

AI IN ACTION: ENHANCING STUDENTS' UNDERSTANDING OF SENTENCE STRUCTURE COMPREHENSION

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Abstract:

This study investigates the integration of AI tools to enhance student engagement and comprehension in EFL grammar instruction, with a specific focus on sentence slots and patterns. Classpoint and Slido were utilized to embed questions into PowerPoint presentations, enabling real-time participation and immediate feedback during lectures. These tools transformed traditional teaching methods by allowing instructors to pose questions, conduct polls, and facilitate active discussions. Additionally, Quizziz and Quizlet were employed for post-class activities, including gamified quizzes and personalized flashcards, which provided students with opportunities to reinforce their learning independently. To evaluate the effectiveness of this intervention, a mixed-methods approach was adopted, incorporating pre- and post-tests to measure learning outcomes, questionnaires to assess student perceptions, and classroom observations to monitor engagement levels. The findings revealed a statistically significant improvement in students' understanding of grammatical structures, increased classroom participation, and strongly positive feedback regarding the learning experience. These results highlight the potential of AI tools in addressing the challenges associated with teaching complex grammatical concepts, offering a more engaging and effective approach to EFL grammar instruction.

Keywords: grammar, AI tools, sentence patterns, sentence slots, AI integration

I. INTRODUCTION:

The mastery of sentence structure has long been recognized as a fundamental objective in language education. The ability to perceive and comprehend the construction of sentences is critical in the development of essential language skills, encompassing listening, reading, and writing (Yu, 2021). As students acquire proficiency in this domain, they become more capable at formulating well-structured sentences, thereby enhancing their linguistic confidence and facilitating more effective communication.

For English as a Foreign Language (EFL) students, a comprehensive understanding of sentence slots is particularly crucial. These slots, which refer to the various positions or roles that words and phrases can assume within a sentence, play a significant role in language acquisition. By familiarizing themselves with these roles, EFL students markedly improve their capacity to comprehend and construct English sentences accurately. Indeed, research indicates that when students can effectively analyze diverse language structures, they are more likely to enhance their understanding and comprehension of the target language (Koh, 2021).

The recognition of sentence slots enables students to identify the fundamental components of a sentence, such as the subject, verb, and object, as well as their interrelationships. This knowledge facilitates the recognition of various sentence patterns, thereby enhancing both comprehension and writing skills. Ultimately, a solid understanding of sentence slots equips EFL learners with the necessary tools to construct clearer sentences, infer meaning from context, and express themselves more effectively in English (Tarone, 2006).

This paper highlights a significant challenge in the field of applied linguistics: the difficulty many students face in grasping the various slots and patterns within sentences, which are essential for their language courses. This struggle can significantly hinder their overall comprehension and writing capabilities. In response to this challenge, this paper explores the potential of integrating artificial intelligence (AI) tools to create a more engaging and accessible learning experience. By leveraging AI technologies, educators can offer personalized support that enhances students' understanding of sentence structures and their functions. This innovative approach not only makes the learning process more engaging but also empowers students to navigate the complexities of language, ultimately improving their proficiency in English.

To achieve this purpose, this paper tries to answer the following questions:

- 1- Does the integration of AI in teaching sentence slots and patterns improve students' overall performance?

- 2- Does the integration of AI in teaching sentence slots and patterns improve students' interaction and involvement in class activities?
- 3- How do students perceive their learning experience when utilizing AI technology?

2. REVIEW OF LITERATURE:

2.1 Sentence Structure Comprehension:

The comprehension of sentence structures plays an essential role in language acquisition and proficiency. Recent research has illuminated various aspects of this complex process, offering insights into effective teaching strategies and the potential of technological integration in language education. Olga (2017) emphasizes the significance of recognizing word combinations within sentences for improving students' ability to identify collocations. The study demonstrates that exercises focusing on word position, structure, and overall sentence flow significantly enhance foreign language learners' capacity to recognize false collocations. This finding underscores the importance of mastering sentence structure and understanding inter-component relationships as critical factors influencing adult ESL learners' collocation recognition skills.

