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Research Article

The Transformative Power of AI Writing Technologies: Enhancing EFL Writing Instruction through the Integrative Use of Writerly and Google Docs

Bantalem Derseh Wale and **Yirgalem Fentie Kassahun**

Department of English Language and Literature, College of Social Sciences and Humanities, Injibara University, Injibara, Ethiopia

Correspondence should be addressed to Bantalem Derseh Wale; bantalemd@gmail.com

AI technologies transform language instruction by offering feedback, support, and guidance to students, ultimately leading to a more effective and efficient learning experience. The present study investigated the impacts of integrating Writerly and Google Docs to enhance EFL writing instruction. It also assessed students' perceptions towards using these AI technologies. The study employed a quasiexperimental pretest-posttest two-group design. It used a mixed-methods approach, utilizing tests, questionnaires, focus group discussions, and teacher diaries to gather data from a sample of 92 randomly selected participants. In the experimental group, students enhanced their writing skills through the integration of Writerly and Google Docs, while the control group students received instruction using the traditional paper and pencil feedback system. When the quantitative data were analyzed through independent samples T-test and descriptive statistics, the qualitative data were analyzed thematically. The results confirmed that the integration of Writerly and Google Docs AI technologies, significantly improved EFL writing instruction, as evidenced by a statistically significant difference in writing performance between the experimental and control groups. Hence, students who learned through the integration of Writerly and Google Docs showed improved writing performance as they were able to produce essays that effectively addressed task achievement, coherence and cohesion, lexical resource, and grammatical range and accuracy, whereas those who learned through the conventional method were less effective in producing quality essays. The findings also revealed that the experimental group students had positive perceptions towards integrating Writerly and Google Docs because they found these AI writing technologies interesting, effective, goal-oriented, and supportive. Consequently, this study recommends researchers, curriculum designers, material designers, teachers, and students pay due attention to Writerly and Google Docs.

1. Introduction

The field of education has been greatly influenced by the rapid development of AI technologies. It is because educational AI writing technologies revolutionize language instruction by offering feedback, support, and guidance to students, ultimately leading to a more effective and efficient learning experience. AI writing technologies score and evaluate learners' written work automatically through computer technologies [1]. They are e-programs that traced their origin to the 1960s in the United States with the evolution of Page Essay Grade (PEG) which works based on a collection of previously rated writing samples [2, 3]. As a result of the advancement of educational AI technology in general, and the enhancement of natural language processing and intelligent language tutoring systems in particular, the design of AI writing technologies has been improving rapidly since the mid of 1990s ([4–8]; and [9]).

These technologies are created to deliver immediate computer-generated scores for a submitted essay, accompanied by diagnostic feedback [3, 4]. Hence, most AI writing technologies offer complementary writing instruction and give diagnostic feedback in terms of organization, mechanics, grammar, diction, and language use [10]. Several AI

writing technologies including IntelliMetric, e-rater, the Intelligent Essay Assessor, Pigai, iTEST, iWrite, Project Essay Grade, My Access!, Criterion, Holt Online Essay Scoring, Writing Roadmap and Write to Learn, Grammarly, Wordtune, Writerly, and Google Docs have been launched to evaluate and enhance written texts [3, 11]. These AI writing technologies often provide instant scores along with corrective feedback in various aspects of writing and can be used for both formative and summative assessment purposes. Hence, they serve as a writing assistant tool beyond assessment for they have editing features that work on grammar, diction, spelling, and style checkers. Accordingly, students use AI writing technologies to write and revise their essays in a self-regulated learning environment [4, 12].

Previous research, such as studies by Ranalli et al. [13], Zhanga and Huang [11], Jingxin and Razali [9], Alharbi [14], and Asratie et al. [15], has demonstrated that the utilization of AI writing technologies has a beneficial impact on students' writing performance. For example, Ranalli et al. [13] reported that using AI writing technologies decreased learners' writing errors. Zhanga and Huang [11] and Jingxin and Razali [9] showed that the use of AI writing technologies improved college EFL learners' writing skills as well as increased their learner autonomy. It provides written corrective feedback in aspects of vocabulary, sentence structure and organization, and content, based on a large corpus of standard English.

Newly developed AI writing technologies such as "Writerly" and "Google Docs" are gaining popularity in writing instruction among various AI writing technologies. This is due to their user-friendly features, including content outlining, sentence boosting, and collaborative writing capabilities [16]. Writerly is an online writing application that utilizes AI to generate texts based on students' input. Hence, it combines automation, integration, and AI to meet students' academic needs quickly and efficiently. It takes students' ideas and thoughts and makes them more fluid by adjusting the organization, diction, content, tone, and style of the text [12, 17]. It has academic and nonacademic platforms including editing, advertising, marketing, sales, e-commerce, social media, website, academic, recruiting, real estate, and long form. Of all these platforms, editing, academic, and long-form are the major writing features of the technology that enable students to enhance their writing quality. Specifically, the "editing" service of this AI writing technology enables students to use the "Grammar Improver," "Elaborator," "Synonym," "Sentence Booster," and "Convincing Bullet Points." Additionally, the "academic" feature of the program incorporates "Elaborator," "Essay Assistant," and "Essay Outline" which are helpful to students enhance the quality of their written texts. Using the "Essay Outline" platform, students type their essay writing topic so that the software generates the contents of the essay that they can incorporate into their essay. In addition, in the "Essay Assistant" and "Elaborator" subplatforms, the students drop their paragraphs in the given space so that the software enhances the contents and ways of expression. Furthermore, this technology translates students' essays from and into the English language which helps students to better express their ideas.

Therefore, via these specific features, Writerly provides several global feedbacks such as content outline, idea development, and sentence booster to enhance writing instruction [17]. On the other hand, Google Docs which is an online collaborative writing tool allows students to collaboratively produce written texts, receive peer and teacher feedback, and revise and edit essays synchronously which is suitable to be applied in writing instruction ([18], and [16]).

Simultaneously, the combined use of Writerly and Google Docs in writing classrooms has improved writing instruction as students utilize both AI writing technologies together to create essays. Particularly, the value of Writerly lies in its ability to provide continuous and constructive feedback to the writers as well as opportunities to review and revise their work until they are satisfied with it. In doing so, learners revise their drafts by referring to the formative automated feedback. Furthermore, it assists students in overcoming the challenges posed by nervousness and shyness, commonly experienced by EFL students from African countries when interacting with their teachers and peers in traditional face-to-face classrooms [9, 16]. Through Google Docs, online peer feedback and teacher feedback are facilitated, and it leads to improvement in students' writing performance.

Nevertheless, despite the extensive research on various AI writing technologies, there is a lack of research on Writerly and Google Docs, especially in the current research context of Ethiopia. Hence, although the use of Google Docs in foreign language writing instruction has been previously studied [16], there are no adequate studies conducted on the integrated use of Writerly and Google Docs in writing instruction. These AI writing technologies were chosen for the purpose of this study because the researchers had prior experience with them. Therefore, the objective of this study was to assess the impacts of integrating Writerly and Google Docs into writing instruction to enhance writing instruction in Ethiopia. In addition, this study was designed to assess students' perceptions towards integrating Writerly and Google Docs in writing instruction.

