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The Impact of Implementing AI-Generated Audio Transcriptions on English Majors' Cognitive Load

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Abstract

AI has become a daily personal tutoring system to address the needs of English majors, particularly those seeking a revolution in listening methods. Automatic AI-Generated Audio transcriptions (AIGATs) can improve learners' listening comprehension (Cao, Yamashita, & Ishida, 2018); however, there are concerns that if AI transcriptions lack thoroughness, it may negatively affect learners' cognition. Within the confines of this study, we investigate how AIGATs engender a profound impact on 86 English majors' cognitive load (CogL) and their perspectives towards the applications of AIGATs. The participants were divided into two groups: one was exposed to the listening practice sessions with AIGATs and the rest with their own transcriptions (PTs). Data is collected through CogL scales on AIGATs and PTs groups, respectively. A semi-structured interview was conducted to examine the AIGATs group's perspectives. The findings revealed statistically significant differences in the two groups' CogL test scores. Using AIGATs helps students lower their CogL test scores and enhance their cognitive abilities in handling task complexity. This research provides valuable insights for integrating AI into language education, helping educators create more efficient language instruction methods for English learners in the digital age.

Keywords: artificial intelligence (AI), listening comprehension (Liscomp), cognitive load (CogL), AI-generated audio transcriptions (AIGATs), participants' transcriptions (PTs)

Introduction

Artificial intelligence (AI) is having a transformative impact on the modern world (Gruetzemacher & Whittlestone, 2019), particularly in reshaping education (Rampersad, 2020; Mhlanga, 2021) by providing a broad, personalized, and efficient learning platform (Becker, 2017). Becker (2017, p. 1) highlighted this by asking: "Artificial Intelligence holds significant promise to revolutionize our educational systems, but are our educational systems ready for a revolution?" Vietnam is moving towards readiness for an AI-driven educational revolution. Since the 2020s, the Vietnamese government has focused on integrating AI into education, especially for foreign language learning. In early 2024, the Ministry of Education proposed utilizing AI technology to improve educational tools and transform language teaching, creating new opportunities for language acquisition.

In language learning, listening is sometimes considered more important than reading, speaking, or writing. Mendelsohn (1994) emphasized its significance in communication, noting that

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listening accounts for 40-50% of communication, while speaking makes up 25-30%, reading 11-16%, and writing around 9%. Listening takes up a larger share of daily communication than other forms of verbal communication (Wolvin and Coakley, 1991), and it is also the most commonly used skill in the classroom (Ferris, 1998). Swanson (1996, p.3) stated, "In reality, without effective listening, learning is a matter of chance."

Despite the importance of listening in language learning, Hamouda (2013) points out that EFL learners encounter significant difficulties in developing listening comprehension skills, as language teaching programs often prioritize grammar, reading, and vocabulary over listening and speaking. Both classroom instruction and textbooks tend to overlook these skills. Osada (2004) highlights that listening is undervalued by both teachers and students, with teachers neglecting to teach listening comprehension and students focusing more on practicing listening exercises. As a result, listening remains one of the most neglected aspects of language education. Hamouda (2013) notes that understanding spoken language is particularly challenging for learners, who face numerous difficulties when trying to comprehend spoken texts. To effectively improve listening comprehension, teachers must first identify the specific challenges learners face, and then introduce strategies to help them improve, allowing students to overcome the barriers to understanding spoken language.

To alleviate this problem, audio transcriptions generally, using AI to generate audio transcripts (AIGATs), in particular, can be considered an effective method of assisting students in Liscomp tasks (Pan, Jiang, Yao, Picheny, & Qin, 2010; Mirzaei, Akita, & Kawahara, 2014; Cao, Yamashita, & Ishida, 2018) and reducing their working memory or cognitive load (CogL) (Chan, Kruger, & Doherty, 2019; Malakul & Park, 2023). It is undeniable that the use of AIGATs can also save time for English learners, as they no longer have to manually transcribe audio recordings themselves (Liu, 2023). However, it is important to investigate whether or not English majors can experience a reduction in CogL and their attitudes towards the benefits of integrating this technology into listening activities in the Vietnamese teaching and learning contexts.

Literature review

Cognitive Load Theory

Cognitive load (CogL) theory focuses on creating instructional approaches that effectively utilize learner's limited cognitive processing capacity to enhance their ability to apply gained knowledge and skills to unfamiliar settings (Paas & van Merriënboer, 1994; Paas, Tuovinen, Tabbers, & van Gerven, 2003). CogL theory is predicated on a cognitive architecture comprising a restricted working memory, processing units for visual and auditory information that are partially independent of one another, and a long-term memory that is relatively boundless. (Paas et al., 2003; Sweller, J. & Sweller, S., 2006; Sweller, 2011). According to Sweller, van Merriënboer, & Paas (1998), Paas et al. (2003), de Jong (2010), and Debue & van de Leemput (2014), there are three forms of CogL theory, distinguished by intrinsic load, extraneous load, and germane load. Specifically, intrinsic load refers to the interplay between the complexity of the content that needs to be acquired and the learner's level of proficiency (Paas et al., 2003). Debue & van de Leemput (2014) defined extraneous load as the educational presentation that may hinder learning by increasing the cognitive load on learners. Regarding germane load, Sweller (2010) stated that this notion specifies the residual capacity that facilitates effective learning, and learning is enhanced by the availability of additional working memory resources during information processing. In conclusion, grasping cognitive load theory

helps educators better tailor teaching methods to enhance learning outcomes by effectively managing intrinsic, extraneous, and germane loads.

Listening Comprehension

Many researchers have provided definitions of listening. Chastain (1971) described it simply as the ability to understand spoken language at its natural speed. Morley (1972) expanded on this, stating that listening involves recognizing sounds, understanding linguistic rules, selecting relevant information, storing it in memory, and linking sounds to meaning.