Complex sentence structures present considerable challenges for language learners in comprehending written texts. Zipoli (2017), Vilhjálmsdóttir (2017), and Balthazar & Scott (2023) propose various strategies to address these difficulties, including explicit instruction on passive voice, nominalization, multi-phrasal coordination, and embedded clauses. They advocate for promoting syntactic awareness and employing effective intervention methods such as priming, modeling, recasting, and metalinguistic instruction to enhance the teaching of complex sentence structures. The integration of sentence structure instruction within authentic academic contexts has been shown to facilitate the meaningful application of linguistic skills among students, enabling learners to contextualize abstract syntactic concepts and transfer their knowledge to real-world academic tasks (Zipoli, 2017; Vilhjálmsdóttir, 2017; Balthazar & Scott, 2023).

Jr. & Duffy (2001) examined the roles of linguistic structure—including syntax, semantics, and discourse context—in sentence inner structure comprehension, revealing that multiple factors can affect students' understanding and reading times. Ding Xinzhe et al. (2021) introduced novel techniques for word slot recognition within sentences, employing approaches based on preset entity sets and pre-trained word slot models. While these methods showed promise, they also demonstrated limitations in cross-linguistic and contextual adaptability.

Haigh (2018) underscores the importance of well-formed sentences in constructing strong paragraphs, which in turn facilitates text comprehension. The study emphasizes core sentence structures, such as subject-verb-object arrangements, and identifies common issues like sentence fragments and run-on sentences as obstacles to students' grasp of sentence structure.

Ghazzoul (2023) asserts that a comprehensive understanding of texts and sentences requires the integration of prior knowledge and context to build coherent mental representations. Her study supports the notion that mapping words to construct meaning, guided by grammatical relations and the reader's familiarity with the language, can significantly enhance sentence structure comprehension.

Yaling Li (2024) highlights the importance of various information sources in understanding meaning, emphasizing that sentence structure comprehension involves parsing for syntactic analysis while considering factors such as prosody, references, and discourse. The study highlights the relationship between linguistic content and other information sources in comprehending meaning and intention.

In the realm of technological integration, Shamsa Khatoon's (2024) study explores the use of AI tools like ChatGPT and Duolingo in language classrooms to enhance collaborative learning. The research demonstrates that AI-driven technologies can foster personalized, adaptive learning experiences, boost student confidence, facilitate real-time communication, and provide instant feedback on language skills. Khatoon emphasizes the importance of balancing technology and pedagogy to promote effective group dynamics and develop linguistic, cultural, and digital literacy skills.

2.2 Studies on English Sentence Structure Comprehension on Arab Students:

Research on English sentence structure comprehension among Arab students highlights the critical role of syntactic awareness in enhancing language proficiency. Abdul Rahman (2017) demonstrated that engaging with text structure tasks improves reading comprehension, as evidenced by increased mean scores and better identification of text structures and main ideas. Similarly, Allaith (2024) identified vocabulary and grammatical knowledge as the strongest predictors of reading comprehension success among Arabic-speaking college students.

Alhussain (2018) investigated if a significant relationship existed between Arab EFL learners' and the English sentence pattern identified. A highly significant relationship between performance and identified sentence patterns was registered. Arab EFL learners particularly struggle in identifying English sentence patterns especially pattern 8, which involves dative and double object structures. The research highlighted notable performance variations linked to these patterns, underscoring the need for targeted instruction.

Al-Halawachy (2019) further emphasized that university EFL students struggle with recognizing complex sentence structures and elements. The authors noted students often have difficulty recognizing more complex sentence structures, especially those requiring multiple objects and object complements. The findings pointed to a significant gap in students' understanding of sentence structures, which the authors attributed to the curriculum and teaching methodologies employed. The study stressed the importance of updating teaching approaches to provide students with more opportunities to practice identifying sentence structures and patterns.

Adam's (2024) qualitative study focused on Arabic-speaking EFL learners in Qatar, revealing frequent syntactic errors, such as verb tense and word order issues, often caused by direct translation from Arabic. The research underscored the need for tailored instructional strategies to address these challenges.

Collectively, these studies underscore the importance of sentence structure recognition in improving comprehension and writing skills among Arab EFL learners. This study seeks to contribute to this growing body of research by implementing an innovative teaching strategy that utilizes AI tools to facilitate understanding of sentence patterns and structures. By doing so, it aims to make the identification of sentence slots and patterns more accessible and effective for students.

