer several pedagogical implications for improving EFL learners' listening comprehension by integrating metacognitive strategies and multimedia-supported instruction. These implications align with contemporary perspectives on learner-centered instruction, cognitive load management, and strategic language learning in technologically enriched environments.

First, the differential impact of auditory-only and audiovisual multimedia formats highlights the importance of aligning instructional materials with learners' cognitive processing capacities and learning preferences. The superior performance observed in the podcast-based group suggests that audio-only materials may facilitate deeper processing by reducing extraneous cognitive load (Mayer, 2009; Sweller, 1994). Therefore, EFL instructors should consider selecting listening materials that align with the Modality Principle, particularly for learners with limited working memory capacity or a preference for auditory processing.

Second, the findings highlight the necessity of comprehensive metacognitive strategy training that encompasses the full cycle of listening comprehension. While the experimental group demonstrated gains in problem-solving and planning strategies, the low frequency of post-listening reflection reported in the MALQ results indicates a gap in students' metacognitive regulation. Instructional designs should explicitly address all three phases of metacognitive listening development: planning, monitoring, and evaluating (Vandergrift & Goh, 2012). The incorporation of reflective journals, post-listening debriefings, and self-assessment tools for strategies can aid learners in consolidating their strategic awareness and promoting self-regulated learning.

Thirdly, affective factors, including listening anxiety, have been identified as potential impediments to comprehension. The students' responses to anxiety-related items on the MALQ indicate that even with strategic training, negative affective states may impede performance. In light of this, language instructors are recommended to incorporate affective support mechanisms into listening instruction. Methods including progressive exposure to authentic materials, implementation of relaxation strategies, and the cultivation of self-efficacy beliefs (Bandura, 1997) are likely to alleviate anxiety and enhance learner confidence.

Fourth, the consistent reliance on prior knowledge and inference strategies indicates that activating learners' existing schemata before engaging with listening texts could improve comprehension outcomes. Pre-listening tasks that stimulate background knowledge, including prediction exercises, thematic discussions, or concept mapping, effectively prepare learners to forge meaningful connections with new information (Vandergrift & Goh, 2012).

Finally, the successful implementation of multimedia-supported instruction requires a foundational level of digital literacy among learners. While this aspect was not directly evaluated in the current study, prior studies (Alammary, 2019; Ng, 2012; Sejdiu, 2017) suggest that technological proficiency may influence the effectiveness of multimedia tools. Therefore, educators must offer suitable scaffolding to ensure that students are adequately prepared to navigate and utilize digital learning platforms effectively.

Integrating metacognitive strategies and multimedia input into EFL listening instruction presents a promising pedagogical pathway. However, its effectiveness relies on careful alignment with learners' cognitive capacities, strategic awareness, affective needs, and technological readiness. A holistic instructional approach that addresses these dimensions is crucial for optimizing listening comprehension outcomes in foreign language contexts.

CONCLUSION

This study sought to investigate the effects of integrating metacognitive strategies with multimedia-assisted instruction on EFL learners' listening comprehension. The findings support the hypothesis that combining strategy instruction with multimedia input significantly enhances listening outcomes, particularly among lower-intermediate learners in remedial TOEIC courses. This finding is consistent with previous studies, which indicate that metacognitive training can positively influence learners'

ability to process listening texts by fostering self-regulation, problem-solving, and planning (Vandergrift & Tafaghodtari, 2010; Xu, 2023).

The empirical findings indicate that participants in the experimental group exhibited relatively greater listening comprehension performance than control group participants, particularly when engaged with audio-based materials. This observation is consistent with prior research, which suggests that modality-specific preferences, such as auditory learning, may mediate the efficacy of multimedia interventions (Rahimi & Katal, 2012; Sejdiu, 2017). The considerable improvement observed in podcast-based assessments substantiates previous conclusions that auditory-only input fosters a higher level of concentration on the speech signal and encourages the use of compensatory strategies (Bozorgian, Yaqubi, & Muhammadpour, 2020; Ramirez, 2024).

Furthermore, students' responses to the Metacognitive Awareness Listening Questionnaire (MALQ) indicate that problem-solving, planning/evaluation strategies, strategic prediction, and systematic self-evaluation were the most commonly utilized approaches. This observation further supports the efficacy of direct metacognitive instruction (Chamot & O'Malley, 1994; Vandergrift et al., 2006). Students' employment of such strategies has been associated with decreased anxiety levels and enhanced confidence in second language listening abilities (Zeng & Zeng, 2014; Bandura, 1997).

