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How Mastery of Linking, Reduction and Assimilation Predicts EFL Learners' TOEFL Listening Proficiency

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ABSTRACT

TOEFL is an international benchmark of academic English proficiency, yet its listening section remains the most demanding because it requires the rapid, real-time processing of natural speech. The difficulty intensifies when connected-speech features—linking, reduction, and assimilation—shift word boundaries and alter pronunciations, posing considerable challenges for test-takers. This study examined how learners' mastery of these features relates to their listening performance, particularly in TOEFL, using a convergent mixed-method design. Learners completed a TOEFL-like listening test and a connected-speech test developed from a connected-speech analysis of the listening materials. Results indicated that connected-speech skills significantly predicted listening comprehension, with linking generally easier to process, while reduction and assimilation frequently caused misperceptions. These findings highlight that limited mastery of connected speech directly affects listening performance and underscore the need for targeted, feature-specific instruction. Pedagogically, to enhance listening instruction—especially in TOEFL preparation training—the curriculum should integrate intensive practice with authentic materials that train students to comprehend and produce connected speech, thereby improving their listening performance and maximizing their TOEFL listening outcome.

Keywords: *Connected Speech, Listening Comprehension, TOEFL Listening*

Introduction

Listening comprehension has long been acknowledged as one of the key components of English proficiency, especially in English as a Foreign Language (EFL) settings where exposure to natural spoken English is limited (Newton & Nation, 2020). In academic contexts, good listening skills are essential for understanding lectures, following discussions, responding to oral instructions, and participating in classroom interaction (Canpolat et al., 2015). Beyond school-related needs, listening proficiency is also increasingly important in professional fields where English serves as a global communication tool (Abdurashidova, 2023). These academic and professional expectations are reflected in high-stakes tests such as the Test of English as a Foreign Language (TOEFL), which evaluates not only general understanding but also the ability to process naturally produced spoken English in academic situations.

The TOEFL test is intentionally designed to measure the English proficiency of non-native speakers in academic contexts (Perdana et al., 2023). It is widely used for university admissions, scholarship requirements, professional certification, and employment in international institutions. The test consists of three major sections—listening, structure, and reading—each assessing different language abilities needed for academic success.

Among these sections, the listening test is considered more challenging than the structure and reading sections because test takers must process the audio instantly, with no opportunity to replay it (Silviyanti et al., 2020). In contrast to structure tasks that rely on knowledge of grammar patterns and reading tasks that allow for rereading, listening requires full and continuous attention to the spoken text. Even advanced learners may struggle if they fail to process the entire passage (Razmalia, Aina and Gani, 2017). The listening section also includes more items than the structure section, increasing cognitive demand. While reading tasks allow learners to move at their own pace, listening requires immediate understanding, sequential processing, and quick decision-making without the option to pause or skip. These demands closely mirror real academic listening

situations, requiring sustained attention and fast information integration. As a result, listening proficiency becomes a key factor in overall TOEFL performance and an essential indicator of academic English ability (Chakiso et al., 2025).

Despite its prominence, listening continues to be a highly demanding skill for EFL learners. This difficulty is made greater by phonological features that shape how spoken input is perceived in real time. Connected speech is especially challenging because it changes pronunciation in natural speech and makes word recognition more difficult (Kang, 2017). As explained by Alameen and Levis (2015), connected speech includes linking, reduction, assimilation, elision, and intrusion—features that alter the sound of phonemes and blur word boundaries. Learners who practice words in isolation often experience a mismatch between what they expect and what they actually hear, which leads to misunderstanding or incomplete comprehension (Laoubi, 2020; Rahimi & Chalak, 2017). As a result, learners may fail to recognize even familiar words when they are reduced or merged in continuous speech, leading to slower processing and heavier cognitive effort during listening tasks.