2. Statement of the Problem

Developing writing skills poses a challenge for language learners as they strive to express their ideas using appropriate written language [19, 20]. EFL learners face a daunting task in outlining key points, structuring ideas, ensuring unity and coherence, and editing for mechanics [21–23]. In order to help students enhance their writing performance, the provision of corrective feedback on students' writing becomes necessary, but it is challenging for writing teachers. Additionally, Zhang [3], Derseh [24], and McNamara et al. [25] also mentioned that conventional writing instruction takes an inordinate amount of teacher time to score students' essays and provide subsequent feedback to the students. Foltz et al. [26] and Wale [27] also stated that while writing is an essential part of the educational process, many teachers find it difficult to incorporate a large number of writing assignments in their courses due to the effort required to provide corrective feedback. Chen et al. [28] and Lee [29]

stressed that marking students' writing is a highly challenging job, and teachers usually devote a substantial amount of time to giving corrective feedback to their students. Reading and correcting students' writing is time-consuming for teachers. Especially in developing countries where there are more than 50 students in a class, asking students to write more means teachers have to devote extended periods of time to assessing and giving comments on students' written works [21, 30].

A potential solution to this challenge involves integrating AI writing technologies that harness artificial intelligence to assess essays and provide instantaneous corrective feedback. With the rapid development of writing educational technology, studies on AI writing technologies have been gaining more ground in EFL writing instruction, particularly due to its potential to give continuous, corrective feedback on students' written texts ([8, 14, 28]; and [9]). Zhang [3] also stated that using AI writing technologies has the advantages of time and cost saving, efficiency, and a learner-centered feedback process. Automated writing feedback can clearly reduce a teacher's workload by providing detailed feedback, and students can receive feedback immediately after submitting their writing. The feedback process becomes learner-centered because learners can conduct self-assessments online. AI writing technologies provide opportunities for students to write online, receive timely feedback, and revise their writing accordingly in an iterative way. In such a context, learner agency plays an important role, as learners comprehend feedback information, make judgments for further improvement, and take responsibility for their learning.

In examining the effectiveness of AI writing technologies on improving learners' writing ability, Jingxin and Razali [9], Wang [30], and LinHuang [31] stated that the use of the Criterion and CorrectEnglish AI writing technologies enhanced students' writing performance in the aspect of linguistic accuracy and grammar in Taiwan. Hence, using the aforementioned AI writing technologies, the students corrected their grammatical errors including fragments, subject-verb disagreement, run-on sentences, and ill-formed verbs. Ibid stressed that the feature of immediate feedback of AI writing technologies makes learning more efficient and interesting. On the contrary, critics of AI writing technologies argued that the validity of AI writing technologies is doubtful. For example, Chen and Cheng [4] and Attali and Burstein [32] distrust the ability of computers to "read" texts and evaluate the quality of writing because computers are unable to understand meaning in the way humans do. They also doubt the value of writing to a machine rather than to a real audience, since no genuine, meaningful communication is likely to be carried out between the writer and the machine. Moreover, they worry whether AI writing technologies led students to focus only on surface features and formulaic patterns without giving sufficient attention to meaning in writing their essays.

All in all, although most previous research findings on AI writing technologies were progressive and fruitful, they are few, and their findings seem to be contradictory, inconclusive, and insufficient in terms of causational empirical studies. Additionally, most previous studies on AI writing technologies have been conducted by a survey or an interview on psychometric evaluations of its validity; however, studies on the effectiveness of AI writing technologies in writing instruction as a pedagogical tool are limited. Therefore, there was a conspicuous research gap to support that integrative AI writing technologies, Writerly and Google Docs, enhance EFL students' writing performance. Accordingly, the current study employed an experimental research design to make the previous research findings more comprehensive. Additionally, though many previous studies have tended to examine AI writing technology's accuracy and validity in scoring essays, little research has paid attention to the effectiveness of giving and receiving automated feedback on improving EFL learners' writing performance. Hence, little research has been conducted on the effectiveness of AI writing technologies' feedback on improving learners' writing performance and students' perceptions towards using integrative AI writing technologies.

On the other hand, most of the aforementioned studies were conducted outside of the EFL context excluding the setting where the current study was conducted. In other terms, though Writerly and Google Docs are being used by writing teachers and students worldwide, the effectiveness of using these integrative AI writing technologies in enhancing writing instruction was not adequately investigated in the Ethiopian context. Additionally, studies examining Ethiopian students' perceptions towards using these integrative AI writing technologies were also scant. Hence, as far as the researchers' reading is concerned, there are no adequate studies that examined the impacts of using integrative AI writing technologies on enhancing EFL students' writing instruction in the Ethiopian context.

In light of these concerns, the purpose of this study was to examine the transformative power of AI in English language instruction in general and in providing written feedback to enhance EFL writing instruction. Particularly, it focused on the impacts of using integrative AI writing technologies (particularly Writerly and Google Docs) on enhancing writing instruction in the Ethiopian context. Accordingly, the current study addressed the following two research questions: (1) What are the impacts of using integrative AI writing technologies on enhancing writing instruction? (2) What are students' perceptions towards using AI writing technologies?

3. Literature Review

3.1. The Integrative Application of AI Writing Technologies in Writing Instruction. The theoretical framework of AI writing technologies is based on the cognitive constructivism theory for they rely on the cognitive process writing theory and sociocultural theory which is based on the notions of the zone of proximal development and scaffolding ([33], and [9]). Hence, as long as Writerly and Google Docs are AI writing technologies, the integrative use of these technologies is also based on the cognitive constructivism theory and sociocultural theory. According to Abdul et al. [34], Nazari et al. [35], Mo and Yaqiong [22], Wibowo [36], and Yang et al. [37], using a variety of AI writing technologies

significantly boost students' writing performance by equipping them with a plethora of tools and feedback mechanisms to enhance their writing skills. Hence, the integrative platforms offer a range of features, including grammar and spell-checking, punctuation, style suggestions, vocabulary enrichment, and coherence. By utilizing multiple AI writing technologies, students gain diverse perspectives and recommendations, enabling them to identify and tackle a broader spectrum of writing issues.

Particularly, in the classroom application of these two integrative AI writing technologies, students begin their learning with the prewriting stage that they discuss their essay writing topic with their team members via Google Docs. Having an agreed-upon writing topic, students type their topic on the "essay outline" platform of "Writerly." Then, Writerly generates possible contents of the essay so that students incorporate them in their essays. Accordingly, the students reconsider the AI-generated essay outline contents and produce a rough draft of their essay by themselves.

Completing the first draft, the students write their first draft into Writerly and receive automated feedback. Using this Writerly AI technology, the students boost their first draft through its subplatforms such as Editing, Sentence Booster, Grammar Improver, Elaborator, Synonym, Academic, and Essay Assistant. Lazar [38] and Daniel et al. [17] have corroborated that by leveraging Writerly, students enhance their initial draft by utilizing its diverse subplatforms, leading to a significant improvement in the overall quality of their written work. Additionally, they revise their first draft based on the automated feedback provided by Writerly, further refining their writing skills and producing more polished final drafts.

This AI writing technology generates one to ten alternative essay outputs so that students select their best essay output or use all of them to combine and reproduce a new one. Then, the students revise the first draft based on the Writerly automated feedback and produce the second draft. After completing the second draft, the students share their essays via Google Docs for peer feedback. Hence, their peers provide corrective feedback using the Google Docs editing feature. Fathi et al. [39] also confirmed that Google Docs offers convenient features for writing including peer feedback, peer editing, redrafting, and tracking the changes to texts.