The concept of comprehension, like listening, has been defined in various ways. It is often viewed as "the first-order goal" of listening and considered the listener's top priority, with many seeing it as the central purpose of listening (Rost, 2011, p. 53). Comprehension involves a cognitive process that Sanders and Gernsbacher (2004) describe as structure building. This process entails linking language to concepts stored in memory and relating them to real-world references to create coherence and relevance.

The term "listening comprehension" (Liscomp) has been defined in various ways within academic literature. Basically, hearing is a physical and passive phenomenon, whereas listening is an active process necessitating focus and comprehension of meaning. It necessitates a diverse range of linguistic expertise, including grammar, vocabulary, and pronunciation (Vo & Cao, 2022). According to Wagner (2004), Liscomp is described as the ability to accurately recognize information explicitly conveyed in speech and infer additional meanings based on that information to meet explicit and implicit listening goals. Chastain (1988) breaks Liscomp into four key components. The first involves distinguishing all phonetic sounds, intonation patterns, and vocal features of a second language, and differentiating them from sounds in one's native language. The second component focuses on understanding the full message conveyed by a speaker. The third involves retaining the spoken message in auditory memory long enough for analysis. The final component is comprehension itself, which includes several steps: establishing context, activating background knowledge, using that knowledge to anticipate the message's content, predicting its overall meaning, identifying key components that convey meaning, and using these to confirm or reject prior predictions. In essence, understanding the complex nature of Liscomp - encompassing recognition, retention, and interpretation - highlights the challenges involved in achieving both implicit and explicit listening goals.

In the context of listening activities, Wilson (2008) identifies three key phases: pre-listening, while-listening, and post-listening, which form a structured approach to listening comprehension in language learning. Gilakjani & Ahmadi (2011) explain that "pre-listening" activities serve two main purposes: activating students' prior knowledge and setting expectations for the material, as well as establishing the relevant background for the specific listening task. "While-listening" activities are designed to improve students' comprehension of the speaker's language and ideas, focus their attention on the speaker's organizational patterns, and encourage critical thinking and personal reactions to the content. Finally, the "post-listening" phase occurs after the task, where learners reflect on what they heard, relate it to their own experiences, and engage in critical and reflective thinking. Post-listening activities also allow teachers to assess students' understanding and deepen their comprehension from the literal to the interpretive and critical levels.

Artificial Intelligence in Education

The incorporation of technology in language instruction has expanded learners' access to language materials and practice opportunities (Ngo, 2024). Among these educational technological advancements, Artificial Intelligence (AI) has emerged as a key tool, though its

definition varies widely in the literature, with no universally agreed-upon definition among AI experts. It is important to note that the relevance and application of AI concepts depend on the specific context in which they are used. Academics often describe AI as a complex field that incorporates a variety of conceptual frameworks and areas of expertise (Becker, 2017; Huang, Saleh, & Liu, 2021; Liu, 2023). Some scholars stress that AI should not be viewed as a single, unified entity (Holmes & Tuomi, 2022). In the context of education, Artificial Intelligence in Education (AIEd) is defined as the study of learning across all environments, from traditional classrooms to workplaces, to support both formal education and lifelong learning (Luckin, Holmes, Griffiths, & Forcier, 2016). AIEd has developed through two main areas: the creation of AI-driven tools for educational settings and the use of AI to analyze, evaluate, and improve the learning process (Holmes, Bialik, & Fadel, 2019).

However, the use of these technologies comes with challenges and potential downsides. AI is unlikely to fully replace human instructors, especially in areas such as language expression and interpersonal communication (Liu, 2023). Additionally, AI's automated and standardized teaching methods may lack the personal touch and tailored approach that some students require. There are also concerns about the reliability and accuracy of AI technology, which could lead to incorrect feedback and the spread of misinformation.

AI-generated Audio Transcriptions and Language Education

According to Medha (2022) on fireflies.ai, AI-generated audio transcriptions (AIGATs) involve the use of AI systems to convert spoken language from audio recordings into written text. This technology relies on methods like speech recognition, natural language processing (NLP), and machine learning to accurately transcribe spoken words. The process typically involves inputting an audio file into an AI model specifically trained for speech recognition. The model analyzes the audio waveform, identifies individual words and phrases, and converts them into text. Advanced AI models are trained on large datasets to improve accuracy and can handle various dialects, languages, and some background noise. AI transcription tools can support a wide range of media and communication efforts, benefiting professionals across industries by providing transcriptions for lectures, seminars, interviews, podcasts, videos, business meetings, voice memos, and personal recordings (VITAC, 2024).

The effectiveness of automatic transcription in supporting instruction and education for students with special educational needs, particularly those learning a second language, is well-recognized (Collin, 2013). AI-generated transcriptions, captions, or subtitles have been shown to positively impact various aspects of language learning, including oral language complexity (Jiang, Jong, Lau, Chai, & Wu, 2021), vocabulary acquisition (Jiang, Jong, Wu, Shen, Chai, Lau, & Huang, 2022), lexical resources, speaking anxiety, and language enjoyment (Bashori, van Hout, Strik, & Cucchiarini, 2021). Additionally, AI transcription improves speaking skills (Sun, 2023), pronunciation performance (Elimat & AbuSeileek, 2014; Bashori, van Hout, Strik, & Cucchiarini, 2022; Cai, 2023; Thi-Nhu Ngo, Chen, & Lai, 2023; Sun, 2023), and listening comprehension (Pan et al., 2010; Mirzaei et al., 2014; Cao et al., 2018). Overall, AI transcription significantly benefits language learners by enhancing their communication abilities, expanding their vocabulary, and increasing their enjoyment of the language, as supported by recent research.