According to Jednaszewski (2022) linking, reduction, and assimilation are among the most difficult features for EFL learners to understand and produce. Linking, where the final sound of one word connects smoothly to the initial sound of the next, appears frequently in English (Alameen & Levis, 2015; Carrillo Almeida, 2023). Fitriani (2024) illustrated that native speakers naturally blend words like "turn off," pronounced as /tɜːn‿ɒf/, or "pick it up," pronounced /pɪk‿ɪt‿ʌp/. Learners who expect clear word boundaries often cannot identify where one word ends and another begins. Meanwhile, Bi et al. (2022) noted that reduction, the weakening of unstressed syllables, makes listening even more complex. Phrases such as "should have" (/ʃʊd əv/) or "let me" (/lɛmi/) sound very different from their written forms. Assimilation also changes sounds to resemble neighboring sounds (Meghlaoui et al., 2017), as in "in case" (/ɪŋ keɪs/) or "good boy" (/gʊbɔɪ/), which learners may not recognize without understanding the phonological rules. Therefore, mastering these features is essential because they strongly influence learners' ability to decode fast and continuous speech—an ability central to fluent listening.

Many studies have shown that connected speech is closely linked to listening comprehension, but most have focused on teaching methods that help learners identify these features (Darwanto, 2024; Moussa Ahmadian, 2014; Musfirah et al., 2019; Omar & Pilus, 2022; Rahimi & Chalak, 2017). Only a few studies have directly examined how learners' actual mastery of connected speech predicts their listening performance.

This gap is important because previous research has not analyzed connected speech comprehension specifically within the TOEFL listening test, which serves as the highest standard for evaluating academic listening proficiency. Understanding how connected speech appears in TOEFL listening can support instructional practices that integrate pronunciation and listening. It can also guide the development of teaching strategies that target specific connected speech features needed for achieving strong TOEFL listening results.

To address this gap, the present study examines how EFL learners' mastery of linking, reduction, and assimilation predicts their TOEFL listening proficiency. This research offers a methodological contribution by carefully analyzing the connected speech patterns found in TOEFL listening materials and using them as the basis to construct a connected speech test. Learners' performance on this test is then statistically correlated with their TOEFL listening scores. Through this combined approach, the study not only deepens understanding of how connected speech influences listening comprehension but also provides practical insights for designing more accurate and evidence-based teaching and assessment practices in EFL listening.

Method

This study employed a convergent mixed-method design, foregrounding quantitative analysis while integrating qualitative insights to enrich interpretation (John W. Creswell & J. David Creswell, 2018). The quantitative analysis investigated the correlation between learners' mastery of connected speech—linking, reduction, and assimilation—and their TOEFL listening proficiency. Complementing this, the qualitative analysis examined the types and patterns of connected speech in TOEFL materials and the common error tendencies among learners, offering nuanced insights into how pronunciation competence shapes listening performance.

The participants of this study were 23 EFL university students enrolled in the English Education program at STAIN Mandailing Natal. The group was selected based on their comparable English proficiency levels and prior engagement

with TOEFL-style listening test. All participants were assumed to possess upper-intermediate competence and foundational knowledge of English phonology. Notably, they had completed a pronunciation course within their curriculum, in which key components of connected speech—such as linking, reduction, and assimilation—were explicitly taught. The same group of students participated in both the listening test and the pronunciation test, allowing for direct correlation of their receptive and productive mastery of connected speech.

Three primary instruments were employed in this study. The first was a TOEFL-like listening test, administered to assess students' listening proficiency through items that closely mirror the structure and linguistic features of an actual TOEFL listening section. The second instrument was a connected speech test designed to measure learners' ability to recognize and produce three key features of connected speech—linking, reduction, and assimilation. The items for this test were systematically developed from a detailed analysis of the 30 listening items in Part A of the TOEFL-style listening test, in which all instances of the targeted connected-speech features were identified and categorized to ensure strong content correspondence between the two instruments. The third instrument was a coding sheet used as a documentation tool to systematically analyze connected-speech features in the listening materials. The coding sheet included the orthographic form of each utterance, its phonetic transcription (IPA), and the specific connected-speech features observed.

The research procedure followed a clear chronological sequence. First, a TOEFL-style listening section was selected and fully transcribed. The transcript was then examined to identify all occurrences of linking, reduction, and assimilation. Each connected-speech feature was coded to ensure consistent classification and to facilitate the calculation of frequency counts for each feature type. Based on this analysis, a set of connected speech test items was constructed to ensure direct correspondence between the listening stimuli and the pronunciation items. After the coding process was completed and all test materials were finalized, the participants undertook the two assessments in separate sessions, beginning with the listening test and followed by the connected speech test. All responses were recorded and evaluated using standardized rubrics. The listening and connected-speech data were systematically analyzed to establish the extent to which learners' command of connected-speech features contributed to, and statistically aligned with, their overall listening comprehension performance.

