

Leveraging Blogging and TED-Ed Videos for Developing Critical Reading and Technical Writing among Engineering Students

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Abstract

The purpose of this study is to examine the effectiveness of integrating TED-Ed videos and blogging in engineering education to improve students' grammar, critical reading, reading comprehension, and technical writing skills. Based on process writing theory and sociocultural theory, the intervention prioritises reflective practice, iterative writing, and group learning. Using a quasi-experimental design, 120 engineering undergraduates from various fields were split into experimental and control groups. The experimental group participated in a 12-week program that combined structured blogging tasks with grammar-focused TED-Ed videos, while the control group received traditional instruction. Student surveys, peer and instructor feedback, and grammar, reading, and writing pre- and post-tests were all used to gather data. The experimental group showed significantly greater improvements than the control group, as confirmed by both paired-sample and independent-sample t-tests ($p < .001$). Students' writing quality, critical thinking, coherence, and grammatical accuracy all showed significant improvements. When compared to conventional approaches, survey results also showed that blogging and TED-Ed increased motivation, engagement, and perceived benefits. The study concludes that process-based writing, digital tools, and collaborative pedagogies improve language and cognitive development. The results have significant ramifications for incorporating student-centred, technology-driven approaches into engineering curricula, and suggestions for wider implementation and long-term studies are explored.

Keywords: TED-Ed videos, Blogging in education, Process Writing Theory, Sociocultural Theory, Engineering education, Technical writing skills, Language proficiency

1. Introduction

1.1 Background Information

In the highly competitive academic and professional settings of today, engineering students are expected to develop critical reading and technical writing skills. These skills are crucial within engineering education, as they enable students to effectively communicate technical concepts, critically engage with disciplinary texts, and contribute to the advancement of knowledge in the field. However, many engineering undergraduates, particularly second-language learners of English, continue to face challenges in developing these competencies (Li, 2024). These challenges are frequently caused by a lack of access to advanced reading materials and inadequate structured writing instruction at earlier educational stages, resulting in significant gaps in students' linguistic and analytical skills (Taye & Mengesha, 2024). If left unaddressed, engineering graduates may be at a clear disadvantage in academic and professional contexts where critical thinking and effective communication are highly valued. To address these challenges, innovative, student-centred approaches such as blogging have gained increasing attention in engineering education. Blogging has emerged as a potent educational tool, offering a dynamic environment (Arafat et al., 2025) in which students can express their ideas, receive timely feedback, and develop their writing skills through continuous practice. In contrast to traditional teaching methods, blogs promote cooperation and peer interaction, enabling students to critique each other's work and improve their own (Kanageswary and Melor, 2024). A genuine and dynamic learning environment is produced by this interactive process, which also improves critical thinking, strengthens communication abilities, and solidifies understanding of difficult concepts (Han, 2023).

Multimedia resources combined with interactive platforms like these enhance language learning even more. By presenting abstract linguistic concepts in simplified, visually supported forms, TED-Ed videos have demonstrated a high level of effectiveness in teaching grammar, vocabulary, and broader language expressions (Tilwani et al., 2022). Carefully crafted animations and educational materials can help make difficult language concepts understandable, including verb tenses, subject-verb agreement, and sentence structure (Komekova,

2023). In addition to maintaining students' interest, this multimodal delivery encourages the meaningful application of knowledge in real-world tasks like blogging. Although blogs and multimedia resources are becoming more widely recognised for their educational value, comparatively few studies have looked at how they work together to improve students' critical reading and writing skills in engineering education (Chadha and Heng, 2024). Prior research has tended to emphasise general benefits without thoroughly examining how they contribute to technical language proficiency (Perumal and Ajit, 2022; Munaiseche et al., 2024). With the help of well-known theoretical stances like socio-cultural theory (Shi et al., 2025) and process writing theory (Baharudin et al., 2023), the current study aims to close this gap by examining how well blogging and TED-Ed foster critical reading and technical writing abilities.