Accordingly, the students rewrite the second draft based on their online peer feedback and produce the third draft. Next to this, the teacher accesses the third draft via Google Docs and provides corrective feedback to enhance the student essays. In the whole writing instructional process, the teacher monitors the students' writing progress and scaffolds them when needed. Additionally, the instructor provides cognitive instruction using Google Docs during the prewriting stage when students are fixing their essay writing topic and its contents. Moreover, teacher supervision is also necessary to ensure the reliability and validity of peer feedback [9, 10]. According to Alharbi and Alqefari [40], teachers provide their students with feedback through comments embedded into students' Google Doc pages, track their work, and see their revisions. Then, the students revise the third draft

based on teacher feedback and upload it into Writerly for final feedback. Lastly, the students produce the final draft based on the Writerly feedback and their own judgment.

3.2. Impacts of Integrating AI Writing Technologies to Enhance Writing Instruction. AI writing technologies offer students precise feedback on specific areas for revision, enhancement, and learning, thereby aiding in the improvement of students' writing performance [11, 13, 16]. Research findings such as Wei et al. [41], Song and Song [42], Ariyanto et al. [10], Aken [43], El Ebyary and Windeatt [44], Utami et al. [45], Wang [30], Fathi et al. [39], and Saricaoglu and Bilki [12] reported positive findings on the impacts of AI writing technologies feedback to develop students' writing performance. For instance, Wei et al. [41] found that AI-based instruction significantly improved students' writing skills in terms of task achievement ($B = 0.38$, $SE = 0.27$, $p = 0.044$), coherence and cohesion ($B = 0.46$, $SE = 0.32$, $p = 0.036$), lexicon ($B = 0.55$, $SE = 0.31$, $p = 0.009$), and grammatical accuracy ($B = 0.74$, $SE = 0.29$, $p = 0.003$).

Ariyanto et al. [10] and Aken [43] also stated that AI writing technologies feedback on grammar, vocabulary, punctuation, voice, and spelling was useful for students. Because AI writing technologies offer automated suggestions and corrections to students' written texts, the use of AI writing technologies in writing classes made class time more effective. In Song and Song [42] study, significant differences were found between the experimental and control groups in writing proficiency ($p < 0.001$, $d = 0.76$), content ($p = 0.003$, $d = 0.65$), organization ($p < 0.001$, $d = 0.84$), language use ($p < 0.001$, $d = 0.88$), and motivation ($p = 0.001$, $d = 0.52$). The experimental group excelled in all areas, showing higher mean scores for proficiency (59.12 vs. 45.18), content (15.96 vs. 13.71), organization (16.56 vs. 13.63), language use (19.89 vs. 15.89), and motivation (20.06 vs. 18.21).

According to El Ebyary and Windeatt [44], students' writing performance had improved as a result of making use of automated feedback. Utami et al. [45] also discovered that the majority of participants (86.00%) who achieved an average score of 4.12 confirmed that AI-based learning tools positively impacted their writing performance. Similarly, Wang [30] uncovered that students improved their writing skills in terms of run-on sentences, sentence fragments, capitalization errors, missing articles, and punctuation due to the use of AI writing technologies. Nazari et al. [35] found that AI-powered writing tools significantly improved nonnative students' English writing performance in various aspects including behavioral engagement (Cohen's $d = 0.75$), emotional engagement (Cohen's $d = 0.82$), cognitive engagement (Cohen's $d = 0.39$), self-efficacy for writing (Cohen's $d = 0.54$), positive emotions (Cohen's $d = 0.44$), and negative emotions (Cohen's $d = 0.98$) compared to the non-AI intervention (NEAI).

In addition, Saricaoglu and Bilki [12], Liao [46], and Li et al. [47] found that AI writing technologies feedback had positive impacts on the reduction of errors like subject-verb disagreement, word choice, verb form, and pronouns. Fathi et al. [39] reported that a statistically significant

difference was observed between the experimental group and the control group in the mean scores on the posttest of writing performance ($F(1, 35) = 21.681$, $p \leq 0.001$, partial eta squared = 0.383), highlighting that online collaborative writing using Google Docs was more effective than collaborative writing in the face-to-face classroom with regard to enhancing the writing performance of the EFL participants. Finally, Li [18] and Seyyedrezaie et al. [16] also revealed that Google Docs played fruitful roles in improving students' writing performance through its collaborative writing and online feedback features.

On the other hand, while AI writing technologies can be a helpful tool for students to improve their writing skills, there are several drawbacks to always relying on it for instruction. First, AI writing technologies may not provide personalized feedback tailored to the individual needs of each student. This lack of personalized instruction hinders students' progress and prevents them from addressing specific weaknesses in their writing. For instance, Warschauer and Grimes [48], since the feedback was predetermined and unable to provide context-sensitive responses involving rich negotiation of meaning, AI writing technologies were useful only for the revision of formal aspects of writing but not for content development.

Fathi et al. [39] reported that using both Google Docs and face-to-face instruction separately has positive impacts on enhancing students' writing performance because the experimental group's mean writing performance score increased from 11.56 (SD = 3.85) to 16.92 (SD = 4.01) on the posttest, while the control group's score increased from 10.94 (SD = 3.91) to 14.26 (SD = 3.97), showing significant improvement with both the Google Docs and face-to-face instruction collaborative writing methods.

Similarly, Chen and Cheng [4] also reported that most of the students found the My Access! AI writing technology is unhelpful in producing their written texts for it cannot address students' writing problems like coherence and idea development. Third-year English major students needed to write with more flexibility and creativity rather than being constrained by machine-controlled rules.

Relying solely on AI writing technologies limits the students' ability to develop critical thinking and problem-solving skills that are essential for writing. By heavily depending on AI writing technologies, students may miss out on the opportunity to engage in meaningful discussions with teachers and colleagues, which can enhance their understanding of writing concepts and strategies. Hence, intermediate and advanced language learners seemed to show less favorable reactions towards the AI writing technologies feedback. Gayed et al. [49] reported a nonsignificant increase in students' lexical resources when using the AI KAKU treatment condition, as indicated by the lack of statistically significant differences between the vocd-D analysis ($U = 40$, $p = 0.47$) and MTLD ($U = 46.5$, $p = 0.81$).

Finally, Ariyanto et al. [10] noted that there was a risk that students only engaged sketchily with the AI writing technologies by hitting the correction directly. Furthermore, overreliance on AI writing technologies may lead to a lack of independence and self-reliance in students' writing abilities,

as they may become overly dependent on the tools rather than developing their own skills and strategies for writing.

All in all, while the teachers use AI writing technologies as a primary mode of instruction, the tools may reduce the direct interaction made with students. Hence, it potentially limits the face-to-face communication between the teachers and his/her students and may hinder to provide targeted feedback and support. Ariyanto et al. [10] reported that teachers overlooked the implementation of AI writing technologies in their writing classes. However, there are inadequate research findings in particular on the effectiveness of using integrative AI writing technologies to enhance students' writing performance.

