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Enhancing EFL Grammatical Competence of Health Science Technology Students through Online Instruction

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Abstract

Grammar competence plays a vital role in the academic and professional development of Health Science Technology students by supporting effective academic writing, disciplinary communication, and professional documentation. In response to the increasing use of digital learning in higher education, this study examined the effectiveness of online grammar instruction in improving the grammatical competence of Health Science Technology students. A one-group pretest–posttest quasi-experimental design was employed with 40 undergraduate students. Participants completed a structured online grammar program that incorporated explicit grammar instruction, guided practice, interactive learning activities, performance-based tasks, and continuous formative feedback. Grammatical competence was assessed before and after the intervention using a validated and reliable grammar test covering five domains: syntax, subject–verb agreement, tense and aspect, articles and determiners, and prepositions. Data were analyzed using paired-samples t-tests and effect size measures. The results demonstrated statistically significant improvements in overall grammatical competence and across all five grammatical domains following the intervention. The greatest improvements were observed in syntax, subject–verb agreement, tense and aspect, and prepositions, indicating the effectiveness of structured online grammar instruction. These findings suggest that well-designed online grammar instruction can support the development of grammatical competence among Health Science Technology students and may serve as a valuable component of technology-enhanced language instruction in higher education.

Keywords: grammar competence, online grammar instruction, e-learning, academic writing, Health Science Technology students

1. Introduction

Grammar competence is a fundamental component of academic literacy for Health Science Technology students, as English is the primary language of scientific communication, clinical documentation, and international healthcare practice (Alharbi & Alsayed, 2021). Accurate

grammar enables students to comprehend medical literature, produce coherent academic texts, and communicate clinical information effectively (Barkaoui & Brooks, 2021). However, many students in health-related disciplines continue to experience difficulties with English grammar, which can negatively affect reading comprehension, academic writing, and professional communication (Hyland, 2019; Hinkel, 2020).

The increasing adoption of digital technologies in higher education has encouraged the integration of online instruction into language learning. Online learning environments offer greater flexibility, interactive learning opportunities, and continuous feedback, making them well suited to grammar instruction (Bond et al., 2020; Martin et al., 2024). Previous studies have reported that well-designed online grammar instruction can improve learner engagement and grammatical accuracy, particularly when combined with guided practice and timely feedback (Means et al., 2013; Sun, 2025).

Despite these advances, limited research has specifically examined the effectiveness of structured online grammar instruction for Health Science Technology students. Most previous studies have focused on general EFL learners, leaving insufficient evidence regarding learners in health-related academic programs, whose linguistic needs differ from those of general English learners.

Accordingly, this study investigated the effectiveness of a structured online grammar instruction program in improving the grammatical competence of Health Science Technology students using a one-group pretest–posttest quasi-experimental design. The findings are expected to contribute to the growing body of research on technology-enhanced language learning and provide practical implications for curriculum development in health science education.

2. Literature Review

2.1 Grammar Competence in Health Science Education

Grammar competence refers to the ability to understand and apply grammatical rules accurately and appropriately in academic and professional communication (Ellis, 2015). For Health Science Technology students, grammatical competence is essential for interpreting medical literature, writing case reports and research assignments, documenting patient information, and communicating clinical findings effectively (Matsuda, 2021). Inadequate grammar skills can reduce the clarity and accuracy of written communication, hinder comprehension, and negatively affect students' academic achievement and professional readiness (Labrador & Ramón, 2020; Shen et al., 2023). Developing grammatical competence is therefore an important component of language instruction for students preparing for healthcare professions.

2.2 Online Instruction for Language Learning

Online instruction encompasses technology-mediated learning environments, including learning management systems, virtual classrooms, discussion forums, and interactive assessments that facilitate language learning beyond the traditional classroom (Moore & Blackmon, 2022). These environments provide learners with greater flexibility, immediate feedback, and opportunities for self-paced practice. Previous research has shown that online grammar instruction can improve learners' grammatical accuracy, autonomy, and motivation, particularly when supported by interactive activities, guided practice, and continuous formative feedback (Zhou et al., 2025). Such instructional approaches have become increasingly relevant in higher education as digital learning continues to expand.