Conversely, qualitative findings from the control group, which lacked explicit metacognitive instruction, revealed a superficial strategic use, predominantly limited to basic test-oriented methods, such as keyword identification. Participants often resorted to passive or non-strategic behaviors such as guessing or abandoning difficult questions, reflecting inadequate self-regulation. Responses indicating anxiety and low self-efficacy showed the necessity of explicit metacognitive training to foster deeper cognitive engagement and enhance learners' emotional resilience.

The findings further substantiate the notion that metacognitive instruction serves not only to enhance comprehension but also to promote the development of autonomous learning habits, particularly when integrated with authentic materials in multimedia-rich environments (Mohsen, 2016; Mayer, 2009). As highlighted in previous research, when learners are provided with strategies for planning, monitoring, and evaluating their listening, they are empowered to become more engaged participants in their own learning processes (Anderson, 2009; Goh, 2018).

Despite the positive outcomes observed, this study is not without limitations. Chief among them is the depth of qualitative data sources, such as participant interviews or reflective journals, which may have

provided deeper insights into learners' cognitive and affective experiences during the intervention. While the quantitative results offer an insight into the effectiveness of metacognitive strategy instruction combined with multimedia support, an extended period of intervention would enhance the efficacy for future research. To further strengthen the rigor of future studies, researchers are encouraged to employ more controlled designs, such as matched-pairs sampling or analysis of covariance (ANCOVA), to account for any initial group differences. By addressing these methodological considerations, future investigations can provide a more nuanced and comprehensive account of the complex processes involved in EFL listening development through strategic and multimedia-enhanced instruction.

REFERENCES

- Alamdari, E. F., & Bozorgian, H. (2022). Gender, metacognitive intervention, and dialogic interaction: EFL multimedia listening. *System, 104*, 102709. <https://doi.org/10.1016/j.system.2021.102709>
- Alammary, A. (2019). Blended learning models for introductory programming courses: A systematic review. *PLoS ONE, 14*(9), e0221765. <https://doi.org/10.1371/journal.pone.0221765>. <https://doi.org/10.1371/journal.pone.0221765>
- Al-Alwan, A., Asassfeh, S., & Al-Shboul, Y. (2013). EFL learners' listening comprehension and awareness of metacognitive strategies: How are they related? *International Education Studies, 6*(9), 31-39. 10.5539/ies.v6n9p31
- Al-Azzemy, A. F.T., & Al-Jamal, D. A. H. (2019). Evaluating cognitive, metacognitive and social listening comprehension teaching strategies in Kuwaiti classrooms. *Heliyon, 5*(2), 1-17. 10.1016/j.heliyon.2019.e01264
- Alhazmi, K. (2024). The effect of multimedia on vocabulary learning and retention. *World Journal of English Language, 14*(6), 390–403. <https://doi.org/10.5430/wjel.v14n6p390>
- Anderson, J. R. (2009). *Cognitive psychology and its implications (7th ed.)*. Worth Publishers.
- Assadi, J., Murad, T., & Muhammad, H. (2025). The necessity of digital tools for Israeli Arab EFL students: Benefits and challenges. *English Language Teaching, 18*(2), 31–41. 10.5539/elt.v18n2p31
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. WH Freeman.
- Bozorgian, H., Yaqubi, B., & Muhammadpour, M. (2020). Metacognitive intervention and awareness: Listeners with low working memory capacity. *International Journal of Listening, 36*(1), 1-14. <https://doi.org/10.1080/10904018.2020.1857764>

