

ENHANCING FORMAL ACADEMIC SPEAKING THROUGH PROBLEM-BASED LEARNING IN EFL HIGHER EDUCATION

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ABSTRACT

Many EFL university students continue to experience difficulties in formal academic speaking, particularly in organizing ideas coherently and delivering presentations confidently, indicating a gap between general speaking ability and discourse-oriented communicative competence. This study aimed to investigate the effectiveness of Problem-Based Learning (PBL) in enhancing formal academic speaking performance among EFL university students. The study employed a quantitative quasi-experimental design using a non-equivalent control group involving two intact classes of fourth-semester students in an English Education program. The experimental group received instruction through Problem-Based Learning, whereas the control group was taught using a conventional teacher-centered method. Data were collected through pre-test and post-test oral presentations assessed using a standardized speaking rubric covering fluency, accuracy, pronunciation, vocabulary, coherence, and confidence. The data were analyzed using descriptive and inferential statistics, including independent samples t-tests, effect size analysis (Cohen's d), and gain score analysis. The findings revealed that the experimental group achieved significantly higher post-test scores than the control group ($p < .001$). The largest improvements were observed in coherence and confidence, indicating that PBL effectively supports students in organizing ideas systematically and delivering academic presentations more confidently. The findings suggest that PBL contributes not only to the improvement of academic speaking performance but also to the development of discourse competence and affective readiness in EFL learning. This study provides empirical evidence supporting the integration of Problem-Based Learning into EFL speaking instruction to enhance formal academic speaking competence in higher education.

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INTRODUCTION

In the context of globalization, English has functioned as a dominant lingua franca that facilitates academic exchange and professional mobility across nations (Andayani, 2022; Li, 2025). Within higher education, English proficiency has been positioned as an essential academic competence for participating in global knowledge production. Among the four language skills, speaking has been widely recognized as a key indicator of communicative

competence in EFL contexts (Adem & Berkessa, 2022; Cloudia Ho, 2020). However, the communicative demands of academic environments extend beyond everyday interaction toward the ability to produce structured, coherent, and contextually appropriate spoken discourse (Adem & Berkessa, 2022; Xiao & Chen, 2023). In this study, academic speaking is conceptualized as the ability to deliver organized, audience-aware, and academically appropriate oral discourse in contexts such as presentations, seminars, and structured discussions. This construct differs from general speaking ability and is closely related to academic speaking and oral presentation skills because it emphasizes the integration of discourse organization, rhetorical clarity, and interactional appropriateness in real-time communication (Telaumbanua et al., 2024; Dewi & Slamet, 2025; Khakimova et al., 2026). Such competence requires not only linguistic accuracy but also coherence, logical sequencing of ideas, and speaker confidence in formal academic settings.

Despite its importance, empirical studies have consistently shown that EFL learners face difficulties in performing academic speaking tasks effectively (Al-khresheh, 2024; Pitura, 2022). In the Indonesian context, students often struggle to balance fluency and accuracy, resulting in oral production that reflects informal language use, limited lexical resources, and weak discourse organization, particularly in academic presentations (Pinilih & Sukarno, 2024; Rizqiyanti, 2023; Muslimawati, 2022). In addition, affective factors, especially speaking anxiety and fear of negative evaluation, have been found to hinder students' confidence and participation in academic speaking situations (Hijra et al., 2024).

These findings suggest that challenges in academic speaking are not only linguistic but also cognitive and affective in nature. These persistent difficulties are closely related to instructional practices that remain predominantly teacher-centered. Speaking instruction in many EFL classrooms has emphasized rule-based learning and controlled exercises rather than meaningful interaction and problem-solving. As a result, students have limited opportunities to develop higher-order thinking skills and to use language for authentic academic communication (Singh & Marappan, 2020). This condition contributes to a gap between expected graduate competencies and actual student performance in academic speaking contexts (Karmaker & Al Hasan, 2025).

Problem-Based Learning (PBL) has been proposed as a student-centered approach that may address these limitations by engaging learners in collaborative problem-solving and authentic communication. Theoretically, PBL facilitates the development of discourse competence by requiring learners to organize ideas, negotiate meaning, and present arguments in structured ways, while also reducing affective barriers through collaborative and contextualized learning environments (Singh & Marappan, 2020; Šliogerienė et al., 2025). Empirical studies have reported that PBL enhances speaking performance, critical thinking, and learner autonomy (Lestari et al., 2025; Saripi & Asari, 2024; Song et al., 2024). In Indonesian EFL contexts, PBL has also been found to contribute to vocabulary development and discourse competence (Muzri S et al., 2024).