2.3 Quasi-Experimental Research in Education

Quasi-experimental research designs are widely used in educational settings where random assignment is not feasible (Shadish et al., 2020). Among these designs, the one-group pretest–posttest design allows researchers to examine changes in participants' performance by comparing measurements collected before and after an instructional intervention. Although this design does not include a control group, it is frequently employed to evaluate the effectiveness of educational interventions implemented under authentic classroom conditions. Researchers should, however, acknowledge potential threats to internal validity, including maturation, testing effects, and history, when interpreting the findings (Dobson Waters & Torgerson, 2021).

3. Theoretical Framework

This study is grounded in two complementary learning theories that explain how online instruction can facilitate the development of grammatical competence among EFL learners.

3.1 Sociocultural Theory

According to Vygotsky's Sociocultural Theory, learning is a socially mediated process in which knowledge is constructed through interaction, collaboration, and guided support. The concept of scaffolding emphasizes the role of teachers and peers in helping learners achieve higher levels of performance than they could independently. Online learning environments support these principles by providing opportunities for guided practice, timely feedback, collaborative interaction, and instructor modeling, all of which facilitate the development of grammatical competence (Lantolf & Thorne, 2021).

3.2 Constructivist Theory

Constructivist Theory views learning as an active process in which learners construct knowledge through exploration, reflection, and meaningful engagement with learning tasks. In online grammar instruction, students actively participate in interactive activities, analyze language patterns, test grammatical hypotheses, and receive continuous feedback that supports independent learning and knowledge construction (Jonassen, 2020; Richards & Schmidt, 2020).

Together, these theoretical perspectives provide a sound foundation for the design of the online instructional intervention adopted in this study and support the use of technology-enhanced learning to promote grammatical competence among Health Science Technology students.

4. Significance of the Study

This study is significant for several reasons. It Provides empirical evidence on the effectiveness of online grammar instruction in improving the grammatical competence of Health Science Technology students.

Helps curriculum designers integrate technology-enhanced grammar instruction into EFL courses for health-related disciplines.

Supports the development of discipline-specific academic literacy and communication skills required in healthcare education.

Contributes to the understanding of how sociocultural and constructivist learning principles can be applied in online grammar instruction.

Presents a practical instructional approach that may be adapted for blended and online learning environments in higher education.

5. Research Questions

Does online grammar instruction significantly improve the grammatical competence of Health Science Technology students?

Are there statistically significant differences between students' pretest and posttest scores on the grammar competence test following the online instructional intervention?

Which grammatical domains demonstrate the greatest improvement following the online instructional intervention?

6. Hypotheses

H1: Online grammar instruction significantly improves the grammatical competence of Health Science Technology students.

H2: Online grammar instruction results in significant improvements across the five grammatical domains assessed, namely syntax, subject–verb agreement, tense and aspect, articles and determiners, and prepositions.

7. Methodology

7.1 Research Design

This study employed a one-group pretest–posttest quasi-experimental design to examine the effectiveness of online grammar instruction in improving the grammatical competence of Health Science Technology students. This design was selected because random assignment and the inclusion of a control group were not feasible within the institutional context. Consequently, a single intact class was used, and participants completed the same grammar competence test before and after the instructional intervention.

The independent variable was the structured online grammar instruction, whereas the dependent variable was students' grammatical competence, measured using a standardized Grammar Competence Test. Comparing students' pretest and posttest performance enabled the researcher to determine the effectiveness of the instructional intervention across the targeted grammatical domains.

7.2 Participants

The study involved 40 undergraduate students enrolled in the Health Science Technology program at a higher education institution. Participants were selected using convenience sampling because they were enrolled in the same academic course and were readily accessible during the study period. All participants had previously completed English language courses as part of their academic program and demonstrated a comparable intermediate level of English proficiency according to institutional placement procedures.

Participation in the study was voluntary. Before data collection, students were informed about the objectives and procedures of the study, and informed consent was obtained from all participants. Confidentiality was maintained by assigning numerical identification codes to each participant, and no personally identifiable information was collected. All participants completed both the pretest and posttest, resulting in a complete dataset for statistical analysis.