Thereafter, an error analysis was conducted to gain deeper insights into learners' misperceptions. All incorrect responses from the listening test were collected, the specific items where errors occurred were identified, and each error was classified according to the connected-speech feature involved—linking, reduction, or assimilation—using a systematic coding scheme. The patterns of recurring errors were examined to identify which features most frequently caused misperceptions.

The data were analyzed using a mixed-methods approach that integrated quantitative and qualitative techniques. Quantitatively, descriptive analysis and multiple regression analysis were employed to examine learners' performance on both the connected speech and listening tests. Descriptive statistics, including the mean, standard deviation, and percentage accuracy, were computed to provide an overall picture of learners' performance. The multiple regression model was applied to determine the extent to which learners' mastery of connected speech in pronunciation predicted their listening comprehension outcomes. Qualitatively, a detailed error analysis of the listening test results was conducted to identify recurring misperceptions associated with specific connected speech patterns. Additionally, the qualitative interpretation of test transcripts and learner responses revealed which types of linking, reduction, or assimilation were most frequently misunderstood or mis produced. The findings from this analysis were then used to draw pedagogical implications, providing guidance for enhancing listening instruction in EFL contexts.

Findings and Discussion

The findings are presented by first reporting quantitative results, including descriptive statistics and correlational analyses, followed by qualitative interpretations of learners' errors and misperceptions. As the study employed a convergent mixed-method design, the integration of both data strands allows for a comprehensive understanding of how connected speech mastery interacts with TOEFL-style listening proficiency, offering both statistical evidence and nuanced insights into learners' phonological behavior and instructional needs.

The quantitative findings highlight the students' overall performance in both connected speech and listening tests, as well as the extent to

which their connected speech subskills—*linking, reduction, and assimilation*—predict their listening proficiency. Descriptive statistics were first analyzed to examine general patterns of the performance, followed by a multiple regression analysis to determine the strength and direction of relationships among variables.

Descriptive Statistics of Students' Listening and Connected Speech Test

The descriptive results of the listening test revealed that students' overall performance was at intermediate level. Scores ranged from 13 to 25, with a mean of 18.35 (*SD* = 3.46), a median of 18.00, and modes of 16, 18, and 19. These values suggest that while most students demonstrated a fair understanding of listening materials, few achieved high proficiency. The moderate central tendency, combined with a relatively wide range of 12 points, indicates notable variability in listening ability among the 23 test-takers. This dispersion reflects differences in students' ability to decode and comprehend naturally spoken English, which often involves complex phonological reductions and assimilations. Such variation is common in EFL contexts, where learners' exposure to authentic input is limited, leading to inconsistent sensitivity to connected-speech cues. The data is presented in table 1.

Table 1 Descriptive Statistics of Students' Listening Test Scores

Statistic	Value
Mean	18.35
Median	18.00
Mode	16, 18, 19
Minimum	13
Maximum	25
Range	12
Standard Deviation	3.46

Note. Scores are based on a maximum of 30 points

In terms of connected speech performance, students displayed uneven mastery across the three subskills. The mean score for *linking* was 3.22 (*SD* = 0.72), suggesting a relatively higher familiarity with connecting sounds between words compared to other features. Students appeared moderately capable of producing linked speech patterns, which are essential for maintaining fluency and rhythm in natural conversation. Meanwhile, the mean score for *assimilation* was slightly higher at 3.26 (*SD* = 0.94), reflecting a reasonable awareness of how adjacent sounds influence each other in fast or natural speech. However, *reduction* showed the lowest mean score of 1.52 (*SD* = 0.91), signifying substantial difficulty in recognizing and producing weakened or contracted forms. The lower standard deviations across all three variables also suggest that these challenges were relatively consistent among the participants. The detailed overview of the data is provided in Table 2.