- Carrell, P. L., & Eisterhold, J. C. (1983). Schema theory and ESL reading pedagogy. *TESOL Quarterly*, 17(4), 553–573. <https://doi.org/10.2307/3586613>
- Chamot, A. U., & O'Malley, J. M. (1994). *The CALLA handbook: Implementing the cognitive academic language learning approach*. Addison-Wesley.
- Chandler, P., & Sweller, J. (1991). Cognitive load theory and the format of instruction. *Cognition and Instruction*, 8(4), 293–332. https://doi.org/10.1207/s1532690xci0804_2
- Chou, M. H. (2017). A task-based language teaching approach to developing metacognitive strategies for listening comprehension. *International Journal of Listening*, 31(1), 51–70. <https://doi.org/10.1080/10904018.2015.1098542>
- Clark, J. M., & Paivio, A. (1991). Dual coding theory and education. *Educational Psychology Review*, 3(3), 149–210. <https://doi.org/10.1007/BF01320076>
- Cross, J. (2009). Effects of listening strategy instruction on news videotext comprehension. *Language Teaching Research*, 13 (2), 151-176. <https://doi.org/10.1177/1362168809103446>
- Cross, J., & Vandergrift, L. (2018). Metacognitive listening strategies. In J. I. Liantas (Ed.), *The TESOL encyclopedia of English language teaching* (pp. 1–7). Wiley.
- Goh, C. C. M. (2018). Metacognition in second language listening. In J. I. Liantas (Ed.), *The TESOL Encyclopedia of English Language Teaching* (pp. 1–7). Wiley.
- Graham, S., & Santos, D. (2015). *Strategies for second language listening: Current scenarios and improved pedagogy*. Palgrave Macmillan.
- Hosseini, G., Izadpanah, S., & Fasih, P. (2020). The effects of metacognitive strategy training on improving Iranian EFL learners' listening performance and the similarities and differences across three elementary, intermediate and advanced proficiency levels. *International Journal of Research in English Education*, 5(2), 29–48. [10.29252/ijree.5.2.29](https://doi.org/10.29252/ijree.5.2.29)
- Juan, L., & Yahaya, N. B. (2019). The problems and countermeasures of applying multimedia technology in college English teaching. *International Journal of Engineering and Advanced Technology*, 8(5C), 1512–1516. [10.35940/ijeat.E1222.0585C19](https://doi.org/10.35940/ijeat.E1222.0585C19)
- Kalyuga, S. (2007). Enhancing instructional efficiency of interactive e-learning environments: A cognitive load perspective. *Educational Psychology Review*, 19(3), 387–399. <https://doi.org/10.1007/s10648-007-9051-6>
- Ko, L. Y. (2019). A study of metacognitive strategies utilized in reading and listening comprehension: An investigation of nursing junior college English learners. *European Journal of Education Studies*, 5(11), 176–188. <https://oapub.org/edu/index.php/ejes/article/view/2317>

- Leveridge, A. N., & Yang, J. C. (2014). Learner perceptions of reliance on captions in EFL multimedia listening comprehension. *Computer Assisted Language Learning*, 27 (6), 545-559. <https://doi.org/10.1080/09588221.2013.776968>
- Li, Q., Zhang, L., & Goh, C. C. M. (2022). Metacognitive instruction in second language listening: Does language proficiency matter? *English as a Foreign Language International Journal*, 26(5), 27–55. 10.56498/3922652022
- Mayer, R. E., & Moreno, R. (2003). Nine ways to reduce cognitive load in multimedia learning. *Educational Psychologist*, 38(1), 43–52. https://doi.org/10.1207/S15326985EP3801_6
- Mayer, R. E. (2009). *Multimedia learning* (2nd ed.). Cambridge University Press.
- Mohsen, M. A. (2016). Effects of help options in a multimedia listening environment on L2 vocabulary acquisition. *Computer Assisted Language Learning*, 29 (7), 1220-1237. <https://doi.org/10.1080/09588221.2016.1210645>
- Ng, W. (2012). Can we teach digital natives digital literacy? *Computers & Education*, 59(3), 1065–1078. <https://doi.org/10.1016/j.compedu.2012.04.016>
- O'Malley, J. M., & Chamot, A. U. (1990). *Learning strategies in second language acquisition*. Cambridge University Press.
- Podhajski, B. (2016). Teaching Listening Comprehension. *Perspectives on Language and Literacy*, 42(3), 43-48. <https://www.scribd.com/document/333542514/%EC%B0%B8%EA%B3%A0%EB%AC%B8%ED%97%8C01>
- Paivio, A. (1986). *Mental representations: A dual coding approach*. Oxford University Press.
- Paivio, A. (2007). *Mind and its evolution: A dual coding theoretical approach*. Psychology Press.
- Plass, J. L., & Jones, L. C. (2005). Multimedia learning in second language acquisition. In R. E. Mayer (Ed.), *The Cambridge handbook of multimedia learning* (pp. 467–488). Cambridge University Press.
- Rahimi, M., & Katal, M. (2012). Metacognitive strategies awareness and success in learning English as a foreign language: An overview. *Procedia - Social and Behavioral Sciences*, 31, 73–81. <https://doi.org/10.1016/j.sbspro.2011.12.019>
- Ramirez, M. G. (2024). The use of podcasts for language learning: A systematic review of literature. *International Journal of English Language Studies*, 6(1), 47–53. <https://doi.org/10.32996/ijels.2024.6.1.4>
- Salaberry, M. R. (2001). The use of technology for second language learning and teaching: A retrospective. *The Modern Language Journal*, 85(1), 39–56. <https://doi.org/10.1111/0026-7902.00096>