7.3 Instruments

Two instruments were used in this study:

- Grammar Competence Test
- Online Grammar Instruction Module

7.3.1 Grammar Competence Test

A Grammar Competence Test was developed to assess students' grammatical competence before and after the instructional intervention. The test consisted of 20 items distributed across five grammatical domains: syntax, subject–verb agreement, tense and aspect, articles and determiners, and prepositions, with four items allocated to each domain.

The test included multiple-choice questions, sentence completion, error correction, and sentence transformation tasks to assess both receptive and productive grammatical knowledge. The total score represented overall grammatical competence, while domain-specific scores were used to evaluate students' performance in each grammatical area.

Content validity was established through expert review by specialists in English language teaching and applied linguistics, who evaluated the clarity, relevance, and representativeness of the test items. Revisions were made based on their recommendations. Evidence of construct validity and internal consistency reliability is presented in Tables 1 and 2, respectively.

7.3.2 Online Grammar Instruction Module

The online instructional module was specifically designed to improve students' grammatical competence through a structured learning sequence delivered via Microsoft Teams. The module covered the same five grammatical domains assessed in the Grammar Competence Test: syntax, subject–verb agreement, tense and aspect, articles and determiners, and prepositions.

The instructional program was implemented over eight weeks, with two sessions per week, each lasting two hours, resulting in a total of 32 instructional hours. Each instructional unit included explicit grammar explanations, guided practice, interactive learning activities, performance-based tasks, and formative assessment.

Microsoft Teams was used to deliver live sessions, distribute learning materials, facilitate discussions, administer practice activities, and provide continuous feedback. Throughout the intervention, the instructor explained grammatical concepts, monitored students' participation, answered questions, provided corrective feedback, and evaluated students' progress to ensure active engagement and continuous improvement.

Before implementation, the instructional module was reviewed by specialists in English language teaching and educational technology to ensure its content validity and alignment with the objectives of the study.

7.4 Procedures

The study was conducted in four sequential phases.

First, participants completed the Grammar Competence Test as a pretest to determine their baseline level of grammatical competence. The test was administered under standardized conditions to ensure consistency across participants.

Second, students participated in the online instructional program for eight weeks through Microsoft Teams. Instruction was delivered twice weekly, with each session lasting two hours. The instructional activities combined explicit grammar instruction, guided practice, interactive exercises, performance-based tasks, and continuous formative feedback. Each instructional unit focused on one or more of the targeted grammatical domains.

Third, immediately following completion of the instructional program, participants completed the same Grammar Competence Test as a posttest under conditions comparable to those of the pretest.

Finally, pretest and posttest scores were compiled and analyzed to determine the extent to which the online instructional program improved students' overall grammatical competence and their performance in each grammatical domain. Figure 1 addresses a flowchart of the study design and instructional procedures.

7.5 Data Analysis

Data were analyzed using descriptive and inferential statistical techniques. Descriptive statistics, including means and standard deviations, were calculated to summarize participants' performance on the pretest and posttest.

To examine changes in grammatical competence following the instructional intervention, paired-samples *t*-tests were conducted for both the overall test scores and each of the five grammatical domains. Statistical significance was determined at the 0.05 level.

To complement the significance tests, effect size estimates were calculated to evaluate the magnitude of the observed differences between pretest and posttest performance. These measures provided additional evidence regarding the practical effectiveness of the online instructional program.

Prior to conducting the paired-samples *t*-tests, the normality of the difference scores was assessed using the Shapiro–Wilk test together with visual inspection of Q–Q plots. The assumptions for the paired-samples *t*-test were satisfactorily met.