AI-generated Audio Transcriptions and Listening Comprehension

It is obvious that most of the papers mentioned above center on language articulating skills, leaving comprehension skills less addressed. Concentrated on listening practice, Pan, Jiang, Yao, Picheny & Qin (2010) conducted a study to examine the effect of the quality of automated

speech recognition transcripts on Liscomp. They discovered that the transcripts became acceptable when the word-error-rate (WER) reached 20%. Furthermore, when the WER was reduced to 10%, there was a considerable improvement in comprehension compared to not having any transcripts at all. Four years later, Mirzaei, Akita, and Kawahara (2014) examined a new approach to captioning, known as partial and synchronized, which is used as a listening aid for second language learners. This synchronization is achieved by utilising advanced automated speech recognition technology. The method automatically filters out words or phrases that are likely to impede the learner's listening comprehension and excludes the remaining ones. In order to assess the system, the listening comprehension skills of 58 students from Kyoto University were evaluated using a TED Talks test. The examination was conducted under three different conditions: no caption, full caption, and partial and synchronized caption. The analysis of the data indicated that by lowering the textual density of captions to less than 30%, the partial and synchronized ones achieved comprehension performance that was equivalent to the full caption condition. Furthermore, it achieves greater scores in comparison to other settings of the identical film without any captions.

Another study conducted by Cao, Yamashita, and Ishida (2018) investigated how AIGATs affected 20 non-native speakers' Liscomp. They did two listening tasks in different setups: one with just audio and the other with audio plus AIGATs. They pressed a button when they had trouble understanding and explained these issues in the later questionnaire and interviews. The study discovered that the participants who focused more on listening to the audio tended to prefer AIGATs, and vice versa. Also, mismatched transcripts had a detrimental impact on their Liscomp. The study tends to conclude that AIGATs influence Liscomp; however, their findings were based only on post-task interviews and a questionnaire on the problems. It would have been better if the authors had dug into the quantitative data of how AIGATs influenced Liscomp. To wrap up, these studies underscore the vital role of AIGATs and innovative captioning methods in improving Liscomp among second language learners, thereby addressing a notable gap in language education research.

AI-generated Audio Transcriptions and Cognitive Load

Much research has not focused on the effects of automated speech recognition on cognitive load. One paper that should be discussed is Malakul & Park (2023) with 79 Thai secondary school students. The two researchers conducted their study to investigate the impact of three distinct forms of Thai language subtitles (namely, auto-subtitles, edited subtitles, and no subtitles) on learning comprehension, cognitive load, and satisfaction. The objective is to ascertain the viability of employing AI technology as an auto-subtitles system to enhance online learning through educational videos. Regarding whether auto-subtitles and edited subtitles have different levels of CogL, the study’s findings indicate no statistically significant variation in cognitive load levels across the three types of subtitles. Specifically, the findings of this project align with that of Chan et al., (2019) in that the study concluded that auto-generated captions and accurately adjusted captions do not have a substantial impact on cognitive load.

Listening Comprehension and Cognitive Load

The two concepts of CogL and Liscomp are strongly related and this relationship has been proven by several researchers (Yang, 2014; Chang, Warden, Liang, & Chou, 2018). A person's CogL, or the amount of mental work necessary to digest information, rises as they are listening to information. The CogL can become too much for the listeners to handle, making it challenging for them to process the data efficiently, especially if the listening task is complex or there are other distractions. In contrast, Liscomp can increase if the CogL is well controlled, possibly by employing efficient listening techniques or understandably providing information.

In conclusion, while good CogL management can improve Liscomp, high CogL can hinder it. In other words, there was a statistically significant negative correlation between English Liscomp and CogL.

Gaps from Previous Studies

To the best of the author's knowledge, three notable gaps were found in the review of previous studies. First, most reports have not been found so far that deeply investigate the effects of AIGATs on CoL. The findings of previous studies lack quantitative data on the effects of AIGATs on CogL of higher-proficiency level learners as undergraduates. While research on the impacts of AIGATs on CogL is limited, the study by Malakul & Park (2023) provides valuable insights into the influence of different forms of Thai language subtitles on learning comprehension and CogL, suggesting that AI-generated subtitles may not significantly affect cognitive load levels. Furthermore, far too little attention has been paid to examining Vietnamese English majors' opinions toward the incorporation of this technology into listening practice. Hence, another motivation for this study is to investigate the effects of the application of AIGATs on learners' CogL and their attitudes towards the implementation of AIGATs.

Research Questions

Concerning helping learners enhance their Liscomp by reducing the CogL with the use of AIGATs, the present study is conducted to investigate the effects of implementing AIGATs on CogL (1) and their perspectives towards the implementation of AIGATs when applying AIGATs and PTs (2). Hence, the study is conducted to answer two questions:

1. To what extent does the application of AI-generated audio transcriptions affect the participants' cognitive load during listening comprehension tasks?
2. What are the participants' perspectives towards the applications of AIGATs?

Methods

Pedagogical Setting & Participants

The study was conducted at a public university, one of the leading universities in Ho Chi Minh City, for high-quality education, especially for English majors. The convenience sampling included 90 English majors since they were available during the time at which this present research was carried out, following the theory of Creswell, J. W. and Creswell, J. D. (2017). They are among about 205 mainstream students at the Faculty of Foreign Languages. The learners here have numerous opportunities to improve their English skills thanks to this environment.

Table 1.

Demographics of the participants

	Gender		
	Male	Female	Total
Control group	14	31	45
Experimental group	10	35	45

This research took place during the third semester of the school year 2023 – 2024 from June to August 2024 by two researchers. One of the researchers was responsible for teaching two intact

classes that studied the same listening and speaking course. The participants' demographic information is described in Table 1, which shows a resemblance in the number of students in the two groups. Moreover, all of the students in each class studied from the same course book and syllabus; and did not attend any English language training from other teachers or language centers in the evenings and weekends. Therefore, it can be considered that the selected participants had the same knowledge background. The other researcher was a debriefer who had already conducted a mixed-method design and understands the nature of quantitative and qualitative research as well. Using peer debriefing is an effective method to enhance credibility while analyzing qualitative data (Creswell & Guetterman, 2019).

