Enhancing Primary ESL Writing Through Artificial Intelligence: The Use of Quillbot as an AI-Assisted Writing Tool

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ABSTRACT

Primary school learners of English as a Second Language (ESL) often face challenges in developing writing proficiency due to limited linguistic resources and insufficient opportunities for feedback. Although artificial intelligence (AI)-assisted writing tools have gained attention for their potential to support language learning, empirical research on their use among young ESL learners remains limited. This study investigates the effectiveness of enhancing primary ESL writing through artificial intelligence, specifically through the integration of QuillBot as an AI-assisted writing tool, in a Malaysian primary classroom. Using a mixed-methods design, the study involved 30 Year 5 pupils who participated in a six-week AI-supported writing intervention. Quantitative data were collected through CEFR-aligned pre- and post-writing assessments measuring grammar accuracy, vocabulary use, and writing fluency, alongside a structured questionnaire examining pupils' perceptions. Qualitative data were obtained from semi-structured interviews with experienced ESL educators to gain instructional insights and professional perspectives on AI integration. Findings indicate meaningful improvements across all assessed writing components, demonstrating the positive impact of AI-assisted support on pupils' writing performance. Pupils also reported increased confidence and motivation towards writing. Educators highlighted QuillBot's value in providing timely formative feedback and promoting learner autonomy.

Keywords: Artificial Intelligence in education, ESL writing, primary learners, AI-assisted writing, QuillBot

INTRODUCTION

Writing proficiency is widely regarded as one of the most demanding skills for learners of English as a Second Language (ESL), particularly at the primary school level, where learners' linguistic, cognitive, and self-regulatory capacities are still developing. Unlike receptive skills, writing requires learners to generate ideas, apply grammatical knowledge accurately, select appropriate vocabulary, organise content coherently, and engage in recursive processes of drafting and revision. These processes place considerable cognitive demands on young learners, who often struggle to balance form and meaning simultaneously, resulting in written output that lacks accuracy, fluency, and clarity.

In the Malaysian primary education context, English is taught as a second language and remains a compulsory subject throughout schooling. Recent curriculum reforms aligned with the Common European Framework of Reference for Languages (CEFR) have aimed to strengthen communicative competence and standardise learning outcomes. Nevertheless, empirical studies continue to report persistent difficulties among primary ESL pupils in producing grammatically accurate sentences, using appropriate vocabulary, and constructing coherent written texts. Such findings suggest that curriculum alignment alone is insufficient to address the developmental and instructional challenges inherent in second language writing at the primary level.

Classroom conditions further constrain effective writing instruction. Large class sizes, limited instructional time, and assessment-driven practices often restrict teachers' ability to provide sustained, individualised feedback or to implement process-based writing approaches that emphasise drafting, revising, and reflection. Consequently, writing instruction in many primary ESL classrooms prioritises final products over the writing process, limiting pupils' opportunities to engage meaningfully with feedback and to develop independent revision strategies.

Research has shown that when feedback is delayed or minimal, pupils tend to make surface-level revisions, which undermines long-term development in writing proficiency.

In response to these instructional constraints, technology-enhanced language learning has been increasingly explored as a means of supporting writing development. Digital tools offer learners opportunities for immediate feedback, extended practice, and greater autonomy beyond classroom limitations. More recently, artificial intelligence (AI)-assisted writing tools have gained attention for their capacity to analyse learner texts and provide real-time feedback on grammar, vocabulary, and sentence structure through natural language processing. Such tools are believed to support process-based writing by enabling iterative revision and offering timely feedback that teachers may be unable to provide consistently in large classroom settings.

Among these tools, QuillBot has emerged as a widely used AI-assisted writing platform that offers features such as grammar checking, paraphrasing, and vocabulary enhancement. By allowing learners to compare their original writing with AI-generated revisions, QuillBot has the potential to raise awareness of language use and support metalinguistic reflection during the revision process. Existing empirical studies, largely conducted in secondary and tertiary education contexts, have reported positive effects of AI-assisted writing tools on grammatical accuracy, lexical diversity, writing fluency, and learner confidence. However, research examining the use of such tools among primary ESL learners remains limited, despite the distinct cognitive, linguistic, and technological characteristics of younger learners.

This lack of primary-level evidence represents a significant research gap. Younger learners differ from older students in their metacognitive awareness, self-regulation skills, and ability to critically evaluate feedback, raising important questions about how AI-generated feedback is interpreted and utilised in primary ESL classrooms. Moreover, teachers play a central role in mediating the use of AI technologies in school contexts, yet their perspectives on the instructional benefits and challenges of AI-assisted writing tools remain underexplored in existing research.

Accordingly, to address these gaps and to examine the pedagogical potential of AI-assisted writing tools in primary ESL contexts, this study investigates the integration of QuillBot in a Malaysian primary school setting. The study adopts a mixed-methods approach to examine both learning outcomes and stakeholder perspectives. Thus, this study addresses the following research questions:

1. How does the use of QuillBot affect Year 5 pupils' writing proficiency in terms of grammar accuracy, vocabulary usage, and writing fluency?
2. What are pupils' perceptions of using QuillBot as an AI-assisted writing tool during the writing and revision processes in the ESL classroom?
3. What are ESL teachers' perceptions of the instructional benefits and challenges associated with the use of QuillBot in supporting writing development among primary ESL pupils?