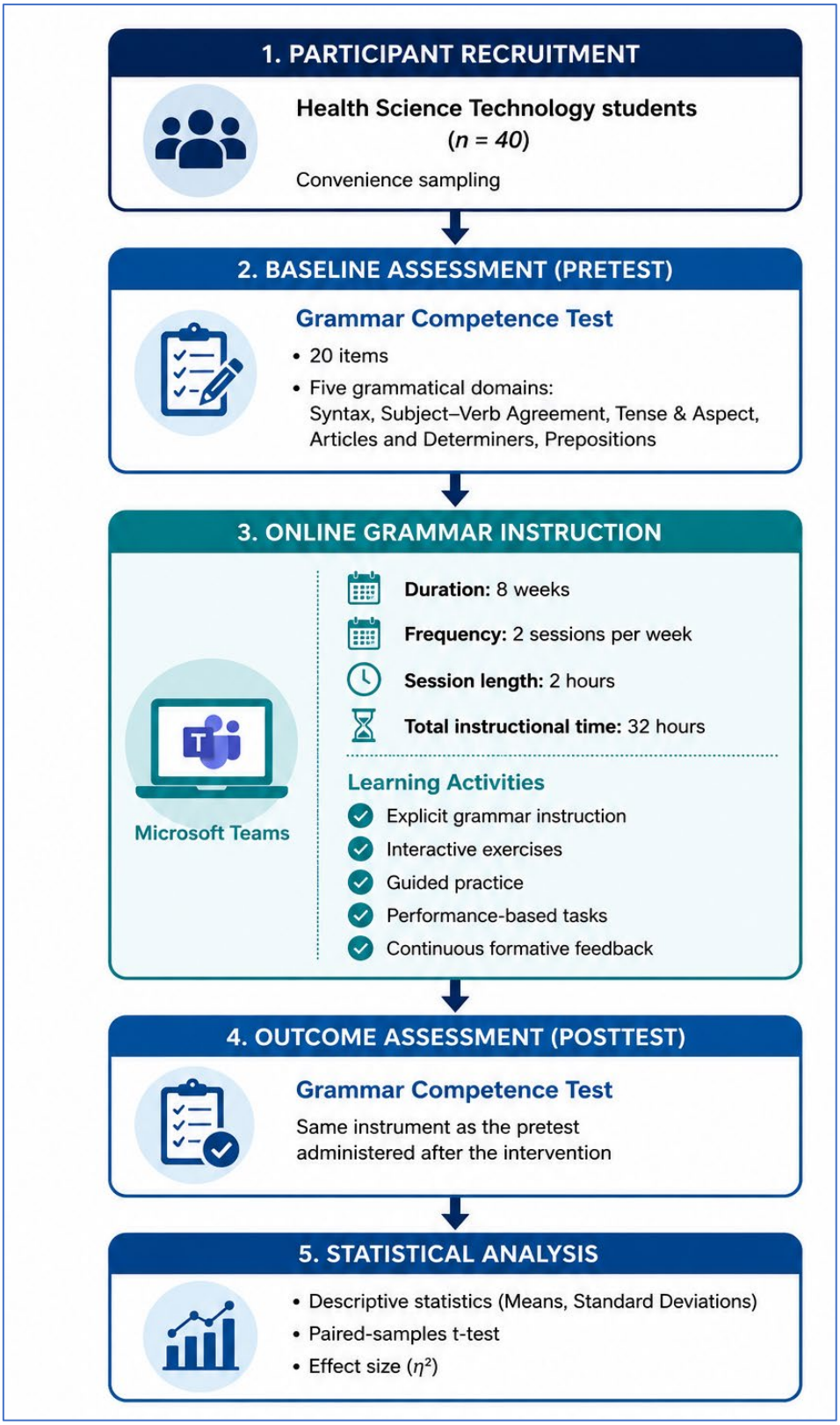

Figure1. Flowchart of the study design and instructional procedures.

8. Results

8.1 Validity and Reliability of the Grammar Competence Test

8.1.1. Content Validity of the Grammar Competence Test

To establish the content validity of the Grammar Competence Test, the preliminary version of the instrument was submitted to a panel of specialists in Teaching English as a Foreign Language (TEFL) (Appendix ---). The experts evaluated the relevance, clarity, sequence, coverage, and appropriateness of the test items, as well as the number of items and the time allocated for test completion. They also examined the extent to which the test adequately measured the grammatical domains addressed in the instructional program.

Based on the experts' recommendations, several revisions were made to improve the wording and clarity of selected items. Minor modifications were also introduced to ensure better alignment between the test content and the instructional objectives. The final version of the test incorporated the suggested revisions and achieved an overall expert agreement rate of 95%, indicating that the instrument was appropriate for measuring students' grammatical competence.