However, the existing literature remains limited in several important respects. First, most previous studies have focused on general speaking ability rather than formal academic speaking, which involves more complex discourse organization and rhetorical demands (Lin et al., 2024; Liu et al., 2025). Second, prior studies have predominantly employed descriptive approaches, with limited comparative or experimental designs capable of providing stronger causal evidence. Third, insufficient attention has been given to key indicators of academic speaking performance, particularly coherence and confidence, despite their central role in effective academic communication. These gaps indicate the need for a more focused and theoretically grounded investigation.

The present study addresses these gaps by examining the effectiveness of Problem-Based Learning (PBL) in improving academic speaking skills, particularly coherence and confidence,

among EFL university students. Conducted in the context of Universitas Nias, where preliminary observations revealed students' difficulties in organizing ideas coherently and maintaining a formal academic register, this study seeks to provide empirical evidence regarding the effectiveness of PBL in enhancing academic speaking performance. By explicitly linking theoretical perspectives with measurable speaking outcomes, this research contributes to ongoing discussions on effective pedagogical strategies for developing academic speaking competence in EFL higher education contexts.

RESEARCH METHOD

Research Design

This study employed a quantitative method using a quasi-experimental design, specifically the non-equivalent control group design (Krishnan, 2019). The design was selected because random assignment of students into new groups was not feasible in the natural educational setting of Universitas Nias and could potentially disrupt the ongoing instructional process (Creswell et al., 2007). Therefore, intact classes were maintained to preserve the authenticity of classroom instruction while enabling a systematic comparison between different teaching methods.

The study involved two groups consisting of an experimental group and a control group. The experimental group received instruction through Problem-Based Learning (PBL), whereas the control group was taught using a conventional teacher-centered method. Both groups were administered a pre-test before the intervention to measure their initial level of academic speaking proficiency and a post-test after the treatment to evaluate students' improvement in speaking performance. The research design followed the structure presented in Table 1.

Table 1
Research design of the non-equivalent control group

Group	Pre-test	Treatment	Post-test
Experimental	O ₁	X	O ₂
Control	O ₃	-	O ₄

Where O₁ and O₃ refer to the pre-test scores of the experimental and control groups, X represents the Problem-Based Learning (PBL) treatment, (-) indicates the absence of experimental treatment through the use of a conventional teacher-centered method, and O₂ and O₄ represent the post-test scores of both groups.

Population and Sample

This study was conducted at Universitas Nias, located in Gunungsitoli, North Sumatra, Indonesia, over one academic semester. The research received official approval from the Research and Community Service Institute of Universitas Nias (LPPM UNIAS) under approval number 047/UN06/PN.01.02/2025. The participants consisted of two intact classes of fourth-semester students from the English Education Study Program, comprising a total of 60 students (Class A = 30; Class B = 30). The participants were between 19 and 22 years old and consisted of 38 female students and 22 male students. All participants had completed prerequisite speaking courses; however, they continued to experience difficulties in formal academic speaking contexts.

A purposive sampling technique was employed using clearly defined inclusion criteria to minimize subjectivity in participant selection. The participants were selected based on three criteria: (1) completion of foundational speaking courses, (2) intermediate English proficiency level as indicated by institutional placement records and pre-test results administered at the beginning of the study, and (3) active enrollment in the fourth semester of the English

Education Study Program. Lecturers' recommendations were used only to confirm students' readiness to participate rather than as the primary basis for selection.

Prior to the implementation of the instructional treatment, a pre-test was administered to both classes to assess students' initial academic speaking performance. The pre-test scores served as baseline information for describing students' speaking proficiency before the intervention and for comparing changes in performance following the implementation of the instructional treatment.

Although the use of intact classes helped maintain the natural classroom setting, this approach may have limited randomization and introduced potential selection bias. Furthermore, because the sample was drawn from a single institution, the generalizability of the findings may be limited. Therefore, the results of this study should be interpreted within the specific educational context in which the research was conducted.

Instruments

Data were collected using multiple instruments to obtain a comprehensive assessment of students' academic speaking performance and to monitor the implementation of the treatment. The primary instrument was an oral speaking test administered as both the pre-test and post-test. In each test, students were required to deliver a formal presentation lasting approximately 5–7 minutes on contemporary social issues. The speaking prompts were developed using a test specification matrix to ensure comparable levels of difficulty in terms of topic familiarity, discourse organization, and language functions across both testing phases.