LITERATURE REVIEW

ESL Writing Proficiency in ESL Contexts

Writing proficiency in English as a Second Language (ESL) is widely recognised as one of the most cognitively demanding language skills, as it requires learners to integrate linguistic knowledge, cognitive processing, and metacognitive control simultaneously (Hyland, 2019; Graham & Harris, 2022). Effective writing involves planning ideas, translating thoughts into linguistic forms, monitoring output, and revising drafts, all of which place substantial demands on working memory and attentional resources, particularly for learners with developing language systems (Graham, 2019; Myhill & Jones, 2020). For ESL learners, these cognitive demands are further intensified by limited exposure to the target language and incomplete grammatical and lexical knowledge.

At the primary level, writing development is closely associated with learners' developmental readiness. Young ESL learners are still acquiring foundational grammatical structures, vocabulary, and sentence patterns while

gradually developing higher-order writing processes such as organisation, coherence, and revision (Graham, 2018; Graham & Harris, 2022). Recent studies indicate that primary ESL pupils often struggle to produce grammatically accurate sentences, employ varied vocabulary, and maintain logical flow in writing, resulting in texts that are fragmented and linguistically constrained (Rahman & Liew, 2022; Yunus & Halim, 2021). Without consistent scaffolding and timely feedback, pupils are unlikely to internalise writing conventions or develop independent writing strategies essential for sustained writing development (Graham & Perin, 2019).

In the Malaysian context, English is taught as a second language and remains a core subject in primary education. The alignment of the English curriculum with the Common European Framework of Reference for Languages (CEFR) was introduced to strengthen communicative competence and establish internationally benchmarked proficiency standards (Ministry of Education Malaysia, 2015; Council of Europe, 2020). Nevertheless, recent empirical studies continue to report that many Malaysian primary ESL pupils do not meet expected writing outcomes, particularly in grammar accuracy, vocabulary range, and writing fluency (Krishnan & Zaini, 2025; Zulkefli & Ismail, 2025). These findings suggest that curriculum reform alone is insufficient to address the instructional and cognitive complexities of ESL writing development.

Writing Challenges in Primary ESL Classrooms

Research consistently identifies a range of linguistic and instructional challenges that hinder writing development among primary ESL learners. Linguistically, pupils frequently demonstrate difficulties with tense usage, subject–verb agreement, prepositions, and sentence structure, which negatively affect clarity and accuracy in writing (Khalid & Lim, 2020; Noor & Faizal, 2022). Limited vocabulary knowledge further constrains pupils' ability to express ideas precisely, often resulting in repetitive word use and oversimplified sentence constructions (Subramaniam & Ibrahim, 2022). Recent Malaysian studies highlight that insufficient lexical resources significantly limit pupils' writing fluency and expressive capacity (Rahman & Liew, 2022).

Instructional practices also play a critical role in shaping pupils' writing outcomes. In many primary ESL classrooms, writing instruction remains predominantly teacher-centred and examination-oriented, with an emphasis on memorisation of model texts rather than process-based writing approaches (Tan & Ibrahim, 2021; Noor & Faizal, 2022). Such practices restrict opportunities for drafting, revising, and reflecting on writing, which are essential for developing writing proficiency (Graham & Harris, 2022). Studies indicate that pupils rarely engage in meaningful revision unless explicit guidance and structured support are provided, often resulting in surface-level corrections rather than substantive improvements (Yunus & Halim, 2021).

Structural constraints further exacerbate these challenges. Large class sizes and limited instructional time reduce teachers' capacity to provide timely, individualised feedback on pupils' writing (Azman & Hashim, 2020; Zakaria & Sulaiman, 2024). As feedback is a key driver of learning in writing, the absence of continuous formative feedback leaves pupils unaware of recurring errors and ineffective writing strategies (Hattie & Timperley, 2019; Rahim & Wahi, 2023). In addition, writing anxiety is commonly reported among primary ESL pupils, with fear of making mistakes reducing motivation and willingness to engage in writing tasks (Ramli & Tew, 2024).

Artificial Intelligence–Assisted Writing Tools in ESL Education

Recent advances in artificial intelligence (AI) have led to the development of AI-assisted writing tools that utilise natural language processing and machine learning to analyse learner writing and provide real-time feedback (Zhang & Hyland, 2022; Ranalli et al., 2021). Unlike traditional grammar checkers, these tools offer context-sensitive feedback on grammar, vocabulary, and sentence structure, supporting deeper linguistic awareness and revision practices.