8.1.2. Construct Validity of the Grammar Competence Test

Construct validity was examined by administering the Grammar Competence Test to a pilot group of 10 participants with characteristics similar to those of the target sample. Pearson's correlation coefficient was calculated between the score of each grammatical domain and the total test score. The results are presented in Table 1.

Table 1. Construct validity of the Grammar Competence Test.

Grammar competence	Pearson correlation
Syntax	0.71
Agreement	0.69
Tense& Aspect	0.73
Articles and determiners	0.65
Prepositions	0.78

Correlation is significant at 0.05 level.

As shown in Table 1, all correlation coefficients were positive and statistically significant ($p < .05$), ranging from 0.65 to 0.78. These findings indicate acceptable construct validity and demonstrate that each grammatical domain was positively associated with the overall measure of grammatical competence.

8.1.3. Reliability of the Grammar Competence Test

The internal consistency of the Grammar Competence Test was evaluated using Cronbach's alpha coefficient. Reliability coefficients were calculated for each grammatical domain as well as for the overall test. The results are presented in Table 2.

Table 2. Internal consistency reliability of the Grammar Competence Test.

Test Dimensions	No. Items	Cronbach Alpha
Syntax	4	0.754
Agreement	4	0.817
Tense& Aspect	4	0.880
Articles and determiners	4	0.849
Prepositions	4	0.702
Total	**20**	**0.907**

As presented in Table 2, Cronbach's alpha coefficients ranged from 0.702 to 0.880 across the five grammatical domains, while the overall reliability coefficient was 0.907. These values indicate good to excellent internal consistency, confirming that the Grammar Competence Test was sufficiently reliable for use in the present study.

Descriptive statistics, including means and standard deviations, were calculated to summarize participants' performance on the pretest and posttest. To examine changes in students' grammatical competence following the instructional intervention, paired-samples t-tests were performed for both the overall Grammar Competence Test and each of the five grammatical domains. Statistical significance was determined at the 0.05 level.

To evaluate the magnitude of the observed differences, effect size estimates (η^2) were calculated and interpreted according to conventional benchmarks. Effect size analysis was conducted to complement the significance testing and to determine the practical impact of the online instructional intervention on students' grammatical competence.

8.2. Hypothesis 1

H1: Online grammar instruction significantly improves the grammatical competence of Health Science Technology students.

To test this hypothesis, participants' pretest and posttest scores on the Grammar Competence Test were compared using paired-samples t-tests. The results are presented in Table 3.

Table 3. Comparison of pretest and posttest scores on the Grammar Competence Test.

Test Domains	Experimental Group	N	Mean	S. D.	t-test for Equality of Means		
					t	*df*	*Sig.*
Syntax	Pre	40	1.750	0.588	-17.103	39	<0.001
	Post	40	3.250	0.438			
Agreement	Pre	40	1.725	0.505	-13.210	39	<0.001
	Post	40	3.550	0.503			
Tense& Aspect	Pre	40	1.825	0.594	-15.922	39	<0.001
	Post	40	3.125	0.335			
Articles and determiners	Pre	40	2.400	0.671	-8.473	39	<0.001
	Post	40	3.300	0.464			
Prepositions	Pre	40	2.525	0.505	-17.737	39	<0.001

Test Domains	Experimental Group	N	Mean	S. D.	t-test for Equality of Means		
					t	*df*	*Sig.*
	Post	40	3.900	0.303			
Total	Pre	**40**	**10.250**	**1.548**	**-49.269**	39	<0.001
	Post	**40**	**17.125**	**1.471**			

As shown in Table 3, statistically significant differences were found between the pretest and posttest mean scores for the overall Grammar Competence Test and for each of the five grammatical domains ($p < 0.001$). Students achieved higher scores after completing the online instructional program, indicating improvements in syntax, subject–verb agreement, tense and aspect, articles and determiners, and prepositions.

Overall grammatical competence increased from a pretest mean score of 10.25 to a posttest mean score of 17.13, demonstrating a substantial improvement following the intervention. These findings support Hypothesis 1 and suggest that the online instructional program contributed positively to the development of students' grammatical competence.