3.3. Students' Perception towards Integrating AI Writing Technologies in Learning Writing Skills. Previous studies presented conflicting results regarding students' attitudes towards integrating AI writing technologies. Hence, while Chen and Cheng [4], Wang [30], Utami et al. [45], Seyyedrezaie et al. [16], Ariyanto et al. [10], and Wahyuningsih et al. [50] reported positive findings, Burkhard [51], Cheng [52], and Yang [53] presented negative results. For instance, Chen and Cheng [4] showed the pedagogical writing practices with AI writing technologies positively affected students' perceptions of the effectiveness of AI writing technologies in facilitating their learning of writing. The AI writing technologies implementation was viewed comparatively more favorably when the technology was used to facilitate students' drafting and revising processes.

As Muthmainnah Seraj and Oteir [54] investigated, while 19.1% of the students strongly agreed on the relevance of AI writing applications to enhance writing skills, 51.6 agreed, and 27.3 were neutral on the issue. Wang [30] also found that AI writing technologies could motivate students to write more for it is stress-free and entertaining to work online. Utami et al. [45] reported that the majority of the students (65.00%) with an average score of 3.85 supported the use of AI-based writing tools due to their effectiveness in stimulating and organizing ideas. However, 33.00% of the students remained neutral, indicating a preference for manual development of language and writing mechanics skills. Overall, most participants indicated a willingness to utilize AI-based writing tools for their learning purposes.

Similarly, Seyyedrezaie et al. [16] also indicated that students showed a positive attitude towards the implication of Google Docs which enhanced their writing performance. In the same manner, Ariyanto et al. [10] also found AI writing technologies were needed as a confidence-builder tool for students. In their study, Wahyuningsih et al. [50] discovered that 59.7% of participants (37 students) believed that using Google Docs facilitated efficient completion of group projects by enabling simultaneous collaborative writing, thereby saving time without the need for in-person meetings.

In contrast, some other findings (including Burkhard [51], Cheng [52], and Yang [53]) revealed that students were dissatisfied with the use of AI writing technologies in their writing classrooms. Accordingly, Burkhard [51] found that 51.9% of students saw limited accuracy in AI-powered writing tools as a major drawback. 23.1% believed that these

tools negatively impacted their writing, leading to concerns like laziness and loss of individual style. 18.3% worried about human replacement, and 4.4% raised plagiarism worries. Additionally, 1.9% highlighted fairness issues, suggesting these tools could simplify achieving good grades.

Cheng [52] noted that students complained that the AI writing technologies feedback was too vague. Likewise, Yang [53] also reported that most students believed the feedback from AI writing technologies was repetitive. Since the AI writing technologies failed to focus on meaning, students did not find a strong need to use it for the learning of intermediate and advanced writing skills. These responses suggest that students who are at an intermediate and advanced language proficiency level did not want their writing to be confined by a set of machine-governed criteria, and furthermore, they do not find such machine-generated form-focused responses to be valuable.

4. Methodology

4.1. Research Design. The aim of this study was to examine the transformative power of AI writing technologies in English language instruction in general and in enhancing students' writing performance in particular. Hence, it focused on the impacts of using integrative AI writing technologies (Writerly and Google Docs) on enhancing writing instruction. It also aimed to assess students' perceptions towards using integrative AI writing technologies. Accordingly, the study utilized a quasiexperimental research design with pretest and posttest measures with two groups of participants escorted by a mixed research approach. Quasiexperimental research design is commonly used in educational research, social sciences, and clinical settings to compare groups, analyze the impact of independent variables, and derive meaningful conclusions from the results [55]. Previous studies by Fathi et al. [39], Wei et al. [41], Liu et al. [56], Song and Song [42], Nazari et al. [35], Palermo and Wilson [57], and Wale and Bogale [23] have also employed this design, reporting positive results that are relevant to the current study, as discussed in Discussion. The mixed research approach combines elements of both quantitative and qualitative research methods in a single study to gain a more comprehensive understanding of a research topic by integrating numerical data analysis with an in-depth exploration of underlying meanings, contexts, and experiences [58] like the use of AI writing technologies in writing classrooms. Prior researches including Palermo and Wilson [57], Wale [27], Fathi et al. [39], Alharbi and Alqefari [40], Abdul et al. [34], Muthmainnah Seraj and Oteir [54], and Utami et al. [45] have similarly employed a mixed research approach, yielding congruent results that correlate with the findings of the current study as presented in Section 6.

4.2. Research Participants. The study involved 92 second-year English language and literature department students enrolled in the "Intermediate Writing Skills" course at Injibara University, Ethiopia. These participants were divided into two groups, sections "B" and "D," chosen randomly from a pool of four sections ("A" to "D") comprising a total of 196 second-year in-service students pursuing their education during the Ethiopian summer season. These students had 13 years of formal English language education, with 12 years in schools and one year at the university. Their English proficiency was deemed intermediate, having completed courses such as "Communicative English Language Skills" and "Basic Writing Skills" in their freshman year, alongside their prior schooling experience.

4.3. Data Collection Tools. The data were collected through essay writing test, questionnaire, focus group discussion, and teacher diary. The utilization of these mixed data collection tools like essay writing test, questionnaire, focus group discussion, and teacher diary significantly enhances the acquisition of comprehensive data regarding the efficacy of independent variables. These instruments have been employed in prior researches such as Wale and Bogale [23], Palermo and Wilson [57], Fathi et al. [39], Alharbi and Alqefari [40], Abdul et al. [34], Muthmainnah et al. [54], and Utami et al. [45], producing robust research outcomes as delineated in Section 6 of this study.

In this study, two sample IELTS essay writing proficiency tests (pretest and posttest) were used to assess the participants' writing performance. The pretest was administered before the intervention to both experimental and control group students to evaluate their existing writing performance. The test reads: "The internet has transformed lives and economies but it is turning the world into a global village. Soon everybody will think and behave in the same way. To what extent do you agree or disagree with this opinion? Present your argument in an essay using over 250 words arguing for or against this idea." Additionally, the posttest was administered after the intervention to both experimental and control groups of students to determine whether the intervention made a difference in the students' writing performance. It reads: "The growing number of smokers is putting a strain on the health care system in an effort to deal with the health issues involved. Some people think that the best way to deal with this problem is to legally prohibit smoking cigarettes. To what extent do you agree or disagree with this opinion? Present your argument in an essay using over 250 words arguing for or against this idea."

Both the pretest and posttest students' essays were scored by two experienced writing teachers using the British Council IELTS writing task-2 descriptors that incorporate task achievement, coherence and cohesion, lexical resource, grammatical range, and accuracy [59]. To minimize bias between the two evaluators when marking students' written texts, first, the evaluators were provided training and calibration on the assessment criteria and scoring rubric to ensure they have a clear understanding of the expected standards in students' writing. Following this, there was a calibration exercise, where evaluators independently score a set of sample texts and compare their scores to identify any discrepancies, aligning their interpretations and judgments. Secondly, blind evaluation procedures were implemented, where evaluators do not have access to identifying information about the students to prevent unconscious biases from influencing their assessments. Hence, the students' written texts were

randomly assigned to the two evaluators to prevent some systematic biases and to distribute the workload equally. The interrater reliability statistics were calculated. Pearson's correlation interrater reliability of the two raters was 0.8, reliable. Moreover, there was ongoing monitoring and feedback throughout the evaluation process to address discrepancies or biases that may arise, to promote consistency in their scoring, and to ensure a fair and reliable evaluation process.