Table 2 Descriptive Statistics of Connected Speech Test Scores

Statistic	Linking	Reduction	Assimilation
Mean	3.22	1.52	3.26
Median	3	2	3
Mode	3	1	3
Min	2	0	2
Max	4	3	5
St Dev	0.72	0.91	0.94

Synthetically, based on the descriptive statistics of the listening and connected speech test results, it can be asserted that students' listening proficiency is substantially higher than their connected speech skills. The mean listening score of 18.35 (SD = 3.46) out of 30 indicates that students, on average, demonstrate intermediate-level comprehension, effectively understanding spoken English. In contrast, the overall mean pronunciation score of 7.57 (SD = 2.44) highlights considerable difficulties, particularly in connected speech features such as reduction, assimilation, and linking, with reduction identified as the most challenging. This disparity suggests that although students are able to comprehend spoken input, their ability to produce accurate and fluent speech remains limited, indicating a pronounced gap between receptive and productive linguistic competence.

Multiple Regression Analysis of Students' Connected Speech and Listening Performance

To determine how these connected speech components contribute to listening proficiency, a multiple regression analysis was performed with

linking (X_1), *reduction* (X_2), and *assimilation* (X_3) as independent variables and *listening performance* as the dependent variable. The overall regression model was statistically significant, F (3,19) = 64.75, $p < .001$, indicating that the three predictors jointly explained 91% of the variance in students' listening scores ($R^2 = .91$, Adjusted $R^2 = .90$). This high coefficient of determination demonstrates a strong predictive power, confirming that students' mastery of connected-speech features is a substantial determinant of their listening comprehension. The empirical data are organized in Table 3.

Table 3. Multiple Regression Analysis Predicting Listening Performance from Pronunciation Variables

Predictor	B	SE B	β	t	p
Constant	3.27	0.85	—	3.84	.001
Linking (X_1)	0.85	0.26	.39	3.27	.002
Reduction (X_2)	0.73	0.25	.35	2.92	.008
Assimilation (X_3)	0.69	0.27	.31	2.63	.014

All three predictors made significant individual contributions to the model. As shown in Table 1, *linking* emerged as the strongest predictor of listening performance (β = .39, $p = .002$), followed by *reduction* (β = .35, $p = .008$) and *assimilation* (β = .31, $p = .014$). The positive regression coefficients indicate that improvement in each connected speech subskills is associated with a corresponding increase in listening proficiency. Specifically, students who demonstrated greater control over *linking* were more capable of segmenting and processing continuous speech, which is often a major barrier in listening comprehension.

The results suggest that connected speech and listening comprehension are interdependent, reinforcing the notion that listening is not merely a passive receptive skill but an active phonological decoding process. Learners who can both perceive and produce connected-speech patterns are better equipped to handle reduced or coalesced forms in authentic listening situations.

Overall, the quantitative findings provide empirical support for the hypothesis that connected speech competence—especially in the areas of *linking*, *reduction*, and *assimilation*—plays a critical role in predicting EFL listening performance. The data demonstrate that listening comprehension cannot be effectively developed in isolation from connected speech training. Instead, integrated instruction that combines both productive and perceptual aspects of connected speech should be prioritized in English pronunciation and listening curricula. Such pedagogical integration may enable learners to internalize the natural rhythm and flow of spoken English, thereby improving both their intelligibility in speaking and their comprehension in listening.

To complement the quantitative results, a qualitative analysis was conducted on the thirty listening test items, each of which incorporated instances of linking, reduction, and assimilation in naturally occurring speech. The purpose of this analysis was to identify specific patterns of comprehension difficulty and to examine how the distribution of connected-speech features corresponded to students' listening and pronunciation performance. By observing the phonological characteristics of each item, the analysis provided a finer-grained understanding of how particular features of connected speech influence learners' ability to decode spoken English in authentic contexts.

Table 4. Sample Analysis of Connected Speech Features in TOEFL Listening Test Items

Type	Examples	Phonetic Representation	Count
Linking	really sorry I, cancel our, plans again, too upset, first I, was angry, but actually, me a, care of a, lot of, backing up, man imply	/ˈrɪəli‿ˈsɒri‿aɪ/, /ˈkænsəl‿aʊə/, /plænz‿əˈgen/, /tuː‿ʌpˈset/, /fɜːst‿aɪ/, /wəz‿ˈæŋgri/, /bət‿ˈæktʃuəli/, /miː‿ə/, /keər‿ə‿ə/, /lɒt‿əv/, /ˈbækɪŋ‿ʌp/, /mæn‿ɪmˈplaɪ/	12
Reduction	I'm, had to, I hope you're, not too, at first, I was, you did me, a lot of	/aɪm/, /hæ tə/, /aɪ həʊpjə/, /nɒ tə/, /ət fɜːs/, /aɪ wəz/, /jə dɪd mi/, /ə lɒtəv/	8
Assimilation	had been backing	/hə‿bɪn‿ˈbækɪŋ/	1
Total	—	—	21

Note: The sentence analyzed in Listening Item 17 was "I'm really sorry I had to cancel our plans again. I hope you're not too upset. At first I was angry, but actually you did me a favor. I took care of a lot of work that had been backing up. What does the man imply?"