As shown in Figure 2, the total average score of the experimental group improved from 10.25 in the pre-test to 17.13 in the post-test, visually showing the significant enhancement in grammar competence following the instructional intervention online.

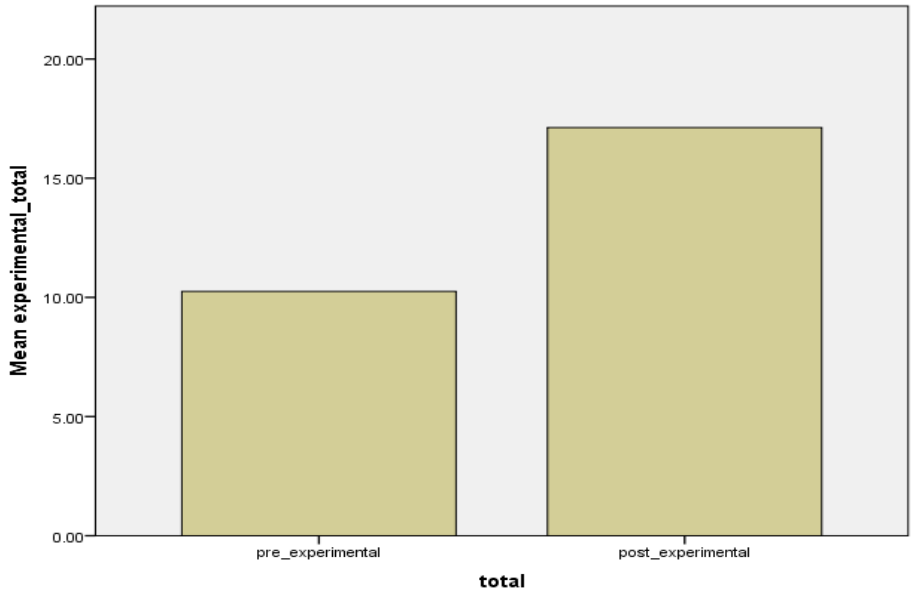

Figure 2. Comparison of the experimental group's mean pretest and posttest scores on the Grammar Competence Test.

8.3. Hypothesis 2

H2: Online grammar instruction results in significant improvements across the five grammatical domains assessed, namely syntax, subject–verb agreement, tense and aspect, articles and determiners, and prepositions.

To evaluate the practical magnitude of the instructional intervention, effect size estimates (η^2) were calculated for each grammatical domain and for the overall Grammar Competence Test. The results are presented in Table 4.

As presented in Table 4, the online instructional intervention produced moderate to high effect sizes across all grammatical domains. The largest effects were observed in syntax, subject–verb agreement, tense and aspect, and prepositions, whereas articles and determiners demonstrated a comparatively moderate effect. The overall effect size indicated that the intervention had a substantial practical impact on students' grammatical competence.

Table 4. Effect sizes for improvements in grammatical competence following the online instructional intervention.

Test Domains	□□	**Effect size**
Syntax	0.88	**High**
Agreement	0.81	**High**
Tense& Aspect	0.86	**High**
Articles and determiners	**0.65**	**Moderate**
Prepositions	**0.88**	**High**
Total	**0.98**	**High**

Taken together, these findings support Hypothesis 2 and demonstrate that the online instructional program was effective in improving students' performance across all grammatical domains assessed.

9. Discussion

9.1 Validity and Reliability of the Grammar Competence Test

The findings demonstrated that the Grammar Competence Test possessed acceptable levels of validity and reliability for assessing the grammatical competence of Health Science Technology students. Content validity was established through expert evaluation, with a high agreement rate (95%) among specialists in Teaching English as a Foreign Language (TEFL). This level of agreement indicates that the test adequately represented the grammatical domains targeted by the instructional program and that the test items were appropriate for the intended participants. Expert review also contributed to improving the clarity and relevance of several items, thereby strengthening the alignment between the instructional objectives and the assessment instrument (Ary et al., 2023).