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3. METHODOLOGY:

3.1 Design of the Study:

This study employs a quasi-experimental design with pre-test and post-test measures to investigate the effectiveness of integrating interactive AI tools into grammar instruction for enhancing students' comprehension of sentence structure and slots. In addition to the testing phases, the research methodology incorporates qualitative approaches to provide a comprehensive analysis of the intervention's impact.

The quantitative method of the study utilizes a pre-test/post-test design to measure changes in students' understanding of sentence structure before and after the implementation of AI-enhanced instruction. This approach allows for the assessment of the intervention's effectiveness through statistical analysis of performance indicators.

To complement the quantitative data, the study incorporates two qualitative methods:

1. **Questionnaire:** A questionnaire, consisting of 6 multiple-choice and true/false questions, is administered to all participants to gather insights into their experiences and perceptions regarding the use of AI in their learning process. This instrument is designed to capture nuanced feedback that may not be evident from quantitative measures alone.
2. **Classroom Observation:** Ongoing observation of classroom interactions is considered to assess the students' engagement levels and the overall effectiveness of AI integration in real-time learning contexts.

3.2 Sample of the Study:

The study sample comprises second-level students enrolled in the Applied Linguistics Department at the College of Languages, Princess Nourah University, Saudi Arabia. All participants are English as a Foreign Language (EFL) learners studying the course "Grammar in Use, LING 132," which focuses on sentence patterns and slots. The total sample size is 52 participants, all of whom completed the questionnaire. However, only 50 students were able to complete both pre- and post-tests.

3.3 Data Collection:

This study employed a comprehensive data collection strategy, incorporating both quantitative and qualitative methods to ensure a thorough evaluation of the intervention's efficacy.

Pre-test Phase: Prior to the intervention, participants received two weeks of traditional instruction on sentence patterns and slots. This instruction utilized conventional pedagogical tools such as PowerPoint presentations, board-based analysis, and both individual and group exercises. Following this instructional period, all students completed a 15-question assessment designed to evaluate their comprehension of the targeted patterns and slots, including both required and optional sentence elements (Figure 1). This pre-test served as a baseline measure of students' knowledge prior to the introduction of AI-enhanced instruction.

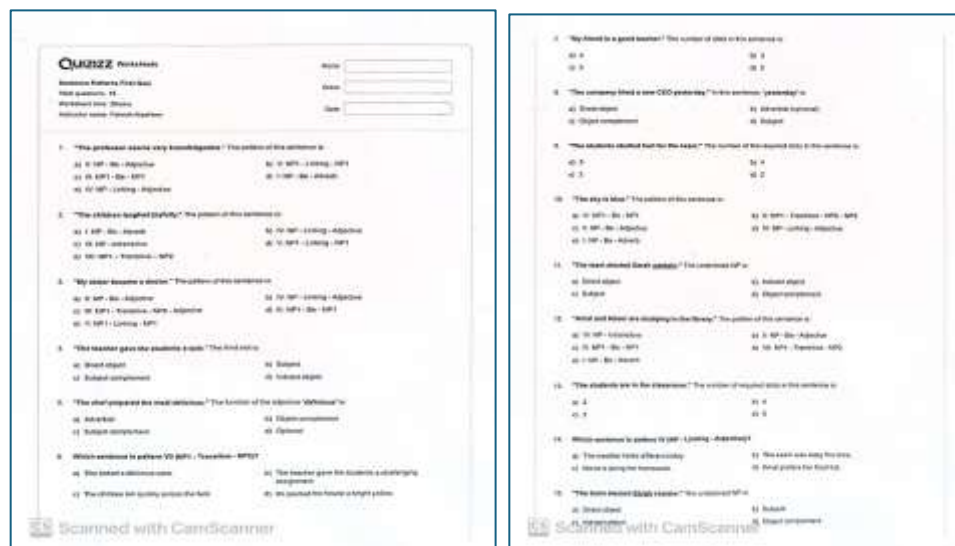


Figure 1. Pre-test Questions.

Post-test Phase: The subsequent two-week period involved the integration of AI-generated questions into PowerPoint presentations, developed under instructor supervision. This phase incorporated interactive elements, with students accessing shared links to respond to on-screen questions. Collective review and analysis of responses fostered engagement, with correct answers being positively reinforced. Supplementary practice activities, including digital flashcards on platforms such as Quizziz and Quizlet, were assigned for independent study. The intervention culminated in a 15-question post-test (Figure 2), mirroring the pre-test in structure and difficulty, to assess the impact of the AI-enhanced instructional method on students' comprehension of English sentence structures and patterns.