Empirical research conducted primarily in secondary and tertiary ESL contexts indicates that AI-assisted writing tools contribute to improvements in grammatical accuracy, lexical diversity, and writing fluency (Li et al., 2021; Tan & Sulaiman, 2023). Immediate feedback enhances learners' noticing of language errors, which is a key mechanism in second language development (Lightbown & Spada, 2021). Furthermore, AI-assisted tools

support self-regulated learning by enabling learners to plan, monitor, and evaluate their writing independently (Zimmerman, 2019; Panadero, 2020).

However, scholars caution that AI-generated feedback may not always be pedagogically accurate or developmentally appropriate, particularly for younger learners (Wilson & Czik, 2016; Palpanadan, 2025). Pupils may accept AI suggestions uncritically, increasing the risk of overreliance and limiting the development of metacognitive awareness. These concerns highlight the importance of teacher mediation and structured instructional frameworks when integrating AI-assisted writing tools in ESL classrooms.

QuillBot as a Tool for Writing Development

QuillBot is an AI-assisted writing tool that provides grammar checking, paraphrasing, vocabulary suggestions, and sentence restructuring features. Its paraphrasing function allows learners to generate multiple alternative versions of a sentence, enabling comparison of syntactic structures and lexical choices (Foo & Teh, 2022). Such comparison supports learners' awareness of form meaning relationships and encourages revision-based learning (Zhang & Hyland, 2022).

AI-assisted writing tools, such as QuillBot, can support self-regulated learning by providing immediate and individualised feedback, which enables learners to monitor their writing performance in real time. Through features such as grammar checking and paraphrasing, pupils are able to compare their original drafts with revised versions, evaluate language choices, and make informed revisions. This aligns with Zimmerman's cyclical model of self-regulation, which includes forethought (planning), performance (monitoring), and self-reflection (evaluation).

Empirical studies conducted in higher education contexts report that QuillBot improves writing clarity, grammatical accuracy, and lexical variety, particularly among ESL learners who struggle with sentence construction (Tan & Sulaiman, 2023; Sudin & Swanto, 2024). The tool has also been found to reduce writing anxiety by providing private, non-judgmental feedback, thereby encouraging experimentation and iterative revision (Ramli & Tew, 2024).

Nevertheless, research examining QuillBot's use among primary school learners remains scarce. Younger learners differ from older students in cognitive development, linguistic awareness, and digital literacy, limiting the direct applicability of findings from tertiary contexts (Jong et al., 2024). Additionally, concerns regarding dependency on automated feedback emphasise the need for empirical studies that examine QuillBot's effectiveness within guided, pedagogically informed instructional frameworks at the primary level.

Research Gap

Although existing literature demonstrates that AI-assisted writing tools can enhance writing accuracy, fluency, and learner autonomy, most empirical studies have focused on secondary and tertiary ESL learners. There remains a significant lack of research examining the integration of AI-assisted writing tools, particularly QuillBot, in primary ESL classrooms. Furthermore, limited attention has been given to pupils' perceptions and teachers' instructional perspectives in primary contexts. Addressing this gap is essential to understanding how AI-assisted writing tools can be implemented effectively, responsibly, and developmentally appropriately with younger learners. The present study addresses this gap by empirically investigating the impact of QuillBot on writing proficiency and learner experiences in a Malaysian primary ESL classroom.

METHODOLOGY

Research Design

This study adopted a mixed-methods research design to investigate the effectiveness of QuillBot as an AI-assisted writing tool in a Malaysian primary ESL classroom. The quantitative component comprised two instruments: pre-test and post-test writing assessments to measure changes in pupils' writing proficiency in terms of grammar accuracy, vocabulary usage, writing fluency, and a structured questionnaire designed to examine

pupils' perceptions and experiences of using AI-assisted writing tools. The qualitative component involved semi-structured interviews with ESL educators to gain in-depth insights into instructional perspectives and classroom implementation of AI-assisted writing. The integration of quantitative and qualitative data enabled triangulation and provided a comprehensive evaluation of QuillBot's pedagogical effectiveness in a primary ESL context.

Participants and Sampling

The participants consisted of 30 Year 5 ESL pupils aged 11 from an existing Year 5 class in a public primary school in Kedah, Malaysia, where English is taught as a second language. Intact group sampling was employed as the study was conducted within a natural classroom setting, allowing the intervention to be implemented without disrupting regular teaching arrangements. This approach enhanced the ecological validity of the study by reflecting authentic classroom conditions typical of Malaysian primary schools.

The selected pupils represented mixed levels of English proficiency, which was considered appropriate for examining the effectiveness of an AI-assisted writing tool across varying ability levels. Year 5 pupils were also deemed developmentally suitable, as they possess sufficient foundational language knowledge to engage meaningfully in paragraph writing while still requiring instructional support in grammar, vocabulary, and writing confidence. Inclusion criteria required parental consent, regular school attendance, and completion of both the pre-test and post-test assessments.

Six experienced ESL educators and scholars were selected through purposive sampling. The inclusion criteria required participants to have a minimum of five years of experience in ESL teaching or research and prior familiarity with digital or AI-assisted writing tools. These participants were considered key informants who could provide informed insights into the pedagogical value, challenges, and feasibility of integrating QuillBot into primary ESL classrooms.