Construct validity was supported by the significant positive correlations between each grammatical domain and the overall test score. Correlation coefficients ranging from 0.65 to 0.78 suggest that each grammatical domain contributed meaningfully to the overall construct of grammatical competence while maintaining sufficient conceptual distinctiveness. These findings are consistent with contemporary perspectives that view grammatical competence as a multidimensional construct composed of several interrelated components rather than a single unified ability (Ellis, 2023; Spinner, 2024).

The reliability analysis further supported the quality of the instrument. The overall Cronbach's alpha coefficient of 0.907 indicates excellent internal consistency, while the reliability coefficients for the individual grammatical domains ranged from 0.702 to 0.880, reflecting acceptable to high levels of reliability. These findings suggest that the instrument consistently measured the targeted grammatical constructs and was suitable for evaluating changes in students' performance before and after the instructional intervention (DeVellis & Thorpe, 2021).

9.2 Effect of Online Instruction on Overall Grammar Competence

The findings revealed a statistically significant improvement in students' overall grammatical competence following participation in the online instructional program. The increase in the mean score from 10.25 in the pretest to 17.13 in the posttest indicates that students demonstrated substantially better grammatical performance after completing the eight-week intervention.

Several characteristics of the instructional program may explain these improvements. First, the structured sequence of explicit grammar instruction, guided practice, and performance-based activities provided students with repeated opportunities to apply grammatical rules in meaningful learning contexts. Second, delivering the program through Microsoft Teams enabled continuous interaction between the instructor and students, allowing immediate clarification of grammatical difficulties and timely formative feedback. Such feedback is widely recognized as an important factor in promoting language development because it helps learners identify and correct grammatical errors during the learning process (Loewen & Sato, 2024).

The flexibility of the online learning environment may also have contributed to the observed improvement. Interactive learning activities and opportunities for self-paced review allowed students to revisit instructional materials whenever needed, supporting individual learning differences and encouraging greater engagement with grammatical content (Hrastinski, 2019). Furthermore, online learning environments may reduce communication anxiety for some learners, encouraging more active participation in learning activities, particularly among students whose primary academic focus is outside language studies (Qu, 2025).

The present findings are consistent with previous research indicating that well-designed online grammar instruction can enhance grammatical accuracy and learner engagement when supported by explicit instruction, interactive activities, and continuous feedback (Al-Samarraie et al., 2024; Zhang et al., 2025). However, the findings should be interpreted within the context of the current study design, which employed a one-group pretest–posttest approach without a comparison group. Consequently, although the observed improvements are encouraging, they cannot be attributed exclusively to the instructional intervention.

9.3 Differential Effects on Specific Grammar Domains

The effect size analysis demonstrated that the online instructional program positively influenced all five grammatical domains assessed in this study, although the magnitude of improvement differed across domains. Large effect sizes were observed for syntax, subject–verb agreement, tense and aspect, and prepositions, suggesting that these grammatical areas responded particularly well to the structured online instructional approach.

The substantial improvement in syntax may be explained by the systematic presentation of sentence structures together with repeated guided practice and interactive exercises. Likewise, subject–verb agreement and tense and aspect are largely rule-based grammatical features that can benefit from explicit explanation, repeated application, and immediate corrective feedback, all of which were integral components of the instructional program (Ellis & Shintani, 2013).

In contrast, articles and determiners demonstrated a comparatively smaller effect size than the other grammatical domains. Although students showed statistically significant improvement, mastering articles and determiners often requires learners to integrate grammatical knowledge with semantic interpretation and discourse context. These linguistic features are widely recognized as persistent challenges for EFL learners because their accurate use depends not only on grammatical rules but also on contextual meaning and language experience (Ionin et

al., 2023; Snape & Kupisch, 2025). Consequently, greater improvement in this domain may require longer instructional periods and increased exposure to authentic language use.

Overall, the effect size findings indicate that structured online grammar instruction can support improvement across multiple dimensions of grammatical competence. Nevertheless, the variation observed among grammatical domains suggests that different grammatical features may require different instructional approaches and varying amounts of practice to achieve comparable levels of mastery. These findings may help instructors prioritize instructional strategies according to the linguistic characteristics of individual grammatical domains and the specific learning needs of Health Science Technology students.

9.4 Limitations of the Study

Several limitations should be considered when interpreting the findings of this study.