The second data gathering instrument was a questionnaire needed to gather data on students' perception towards using integrative AI writing technologies (Writerly and Google Docs). It was designed using Google Forms incorporating 18 five-point Likert-scale type questions and four open-ended type questions and administered via Google Forms to the experimental group students after the intervention. The questionnaire was crafted by drawing upon the expertise of three different researchers who had previously utilized similar questionnaires for their own studies. Its reliability was 0.79 as calculated by Cronbach's α, which indicated that it was reliable.

Thirdly, focus group discussion was also used to collect data on students' perceptions towards using integrative AI writing technologies and the development of students' writing performance. The discussion was conducted for 180 minutes with 12 experimental group students using eight thought-provoking questions that revolved around the effectiveness of AI writing technologies, Writerly and Google Docs. The focus group discussion was audio recorded and later transcribed for analysis purposes.

Finally, teacher-diary which is the teacher's daily classroom note was also used to collect data on the effectiveness of integrative AI writing technologies in enhancing writing instruction and the enhancement of students' writing performance.

4.4. Procedure of Data Collection. In the data collection process, first, the data gathering instruments were designed and piloted. Then, a sample IELTS writing test was administered to all four sections of English language and literature department students to select a homogeneous group of participants. Based on the diagnostic test, two sections of students ("A" and "C") were found homogeneous and selected to be the participants of the study. Section "A" students were assigned as the experimental group, and section "C" students were assigned as the control group randomly. Following the group assignment, the IELTS sample essay writing pretest was administered to both experimental and control groups to get baseline data on the students' writing performance: task achievement, coherence and cohesion, lexical resource, grammatical range, and accuracy. After collecting the baseline data through the pretest, the intervention was conducted for eight weeks.

During the intervention, the experimental group students (section "A") learned argumentative essay writing using the integrative AI writing technologies, Writerly and Google Docs, while the control group students (section "C") learned argumentative writing with the conventional method. Hence, the experimental group students followed their essay writing instruction in the English Language Improvement Centre (ELIC) where the Writerly and Google

Docs writing tools were installed on its desktop computers. These AI writing technologies were also installed on the experimental group students' smartphones. Before the intervention was started, the experimental group students received short-term training on how Writerly and Google Docs work. Hence, the teacher assisted students in how to use the Writerly-specific features like Editing, Essay Outline, Sentence Booster, Grammar Improver, Essay Assistant, Elaborator, Synonym, and Convincing Bullet Points. Accordingly, using this AI writing technology, the students outlined their essay contents, boosted sentences, worked on grammar and synonyms, elaborated their expressions, and revised and edited their essays several times. The students also wrote argumentative essays collaboratively and gained peer and teacher feedback using Google Docs to improve their written texts and enhance their writing performance. Hence, the students were categorized into groups to share feedback on each other's argumentative essays via Google Docs. The group members were required to read and provide corrective feedback on the other group members' argumentative essays based on IELTS writing task-2 descriptors that incorporated task achievement, coherence and cohesion, lexical resource, grammatical range, and accuracy. Following the peer feedback, the students received the teacher's feedback on the correctness of the peer feedback that might be incorrect or incomplete so that the students could receive balanced and better feedback on their draft essays. Moreover, the teacher also provided detailed corrective feedback on the quality of the essays based on the aforementioned IELTS writing task-2 descriptors. When the students had difficulties in revising and editing their draft essays based on the automated feedback, the teacher assisted them on how to revise and edit their draft essays via Writerly and Google Docs. On the other hand, the control group students also learned argumentative essay writing face-to-face through the conventional paper and pencil feedback system and with their printed teaching material that incorporated the theoretical aspects of argumentative essay writing.

When the intervention was conducted, the teacher diary was held side by side in both the control and experimental groups. Hence, the teacher has recorded the daily teaching-learning experiences such as the strengths, weaknesses, and impacts of Writerly and Google Docs from the experimental group and the conventional teaching-learning practices of the control group. At the end of the intervention, the sample IELTS essay writing posttest was administered to the experimental and control group students to evaluate the students' writing performance. Following the posttest, the questionnaire and the focus group discussion were conducted with the experimental group students to collect data on the effectiveness of using the integrated AI writing technologies, Writerly and Google Docs, and the students' perception towards using the integrated writing technologies. Finally, the students' essays were assessed by two raters who were experienced writing teachers, while the questionnaire and focus group discussion data were analyzed by the researchers.

4.5. Methods of Data Analysis. The data were analyzed using quantitative and qualitative methods. The quantitative data collected through tests were analyzed through independent

TABLE 1: Descriptive statistics of experimental and control groups.

Test	Participants' group	N	Mean	Std. deviation	Std. error mean
Pretest	Experimental group	45	45.0	4.1	0.6
	Control group	47	44.7	3.6	0.5
Posttest	Experimental group	45	54.6	4.7	0.7
	Control group	47	45.8	4.0	0.5

TABLE 2: Independent samples T-test of experimental and control groups.

Test		F	Sig.	T	Df	Sig. (2-tailed)	Mean difference	Std. error difference
Pretest	Equal variances assumed	0.4	0.5	0.3	90	0.7	0.2	0.8
	Equal variances not assumed			0.3	87.2	0.7	0.2	0.8
Posttest	Equal variances assumed	0.2	0.6	9.5	90	0.0	8.8	0.9
	Equal variances not assumed			9.5	86.5	0.0	8.8	0.9

samples T-test using Statistical Package for Social Sciences (SPSS) version-25 software to examine whether there were differences between the experimental and control groups of students' writing performance that incorporate task achievement, coherence and cohesion, lexical resource, grammatical range, and accuracy. Additionally, the close-ended questionnaire data collected on students' perceptions were also analyzed quantitatively using descriptive statistics including mean and standard deviation. On the other hand, the qualitative data gathered through open-ended questionnaire, focus group discussion, and teacher-log were thematically analyzed through the qualitative data analysis (QDA) method and presented coherently based on the common themes.

5. Results and Discussions

5.1. Results

5.1.1. Enhancing Writing Instruction through Integrating AI Writing Technologies. The results showed that the students enhanced their writing performance through the integrative AI writing technologies, Writerly and Google Docs. The descriptive statistics result depicted in Table 1 indicated that both the experimental and control group students had comparable writing performance in the pretest. Hence, while the experimental group students had a mean score of 45.0, Std. deviation of 4.1, and Std. error mean of 0.6, the control group students had a 44.7 mean score, 3.6 Std. deviation, and 0.5 Std. error mean.

Thus, though it appeared the students' results had some difference, the variance they had is statistically insignificant. Therefore, it can be understood that both the experimental and control group students had comparable writing performance prior to taking the treatment. Nonetheless, the experimental group ($M = 54.6$; SD = 4.7; SEM = 0.7) and control group ($M = 45.8$; SD = 4.0; SEM = 0.5) students' posttest result mean scores were statistically significant as can be seen in Table 1. Accordingly, based on the variation observed between the pretest and posttest result mean scores, it can be concluded that the experimental group students who learned with integrated AI writing technologies

showed better enhancement in their writing performance over the control group students who learned the course with the conventional paper and pencil feedback system.