Research Instruments and Data Collection Methods

To address the research objectives, this study employed research instruments, comprising two quantitative instrument and qualitative instrument. The use of multiple instruments enabled data triangulation, thereby strengthening the validity and reliability of the findings by capturing both measurable learning outcomes and in-depth experiential insights (Creswell, 2019; Tashakkori & Teddlie, 2021).

CEFR-Aligned Writing Pre-Test and Post-Test

The first quantitative instrument was a CEFR A2-aligned writing pre-test and post-test designed to measure pupils' writing proficiency before and after the QuillBot intervention. Pupils were required to write an 80–100-word paragraph based on familiar, age-appropriate topics to minimise cognitive load and elicit authentic writing performance. Writing scripts were assessed using an analytic scoring rubric covering grammar accuracy, vocabulary usage, and writing fluency. Content validity was ensured through alignment with CEFR A2 descriptors and the Malaysian primary English curriculum, while reliability was strengthened by applying the same rubric and scoring procedures for both tests to ensure consistency and comparability (Brookhart, 2018; Fraenkel et al., 2019).

Structured Questionnaire

The second quantitative instrument was a structured questionnaire designed to examine pupils' perceptions and experiences of using QuillBot as an AI-assisted writing tool in the ESL classroom. The questionnaire focused on pupils' motivation, confidence, enjoyment, reduced writing anxiety, and self-regulated learning behaviours, such as revising independently and understanding writing mistakes. Responses were recorded using a five-point Likert scale ranging from *strongly disagree* to *strongly agree*.

The questionnaire items were adapted from existing technology-enhanced language learning instruments, as stated previously, and modified to suit the linguistic and cognitive level of primary school pupils (Joshi et al., 2019; Teo, 2021). The instrument was piloted prior to administration to ensure clarity and age appropriateness.

In addition to the Likert-scale items, the questionnaire included open-ended reflection questions that invited pupils to describe their experiences, challenges, and perceived benefits of using QuillBot in their own words

Semi-Structured Interviews

Semi-structured interviews were conducted with the selected ESL educators and scholars to obtain in-depth qualitative insights into their experiences and perceptions of AI-assisted writing tools. The interview protocol focused on pedagogical benefits, instructional challenges, learner engagement, and concerns related to overreliance on AI feedback. The semi-structured format allowed flexibility for probing while maintaining consistency across interviews (Kvale & Brinkmann, 2019).

Procedures

Data collection was conducted over a six-week intervention period. Prior to the intervention, pupils completed the writing pre-test under standard classroom conditions to establish baseline writing proficiency. During the intervention, QuillBot was integrated into regular ESL writing lessons as a supportive tool for drafting and revising written work. Pupils were guided on how to use QuillBot responsibly, with emphasis placed on evaluating AI-generated suggestions rather than accepting them uncritically.

At the end of the intervention period, pupils completed the writing post-test using the same assessment criteria as the pre-test. The questionnaire was subsequently administered to document pupils' perceptions and learning experiences. Semi-structured interviews with educators and scholars were conducted after the intervention to gather reflective insights on the instructional use of QuillBot.

Data Analysis

All data were analysed using the Statistical Package for the Social Sciences (SPSS) and a systematic thematic approach. Writing pre-test and post-test scores were first examined using descriptive statistics, including means and standard deviations, to summarise pupils' performance in grammar accuracy, vocabulary usage, and writing fluency and to provide an overview of baseline and post-intervention outcomes. To determine whether observed score differences were statistically significant, paired-samples t-tests were conducted, as this test is suitable for comparing related measurements from the same participants across two time points (Fraenkel, Wallen, & Hyun, 2019). Statistical significance was evaluated at the conventional alpha level of $p < .05$.

Responses from the Likert-scale questionnaire were analysed using descriptive statistics to identify trends in pupils' perceptions of QuillBot's usefulness, ease of use, and perceived impact on writing development, allowing learners' attitudes to be quantified systematically (Joshi et al., 2019; Teo, 2021). In addition, educators' semi-structured interview data were analysed thematically following an inductive process of familiarisation, coding, categorisation, and theme development (Braun & Clarke, 2021). Constant comparison across data sources was employed to refine themes and ensure alignment with the research objectives (Guest, Namey, & Saldaña, 2020). Trustworthiness was enhanced through careful documentation of the analytic process, the use of representative excerpts, and triangulation of pupil and teacher perspectives, thereby strengthening the credibility of the findings (Poth, 2018).

Reliability and Validity

Several measures were implemented to ensure the reliability and validity of the study. Content validity was strengthened through the use of CEFR-aligned writing assessments and established questionnaire items adapted from prior research. The writing scripts were assessed using a consistent analytic rubric to enhance scoring reliability. Piloting of the questionnaire contributed to improved internal consistency and clarity of items.

Triangulation of data sources writing assessments, questionnaires, and interviews enhanced the credibility and trustworthiness of the findings (Creswell & Plano Clark, 2019). The use of established analytical procedures and transparent reporting further supported the methodological rigour of the study.