Students' speaking performances were assessed using an academic speaking rubric adapted from Brown (2020) and aligned with the descriptors of the IELTS Speaking Test. The rubric consisted of six indicators: (1) fluency, referring to the smoothness and rate of speech; (2) accuracy, referring to grammatical correctness and sentence complexity; (3) pronunciation, referring to clarity and intonation; (4) vocabulary, referring to the range and appropriateness of lexical use; (5) coherence, referring to the logical organization of ideas and the use of transition signals; and (6) confidence, referring to eye contact and presentation delivery. Each indicator was evaluated using a five-point rating scale with clearly defined scoring descriptors.

The validity of the instrument was established through expert judgment involving two English lecturers who evaluated the rubric in terms of relevance, clarity, and representativeness. The evaluation resulted in a Content Validity Index (CVI) above 0.80, indicating acceptable content validity. In addition, construct validity was supported through pilot testing involving students with characteristics similar to those of the research participants. The pilot results confirmed that the rubric appropriately measured the multidimensional aspects of speaking proficiency (Creswell & Creswell, 2018).

To ensure reliability, inter-rater reliability procedures were applied. Two independent raters assessed students' speaking performances using the same rubric. The analysis demonstrated high consistency between raters, with Pearson correlation coefficients of 0.87 for the pre-test and 0.89 for the post-test, as well as strong inter-rater agreement indicated by Cohen's κ value of 0.81 (Creswell & Creswell, 2018).

In addition to the speaking test, an observation checklist was used during the implementation of Problem-Based Learning (PBL) to monitor students' participation and the consistency of the procedures. The checklist consisted of ten indicators assessed using a four-point scale and demonstrated acceptable validity (CVI > 0.80) and reliability (Cronbach's α = 0.85).

The implementation of the treatment was conducted over six sessions during one academic semester, with each session lasting approximately 90 minutes. The experimental group received instruction through the Problem-Based Learning (PBL) method, while the control group was taught using a conventional teacher-centered method. In the experimental

group, PBL was implemented systematically through five stages: problem orientation, collaborative discussion, independent inquiry, solution development, and formal presentation. During the learning process, students worked collaboratively to analyze authentic social issues, gather relevant information, organize arguments, and deliver formal oral presentations emphasizing coherence, logical organization, and the use of formal academic English. The instructor primarily acted as a facilitator by guiding discussions, providing scaffolding when necessary, and ensuring active student engagement throughout the learning process.

In contrast, the control group received a conventional teacher-centered method consisting of teacher explanation, guided practice, and individual speaking exercises conducted over the same number of sessions and duration. This method emphasized content delivery and individual performance without structured collaborative problem-solving activities. To minimize the bias, both groups were taught by the same instructor, used the same learning objectives, and discussed comparable speaking topics. The primary difference between the two groups was the method employed during the learning process.

Data Analysis

The data obtained from the pre-test and post-test speaking assessments were analyzed quantitatively using IBM SPSS Statistics to examine the effectiveness of Problem-Based Learning (PBL) in improving students' academic speaking performance. Descriptive statistics, including mean scores, standard deviations, minimum values, and maximum values, were calculated to provide an overview of students' speaking performance in both the experimental and control groups.

Prior to hypothesis testing, prerequisite analyses were conducted to examine whether the data satisfied the assumptions required for parametric statistical procedures. The Shapiro–Wilk test was employed to assess the normality of score distributions, while Levene's test was used to examine the homogeneity of variances between groups (Field, 2018).

To evaluate the effectiveness of the instructional treatment, paired samples t-tests were conducted to examine within-group improvements from pre-test to post-test, whereas an independent samples t-test was performed to compare the post-test scores between the experimental and control groups. The level of statistical significance was set at 0.05 ($p < .05$). When the assumptions of normality were not met, non-parametric alternatives such as the Mann–Whitney U test were considered (Pallant, 2020).

To complement significance testing, effect sizes were calculated using Cohen's d to determine the magnitude of the treatment effect. The interpretation followed Cohen's (1988) guidelines, where values of 0.20, 0.50, and 0.80 indicate small, medium, and large effect sizes, respectively.