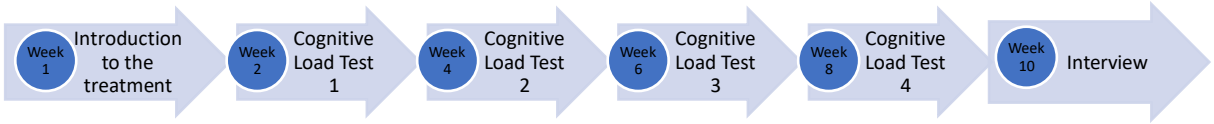
Design of the Study

The quasi-experimental approach suggested by Fraenkel and Wallen (2009) was adhered to in the research design. The investigation also employed a mixed-method approach, as it necessitated participants' completion of a questionnaire and an interview to gather data (Creswell, J. W., & Creswell, J. D., 2017). Each class was divided into two groups: the experimental group (EG) experienced AI-generated transcriptions (AIGATs) and the control group (CG) did transcriptions themselves (PTs).

At first, both two groups were introduced to the stages and activities of the treatment. Each group was required to listen to the recordings in each unit and do the task that belonged to their group in the second stage. For example, the EG was instructed to use AI tools such as Speak AI, Otter.ai, Cockatoo, Auris, Nova AI, Google AI, Chat GPT, Microsoft speech-to-text, and Beey.io to transcribe the recordings. All participants were encouraged to skip using the tool(s) which couldn't help them transcribe exactly 95% of the content of the recording to avoid the CoL measurement. They were asked to listen to the recordings while checking whether the tools could give the appropriate transcriptions or not and after that, they were required to work in a group of 4 or 5 members to read the transcriptions and record them as videos to submit to the lecturer. The video transcriptions were checked by the lecturers to give feedback on the content of the transcriptions to see whether using AI could help them transcribe exactly as the scripts provided by the course book. The CG were required to independently transcribe the tapes without the use of AI techniques. They were suggested to listen repeatedly until they could finish their transcriptions. Then, they gathered in groups of four or five to go over the transcriptions and make films of them to send to the lecturer. Each member was responsible for a part of the recording. After the classes finished the listening tasks from the course book, the lecturers would provide the correct transcriptions to the two groups and the best videos with the most exact transcriptions were also praised in front of the class. Both groups were given a week to finish their task and during the next meeting the following week, they had to take a Cognitive Load (CogL) test to evaluate their CogL. Every participant had to complete four CogL tests. Lastly, twenty-two of the EG were invited to the interview to see their perspectives towards the applications of AIGATs. The summary of the research procedure is presented in Figure 1.

Figure 1.

Research procedure



Instruments

The CogL tests were used to examine the participants' levels of CogL following the treatment in each lesson unit. The CogL tests were used to determine the amount of self-perceived CogL while transcribing the recording with AIGATs and PTs. The CogL measurement is an adaptation from Leppink, Paas, van Gog, van der Vleuten, & van Merriënboer (2014). This measurement including 13 items for self-evaluating effectively distinguishes between the three categories of CogL: germane, extraneous, and intrinsic load. Items 1 to 4 measure intrinsic load (e.g., the complexity of the content covered in the recording or video), items 5 to 8 measure extraneous load (e.g., the clarity of the explanations and instructions in the recording or video), and items 9 to 13 measure germane load (e.g., the level of comprehension of the material presented in the recording or video). In this study, the measure is only taken from items 1 – 8 and item 13 to measure the complexity of the listening materials. The test-takers would respond to each of the questions by clicking the most applicable number on the following scale 0 - 10 (0 means not at all and 10 means completely). The CogL test has an item reliability index of above .77, which was calculated using Cronbach's alpha. As noted by Pallant (2007), values above .7 indicate acceptable reliability for the scale in a Cronbach's Alpha test. In addition, the reliability coefficient of CogL measurement was .768 as measured by Cronbach's α, indicating good reliability.

The semi-structured interviews were conducted with 22 participants randomly selected from the AIGATs groups. They were asked four questions related to the tools they often use to generate the transcription, and the benefits and challenges of using AI to transcribe audio texts. The interviewers also solicited suggestions from these respondents to enhance the overall experience. The interviewees could freely choose to share what they thought in either English or Vietnamese. To ensure confidentiality, the identities of the respondents remained unidentified, and the interviewees would be referred to as S1 to S22.

Data Collection & Analysis

IBM SPSS Statistics 23 was used to analyze the data of the CogL tests and a questionnaire in this study. An independent-sample t-test was employed to compare the CogL test scores between the two groups to assess the impact of AIGATS on CogL. The independent t-test was a suitable test for determining whether there were any statistically significant variations in the mean scores between two distinct groups (Pallant, 2007). Concerning the qualitative phase, the interviews were meticulously recorded and transcribed. The researchers utilized thematic analysis to scrutinize the participants' responses, organizing them into primary themes, and subsequently documenting the findings in this paper.

Findings and Discussion

The Effects of Using AI-generated Audio Transcriptions on Students' Cognitive Load

As can be seen in Table 2 and Figure 2, the data collected from the CogL test scores were analyzed from the 9-item-CogL tests' results. The data presents the mean scores and standard deviations (SD) of the participants' cognitive load across four tests for both the control and experimental groups. The cognitive load refers to the mental effort required to perform a task, and it was assessed at different stages throughout the study.

In the CG, the mean CogL scores remained relatively stable for the first two tests, with means of 4.539 for test 1 and 4.574 for test 2. However, there was a notable decrease in CogL in the third and fourth tests, where the mean scores dropped to 3.743 and 3.774, respectively. The

standard deviations for these tests ranged from 1.897 to 2.296, indicating moderate variability in cognitive load among participants. This drop in CogL suggests that CG perceived tasks in the latter stages as less mentally demanding.