FINDINGS

This section presents the findings of the study based on quantitative and qualitative data analyses conducted to examine the impact of QuillBot on pupils' ESL writing proficiency and to explore pupils' and teachers' perceptions of its use in the writing classroom. The findings are organised according to the research questions and reported without interpretation beyond the data.

Pre-Test and Post-Test Results

To address the first research question, pupils' writing proficiency was measured using CEFR-aligned writing assessments administered before and after a six-week QuillBot-supported intervention. Pupils' writing scripts were evaluated using an analytic rubric assessing grammar accuracy, vocabulary usage, and writing fluency, with each component allocated 10 marks, resulting in a maximum total score of 30 marks.

Descriptive statistics were calculated to summarise pupils' writing performance in the pre-test and post-test. The results are presented in Table 4.1.

Component	Pre-Test Mean	Pre-Test SD	Post-Test Mean	Post-Test SD	Mean Difference
Grammar Accuracy	4.87	1.12	7.21	0.98	2.34
Vocabulary Usage	5.02	1.09	7.56	1.02	2.54
Writing Fluency	4.73	1.15	7.03	1.07	2.30
Total Score	14.62	2.90	21.80	2.74	7.18

Table 4.1 Descriptive Statistics for Writing Pre-Test and Post-Test Scores (n = 30)

The descriptive statistics presented in Table 4.1 indicate a consistent pattern of improvement across all assessed writing components following the six-week QuillBot-supported intervention. In the pre-test, pupils' mean scores for grammar accuracy, vocabulary usage, and writing fluency were below the midpoint of the 10-mark scale, suggesting moderate limitations in linguistic accuracy and written expression prior to the intervention. Following the intervention, mean scores for all components increased substantially, with gains of more than two marks per component. Vocabulary usage recorded the highest mean increase (2.54), followed by grammar accuracy (2.34) and writing fluency (2.30), indicating that pupils benefited particularly from exposure to alternative lexical choices and revised sentence structures during the writing process.

The increase in the total mean writing score from 14.62 to 21.80 reflects a marked overall improvement in pupils' writing proficiency. This gain of 7.18 marks represents nearly half of the total possible score, highlighting the practical significance of the observed improvement. In addition to higher mean scores, the slight reduction in standard deviation values from the pre-test (SD = 2.90) to the post-test (SD = 2.74) suggests that pupils' performance became more consistent after the intervention. This reduction indicates that weaker writers may have benefited alongside higher-performing pupils, contributing to a narrowing of performance variability within the group.

To determine whether the observed improvement in total writing scores was statistically significant, a paired-samples t-test was conducted. The inferential statistics are presented in Table 4.2.

Statistic	Value
Mean Pre-Test	14.62
Mean Post-Test	21.80

Mean Difference	7.18
Standard Deviation of Difference	1.98
t-value	20.04
df	29
p-value	< .001
Effect Size (Cohen's d)	3.66 (Large)

Table 4.2 Paired-Samples t-Test Results for Total Writing Scores (n = 30)

As shown in Table 4.2, the analysis revealed a statistically significant difference between pre-test and post-test scores, $t(29) = 20.04$, $p < .001$. The very small p-value indicates strong evidence against the null hypothesis, confirming that the improvement in writing performance was unlikely to have occurred by chance.

Beyond statistical significance, the effect size provides insight into the magnitude of the intervention's impact. The Cohen's d value of 3.66 represents a large effect. This finding suggests that the QuillBot-supported intervention had a substantial instructional impact on pupils' writing proficiency. The large effect size underscores the educational relevance of the results, demonstrating that the observed gains were not only statistically detectable but also pedagogically meaningful.

Taken together, the descriptive and inferential findings provide strong empirical evidence that the QuillBot supported intervention positively influenced pupils' writing proficiency in terms of grammar accuracy, vocabulary usage, and writing fluency. These results suggest that structured integration of AI-assisted writing tools can offer effective scaffolding for primary ESL pupils, supporting both overall performance gains and more consistent writing outcomes across learners

Questionnaire Findings

A questionnaire was administered to examine pupils' perceptions of using QuillBot during the writing process. Responses were recorded on a five-point Likert scale ranging from *Strongly Disagree (1) to Strongly Agree (5).*

Item	**Description**	**Mean**	**SD**
Q1	QuillBot helped me write clearer and more accurate sentences.	4.43	0.68
Q2	QuillBot helped me learn new vocabulary.	4.50	0.63
Q3	QuillBot made it easier for me to revise my writing.	4.40	0.62
Q4	Using QuillBot increased my confidence in writing.	4.33	0.71
Q5	I feel more motivated to write when using QuillBot.	4.30	0.74
Q6	QuillBot helped me understand my writing mistakes.	4.37	0.69
Q7	QuillBot made writing activities more enjoyable.	4.28	0.77

Table 4.3 presents Descriptive Statistics for Pupils' Questionnaire Responses (n = 30)

Overall, the questionnaire results indicate highly positive pupil perceptions of QuillBot as a writing support tool. All seven items recorded mean scores above 4.20, reflecting strong agreement among pupils regarding the

usefulness of QuillBot in supporting various aspects of the writing process. These consistently high mean values suggest that pupils generally perceived QuillBot as beneficial rather than neutral or challenging to use.