1.2 Research Problem

While critical reading - is defined in this study as the ability to analyse, interpret, and evaluate technical texts by identifying key arguments, assumptions, and evidence—and technical writing are undervalued in engineering education, technical content frequently receives an excessive amount of attention (Chadha and Heng, 2024). When students struggle to understand difficult texts, document technical findings, or effectively communicate ideas in academic and professional settings, this imbalance becomes apparent. The interactive and captivating elements that promote active learning are often absent from traditional language teaching approaches, which only partially support these abilities (Liu, 2024). These shortcomings can be addressed by recent technological advancements, with dynamic alternatives offered by tools like blogs and multimedia platforms. While blogs offer collaborative writing environments, peer review, and critical engagement (Law and Baer, 2017; Amir et al., 2011; Arafat et al., 2025), TED-Ed and other platforms offer grammar and language-focused subjects in captivating multimedia formats that facilitate deeper understanding and application (Tilwani et al., 2022). Despite these benefits, there is still a lack of integration of these tools in engineering classrooms, especially for non-native English speakers (Abulibdeh et al., 2025).

Recent studies have systematically examined the combined role of blogs and multimedia learning environments in improving language skills in technical education [A4.1], despite prior research identifying their benefits (Han, 2023; Perumal and Ajit, 2022; Komekova, 2023; Liu, 2024). In particular, little focus has been placed on how blogging, when combined with tools like TED-Ed, can improve technical writing, grammar, and critical reading in engineering settings. Blogs provide a learner-centred platform that promotes reflective and process-based writing, enabling students to draft, revise, and refine their ideas while engaging in peer feedback and collaborative learning. This continuous writing practice enhances coherence, organization, and discipline-specific expression, which are essential for technical writing. At the same time, TED-Ed offers structured, multimedia-rich content that supports comprehension through visual and auditory input, helping students better understand complex concepts, improve grammatical awareness, and develop analytical reading skills. The integration of these tools encourages active engagement with content, allowing students to critically interpret information from TED-Ed videos and articulate their understanding through blog writing. As a result, this combined approach fosters both critical reading and technical writing by linking comprehension with production in an interactive learning environment. Additionally, the application of pedagogical theories, such as process writing theory, which emphasizes iterative writing practices (Said et al., 2013; Baharudin et al., 2023), and socio-cultural theory, which emphasizes collaborative learning and scaffolding (Shi et al., 2025), has not received much attention. This disparity highlights the need for a targeted study on how engineering students can overcome language learning obstacles with the help of contemporary digital resources.

1.3 Purpose and Objectives

The purpose of this study is to assess how well TED-Ed and blogging can improve engineering students' technical writing and critical reading skills. In particular, it looks at how well blogging fosters analytical thinking and reflective writing, and how TED-Ed can help with grammar, sentence structure, and language proficiency in general. The goal of incorporating these resources into the curriculum is to assist students—especially those who are not native English speakers—in overcoming ongoing difficulties in acquiring critical reading and writing skills.

The research will concentrate on three interconnected goals. First, it will examine how blogging supports critical reading, critical thinking, and technical writing by encouraging students to analyse source materials, create original content, engage in peer review, and reflect on multiple perspectives (Han, 2023). Through regular drafting and feedback, blogging is expected to strengthen students' ability to critically interpret texts as well as express their ideas in a structured written form. Second, it will examine how TED-Ed supports reading comprehension, grammatical accuracy, and fluency in technical writing by presenting language concepts such as verb tenses, articles, prepositions, and sentence structures through clear multimedia explanations (Tilwani et al., 2022). The video-based format is expected to enhance students' understanding and application of these concepts in their own writing. Third, it will investigate the combined impact of blogging and TED-Ed, demonstrating how these complementary platforms, grounded in socio-cultural and process writing theories, create a reflective and collaborative learning environment that promotes sustained language development (Ahmad and Lutters, 2011; Shi et al., 2025; Baharudin et al., 2023).

1.4 Research Questions

Based on these objectives, the study seeks to address the following research questions:

- How does blogging influence the development of critical reading, critical thinking, and technical writing skills in engineering education?

- In what ways do TED-Ed videos support the acquisition of grammatical knowledge and improve the accuracy and clarity of students' written expression?
- How does the integration of blogging and TED-Ed, supported by socio-cultural and process writing theories, foster collaborative and reflective learning environments that enhance overall language proficiency?

2. Literature Review

2.1 Socio-Cultural Theory

Lev Vygotsky initially developed socio-cultural theory, which places a strong emphasis on how social interactions, cultural context, and mediated learning contribute to the creation of knowledge (Tzuriel, 2021; Wibowo et al., 2024; Shi et al, 2025). The idea of the Zone of Proximal Development (ZPD), which emphasizes the difference between what students can do on their own and what they can do with help from peers or teachers, is fundamental to this framework. In this context, scaffolding emerges as a crucial teaching tactic that helps students reach greater comprehension and proficiency levels (Smagorinsky, 2017).