For the EG, the mean CogL scores were slightly lower than those of the CG in the earlier tests, with means of 4.143 for test 1 and 3.978 for test 2. In contrast to the Cg, the EG maintained relatively consistent CogL scores throughout the tests. In test 3, the mean score was 3.948, while in test 4, it dropped further to 3.260, indicating a gradual reduction in perceived cognitive load over time. The standard deviations ranged from 1.651 to 2.144, showing similar variability in participants' CogL as the CG.

When examining the mean differences between the groups, test 1 showed a slight difference of 0.3957, with the CG experiencing a higher CogL than the EG. The difference increased to 0.5957 in test 2, reflecting a widening gap between the two groups. However, in test 3, the EG reported a slightly higher CogL (-0.2043 difference), while in test 4, the CG again experienced a higher load, with a difference of 0.5140. The significance levels (p-values) across all four tests indicate no statistically significant differences between the groups, as all p-values are above 0.05.

In terms of the overall average CogL across all tests, the mean CogL was 4.3 for both test 1 and test 2, 3.8 for test 3 and 3.5 for test 4, with standard deviations ranging from 1.893 to 2.199. This reflects a general trend of decreasing CogL over time for both groups, suggesting that participants found the tasks less mentally demanding as the study progressed, potentially due to increased familiarity or adaptation to the tasks.

In summary, the CG experienced a higher CogL initially, but both groups showed a similar trend of reduced CogL in the later tests. The EG consistently reported slightly lower cognitive loads, though the differences were not statistically significant. This could suggest that the treatment applied to the EG was effective in slightly reducing cognitive effort over time, although further analysis would be required to confirm the significance of these results. Hence, using AIGATs may benefit learners in listening practice to ease the difficulty and complexity of listening audios.

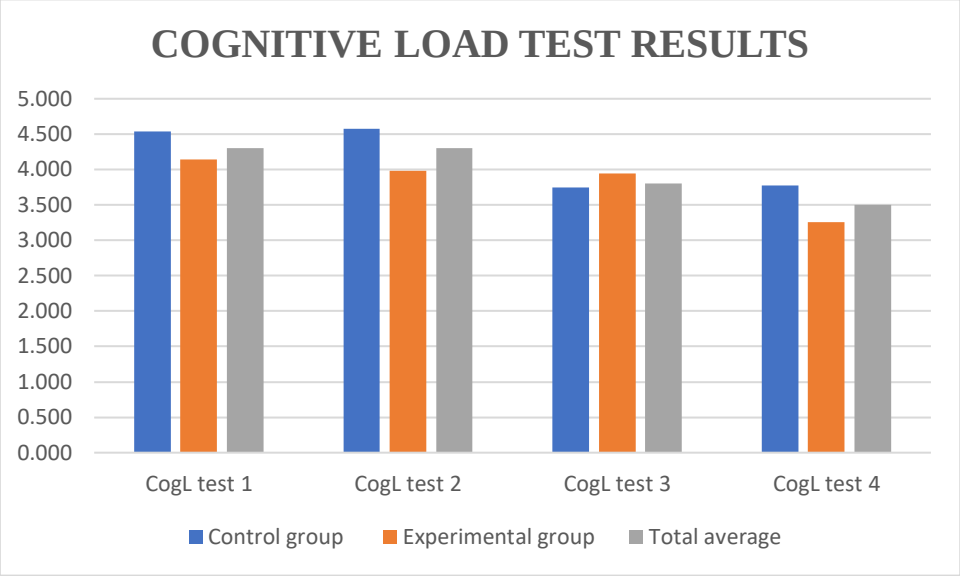
Table 2.

The mean scores of the participants' cognitive load

		CogL test 1	***CogL test 2***	***CogL test 3***	***CogL test 4***
Control group	***Mean***	4.539	4.574	3.743	3.774
	SD	2.189	1.897	2.296	2.114
Experimental group	***Mean***	4.143	3.978	3.948	3.260
	SD	2.082	1.909	2.144	1.651
	Mean difference between the two groups	.3957	.5957	-.2043	.5140
	Sig. (2-tailed)	.533	.294	.757	.363
Total average	***Mean***	4.3	4.3	3.8	3.5
	SD	2.122	1.905	2.199	1.893

Figure 2.

The mean scores of the participants' cognitive load



Comparing the findings of this study to the research of Malakul & Park (2023) reveals interesting parallels and differences concerning the effects of subtitles and task variations on cognitive load (CogL). The findings suggest that CogL remains relatively stable regardless of minor variations in learning conditions, whether through subtitles or task design. In both studies, neither the experimental conditions nor the use of AI-generated subtitles imposed a substantial increase or reduction in CogL. Although both studies point to minimal impact on cognitive load, Malakul & Park's research suggests that comprehension remains unaffected by the type of subtitle used. This is somewhat similar to the findings of this study, where participants in the EG experienced slightly lower cognitive loads but not to a significant extent. Both studies emphasize that learners adapt to new learning environments or subtitling methods without facing increased mental strain. This consistency in findings suggests that learners can adapt to new tools or methods (like AI subtitles or alternative tasks) without experiencing a significant increase in cognitive difficulty.

The Participants' Perspectives towards the Applications of AIGATs.

The findings from the semi-structured interview seek to clarify the participants' perspectives on AIGATs in listening activities.