Among the questionnaire items, vocabulary learning (Q2) recorded the highest mean score ($M = 4.50$, $SD = 0.63$), indicating that pupils strongly agreed that QuillBot helped them learn new vocabulary. This finding suggests that exposure to alternative word choices and paraphrasing suggestions may have supported pupils' lexical development and increased their awareness of vocabulary use in context. Vocabulary support is particularly important for primary ESL learners, who often face limitations in lexical range when expressing ideas in writing.

High mean scores were also observed for sentence clarity and accuracy (Q1) ($M = 4.43$, $SD = 0.68$) and ease of revision (Q3) ($M = 4.40$, $SD = 0.62$). These results indicate that pupils perceived QuillBot as helpful in improving sentence construction and facilitating the revision process. The ability to revise more easily may have reduced the cognitive burden associated with identifying and correcting errors independently, thereby encouraging pupils to engage more actively in revising their writing rather than viewing revision as a difficult or discouraging task.

Items related to confidence (Q4) and motivation (Q5) also recorded high mean scores ($M = 4.33$ and $M = 4.30$, respectively), suggesting that pupils felt more confident and motivated when writing with QuillBot support. This finding implies that the availability of immediate feedback may have reduced pupils' fear of making mistakes, a common issue among ESL learners, and contributed to a more supportive and less anxiety-inducing writing environment.

Furthermore, pupils reported that QuillBot helped them understand their writing mistakes (Q6) ($M = 4.37$, $SD = 0.69$) and made writing activities more enjoyable (Q7) ($M = 4.28$, $SD = 0.77$). These responses suggest that QuillBot may have promoted greater awareness of language use while simultaneously increasing engagement in writing tasks. Enjoyment in writing is a critical affective factor, as positive emotional experiences are closely linked to sustained motivation and willingness to practise writing.

In terms of response consistency, the relatively low standard deviation values across all items indicate that pupils' perceptions were largely consistent, with minimal variation in responses. This suggests that positive perceptions of QuillBot were shared by most pupils rather than limited to a small subgroup, reinforcing the reliability of the findings.

Overall, the questionnaire results demonstrate that pupils perceived QuillBot as a supportive and user-friendly tool that contributed positively to their writing accuracy, vocabulary development, motivation, confidence, and engagement. These findings are consistent with previous studies reporting favourable learner perceptions of AI-assisted writing tools, particularly in relation to language accuracy, learner motivation, and reduced writing anxiety (Tan & Sulaiman, 2023; Sudin & Swanto, 2024).

Teachers' Semi-Structured Interview

Theme	Teachers' Perceptions / Key Insights
Theme 1: QuillBot as a Scaffold for Linguistic Accuracy and Clarity	Teachers perceived QuillBot as an effective instructional scaffold that helped pupils notice and correct grammar errors, improve sentence structure, and make better vocabulary choices. The side-by-side comparison of original and revised sentences supported pupils' understanding of correct language forms. Immediate, individualised feedback reduced teachers' marking load and allowed pupils to improve more efficiently.
Theme 2: Enhanced Learner Autonomy and Reduced Writing Anxiety	Teachers observed increased pupil confidence, motivation, and willingness to write. Pupils became more independent in revising their work, consulted QuillBot before approaching the teacher, and experimented with longer sentences. The non-judgmental and private nature of AI feedback reduced writing anxiety, particularly among lower-proficiency pupils.

Theme 3: Overreliance, AI Literacy Issues, and Contextual Challenges	Teachers expressed concerns about pupils' overreliance on QuillBot, with some accepting suggestions uncritically. Pupils sometimes struggled to understand why changes were made, indicating limited AI literacy. Technical issues (e.g. internet connectivity) and mismatches between AI suggestions and pupils' proficiency levels further constrained effective use. Teachers emphasised the need for continuous guidance and structured scaffolding.

Table 4.4 presents the summary of teachers' semi-structured interview themes

Table 4.4 presents a thematic analyse of ESL teachers' perceptions regarding the implementation of QuillBot in the primary ESL writing classroom. Overall, the themes indicate that teachers perceived QuillBot as an effective instructional scaffold that supported pupils in improving linguistic accuracy, particularly in grammar, sentence structure, and vocabulary use. Teachers emphasised that the immediate and individualised feedback provided by QuillBot enabled pupils to notice errors more efficiently and apply corrections independently, helping to address common classroom constraints such as limited instructional time and large class sizes.

In addition to linguistic benefits, teachers observed positive affective and behavioural changes among pupils. Specifically, pupils demonstrated increased confidence, motivation, and willingness to revise their writing, suggesting enhanced learner autonomy and reduced writing anxiety. However, the thematic findings also highlight teachers' concerns related to overreliance on AI-generated suggestions, limited AI literacy among pupils, and contextual challenges such as technical issues and mismatches between AI feedback and pupils' proficiency levels. Collectively, the themes in Table 4.3 suggest that while QuillBot has strong potential to enhance ESL writing instruction, its effectiveness is contingent upon structured guidance, ongoing teacher mediation, and purposeful integration to ensure pupils engage critically with AI feedback rather than relying on it passively.