First, the study employed a one-group pretest–posttest quasi-experimental design without a control group. Consequently, improvements observed following the intervention cannot be attributed exclusively to the online instructional program, as other factors such as testing effects, maturation, or prior learning experiences may have influenced students' performance.

Second, the study was conducted with a relatively small convenience sample drawn from a single Health Science Technology program. Although the participants represented the target population of the study, the sampling approach limits the generalizability of the findings to students from other institutions, disciplines, or educational contexts.

Third, the instructional intervention lasted eight weeks, which was sufficient to detect measurable improvements in grammatical competence but did not allow the researcher to examine the long-term retention of grammatical knowledge. Future longitudinal studies are needed to determine whether the observed gains can be maintained over extended periods.

Another limitation concerns the outcome measures used in the study. Students' grammatical competence was evaluated using a standardized grammar test only. Although this instrument provided quantitative evidence of improvement, it did not assess whether these gains transferred to authentic language production, such as academic writing or professional communication. Including writing-based performance measures would provide a more comprehensive evaluation of the effectiveness of online grammar instruction.

Finally, although the study demonstrated acceptable evidence of content validity, construct validity, and internal consistency reliability for the Grammar Competence Test, additional psychometric investigations involving larger samples could further strengthen the measurement properties of the instrument.

9.5 Implications for Pedagogy and Future Research

The findings of this study have several implications for English language teaching in higher education, particularly within Health Science Technology programs. The results suggest that structured online grammar instruction can serve as an effective supplement to traditional classroom teaching by providing learners with opportunities for explicit instruction, guided practice, interactive learning activities, and continuous formative feedback. Incorporating these elements into English language courses may contribute to improving students' grammatical accuracy and academic language proficiency.

The findings also highlight the importance of designing instructional activities that address the specific characteristics of different grammatical domains. While rule-based grammatical features responded well to the instructional program, comparatively smaller improvements in

articles and determiners suggest that these areas may benefit from greater exposure to authentic language use, contextualized learning activities, and extended practice.

From a curriculum perspective, integrating well-designed online grammar modules into English for Specific Purposes (ESP) courses may help strengthen the academic communication skills required by Health Science Technology students. Such integration may be particularly valuable in blended and technology-enhanced learning environments.

Future research should employ larger and more diverse samples to improve the generalizability of the findings. Studies incorporating control or comparison groups would provide stronger evidence regarding the effectiveness of online grammar instruction by reducing potential threats to internal validity. Longitudinal research is also recommended to investigate the sustainability of learning gains over time. In addition, future studies should include performance-based outcomes, particularly academic writing, to determine whether improvements in grammatical competence transfer to authentic language use in educational and professional contexts.

10. Conclusions and Recommendations

This study investigated the effectiveness of structured online grammar instruction in improving the grammatical competence of Health Science Technology students. The findings demonstrated significant improvements in students' overall grammatical competence following participation in the eight-week online instructional program. Improvements were observed across all five grammatical domains assessed, with particularly strong gains in syntax, subject–verb agreement, tense and aspect, and prepositions.

The findings also provided evidence that the Grammar Competence Test possessed acceptable levels of validity and reliability for measuring grammatical competence in the target population. Together, these results suggest that carefully designed online grammar instruction can support the development of grammatical competence among university students studying English as a foreign language.

Despite these encouraging findings, the results should be interpreted with caution because of the study's methodological limitations, particularly the absence of a control group and the relatively small convenience sample. Consequently, the findings should be viewed as evidence supporting the potential value of structured online grammar instruction rather than definitive proof of its superiority over other instructional approaches.

Based on the findings of this study, the following recommendations are proposed:

Integrate structured online grammar instruction into English language courses for Health Science Technology students to complement face-to-face teaching.

Design online grammar activities that combine explicit instruction, guided practice, interactive learning tasks, and continuous formative feedback.

Provide additional instructional support for grammatical features that require greater contextual understanding, particularly articles and determiners.

Incorporate writing-based assessments alongside grammar tests to evaluate the transfer of grammatical competence to authentic academic communication.

Conduct future research using larger samples, comparison groups, and longitudinal designs to strengthen the evidence regarding the effectiveness of online grammar instruction.

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