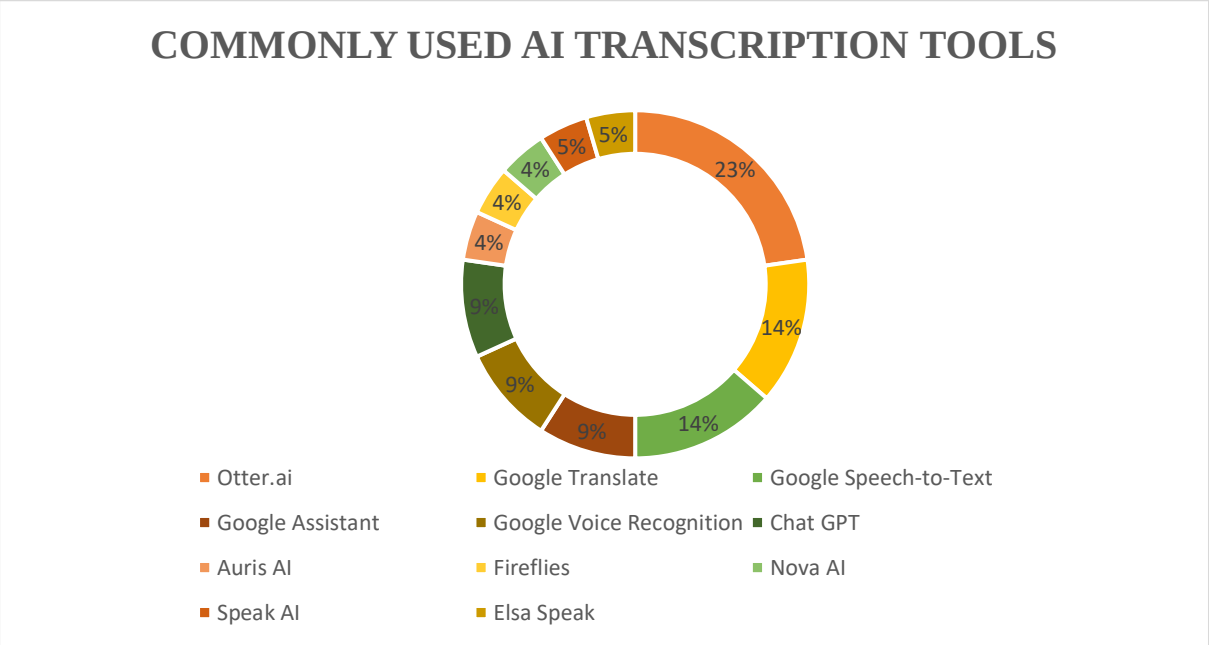
Commonly used AI transcription tools

The answer to the first question highlights several widely utilized AI transcription tools depicted in Figure 3, featuring Otter.ai and Google's array of tools, which encompasses Google Translate, Google Speech-to-Text, Google Assistant, and the voice recognition functionality within Google Docs. Furthermore, several exceptional AI platforms were highlighted, including Chat GPT, Auris AI, Fireflies, Nova AI, Speak AI, and Elsa Speak. Fifteen respondents specifically highlighted the accuracy, speed, and ability to handle complex topics in oral texts of Otter.ai and Google's services. Twelve students expressed their appreciation for the diverse array of options available and frequently depend on the suggestions of their peers when choosing AI tools. "I found myself flooding with countless suggestions online until my teammate pointed me towards Otter.ai," shared student 8. These tools, particularly Otter.ai and Google's services, are appreciated for their dependability, user-friendliness, and efficiency in supporting language

acquisition and managing intricate material.

Figure 3.

Commonly used AI transcription tools



Benefits of AI transcription

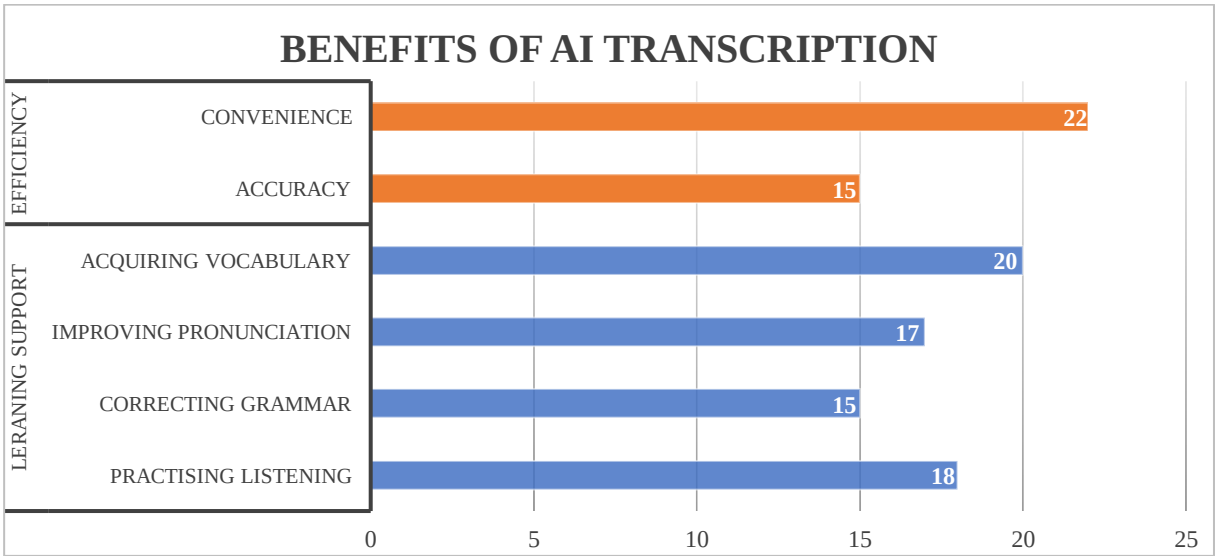
The responses from the interviewed students regarding the second question – "Why do you prefer using AIGATs?" - emphasized the benefits of utilizing AIGATs through two primary factors (see Figure 4). Initially, all respondents placed a significant emphasis on efficiency. AI transcription tools were user-friendly (17 students), providing both efficiency and precision (13 students), thereby saving learners' time and energy (22 students), especially when faced with unfamiliar vocabulary. For instance, one student remarked, "I really like Chat GPT because it's fast and easy to use, allowing me to save time for other activities." Another student noted, "I find Otter AI extremely useful as it helps me understand words I can't hear, and it saves time compared to listening on my own, so I can engage in other tasks."