DISCUSSION

This section discusses the findings of the study in relation to the research questions, existing literature, and relevant theoretical perspectives. The discussion integrates quantitative and qualitative findings to provide a comprehensive interpretation of the impact of QuillBot on pupils' writing proficiency and learning experiences in a primary ESL context.

RQ1: How does QuillBot affect pupils' writing proficiency in terms of grammar accuracy, vocabulary usage, and writing fluency?

The findings of this study indicate that the integration of QuillBot had a positive and meaningful effect on pupils' writing proficiency across grammar accuracy, vocabulary usage, and writing fluency. Quantitative results from the CEFR-aligned pre-test and post-test assessments demonstrated substantial increases in mean scores for all writing components, alongside reduced score variability. Inferential analysis further confirmed that these improvements were statistically significant ($p < .001$) and associated with a large instructional impact within the study context. Collectively, these results suggest that QuillBot-supported writing instruction contributed not only to overall performance gains but also to more consistent learning outcomes among pupils.

Beyond the numerical gains, the findings suggest that QuillBot functioned as a form of procedural and linguistic scaffolding during the writing process. The marked improvement in grammar accuracy indicates that immediate corrective feedback supported pupils' ability to notice and address recurring grammatical errors during revision. This aligns with prior research demonstrating that AI-assisted writing tools enhance linguistic accuracy by providing timely, individualised feedback that facilitates iterative revision (Tan & Sulaiman, 2023; Wang, 2024). For primary ESL learners, who often lack the metalinguistic awareness to independently diagnose errors, such feedback appears particularly valuable (Rahman & Liew, 2022).

Similarly, the substantial gains in vocabulary usage suggest that exposure to AI-generated paraphrases and alternative lexical choices supported pupils' lexical development. Rather than merely correcting errors, QuillBot

appears to have expanded pupils' awareness of vocabulary options within meaningful contexts, encouraging experimentation with word choice. This finding is consistent with studies reporting that modelling varied lexical forms through AI-assisted feedback can promote vocabulary growth and contextual appropriateness in ESL writing (Zhang & Hyland, 2022).

Improvements in writing fluency further indicate that QuillBot may have reduced the cognitive burden associated with lower-level linguistic concerns, enabling pupils to allocate more attention to idea development and text organisation. Importantly, the reduction in score variability observed in the post-test suggests that the intervention may have contributed to more equitable learning outcomes in a mixed-ability classroom. Rather than amplifying proficiency gaps, the AI-assisted feedback provided consistent support that benefited both higher- and lower-proficiency pupils. This insight highlights QuillBot's potential to complement differentiated instruction in primary ESL classrooms where individual teacher feedback is necessarily limited.

RQ2: What are pupils' perceptions of using QuillBot as an AI-assisted writing tool in the ESL classroom?

Pupils' questionnaire responses revealed consistently positive perceptions of using QuillBot during the writing process. High mean scores across all items indicate that pupils perceived the tool as helpful in improving sentence clarity and accuracy, facilitating revision, enhancing confidence, increasing motivation, and making writing activities more enjoyable. These findings suggest that QuillBot supported not only the cognitive aspects of writing but also important affective dimensions of learning.

A key insight from these findings is that QuillBot appears to have reshaped pupils' emotional engagement with writing. Writing anxiety is a well-documented barrier among ESL learners, particularly at the primary level, where fear of making mistakes often discourages experimentation and revision. The immediate and non-judgmental nature of AI feedback may have lowered the emotional risk associated with writing, enabling pupils to engage more confidently with the revision process. This interpretation aligns with previous studies reporting that AI-assisted writing tools reduce writing anxiety and foster greater learner motivation by providing a private and supportive feedback environment (Sudin & Swanto, 2024; Ramli & Tew, 2024).

Furthermore, pupils' perceptions suggest emerging self-regulated learning behaviours, such as independently revising writing and recognising errors without immediate teacher intervention. This finding supports self-regulated learning theory, which emphasises the role of feedback and learner agency in developing effective writing practices (Panadero, 2020). However, while pupils' perceptions were largely positive, these affective and behavioural gains must be interpreted alongside teachers' observations, which highlight the need for guided use to ensure that autonomy develops alongside understanding rather than dependency.

RQ3: What are ESL educators' perceptions of the instructional benefits and challenges of using QuillBot in primary ESL writing instruction?

Findings from the semi-structured interviews indicate that ESL educators generally perceived QuillBot as a valuable instructional support tool. Teachers reported that the tool facilitated linguistic accuracy, supported sentence-level revision, and reduced marking workload by providing immediate feedback. These insights help explain the quantitative improvements observed in pupils' writing performance, as timely feedback and modelling were identified as key mechanisms supporting pupils' noticing and correction of language errors.