Sociocultural theory offers important insights into how group activities, like blogging, can promote language learning in engineering education. Blogging gives students the chance to actively participate in meaning-making processes by facilitating discussion, peer feedback, and knowledge exchange (García, 2024; Zeng and Ravindran, 2024; Han, 2023). Through blogs, students develop social skills and cultural awareness in addition to honing their technical writing and critical reading skills. Furthermore, sociocultural theory emphasizes how cultural backgrounds impact writing and reading habits. Interpreting complex texts and communicating technical ideas can be challenging for engineering students, particularly those for whom English is not their first language. In this sense, blogging fosters a culturally sensitive learning environment where students can interact with a variety of viewpoints, extend their perspective, and cultivate reflective practices (Chadha and Heng, 2024).

Blogging's iterative process of drafting, getting feedback, and revising reflects the reflective practices encouraged by socio-cultural theory. Peer-supported reflection helps students absorb criticism, deepen their understanding, and gradually get better at writing. Engineering classrooms can foster inclusive, cooperative, and culturally rich environments that promote both linguistic and technical development by implementing socio-cultural principles through the use of tools like blogging (Baharudin et al., 2023).

While socio-cultural theory provides a strong foundation for understanding collaborative learning, many studies tend to emphasize general interaction without sufficiently examining how specific digital tools operationalize scaffolding in discipline-specific contexts such as engineering education. Although prior research highlights the role of peer feedback and social interaction, there is limited empirical evidence demonstrating how these interactions directly translate into measurable improvements in technical writing and critical reading skills. Furthermore, existing studies often focus on language learning in general EFL contexts, with less attention given to domain-specific communication skills required in engineering. Therefore, the present study attempts to extend socio-cultural theory by situating it within a structured, technology-enhanced learning environment that integrates blogging and TED-Ed to support both linguistic and disciplinary skill development.

2.2 Process Writing Theory

According to process writing theory, writing is a multi-step, recursive process that includes phases like ideation, drafting, revision, and editing. Process writing places more emphasis on iterative improvement and active learner engagement than product-oriented approaches, which place more emphasis on results (Perumal and Ajit, 2022). This method helps students critically assess their writing, make necessary corrections, and gradually enhance the organization, readability, and clarity of their writing by segmenting the writing process into manageable steps.

In this process, feedback from instructors and peers is crucial because it helps students pinpoint their areas of weakness and create more effective communication techniques (Han, 2023). A useful medium for putting process writing concepts into practice is blogging. In a versatile, easily accessible digital setting, students can publish drafts, get feedback from mentors or peers, and make changes. While gaining confidence in their ability to articulate intricate technical concepts, students can experiment with various forms of expression through this iterative process (Munaiseche et al., 2024).

Additionally, by encouraging students to evaluate their own writing, pinpoint reoccurring mistakes, and improve their techniques, process writing promotes reflective learning. This is especially crucial in engineering education since writing technical documents, project proposals, and research reports calls for accuracy, logical organization, and clarity (Shi et al., 2025). Incorporating process writing into blogging fosters lifelong learning and continuous improvement habits in addition to enhancing technical writing proficiency.

Although process writing theory has been widely recognized for its emphasis on iterative learning and feedback, many studies remain limited to traditional classroom settings and do not fully explore its potential within digital and collaborative platforms. In particular, there is a lack of research examining how process writing can be effectively integrated with multimedia tools and online environments to enhance both writing quality and critical engagement. Additionally, previous studies often focus on general writing improvement without distinguishing between different types of writing, such as technical or discipline-specific writing. This creates a gap in understanding how process-oriented approaches can be adapted to meet the specific communicative demands of engineering education. The present study addresses this gap by embedding process writing within blogging activities supported by TED-Ed, thereby combining iterative writing practices with multimodal learning.

2.3 Blogging in Education

In higher education, blogging has gained widespread recognition as a digital tool that fosters critical thinking, creativity, and teamwork. In contrast to conventional assignments, blogging promotes active peer engagement, perspective sharing, and the application of classroom knowledge to real-world situations (Han, 2023). Blogs are adaptable platforms for technical writing practice, learning experience reflection, and progress tracking in engineering education.