Table 4 presents a sample from the thirty detailed analyses of connected speech features

conducted across all listening test items. Listening Item 17 was selected as the representative example because it contained the highest number of connected speech occurrences, making it the most challenging item for students to comprehend. The analysis identified 21 instances of connected speech, consisting of 12 cases of linking, 8 of reduction, and 1 of assimilation. Linking appeared most frequently, as in really sorry I (/ˈrɪəli‿ˈsɒri‿aɪ/), plans again (/plænz‿əˈgen/), and man imply (/mæn‿ɪmˈplaɪ/), where adjacent words are connected smoothly, often obscuring word boundaries. Reduction features, such as had to (/hæ tə/), I hope you're (/aɪ həʊpjə/), and not too (/nɒ tə/), further contributed to listening difficulty due to vowel weakening or elision. A single instance of assimilation occurred in had been backing (/hə‿bɪn‿ˈbækɪŋ/), where the /d/ sound blends with /b/, resulting in a smoother transition. Overall, this sample illustrates that a higher density of connected speech—particularly involving linking and reduction—correlates with greater perceptual and cognitive demands in listening comprehension.

In greater depth, the 30 items analysis revealed that linking appeared most frequently across the listening items and was associated with relatively higher comprehension accuracy. Students demonstrated better recognition of word junctures such as "go on," "turn off," and "cancel our," which facilitated segmentation and understanding of continuous speech. However, items that contained multiple linkings (e.g., Items 17 and 21) posed greater difficulty, suggesting that processing dense linking sequences requires higher levels of phonological awareness and perceptual agility. This observation supports the regression finding that linking was the strongest predictor of listening performance ($\beta = .39$, $p = .002$), indicating that learners who have greater control over linking are more adept at parsing the rhythm and flow of fluent speech.

In contrast, reduction emerged as the most problematic feature for the majority of students. Items involving weak forms, contractions, or vowel elisions—such as "had to," and "for a"—elicited the lowest comprehension rates. Many students appeared to misinterpret these reduced forms, likely because such expressions differ significantly from their canonical representations in written English. This finding aligns with the quantitative data showing that reduction had a significant yet moderate predictive effect on listening proficiency ($\beta = .35$, $p = .008$).

Meanwhile, assimilation appeared less frequently but played an equally critical role in listening comprehension. Items containing coalescent assimilation—such as "did you" (/dɪdʒu/) and "would you" (/wʊdʒu/)—often confused students with weaker phonological decoding skills, as the surface forms differ considerably from the underlying lexical items. While assimilation had the smallest predictive weight among the three features ($\beta = .31$, $p = .014$), its influence was still notable, revealing that even minor phonetic adjustments can impede understanding when learners lack sufficient exposure to natural speech. The qualitative trend showed that students who performed better in producing assimilated forms during the pronunciation test were also more successful in recognizing them during listening tasks.

Overall, the qualitative findings demonstrate a consistent relationship between pronunciation and listening performance across all three connected-speech features. Students who displayed higher accuracy in pronouncing linking, reduction, and assimilation also tended to perform better in corresponding listening items. These results affirm that listening is not merely a receptive process but one that depends on active phonological decoding grounded in productive knowledge of connected speech. In line with the quantitative analysis, the qualitative evidence highlights that linking is the most facilitative feature, while reduction remains the principal source of difficulty. Together, these findings underscore the importance of integrated pronunciation and listening instruction that explicitly targets connected-speech phenomena to enhance learners' overall communicative competence.

Discussion

This study examined how learners' mastery of connected speech—linking, reduction, and assimilation—relates to their listening comprehension. The results show that students had moderate ability in connected speech, with assimilation being the most difficult feature. While students could often recognize simple linking patterns, they struggled to identify reduced and assimilated sounds that occur in natural, fast speech. These findings are in line with earlier studies showing that connected speech is a major challenge for EFL learners, especially in environments with limited exposure to authentic spoken language (Gilakjani & Sabouri, 2016; Wong et al., 2021) .