Furthermore, gain scores were calculated by subtracting the pre-test scores from the post-test scores for each speaking indicator (fluency, accuracy, pronunciation, vocabulary, coherence, and confidence). The gain score analysis was used descriptively to identify which dimensions of academic speaking demonstrated the greatest improvement following the implementation of Problem-Based Learning.

In addition, data obtained from the observation checklist were analyzed descriptively to monitor students' participation and the consistency of the instructional procedures throughout the treatment sessions. The results were used to support the implementation process rather than as the primary evidence of instructional effectiveness. The findings of all statistical analyses were presented in tables and interpreted systematically to provide comprehensive evidence regarding the effectiveness of Problem-Based Learning in improving students' academic speaking performance.

RESEARCH FINDINGS AND DISCUSSION

Research Findings

The findings of this study were obtained from a comparison of the pre-test and post-test scores of students in the experimental group, which received instruction through Problem-Based Learning (PBL), and the control group, which was taught using a conventional teacher-centered approach.

The descriptive statistics of the pre-test scores are presented in Table 2. Prior to the implementation of the instructional treatment, the experimental group obtained a mean score of 58.45 (SD = 7.34), whereas the control group achieved a mean score of 49.12 (SD = 6.88). These results provide an overview of the students' initial academic speaking performance before the intervention. The descriptive statistics indicate that the experimental group obtained a higher mean score than the control group prior to the intervention.

Table 2
Descriptive statistics of pre-test scores

Group	N	Mean	Minimum	Maximum	Standard Deviation
Experimental Group	30	58.45	45	72	7.34
Control Group	30	49.12	48	70	6.88

Following six instructional sessions, both groups demonstrated improvement in academic speaking performance. However, the improvement observed in the experimental group was considerably greater than that of the control group. As presented in Table 3, the experimental group obtained a mean post-test score of 78.60 (SD = 5.22), while the control group achieved a mean score of 65.40 (SD = 6.15), resulting in a mean difference of 13.20 points. Moreover, the lower standard deviation in the experimental group indicates more consistent speaking performance following the implementation of Problem-Based Learning. These findings provide preliminary evidence that PBL contributed positively to the enhancement of students' academic speaking skills.

Table 3
Descriptive statistics of post-test scores

Group	N	Mean	Minimum	Maximum	Standard Deviation
Experimental Group	30	78.60	68	88	5.22
Control Group	30	65.40	55	75	6.15

Before conducting inferential statistical analyses, prerequisite assumption tests were performed to examine the normality of the data distribution and the homogeneity of variances between groups. The Shapiro–Wilk test indicated that all datasets were normally distributed ($p > .05$), while Levene's test confirmed that the variances of the two groups were homogeneous ($p > .05$). These results satisfied the assumptions required for parametric statistical analysis. The results are presented in Tables 4 and 5.

Table 4
Tests of normality (Shapiro-Wilk)

Group	Test	Statistic	df	Sig.	Result
Experimental	Pre-test	0.956	30	0.245	Normal
Experimental	Post-test	0.968	30	0.482	Normal
Control	Pre-test	0.948	30	0.154	Normal
Control	Post-test	0.952	30	0.198	Normal

Table 5
Test of homogeneity of variances

Variable	Levene Statistic	df1	df2	Sig.	Result
Post-test Scores	1.124	1	58	0.293	Homogeneous

To determine the effectiveness of the instructional treatment, an independent samples t-test was conducted to compare the post-test scores of the experimental and control groups. The analysis revealed a statistically significant difference between the two groups, $t(58) = 8.921$, $p < .001$. The experimental group outperformed the control group by a mean difference of 13.20 points, indicating that Problem-Based Learning was more effective than the conventional teacher-centered approach in improving students' academic speaking performance. The summary of the statistical analysis is presented in Table 6.

Table 6
Independent samples t-test (post-test scores)

Variable	t	df	Sig. (2-tailed)	Mean Difference
Post-test Score	8.921	58	0.000	13.20

To complement the hypothesis testing, effect size analysis was conducted using Cohen's d . The analysis indicated a large effect size ($d > 0.80$), suggesting that the implementation of Problem-Based Learning produced not only statistically significant differences but also substantial educational impact on students' academic speaking performance.