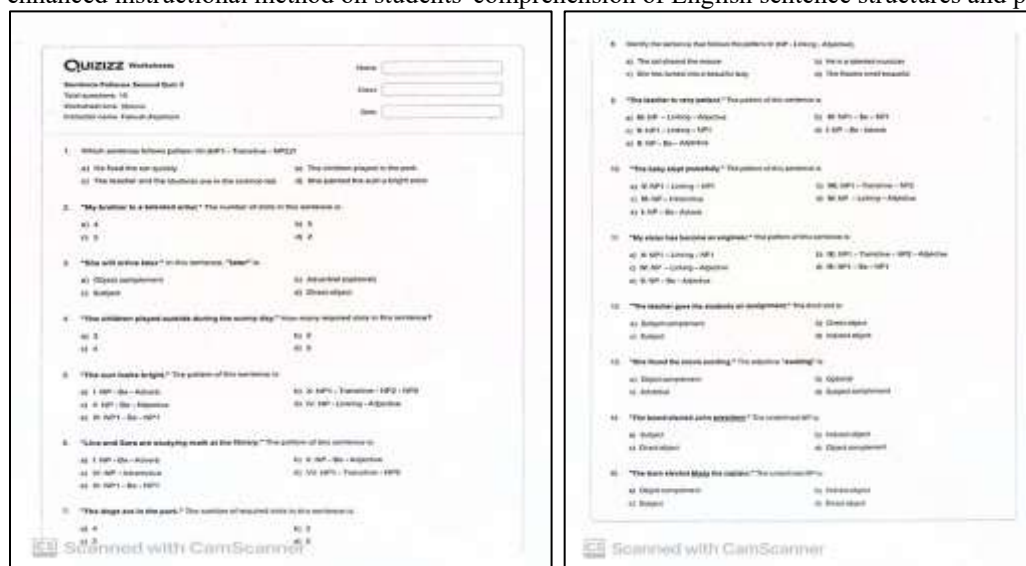


Figure 2. Post-test Questions.

Questionnaire: An electronic questionnaire comprising six multiple-choice and true/false items was distributed to all study participants. The electronic format facilitated efficient data collection and analysis.

Observation: Throughout the implementation of this teaching method, the researcher continuously monitors the impact of integrating AI tools into grammar classes. This ongoing observation aims to assess how students respond to this integration, including their engagement levels, comprehension, and overall learning outcomes. By collecting data on student interactions and feedback, the researcher seeks to identify both the benefits and challenges associated with the use of AI tools in enhancing students' understanding of sentence structure and patterns.

4. Data Analysis:

4.1 Pre-test and Post-Test:

The study collected and analyzed data from 50 participants who completed both the pre-test and post-test. The results of these assessments are presented in Table 1.

	Student ID	pretest	posttest		Student ID	pretest	posttest
1	446007701	8	9	26	446007645	3	6
2	446007606	4	9	27	446007647	6	11
3	446007694	4	6	28	446007621	6	7
4	446007670	6	5	29	446007685	5	9
5	446007653	8	8	30	446008888	6	11
6	446007623	14	5	31	445008185	4	8
7	446007447	6	8	32	446007702	4	4
8	446007682	6	12	33	446007627	4	6
9	446008885	5	10	34	446007713	6	4
10	446007634	3	9	35	446010029	8	6
11	446007635	7	5	36	446007651	4	4
12	446007686	3	6	37	446007642	6	7
13	445007920	8	8	38	446007654	4	7
14	446007616	6	9	39	446007644	4	5
15	446007673	4	7	40	446007700	7	4
16	446007698	2	2	41	446007681	10	13
17	446007697	8	7	42	446007663	5	6
18	446007664	4	10	43	446007639	9	8
19	446007628	3	11	44	446007662	1	7
20	446007637	9	13	45	446007658	2	1
21	446007708	7	9	46	446007696	7	8
22	446007652	2	9	47	446007648	6	7
23	446007643	6	10	48	446008891	9	11
24	446007689	2	4	49	446007721	9	7
25	446007304	6	10	50	446007660	5	6

Table 1. Students' Scores on the Pre and Post-Tests.