Most essentially, the independent samples T-test was run to understand the differences between the experimental and control group students' pretest and posttest results. As depicted in Table 2, Levene's test for equality of variances showed no violations, $p = 0.5$ in the pretest and $p = 0.6$ in the posttest. Additionally, the pretest result also indicates that there was no statistically significant difference between the experimental and control groups before the intervention ($t(90) = 0.4$, $p > 0.05$, $d = 0.8$). However, the posttest results disclosed that there was a statistically significant difference between the experimental and control groups ($t(90) = 0.2$, $p < 0.05$, $d = 0.9$). Moreover, the mean difference (pretest = 0.2; posttest = 8.8) also indicates that there was a statistically significant difference between the two groups.

It reveals that the students who had learned writing skills through the integrated AI writing technologies, Writerly and Google Docs, outperformed in their writing performance compared to the students who learned the skills in the conventional face-to-face and paper and pencil method of teaching.

On the other hand, the results gained through the teacher diary also ensured that the students' writing performance was enhanced when they practiced writing using Writerly text-enhancing features and with Google Docs. In the first week of the intervention, the teacher in his diary noted:

It is towards the beginning of the training. The students who are using Writerly and Google Docs are facing several challenges in editing, revising, and organizing their essay content through the software technologies. However, the other groups who are learning without the AI writing technologies are writing better essays for they are receiving written feedback face to face with no machine distraction.

Nevertheless, towards the end of the intervention, the following was recorded in the teachers' diary:

Now, the students who are using the AI writing technologies are producing better essays in terms of task achievement, coherence and cohesion, lexical resource, grammatical range and accuracy. They are almost properly using Writerly and Google Docs to outline their essay contents, draft coherent

TABLE 3: Students' interest in using the integrated AI writing technologies.

No.	Items	Mean	Std. deviation	Std. error of mean
1	I enjoy writing through Writerly and Google Docs.	4.1	0.7	0.1
2	I would like to use Writerly and Google Docs to write essays.	4.2	0.8	0.1
3	I was interested in using Writerly and Google Docs.	4.0	0.7	0.1

sentences and paragraphs, write essays collaboratively, share peer feedback and teacher feedback, and correct the comments accordingly. Their essays are by far better compared to their own previous essays. However, the essays that are written by the students who are not using the Writerly and Google Docs are not that much improving in their writing compared to their previous performance because their dictions are not good, the language used is not that sound, the paragraphs are not well organized. Even, the students get into confrontation when they write essays in face-to-face groups. They got board to repeatedly revise their draft essays using pen and paper.

In addition, the teacher in his diary recorded: "Using the Writerly and Google Docs reduced my workload as a teacher since they provided detailed feedback to the students' essays. They are also time and cost-saving since they generate learner-centered feedback that could be corrected by the students."

Moreover, the experimental group students in their open-ended questionnaire also reported that they had developed their writing performance while using Writerly and Google Docs through integration. For instance, one of the students recorded:

I had known something about Google Docs before this time, but the Writerly system was totally new to me. I was challenged to write my first argumentative essay using Writerly. However, after some time, I had written good essays with the help of the software. The Google Docs was also interesting to me because it helped us to write essays together with my group members. I feel that the AI writing technologies have supported me to improve my writing skills.

Similarly, another student also wrote:

Writerly is amazing to me. I used to struggle to set my essay contents, boost sentences, organize ideas in paragraphs, revise and edit essays before this training. In this training, the teacher has shown us this technique which is surprising to most of us. All can be done with it! The technology gave me several options to boost my sentences and paragraphs. In addition, Google Docs helps us to write paragraphs and essays with friends on a certain title. We do not need to print our essays and submit them to the teacher because he himself can access the essays via Google Docs and give us constructive comments.

Finally, the students in their focus group discussion also ascertained that using Writerly and Google Docs in amalgam enhanced their writing performance. Hence, most of the focus group discussion members agreed that they have developed their writing performance due to the AI writing technologies in their writing course.

Consequently, it can be generalized that the use of the integrative AI writing technologies, Writerly and Google Docs, was effective in enhancing the students' writing performance including achievement, coherence and cohesion, lexical resource, grammatical range, and accuracy.

5.1.2. Students' Perception towards Using Integrative AI Writing Technologies. The students' perceptions towards using the integrated AI writing technologies, Writerly and Google Docs, in writing instruction were assessed through questionnaire, focus group discussion, and teacher diary. The results showed that the students had positive perceptions towards using the integrative AI writing technologies for these AI writing technologies enhanced their writing performance in terms of achievement, coherence and cohesion, lexical resource, grammatical range, and accuracy.

Specifically, the students' questionnaire results indicated that the Writerly and Google Docs were interesting, effective, and goal-oriented, and as a result, they enhanced students' writing performance. Table 3 disclosed that the students had $M = 4.1$, SD = 0.7, and SEM = 0.1 regarding whether they enjoy writing through Writerly and Google Docs. This result implied that most of the participants enjoyed writing through Writerly and Google Docs. Similarly, the majority of the respondents ($M = 4.2$; SD = 0.8; SEM = 0.1) would like to use Writerly and Google Docs to write essays. Most of the students ($M = 4.0$; SD = 0.7; SEM = 0.1) were interested in using Writerly and Google Docs in their writing instruction. Thus, it implied that the students were interested in using integrative AI writing technologies, Writerly and Google Docs.

The results on the students' views on the effectiveness of integrated AI writing technologies indicated that the use of Writerly and Google Docs was effective. For instance, as depicted in Table 4, the students had $M = 4.2$, SD = 0.8, and SEM = 0.1 on whether Writerly took their essay writing idea and made it more fluid by adjusting the organization, diction, content, tone, and style of the text. It can be, therefore, deduced that the students have a positive perception towards Writerly because this technology took their writing idea and made it more fluid by adjusting the organization, diction, content, tone, and style of the text. Likewise, the students viewed ($M = 4.1$; SD = 0.7; SEM = 0.1) that Writerly provided them several global feedback such as content outline, idea development, and sentence booster to enhance their writing instruction. Hence, this result showed that they positively perceived Writerly since it offered them several global feedback. In the same manner, the participants understood ($M = 4.0$; SD = 0.7; SEM = 0.1) that Google Docs allowed them to edit their written texts synchronously. In the same way, the students perceived ($M = 4.2$; SD = 0.7; SEM = 0.1) that Google Docs enabled them to write essays collaboratively with their colleagues. Lastly, they also

TABLE 4: Students' view on the effectiveness of integrated AI writing technologies.

No.	Items	Mean	Std. deviation	Std. error of mean
1	Writerly took my essay writing idea and made it more fluid by adjusting the organization, diction, content, tone, and style of the text.	4.2	0.8	0.1
2	Writerly provided me with several global feedbacks such as content outline, idea development, and sentence booster to enhance writing instruction.	4.1	0.7	0.1
3	Google Docs allowed me to edit my written texts synchronously.	4.0	0.7	0.1
4	Google Docs enabled me to write essays collaboratively with my colleagues.	4.2	0.7	0.1
5	Google Docs helped me comment on my colleagues' written works online.	4.1	0.7	0.1

TABLE 5: Students' perception on the goal-oriented effectiveness of AI writing technologies.