A more detailed analysis was conducted to examine students' improvement across individual speaking indicators within the experimental group. Gain scores were calculated by subtracting the pre-test scores from the post-test scores for each indicator. As presented in Table 7, improvement was observed across all dimensions of academic speaking performance. The largest gains were found in coherence (Gain = 5.80) and confidence (Gain = 5.75), followed by fluency (Gain = 5.30). Meanwhile, vocabulary (Gain = 3.90), accuracy (Gain = 4.30), and pronunciation (Gain = 3.10) demonstrated relatively smaller gains. These descriptive findings suggest that Problem-Based Learning may be particularly beneficial in promoting discourse organization and students' confidence during academic speaking activities.

Table 7
Improvement per speaking indicator

Indicator	Pre-Test	Post-Test	Gain Score	Category
Fluency	11.20	16.50	5.30	Significant
Accuracy	10.50	14.80	4.30	Moderate
Pronunciation	12.10	15.20	3.10	Moderate
Vocabulary	11.80	15.70	3.90	Moderate
Coherence	10.40	16.20	5.80	Highly Significant
Confidence	12.45	18.20	5.75	Highly Significant

The findings demonstrate that Problem-Based Learning significantly improves students' academic speaking skills. The most substantial improvements observed in coherence and confidence indicate that PBL contributes not only to linguistic performance but also to the development of discourse competence and students' confidence in academic speaking situations. These findings suggest that the collaborative and problem-oriented characteristics of PBL facilitate deeper cognitive engagement and more meaningful communication practices, which are essential for effective academic speaking in higher education contexts.

Discussion

The findings of this study demonstrate that Problem-Based Learning (PBL) was effective in improving students' academic speaking skills in the EFL context. This result supports the theoretical foundation of PBL, which emphasizes authentic problem-solving, collaborative learning, and meaningful communication as central components of the learning process rather than passive knowledge acquisition (Hung, 2013). In the context of Universitas Nias, where students experienced difficulties in applying linguistic knowledge in formal communication settings, the implementation of PBL appears to have reduced the gap between theoretical knowledge and actual speaking performance. Through collaborative inquiry and presentation activities, students were encouraged to use English as a functional medium for discussion, negotiation, and academic presentation, thereby strengthening their communicative competence at the discourse level.

A more detailed analysis revealed that coherence and confidence demonstrated the most substantial improvement among all speaking indicators. From a cognitive and discourse-based perspective, this finding suggests that PBL facilitated students' ability to organize ideas systematically and present arguments in a logical sequence. The structured stages of PBL, including problem identification, information analysis, and solution presentation, may have contributed to the development of coherent discourse organization (Gomoll et al., 2022). The significant improvement in coherence indicates that students became more capable of connecting ideas logically and delivering structured academic presentations. At the same time, the improvement in confidence may be associated with the collaborative and supportive learning environment created through PBL activities. Collaborative interaction has been shown to reduce speaking anxiety and increase learners' willingness to communicate in a second language (Ayiz & Tauchid, 2025). Therefore, the findings suggest that PBL supports both cognitive organization and affective readiness, which are essential elements of effective academic speaking performance.

However, the findings also demonstrated variation in the degree of improvement across speaking components. While coherence and confidence improved significantly, gains in fluency, accuracy, pronunciation, and vocabulary were comparatively moderate. This pattern indicates that PBL may be more effective in promoting discourse-level competence and affective development than in improving micro-linguistic aspects of language performance (MacWhinney et al., 2024). This result is consistent with communicative and task-based language learning theories, which prioritize meaning-focused interaction and authentic communication over explicit attention to grammatical form (Xiang, 2025). As a consequence, improvements in grammatical accuracy and pronunciation may remain limited when language form is not explicitly emphasized during instruction. These findings suggest that combining PBL with form-focused instructional strategies may provide a more balanced method for developing both communicative fluency and linguistic accuracy (Datu, 2025).

The present findings are generally consistent with previous studies examining the effectiveness of PBL in EFL learning contexts. Chen et al. (2024) reported that collaborative problem-solving activities reduce affective barriers and improve oral communication performance among language learners. Similarly, Azzahra et al. (2025) found that PBL significantly enhances academic speaking skills, particularly in relation to discourse competence among Indonesian EFL students. Nevertheless, the present study extends previous research by demonstrating that coherence emerged as the most prominently improved speaking indicator. This finding provides more specific evidence that PBL contributes substantially to higher-order discourse organization rather than merely improving general speaking performance (Amonge, 2026; Tamene et al., 2026; Waruwu, 2024). Therefore, this study contributes to the growing body of literature by emphasizing the role of PBL in supporting discourse-oriented speaking competence in formal academic contexts.