Secondly, "I failed to get the word "hierarchy" in Unit 3 until I read the script generated by Fireflies"; "I used to pronounce "hyperbole" as / haɪˈpɜːbəl/, and now I know that the last syllables should be /bəli/ thanks to AI transcription," reported by students 2 and 17, underscored the second benefit of AIGATs in facilitating language learning by assisting in the acquisition of new vocabulary (20 students) and enhancing pronunciation (17 students), as well as correcting grammatical errors (15 students). The results align with earlier research that highlighted the beneficial impact of automated speech recognition technology on broadening lexical resources (Bashori et al., 2021; Jiang et al., 2022;) and improving pronunciation (Cai, 2023; Elimat & AbuSeileek, 2014; Sun, 2023; Thi-Nhu Ngo et al., 2023). Moreover, a significant majority of the participants (18 students) indicated that this technology offered them chances to enhance their listening skills by reviewing, rectifying, and completing gaps while assessing the precision of AI-generated text. In the responses provided by students 5 and 21, it is noted that "When I read the words AI transcribes automatically, I can focus on the listening, and it helps me catch up the audio speed and get the main ideas." "It instills a sense of assurance in my listening abilities when I can discern the words to rectify the mistakes or complete the omissions in the transcription." The findings of Pan et al. (2010), Mirzaei et al. (2014), and Cao et al. (2018) are

supported by these shared insights regarding the impact of automated-generated transcriptions on enhancing listening skills. Students recognize the effective equilibrium that AIGATs provide between enhancing productivity and offering learning support, establishing it as a significant resource for language acquisition and understanding.

Figure 4.

Benefits of AI transcriptions



Challenges in AI transcription usage

The responses gathered from the third question, "What problems or difficulties did you face while using AI transcribing?" reveal several significant challenges (see Figure 5). Initially, nearly all of the students who were interviewed expressed concerns regarding accuracy due to misinterpretations related to homophones, proper names, specific dialects, terminologies, overlapping speech, and contextual comprehension errors (18 students). Consider the experience of student 7: "I was really confused with the way "Kel & Partners" was transcribed into "Kalin partners" by Otter.ai, then I had to listen again to clarify the proper name." Student 22 noted, "The transcription says 'their' instead of 'they're' in some cases." The challenges presented are further complicated by inconsistent transcriptions resulting from background noise present in the audio input or the presence of multiple speakers. Consequently, the involvement of users in effort and verification is crucial, as they frequently have to manually check and amend transcriptions. Seven participants reported that they needed to listen repeatedly to certain sections of the recordings multiple times to verify accuracy. The accuracy issues of AI transcription have been notably emphasized in earlier studies on the use of automated transcripts in listening activities by Pan et al. (2010) and Cao et al. (2018).

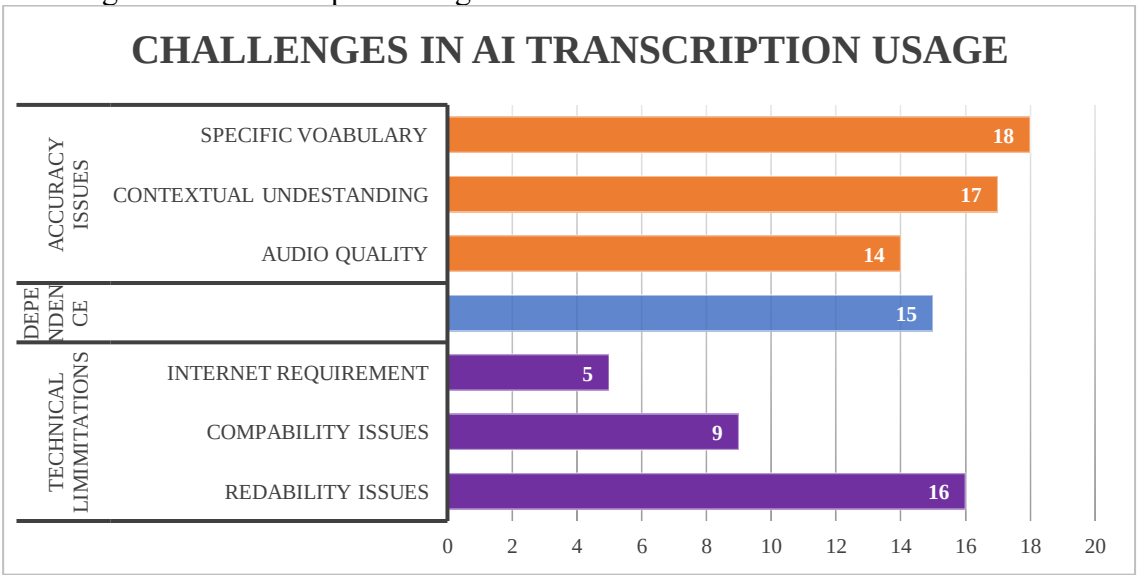
Secondly, more than half of the respondents expressed concerns about dependency and over-reliance on AI, which could hinder personal language learning overall and specifically affect listening skills. Among them, eight students acknowledged their excessive reliance on AI, which has resulted in a decline in their manual transcription skills: "I think I'll depend on it sometimes. I tend to trust it completely, so I won't revisit it when I'm feeling unmotivated". and "Utilising AI can significantly reduce the time and effort required, but it also implies that I won't need to repeatedly listen to the audio. It appears that enhancing my listening skills is challenging, and I find it more difficult to retain new vocabulary compared to when I study independently". In a similar vein, the use of automatic speech recognition to produce

synchronized captions during video viewing (Mirzaei et al., 2014) has faced criticism for fostering dependence.