No.	Items	Mean	Std. deviation	Std. error of mean
1	Writerly provides corrective feedback in terms of organization, content, grammar, diction, mechanics, style, and language use	4.2	0.7	0.1
2	Writerly helped me revise and edit my essays in a self-regulated learning environment.	4.2	0.8	0.1
3	Writerly generates essay content that could be incorporated into essays.	4.1	0.6	0.1
4	Writerly boosts ways of written expressions.	4.0	0.7	0.1
5	Writerly translates written texts from and into English which helps to better express ideas.	4.1	0.7	0.1

thought ($M = 4.1$; SD $= 0.7$; SEM $= 0.1$) that Google Docs helped them comment their colleagues' written works online. Therefore, the results indicated that the students had a positive perception towards using Google Docs in their writing instruction because it allowed them to edit written texts synchronously, enabled them to write essays collaboratively with their colleagues, and helped them comment on their colleagues' written works online.

Table 5 shows that the students viewed the integrative AI writing technologies were goal-oriented to produce quality written texts. Specifically, the participants had $M = 4.2$, SD $= 0.7$, and SEM $= 0.1$ about whether Writerly provided them corrective feedback in terms of organization, content, grammar, diction, mechanics, style, and language use. In the same manner, the students perceived ($M = 4.2$; SD $= 0.8$; SEM $= 0.1$) that Writerly helped them revise and edit their essays in a self-regulated learning environment. They also understood ($M = 4.1$; SD $= 0.6$; SEM $= 0.1$) that Writerly generated their essay contents that could be incorporated into their essays. Similarly, the participants viewed ($M = 4.0$; SD $= 0.7$; SEM $= 0.1$) that the Writerly boosts ways of written expressions. Additionally, the students pointed out ($M = 4.1$; SD $= 0.7$; SEM $= 0.1$) that Writerly translated written texts from and into English helped them to better express ideas. These results uncovered that the students had positive perceptions towards using the AI writing technologies, Writerly and Google Docs, for the technology and were goal-oriented in producing quality written texts. Hence, Writerly provides them with corrective feedback, enables them to revise and edit their essays, generates essay contents that could be incorporated into their essays, boosts ways of written expressions, and translates written texts from and into English that helps them to better express ideas.

Table 6 presented, the relevance of integrating Writerly and Google Docs in writing instruction. Accordingly, the students perceived ($M = 4.1$; SD $= 0.8$; SEM $= 0.1$) that the integrative use of Writerly and Google Docs helped them to overcome the nervousness and shyness that most of them had faced to interact face-to-face. Similarly, the participants viewed ($M = 4.2$; SD $= 0.6$; SEM $= 0.0$) that using Writerly and Google Docs through integration increased their writing achievement. Likewise, the students understood ($M = 4.2$; SD $= 0.6$; SEM $= 0.1$) that the use of Writerly and Google Docs in integration improved the coherence and cohesion of their essays. Additionally, they thought ($M = 4.3$; SD $= 0.7$; SEM $= 0.1$) that the integration of Writerly and Google Docs enhanced the lexical resources of their essays. In the same way, the students viewed ($M = 4.3$; SD $= 0.7$; SEM $= 0.1$) that integrating Writerly and Google Docs together boosted the grammatical range and accuracy of their written texts. The results, therefore, implied that the students' perception towards using the integrative AI writing technologies, Writerly and Google Docs, was positive for the technologies helped them overcome their nervousness and shyness, developed the lexical resources of their essays, increased their writing achievement, improved the coherence and cohesion of their written texts, and, and boosted the grammatical range and accuracy of their written texts.

The students' focus group discussion results also assured that students had positive perceptions towards using integrative AI writing technologies, Writerly and Google Docs, for the technologies were interesting to use, effective for developing written texts, goal-oriented to produce quality essays, and relevant in writing instructions. Hence, most of the focus group discussion participants agreed that Writerly was enjoyable, and they would like to use it for their future academic and career journeys. For instance, one of the focus

TABLE 6: The relevance of integrating Writerly and Google Docs in writing instruction.

No.	Items	Mean	Std. deviation	Std. error of mean
1	The integrative use of Writerly and Google Docs helped me to overcome the nervousness and shyness that I had faced to interact face to face.	4.1	0.8	0.1
2	Using Writerly and Google Docs through integration increased my writing achievement.	4.2	0.6	0.0
3	The use of Writerly and Google Docs in integration improved coherence and cohesion	42	0.6	0.1
4	The integration of Writerly and Google Docs enhanced lexical resources.	4.3	0.7	0.1
5	Integrating Writerly and Google Docs together boosted grammatical range and accuracy.	4.3	0.7	0.1

group discussion participants explained that Writerly has helped her to outline the contents of her essay, develop major ideas, and boost sentences. Additionally, the other participant also reported that Google Docs supported her in editing draft essays, producing paragraphs and essays collaboratively, obtaining comments from friends, and receiving feedback from her writing teacher.

One of the participants in the focus group discussion also voiced:

I enjoyed using Writerly to write the essays [because] it was really helpful to translate the essay into Amharic [Ethiopian national language]. I also translated our Amharic written paragraphs into the English language based on the software technology. I was surprised when the program gave us interesting essay content after we wrote our essay title on the software. It was funny and friendly.

In the same manner, the other member of the focus group discussion also reported:

The Writerly feedback is helpful and amazing. For example, from what I remember, when I wrote a sentence on Sentence Booster in the Writerly, it totally modified the sentence's content. The new sentence was grammatically correct and written with better word choices. The computer corrected the organization of the essay, the content, grammar errors, and word choice.

In addition, most of the participants in the focus group discussion agreed that using Writerly and Google Docs in integration was fascinating to them because it enhanced their writing performance in terms of writing task achievement, coherence and cohesion, lexical resource, grammatical range, and accuracy which are the qualities of a good essay based on IELTS writing task-2 descriptors. Thus, the results uncovered that the use of Writerly and Google Docs through integration was positively perceived by the students.

The results gained through the teacher diary also confirmed that most of the students were comfortable with Writerly and Google Docs in producing essays with them. The note recorded in the diary in the middle of the intervention reads:

Now it seems that the students have understood how the AI writing technologies work. They are entertaining with Writerly when they receive immediate feedback after submitting their unfinished essays to this software technology. Today, the students felt happy and appreciated Writerly when they themselves ran the feedback process and received software-generated comments on their specific essays.

Additionally, the questionnaire results also confirmed that these technologies were interesting to them to receive and correct draft essays. It unveiled that the students had positively perceived Writerly and Google Docs. The results, therefore, revealed that the students' perception towards the integrated AI writing technologies, Writerly and Google Docs, was positive for these AI writing technologies were interesting, effective, and goal-oriented.

All in all, the results divulged that the integrative use of Writerly and Google Docs was effective in enhancing students' writing performance that incorporated task achievement, coherence and cohesion, lexical resource, grammatical range, and accuracy. The results also uncovered that the students' perceptions towards using these AI writing technologies were positive for the technologies provided them several corrective feedback which is helpful in producing quality written texts.