A paired-samples t-test was conducted to evaluate the impact of AI integration on students' performance in learning sentence slots and patterns. The analysis compared pre-test (M = 5.48, SD = 2.18) and post-test (M = 7.48, SD = 2.67) scores for 50 participants.

	Variable 1: Pre-Test	Variable 2: Post-Test
Mean	5.48	7.48
Variance	4.744489796	7.111836735
Observations	50	50
Pearson Correlation	0.395178747	
Hypothesized Mean Difference	0	
df	49	
t Stat	-5.246721823	
P(T<=t) one-tail	1.65102E-06	
t Critical one-tail	1.676550893	
P(T<=t) two-tail	3.30203E-06	
t Critical two-tail	2.009575237	

Table 2. T Test Analysis of the Students' Scores on the Two Tests.

The results indicated a statistically significant improvement in performance from pre-test to post-test, $t(49) = -5.25$, $p < .001$ (two-tailed). The mean increase in test scores was 2.00 points. The negative t-statistic value confirms that the post-test scores were significantly higher than the pre-test scores, indicating improved performance following the AI integration.

Notably, the variance increased from the pre-test (4.74) to the post-test (7.11), suggesting a wider spread of scores after the intervention. This could indicate that while overall performance improved, individual responses to the AI-enhanced instruction varied.

The Pearson correlation coefficient ($r = 0.395$) suggests a moderate positive relationship between pre-test and post-test scores. This indicates that, generally, students who performed well on the pre-test also tended to perform well on the post-test, although the relationship is not strong.

The observed t-statistic (5.25) exceeds both the one-tailed (1.67) and two-tailed (2.01) critical values, further confirming the statistical significance of the improvement.

These findings provide strong evidence that the integration of AI-enhanced instructional methods significantly improved students' understanding of sentence slots and patterns. The substantial effect size underscores the practical significance of this improvement, suggesting that the AI-integrated approach may be an effective pedagogical strategy for enhancing grammar instruction in EFL contexts.

4.2 Questionnaire:

To assess students' perceptions of AI integration in grammar instruction, an electronic questionnaire was administered to 52 participants. The instrument comprised six items designed to evaluate various aspects of the AI-enhanced learning experience.

Results indicated a highly positive reception of AI integration:

Question 1 (Engagement): Do you find the AI questions in PowerPoint presentations helpful to stay alert and engaged during lectures?

94.2% ($n = 49$) of respondents reported that AI questions in PowerPoint presentations enhanced their alertness and engagement during lectures.

Question 2 (Comprehension Check): How effective are the AI questions in checking your understanding of the material?

The effectiveness of AI questions in assessing understanding was rated as follows:

- Very effective: 71.2% ($n = 37$)
- Somewhat effective: 28.8% ($n = 15$)
- Not effective: 0% ($n = 0$)

Question 3 (Reinforcement): Did you find the short quizzes at the end of the class helpful for reinforcing your learning?

96.2% ($n = 50$) found end-of-class quizzes helpful for reinforcing learning.

Question 4 (Post-Class Practice): How often do you complete the flashcards sent for practice after class?

Engagement with flashcards for post-class practice was reported as:

- Always: 44.2% ($n = 23$)
- Often: 21.2% ($n = 11$)
- Sometimes: 28.8% ($n = 15$)
- Rarely: 3.8% ($n = 2$)
- Never: 1.9% ($n = 1$)

Question 5 (Overall Understanding): Do you feel that the combination of AI activities and quizzes improves your overall understanding of the sentence patterns?

96.2% ($n = 50$) believed that the combination of AI activities and quizzes improved their comprehension of sentence patterns.

Question 6 (Future Integration): Would you like to see more interactive AI elements integrated into your lessons?

92.3% ($n = 48$) expressed a desire for increased integration of interactive AI elements in future lessons.

4.3 Observation:

Throughout the implementation of this study, the researcher conducted systematic classroom observations to assess students' attitudes and perceptions towards the integration of AI-enhanced activities and quizzes in grammar instruction. The researcher noted increased levels of student engagement and attentiveness during presentations due to the expectation of impromptu questions. The display of responses with student names on screens appeared to foster a competitive yet collaborative learning environment. Students exhibited positive visible signs, such as excitement and satisfaction, upon correctly answering questions.