The third issue involved both technical and practical constraints. Five students experienced challenges related to internet connectivity, while nine students faced difficulties in uploading audio files, which were attributed to restrictions or compatibility issues, which hindered smooth usage. Specifically, the functionality of a free trial account was limited, necessitating payment for those wishing to fully utilise the AI tools. "I'm investing a significant amount in a quality product, but it's prohibitively expensive for students like myself," stated student 11. Additionally, it was noted that AI tools tend to transcribe unnecessary fillers such as "uhm" or "oh," or misinterpret the speaker's hesitations, which impacts the readability and comprehensiveness of the script (16 students). "At times, the speaker takes a moment to consider their next words, which effectively concludes the sentence," as noted by student 8. In summary, although AI transcription tools provide ease of use, they still necessitate user involvement to ensure accuracy and understanding of context, and depending on them may hinder the development of personal skills.

Figure 5.

Challenges in AI Transcription Usage



Practical suggestions for enhancing AI transcription

The final interview question was, "What recommendations do you have for enhancing AI transcription processes?" Collecting comprehensive data uncovers students' suggestions for the effective use of AIGATs, highlighting several important areas. Initially, concerning the educational application of AI transcription tools, all respondents indicated that they would recommend AI transcription software to their friends and peers, while also believing it was crucial to utilise AI thoughtfully. They suggested using it as an additional resource instead of relying on it exclusively and advised restricting its application to essential circumstances to avoid excessive reliance and promote individual learning and skill enhancement. As noted by student 19, "While employing AI transcription can be time-saving, we must be cautious not to rely on it excessively." It is essential to utilise it thoughtfully to enhance our listening skills. In student 3's response, it is clear that reliance on AI tools should be approached with caution. Relying on others for transcription can hinder your long-term listening skills development, as it prevents you from actively engaging in the process yourself. It is most effective to tackle the

task independently first and then seek assistance from AI when needed. The significance of student autonomy in enhancing language skills is highlighted by these ideas (Benson, 2013).

Secondly, to address various transcription challenges more effectively, participants concurred that continuous advancements in AI technology are essential. It is essential to prioritise accuracy enhancement (19 students), multi-speaker recognition (13 students), and contextual understanding (12 students) to broaden the capabilities of AI. Student 7 proposed, "AI should 'learn' more vocabulary to improve the accuracy of the transcription, which would lead to more users being inclined to pay for premium accounts." These recommendations are consistent with findings highlighting the importance of a low word-error-rate in automated transcription for user satisfaction (Pan et al., 2010).

Additionally, participants provided practical recommendations to enhance the effectiveness of AIGATs, which included choosing dependable AI transcription tools (21 students), conducting manual reviews and corrections of AIGATs (17 students), utilising AIGATs following manual transcription (16 students), and ensuring the use of high-quality audio files (8 students). For example, "In my view, after utilising AI for transcription, it is essential to revisit the recording and meticulously examine the vocabulary to guarantee that everything is precise." Additionally, it would be beneficial to utilise Google to search for the relevant terminologies, as proposed by student 16. In conclusion, students advised the prudent use of AIGATs to prevent over-dependence and to foster the development of personal learning skills. Their emphasis was on the necessity for continuous technical improvements in AI capabilities, alongside practical recommendations for boosting the efficiency of AIGATs.

Conclusion and Recommendations

The purpose of the current study was to ascertain how much students' CogL during Liscomp tasks are impacted by the AIGATs application and their attitudes regarding utilizing AIGATs. For the first question, "To what extent does the application of AI-generated audio transcriptions affect the participants' cognitive load during listening comprehension tasks?", the research has demonstrated that AIGATs can help students practice listening by reducing the complexity and difficulty of listening to audio files. In other words, although AIGATs were not entirely effective, they offered some praiseworthy assistance in CogL reduction. In addition, learners can adapt to new environments or methods without added mental strain, suggesting they can handle new tools or tasks, like AI subtitles, without significantly increasing cognitive difficulty. About the second research question, "What are the participants' perspectives towards the applications of AIGATs?", the results show that language learners should be introduced to AIGATs since students find them to be a helpful tool for language acquisition because they successfully blend efficiency with learning support. However, in order to guarantee accuracy and context, this technology still requires human input. As a result, relying too much on it could impede the development of personal talents. Students recommended using AIGATs sparingly to support personalized language learning and emphasize the need for ongoing technological advancements to improve AI effectiveness.

The results of this study, especially in the Vietnamese setting, greatly add to the body of knowledge already available on reducing students' cognitive load to some extent. Above all, this study is one of the first to look into how AIGATs affect students' cognitive load and attitudes toward the application. Furthermore, the results of this study offer empirical support for the notion that learners, particularly those with higher competence levels in university settings, might benefit greatly from the use of AI to generate audio transcriptions. Lastly, it suggested that AIGATs might help students with their independent listening practice. In conclusion, this study's findings add to the literature about the advantages of AIGATs in lowering students'

cognitive load and enhancing their favorable attitudes towards using AIGATs in listening activities.

As a result of this research, there are various educational ramifications for educators and learners. First, according to the implementation of AIGATs, teachers should either educate students on how to use AIGATs as a way to get ready for upcoming sessions or as a way to help them consolidate the lessons after they have finished listening. Teachers should also teach students the proper use of AIGATs in order to motivate them to practice listening. Finally, students can improve their English listening comprehension and self-directed learning by using AIGATs sparingly in conjunction with their own transcriptions. This approach is both practical and efficient.

This research has certain constraints that may influence the interpretation of the results. First, the use of various AI tools may somewhat affect the participants' CogL, although most of them stated that they were using Otter.ai and Google services. Second, due to the time limitation, the researchers did not carry out more CogL tests and the experiment was conducted only around 3 months and thus it lacks the findings from a long-term practice. To enhance the generalizability of the findings, future research might consider to conduct a more prolong research with a specific AI AI-generated audio transcription tool.

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