6. Discussions

This study examined the transformative power of AI writing technologies in English language instruction in general and in enhancing writing instruction in particular. Predominantly, it focused on the impacts of using integrative AI writing technologies, Writerly and Google Docs, on enhancing writing instruction in the Ethiopian context. In addition, it also assessed students' perception towards using integrative AI writing technologies. The results uncovered that the integrative use of Writerly and Google Docs was effective in enhancing students' writing performance that incorporated task achievement, coherence and cohesion, lexical resource, grammatical range, and accuracy. Hence, the current study unveiled that the students who had learned writing skills through the aforementioned integrated AI writing technologies outperformed in their writing performance compared to the students who learned the skills face-to-face through the conventional paper and pencil feedback system with their printed learning material that incorporated the theoretical aspects of writing. This finding is in accordance with Palermo and Wilson [57], Ranalli et. al. [13], Alharbi [14], Seyyedrezaie et al. [16], Wei et al. [41], Song and Song [42], Utami et al. [45], and Zhanga and Huang [11] that found AI writing technologies provide students with accurate information to target relevant areas of revision, improvement, and learning that help students improve their writing performance.

The present study found that Writerly provided students with corrective feedback, enabled them to revise and edit their essays, generated essay contents that could be incorporated into their essays, boosted ways of written expressions,

and translated written texts from English into Amharic and visa vice that helped them express their ideas better. This finding bears resemblance to Daniel et al. [17], Saricaoglu and Bilki [12], Liao [46], and Li et al. [47] uncovered that AI writing technologies' feedback had positive impacts on the reduction of errors and enriched the quality of student written texts. Additionally, the current study showed that while Writerly took the students' writing ideas and made them more fluid by adjusting the organization, diction, content, tone, and style of the text, the Google Docs enabled students to edit their written texts synchronously, write essays collaboratively with their colleagues, and comment their colleagues' written works online. In line with this result, Aken [43] and Wibowo [36] discovered that AI writing technologies enabled learners to collaborate with each other online and receive feedback from both the teacher and colleagues to enhance organization and language usage.

On the contrary, this research finding does not semblance to Warschauer and Grimes [48], Ariyanto et al. [10], Fathi et al. [39], and [4] that discovered since the feedback was predetermined and unable to provide context-sensitive responses involving rich negotiation of meaning; AI writing technology was not useful for content development. For example, Chen and Cheng [4] discovered that most intermediate and advanced language learners found AI writing technology unhelpful in producing their written texts because the computer system could not understand contextual meaning and was unable to address their writing problems including coherence and idea development. Additionally, Ariyanto et al. [10] also reported that teachers overlooked the implementation of AI writing technology in their writing classes for there was a risk that their students only engaged sketchily with the technologies by hitting the correction directly.

Additionally, the current study also assessed students' perceptions towards using the integrative AI writing technologies, Writerly and Google Docs. The results discovered that the students had positive perceptions towards using these AI writing technologies because they found these AI writing technologies interesting to use, effective to be used in writing instructions, goal-oriented to develop essays, and supportive to overcome their nervousness and shyness faced in face-to-face conversation.

This finding is in congruence with Wang [30], Wahyuningsih et al. [50], Muthmainnah Seraj and Oteir [54], and Seyyedrezaie et al. [16] that showed the pedagogical writing practices with AI writing technology positively affected students' perceptions when the students used the program to facilitate their drafting and revising process. For instance, Wang [30] underscored that AI writing technologies build students' confidence and motivated them to write more because the technologies are stress-free and entertaining to correct feedback online. Similarly, Seyyedrezaie et al. [16] also indicated that the students had a positive attitude towards Google Docs which enabled them to write collaboratively through an entertaining online learning environment.

Quite the reverse, this specific finding is in contradiction with Ariyanto et al. [10], Burkhard [51], Chen and Cheng [4], Cheng [52], and Yang [53] that revealed students were dissatisfied with the use of AI writing technologies in their writing classrooms because the AI writing technology feedback was vague and repetitive. Particularly, Chen and Cheng [4] specified that students whose language proficiency level were intermediate and advanced did not need to circumscribe themselves with automated criteria because they believed that the machine-generated form-focused responses were inconsequential. Overall, the current research findings resemble most previous research findings though they also gainsaid with some other previous discoveries.

7. Conclusions and Implications

The current study explored the transformative power of AI writing technologies in English language instruction in providing written corrective feedback to enhance writing instruction. It, specifically, focused on examining the impacts of using integrative AI writing technologies, namely, Writerly and Google Docs, on enhancing writing instruction in the Ethiopian context. Additionally, it also assessed students' perception towards using integrative AI writing technologies. The findings of the study revealed that using integrative AI writing technologies enhanced EFL writing instruction. In other terms, the integrative use of Writerly and Google Docs in writing instruction was effective in enhancing students' writing performance because these AI writing technologies enabled the experimental group students to produce essays that fulfilled writing task achievement, coherence and cohesion, lexical resource, grammatical range, and accuracy that are the essential features of writing. On the contrary, the control group students were unable to develop quality essays that satisfied the aforementioned descriptors because the control group students learned writing skills through the conventional paper and pencil feedback system with their printed learning material that incorporated the theoretical aspects of writing.

The findings showed that while Writerly took students' writing ideas and made them more fluid, generated essay content outlines, boosted ways of written expressions, and translated written texts from English into Amharic and visa vice that helped students express their ideas better, Google Docs also enabled students to write essays collaboratively with their colleagues, comment their colleagues' written works online, receive teacher and peer feedback, and revise and edit their written texts synchronously. The results also disclosed that the students had positive perceptions towards using the integrative AI writing technologies, Writerly and Google Docs, to enhance their writing performance because these technologies were interesting to students, effective in developing written texts, goal-oriented to produce quality essays, and relevant in writing instructions.

Thus, using integrated AI writing technologies in writing instruction is recommended to enhance EFL writing instruction. Hence, it implies that it is significant to instigate using integrated AI writing technologies to enhance writing instruction and enable students to enhance their writing performance. Writing teachers need to use Writerly and Google Docs in their writing instruction to enhance their students' writing performance. Correspondingly, writing course

material developers should reconsider these integrated AI writing technologies while developing writing course instructional materials. Moreover, students have to use these integrated AI writing technologies to enhance their writing performance since writing is required in their academic journey and future careers.

However, due to limited resources and time constraints, this study was conducted with a relatively small number of students and focused on just two AI writing technologies. Consequently, the study's focus on specific participants in terms of geographical scope, field of specialization, English language proficiency, and educational background may restrict the applicability of the findings to other student populations or educational settings. However, the study's findings can still be considered broadly applicable, given that nearly half of the population took part in the research. Moreover, the findings remain comprehensive as the selected AI writing technologies were utilized by the experimental group students throughout the intervention period. It is worth mentioning that the study did not address individual differences in learning styles. Future studies on the use of AI writing technologies should consider examining these differences. Furthermore, the intervention period of eight weeks might overlook the long-term impacts of using AI writing technologies. Nevertheless, this does not imply that the intervention period was insufficient, as the participants practiced writing skills with the integrated AI writing technologies for two consecutive months. Overall, the findings of the current research would have been more comprehensive if additional time and resources had been allocated for the intervention, with a larger number of students participating in the study and a greater variety of AI writing technologies integrated into the intervention. Therefore, it is recommended that future studies be conducted with longer duration, increased resources, larger sample sizes, address learning styles, and the exploration of different writing achievements using more advanced AI writing technologies.

Data Availability

The authors declared that the data supporting the findings of this study are available on request. The data are not publicly available due to containing information that could compromise research participant privacy/consent.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

The corresponding author took on the roles of leading and conducting the research, gathering the data, drafting, revising, reviewing, and editing the manuscript, as well as addressing peer review comments. The coauthor participated in drafting, revising, reviewing, and editing the manuscript.

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