Incorrect responses were addressed through constructive dialogue, with the researcher framing these instances as valuable learning opportunities. The researcher consistently emphasized that incorrect answers provided insights into students' comprehension, facilitating targeted re-explanation of challenging concepts. This approach aligns with the concept of formative assessment, where errors are viewed as diagnostic tools to inform instruction (Black & Wiliam, 2009).

4.4 Findings and Discussion:

Based on the analysis of both quantitative and qualitative data, the research questions can be addressed as follows:

Q1. Does the integration of AI in teaching sentence slots and patterns improve students' overall performance?

The paired-samples t-test analysis of pre- and post-test scores revealed a statistically significant improvement in students' performance following the integration of AI activities ($t(49) = -5.25, p < .001$). The intervention, which included AI-enhanced PowerPoint presentations, end-of-lecture quizzes, and post-class flashcards, was associated with significantly higher post-test scores ($M = 7.48, SD = 2.67$) compared to pre-test scores ($M = 5.48, SD = 2.18$). This improvement suggests that the integration of AI tools in teaching sentence structure and slots had a significant positive effect on students' performance.

Q2. Does the integration of AI in teaching sentence slots and patterns improve students' interaction and involvement in class activities?

Observational data and questionnaire responses indicate that the integration of AI activities enhanced student engagement and participation. Notably, 94.2% of participants reported that AI questions in PowerPoint presentations helped them stay alert and engaged during lectures.

Q3. How do students perceive their learning experience when utilizing AI technology?

The majority of participants expressed positive perceptions of their AI-enhanced learning experience:

1. 71.2% found AI questions very effective in checking their understanding.
2. 96.2% believed that AI activities and quizzes improved their overall understanding of sentence patterns.
3. 94% reported engaging with post-class flashcards to some degree.
4. 92.3% expressed a desire for increased integration of interactive AI elements in future lessons.

These findings suggest that students perceived the AI-enhanced instruction as beneficial for their learning, reinforcement, and overall comprehension of grammatical concepts.

In conclusion, this study offers practical evidence supporting the effectiveness of AI integration in enhancing the instruction and learning of English sentence slots and patterns. The statistically significant improvement in student performance, as revealed by the t-test analysis, coupled with the positive perceptions reported in the questionnaire, underscores the potential of AI-enhanced instruction as a promising approach to grammar education in EFL contexts. The observed enthusiasm among students for continued AI integration in their lessons suggests a potential shift in learner attitudes towards technology-enhanced language learning.

5. CONCLUSION:

This study addressed a persistent challenge in English language learning, particularly for EFL students: the comprehension of sentence slots and patterns. Recognizing the potential of emerging AI technologies, this research sought to develop and evaluate an innovative teaching strategy that integrates AI tools into grammar instruction.

The study was designed with three primary objectives: to enhance student interaction, monitor comprehension in real-time, and assess understanding at the conclusion of each lecture. To achieve these goals, AI-enhanced tools such as Classpoint and Slido were integrated into PowerPoint presentations. These tools enabled instructors to pose questions, facilitate discussions, and provide immediate feedback during class sessions. Following the lectures, practice activities were created using Quizlet and Quizziz to enhance learning and allow students to reinforce their understanding outside the classroom. This structured approach aimed to create a cohesive learning experience that combined in-class engagement with independent practice.

The effectiveness of this intervention was evaluated through a mixed-method approach, utilizing pre- and post-tests, questionnaire, and classroom observation. The findings strongly support the integration of AI tools in grammar instruction, demonstrating:

1. Statistically significant improvement in students' test scores following the intervention.
2. Increased student engagement and participation during lessons.
3. Positive student perceptions of the AI-integrated learning experience.

These results suggest that the incorporation of AI-enhanced activities can effectively address the challenges associated with teaching complex grammatical structures in EFL contexts. The combination of interactive elements, immediate feedback, and personalized practice opportunities appears to create a more dynamic and effective learning environment.

This study demonstrates the potential of AI-enhanced instruction to revolutionize grammar teaching in EFL contexts. As educational technology continues to evolve, the integration of AI tools in language classrooms may play an increasingly important role in enhancing the effectiveness of grammar instruction and improving overall language proficiency among EFL learners. Further research in this area will be crucial in refining these approaches and maximizing their benefits for language learners and educators alike.

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