The statistical analysis showed a significant positive relationship between connected-speech

mastery and listening scores. Learners who better understand connected-speech features tended to perform better in listening tasks. This supports earlier research on the link between phonological skills and listening comprehension (Attia, n.d.; Cauldwell, 2018; Sun & Lee, 2021). However, the present study adds a new and important insight that each connected-speech feature does not contribute equally, and assimilation has the strongest effect on listening performance. This means that assimilation may serve as a clearer indicator of listening ability than linking or reduction.

A central contribution of this study lies in its feature-specific analysis, which addresses a gap in previous research by highlighting the differential impact of connected-speech features on listening comprehension. Unlike earlier studies that treated connected speech as a general skill, the present findings show that learners' difficulties are often linked to specific sound changes, particularly assimilation, which emerged as the most challenging feature despite occurring less frequently than linking or reduction.

Pedagogically, listening instruction should move beyond traditional exercises or transcript-based practice and provide targeted training on assimilation alongside other connected-speech features. Incorporating activities such as noticing, shadowing, and dictation in authentic contexts can help learners better recognize and process subtle pronunciation changes in fluent speech, ultimately enhancing their ability to understand natural English, identify key information, and cope with the demands of fast or spontaneous speech. By emphasizing feature-specific challenges, this study offers a practical framework for designing more effective listening instruction in EFL contexts, where evidence-based guidance on prioritizing connected-speech elements has been limited.

In the context of TOEFL preparation, the findings underscore the importance of integrating connected-speech training with effective test-taking strategies, emphasizing sustained exposure to natural speech patterns to improve listening outcomes. TOEFL instructors are encouraged to guide learners to anticipate sound reductions, phoneme changes, and word linking in conversations and lectures, with particular focus on assimilation, which has the greatest impact on listening performance. Combining this training with fast-paced listening simulations, transcript analysis, and contextual inference exercises enables learners to more accurately capture information even when sounds are reduced or blended. Such targeted and systematic practice not only strengthens general listening competence and bottom-up processing skills but also equips learners with practical strategies that potentially maximize their TOEFL listening score.

This study reinforces the theoretical link between learners' mastery of connected speech and their listening comprehension, confirming that proficiency in features such as linking, reduction, and assimilation contributes to more accurate processing of spoken English. While previous frameworks have established the general relationship between phonological skills and listening, the present study extends these theories by specifying the pedagogical implications for EFL instruction, demonstrating that intensive and systematic training in connected-speech patterns can significantly enhance listening competence. By highlighting the practical role of targeted connected-speech exercises in anticipating and decoding natural sound changes, this research not only corroborates existing concepts but also refines them, offering a more nuanced understanding of how listening instruction can be optimized to improve bottom-up processing skills and overall listening outcomes.

Conclusion

This study demonstrates a clear and significant relationship between learners' mastery of connected speech—linking, reduction, and assimilation—and their listening comprehension in TOEFL-style contexts. The findings reveal that students' intermediate listening proficiency is strongly predicted by their connected-speech skills, with linking, reduction, and assimilation collectively accounting for 91% of the variance in listening scores. While linking was relatively easier to process, reduction and assimilation posed considerable challenges, with assimilation emerging as the most difficult feature. These results confirm and extend prior theoretical frameworks by emphasizing the feature-specific impact of connected speech on listening performance, rather than treating it as a uniform skill. Pedagogically, the study underscores the importance of intensive, targeted instruction that integrates authentic listening activities such as noticing, shadowing, and dictation, which can effectively enhance learners' ability to decode natural spoken English. Despite these contributions, this study has limitations, including a small, homogeneous sample and a cross-sectional design that captures only a snapshot of learners' skills. Future research should involve

larger, more diverse participants and employ longitudinal or experimental designs to examine the effects of targeted connected-speech instruction. Conducting such research is necessary to validate the current findings, explore how connected-speech mastery develops over time, and provide stronger empirical evidence for designing effective, feature-specific listening instruction. Additionally, future studies could investigate interactions with other listening-related factors, such as vocabulary knowledge, working memory, and listening strategies, to gain a more comprehensive understanding of EFL listening comprehension.

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