Teachers also observed notable affective and behavioural changes among pupils, including increased confidence, motivation, and willingness to write, particularly among lower-proficiency learners. These observations corroborate pupils' questionnaire responses and reinforce the view that AI-assisted writing tools can create more supportive and engaging learning environments (Bai & Guo, 2023). Importantly, teachers noted that pupils became more willing to attempt longer sentences and revise their work independently, suggesting a shift in how pupils approached writing tasks.

At the same time, educators expressed concerns regarding overreliance on AI-generated feedback, limited AI literacy, and contextual constraints such as technical issues and mismatches between AI suggestions and pupils' proficiency levels. These concerns underscore a critical insight: AI-assisted feedback alone does not guarantee

learning. Without explicit instruction and mediation, pupils may accept AI suggestions mechanically rather than developing an understanding of underlying language principles. This aligns with existing cautions in the literature that uncritical reliance on AI feedback may hinder the development of metacognitive awareness, particularly among younger learners (Zhang & Hyland, 2023; Palpanadan, 2025).

From a theoretical perspective, the findings extend sociocognitive views of learning by illustrating how QuillBot functioned as a mediational artefact that supported pupils within their Zone of Proximal Development (Vygotsky, 1978). By making implicit language features more visible and actionable, the tool supported pupils' progression in grammar accuracy and vocabulary usage. At the same time, the findings provide empirical support for Self-Regulated Learning Theory, demonstrating that guided use of AI-assisted tools can promote learners' ability to monitor, evaluate, and revise their writing (Zimmerman, 2019; Panadero, 2020).

However, the study also nuances these theoretical perspectives by highlighting the necessity of pedagogical mediation. Teachers' concerns regarding overreliance reflect principles from Cognitive Load Theory, which cautions that excessive or unfiltered feedback may overwhelm learners and hinder meaningful processing (Sweller, 2019). Consequently, this study positions AI-assisted writing tools not as autonomous instructors but as instructional scaffolds whose effectiveness depends on purposeful integration and teacher guidance.

Implications of the Study

The findings of this study suggest that AI-assisted writing tools such as QuillBot can meaningfully support writing instruction in primary ESL classrooms when integrated in a pedagogically guided manner. The improvements observed in pupils' grammar accuracy, vocabulary usage, and writing fluency indicate that immediate and individualised AI feedback can enhance process-based writing by supporting drafting and revision activities. This is particularly valuable in primary classrooms where teachers often face constraints related to large class sizes and limited instructional time.

In addition to linguistic gains, the study highlights important affective implications. Pupils' increased confidence, motivation, and enjoyment in writing suggest that QuillBot can help reduce writing anxiety and create a more supportive learning environment for young ESL learners. However, teachers' perspectives indicate that these benefits are most effective when pupils are guided to engage critically with AI feedback. Explicit instruction in AI literacy and continuous teacher mediation is, therefore essential to prevent overreliance and to promote independent writing development.

CONCLUSION

This study examined the effectiveness of QuillBot as an AI-assisted writing tool in supporting the writing development of Year 5 ESL pupils in a Malaysian primary school context. Employing a mixed-methods approach, the findings demonstrated clear and meaningful improvements in pupils' grammar accuracy, vocabulary usage, and writing fluency following a six-week QuillBot-supported intervention. Beyond measurable gains in writing performance, pupils reported increased confidence, motivation, enjoyment, and engagement in writing tasks, while teachers perceived QuillBot as a valuable instructional scaffold that facilitated timely feedback and supported the development of learner autonomy. Collectively, these findings provide empirical support for the pedagogically guided integration of AI-assisted writing tools in primary ESL classrooms, highlighting their potential to enhance both the cognitive and affective dimensions of writing development.

At the same time, the findings point to several important directions for future research. Expanding the scope of investigation to include larger and more diverse samples across multiple primary school contexts would strengthen the generalisability of results and allow for meaningful comparisons across varying socio-economic backgrounds, proficiency levels, and technological conditions. Longitudinal research is also needed to examine whether the observed improvements in writing proficiency are sustained over time and whether pupils are able to transfer these skills to independent writing tasks completed without AI support. Such studies would provide deeper insight into the durability of learning and the long-term instructional value of AI-assisted writing tools.

Furthermore, future research should pay closer attention to the development of AI literacy among primary ESL pupils, particularly in relation to their ability to critically evaluate and apply AI-generated feedback rather than accepting it unreflectively. Understanding how young learners interact cognitively and metacognitively with AI feedback is essential to ensuring that such tools promote meaningful learning rather than dependency. In parallel, research examining teachers' professional development needs in relation to AI integration would contribute to more responsible and effective classroom implementation. Investigating training models, pedagogical guidelines, and ethical frameworks could support teachers in aligning AI-assisted tools with instructional objectives and curriculum expectations.

In conclusion, while this study provides promising evidence for the use of QuillBot in enhancing primary ESL writing, continued empirical inquiry is necessary to refine implementation practices, strengthen theoretical understanding, and ensure sustainable, ethical, and developmentally appropriate use of AI technologies in language education.

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