Additional support for these findings can be identified in broader empirical research on Problem-Based Learning. Dolmans & Schmidt (2010) argued that PBL environments enhance learners' ability to organize and apply knowledge in authentic situations, which may explain the substantial improvement in coherence observed in this study. Furthermore, Rahimi & Fathi (2024) demonstrated that collaborative learning environments positively influence learners' confidence and willingness to communicate in a second language. However, these studies also noted that improvements in grammatical accuracy often remain limited when explicit attention to linguistic form is absent. The consistency between the present findings and previous studies strengthens the argument that PBL is particularly effective in improving discourse competence and affective dimensions of speaking while requiring complementary instructional support to address micro-linguistic development.

Despite these contributions, several limitations should be acknowledged. First, the use of a quasi-experimental design with intact classes limited the degree of randomization and may have introduced uncontrolled variables that affected internal validity. Second, the duration of the intervention, which consisted of six sessions, may not have been sufficient to produce substantial improvements across all aspects of language proficiency. Third, the study was conducted within a single institutional context, namely Universitas Nias, which may limit the generalizability of the findings to other EFL contexts with different sociolinguistic and educational characteristics. Therefore, the findings should be interpreted within the specific context of this study.

Based on these limitations, several recommendations for future research can be proposed. Future studies are encouraged to implement longer intervention periods to investigate the long-term effects of PBL on both macro-level and micro-level speaking competencies. In addition, integrating PBL with explicit form-focused instruction may help promote a more balanced development of communicative fluency and linguistic accuracy. Future research may also employ mixed methods to provide deeper insights into students' learning experiences and interaction processes during PBL implementation. Expanding the research across different educational settings and proficiency levels would further strengthen the external validity of the findings.

From a pedagogical perspective, the findings indicate that Problem-Based Learning offers considerable potential for improving academic speaking instruction in higher education contexts. Its emphasis on authentic problems, collaborative interaction, and structured presentation activities aligns closely with the communicative demands of academic and professional environments. For institutions such as Universitas Nias, integrating PBL into speaking instruction may contribute to the development of students' discourse competence, critical thinking skills, and confidence in formal communication. This study highlights the importance of methods that integrate cognitive, social, and communicative dimensions in EFL learning.

CONCLUSION

This study demonstrates that Problem-Based Learning (PBL) is effective in improving students' academic speaking skills in EFL contexts. The findings indicate that PBL not only enhances linguistic performance but also strengthens coherence as a key component of discourse competence and increases students' confidence in academic speaking. These results suggest that PBL contributes to both cognitive and affective dimensions of speaking development.

From a theoretical perspective, this study reinforces the alignment between PBL principles and communicative language teaching, particularly in emphasizing meaning-making, structured reasoning, and authentic interaction as foundations for developing academic speaking proficiency. It also contributes to ongoing discussions in language pedagogy by

highlighting the interdependence between cognitive organization (coherence) and affective readiness (confidence) in shaping effective oral communication.

Practically, the results suggest that EFL curriculum design should incorporate problem-based tasks that require students to construct, organize, and present ideas in coherent and contextually appropriate ways. Instructional practices should move beyond a sole focus on grammatical accuracy toward a balanced approach that integrates discourse development, critical thinking, and confidence-building strategies.

Several limitations should be acknowledged. The study was conducted within a single institutional context and involved a relatively short intervention period, which may limit the generalizability of the findings. Therefore, future research is encouraged to investigate the long-term effects of PBL across diverse educational settings, proficiency levels, and instructional contexts. Further studies may also explore the integration of PBL with form-focused instruction to support balanced development between communicative fluency and linguistic accuracy.

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INFORMED CONSENT STATEMENT

Participation in this study was voluntary. Prior to participation, all participants were provided with clear information regarding the study's objectives, procedures, potential risks, and anticipated benefits. Participants were assured of the confidentiality of their personal information and informed that all data collected would be used solely for research purposes. They were also informed of their right to withdraw from the study at any time without penalty. Informed consent was obtained from all participants prior to data collection.

DATA AVAILABILITY STATEMENT

The data generated and analyzed in this study are not publicly available because they contain information that could compromise participant privacy and confidentiality. Restricting public access ensures compliance with ethical research principles and applicable data protection regulations. Nevertheless, the dataset may be made available to qualified researchers upon reasonable request for verification or further analysis. Any such request will be reviewed on a case-by-case basis and will require prior approval from the appropriate institutional ethics authority.

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