- Sejdiu, S. (2017). Are listening skills best enhanced through the use of multimedia technology. *Digital Education Review*,32,60-72. chrome-extension://kdpelmjpfafjppnhbloffcjpeomlnpah/https://files.eric.ed.gov/fulltext/EJ1166469.pdf
- Sendag, S., Gedik, N., & Toker, S. (2018). Impact of repetitive listening, listening-aid and podcast length on EFL podcast listening. *Computer & Education*, 125, 273-283.https://doi.org/10.1016/j.compedu.2018.06.019
- Sorden, S. D. (2012). *The cognitive theory of multimedia learning*. In N. M. Seel (Ed.), *Encyclopedia of the Sciences of Learning* (pp. 586–590). Springer.
- Sweller, J. (1994). Cognitive load theory, learning difficulty, and instructional design. *Learning and Instruction*, 4(4), 295–312.https://doi.org/10.1016/0959-4752(94)90003-5
- Taheri, P., & Hedayat Zade, M. (2018). The contribution of metacognitive strategies to EFL learners' listening comprehension task types. *Teaching English Language*, 12(2), 169–198.10.22132/tel.2018.82864
- Taherkhani, B., Aliasin, S. H., Khosravi, R., & Izadpanah, S. (2022). The interface between metacognitive strategy training and locus of control in developing EFL learners' listening comprehension skill. *Frontiers in Education*, 7, 1-10. https://doi.org/10.3389/feduc.2022.847564
- Teng, M. F., & Zhang, D. (2021). The associations between working memory and the effects of multimedia input on L2 vocabulary learning. *International Review of Applied Linguistics in Language Teaching*, 61(3), 1021-1049. https://www.degruyterbrill.com/document/doi/10.1515/iral-2021-0130/html
- Teng, M. F., & Zhang, D. (2023). Vocabulary learning in a foreign language: Multimedia input, sentence-writing task, and their combination. *Applied Linguistics Review*, 15(5), 1-26. https://www.degruyterbrill.com/document/doi/10.1515/applirev-2022-0160/html
- Tham, H.T. (2018). Applying metacognitive strategies in teaching listening comprehension to advanced program students at Thai Nguyen University of Technology. *International Journal of Humanities and Social Science*, 5(3), 4-9.10.14445/23942703/IJHSS-V5I3P102
- Vandergrift, L. (1997). The comprehension strategies of second language (French) listeners: A descriptive study. *Foreign Language Annals*, 30(3), 387-409. **https://doi.org/10.1111/j.1944-9720.1997.tb02362.x**
- Vandergrift, L. (2003). Orchestrating strategy use: Toward a model of the skilled second language listener. *Language Learning*, 53(3), 463-496. **https://doi.org/10.1111/1467-9922.00232**

- Vandergrift, L., Goh, C. C. M., Mareschal, C. J., & Tafaghodtari, M. H. (2006). The Metacognitive Awareness Listening Questionnaire: Development and Validation. *Language Learning*, 56(3), 431–462. <https://doi.org/10.1111/j.1467-9922.2006.00373.x>
- Vandergrift, L., & Goh, C. M. (2012). *Teaching and learning second language listening: Metacognition in action*. Routledge.
- Vandergrift, L., & Tafaghodtari, M. H. (2010). Teaching L2 learners how to listen does make a difference: An empirical study. *Language Learning*, 60(2), 470–497. <https://doi.org/10.1111/j.1467-9922.2009.00559.x>
- Xu, Z. (2023). Metacognition in language teaching and research: A conversation with professor Lawrence Jun Zhang. *RELC Journal*, 54(1), 300–308. <https://doi.org/10.1177/00336882231157497>
- Yang, H. Y. (2014). Does multimedia support individual differences? – EFL learners' listening comprehension and cognitive load. *Australasian Journal of Educational Technology*, 30(6), 699-713. <https://doi.org/10.14742/ajet.639>
- Yekeler, A.D., & Ulusoy, M. (2021). The relationship among listening comprehension and factors affecting listening. *Education and Science*, 46(205), 1-17. [10.15390/eb.2020.90066](https://doi.org/10.15390/eb.2020.90066)
- Zeng, Y., & Zeng, Y. (2014). Chinese EFL learners' metacognitive knowledge in listening: A survey study. In Z. Zeng (Ed.), *Frontier and future development of information technology in medicine and education* (Vol. 269, pp. 2975–2979). Springer. https://doi.org/10.1007/978-94-007-7618-0_378
- Zhao, Y., & Frank, K. A. (2003). Factors affecting technology uses in schools: An ecological perspective. *American Educational Research Journal*, 40(4), 807–840. <https://doi.org/10.3102/00028312040004807>
- Zhang, R., & Zou, D. (2022). A state-of-the-art review of the modes and effectiveness of multimedia input for second and foreign language learning. *Computer Assisted Language Learning*, 35 (9), 2790-2816. <https://doi.org/10.1080/09588221.2021.1896555>
- Zheng, J. (2018). The metacognitive strategy in English listening comprehension. *Theory and Practice in Language Studies*, 8(2), 226-231. <http://dx.doi.org/10.17507/tpls.0802.07>