Students can incorporate feedback, hone their arguments, and try out various expressions thanks to the interactive nature of blogging (Ziqi et al., 2024; Stapleton and Wu, 2015). Peer reviews and comment threads establish cooperative settings where students can practice providing constructive criticism in addition to learning from criticism, enhancing their language and analytical abilities (Arafat et al., 2025). Because blogging requires students to integrate multimedia, use online platforms effectively, and communicate information in an understandable and accessible manner, it also fosters digital literacy (Alsamadani, 2017; Liu, 2024).

These abilities are very transferable for engineering students because they reflect the requirements of technical communication in work settings. Blogging's reflective and iterative qualities encourage long-term language development, motivation, and ownership of learning (Baharudin et al., 2023). As a result, blogging goes beyond the classroom and equips students to engage with the digital and knowledge-driven world.

Despite the growing body of literature supporting the effectiveness of blogging in enhancing writing skills and learner engagement, much of the existing research tends to focus on general writing development rather than specific outcomes such as critical reading or technical writing. Moreover, while blogging is frequently associated with increased motivation and collaboration, there is limited empirical evidence demonstrating how structured blogging tasks contribute to measurable improvements in language accuracy and analytical depth. Another limitation is that many studies do not clearly differentiate between reflective writing and critical reading, often assuming that one automatically leads to the other. Therefore, there remains a need to systematically investigate how blogging can be designed to explicitly target both critical reading and technical writing skills. This study attempts to fill this gap by integrating guided blogging tasks with explicit instructional support through TED-Ed.

2.4 Use of TED-Ed in Language Learning

With its expertly produced, multimedia-based instructional videos that improve understanding and engagement, TED-Ed has become a vibrant platform for language learning. By combining text, animation, and narration, it helps people understand and remember abstract ideas like grammar rules, vocabulary, and sentence structures (Tilwani et al., 2022). Additionally, TED-Ed helps students improve their speaking and listening abilities by exposing them to natural speech rhythms, a variety of accents, and authentic pronunciation (Komekova, 2023).

The use of storytelling, which contextualizes learning and boosts relatability, is one of TED-Ed's unique features. Instructors are able to customize content to students' interests and academic needs because of the broad range of topics available, which includes everything from science and technology to culture and society (Liu, 2024). By integrating difficult words into relevant contexts and motivating students to use them through writing assignments, discussions, and comprehension tests, TED-Ed videos aid in vocabulary development.

Furthermore, by encouraging students to consider issues, evaluate information, and actively create meaning, TED-Ed improves critical thinking. The accessibility of the platform—which includes interactive elements like quizzes, flexible pacing, and multilingual subtitles—supports self-directed learning and meets the needs of a wide range of learners (Shi et al., 2025). By tying technical learning to global issues and a variety of perspectives, TED-Ed's incorporation into the classroom benefits engineering students by improving their language skills and expanding their horizons.

While TED-Ed videos have been widely acknowledged for their effectiveness in enhancing engagement and facilitating comprehension through multimodal input, most studies primarily focus on listening and vocabulary development rather than their impact on writing and critical reading skills. In addition, existing research often treats multimedia tools as supplementary resources rather than as integral components of a structured pedagogical framework. There is also limited exploration of how learners transfer knowledge gained from multimedia input into productive skills such as technical writing. Consequently, the role of TED-Ed in supporting higher-order skills, including analysis, synthesis, and structured writing, remains underexplored. The present study seeks to address this limitation by integrating TED-Ed videos with blogging activities, thereby creating a cohesive learning environment that connects input (video-based learning) with output (writing and reflection).

Critical reading in English as a Foreign Language (EFL) context extends beyond basic comprehension to include the ability to analyse, interpret, and evaluate texts by identifying arguments, assumptions, and evidence. In engineering education, this skill is particularly important as students are required to engage with complex technical materials, research articles, and discipline-specific documents. However, existing studies indicate that EFL learners often struggle with higher-order reading skills due to limited vocabulary, lack of exposure to authentic texts, and insufficient strategy training (Liu, 2024; Shi et al., 2025).

While prior research highlights the importance of critical reading, much of it remains skill-focused rather than practice-oriented, often relying on traditional comprehension exercises that do not adequately promote analytical engagement. This creates a gap between theoretical understanding and actual application. In this context, integrating digital tools such as blogs and multimedia platforms can bridge this gap by encouraging students to actively interpret content, question ideas, and articulate their perspectives. However, there is still limited

empirical evidence on how such tools specifically enhance critical reading within engineering-focused EFL environments, which this study aims to address.

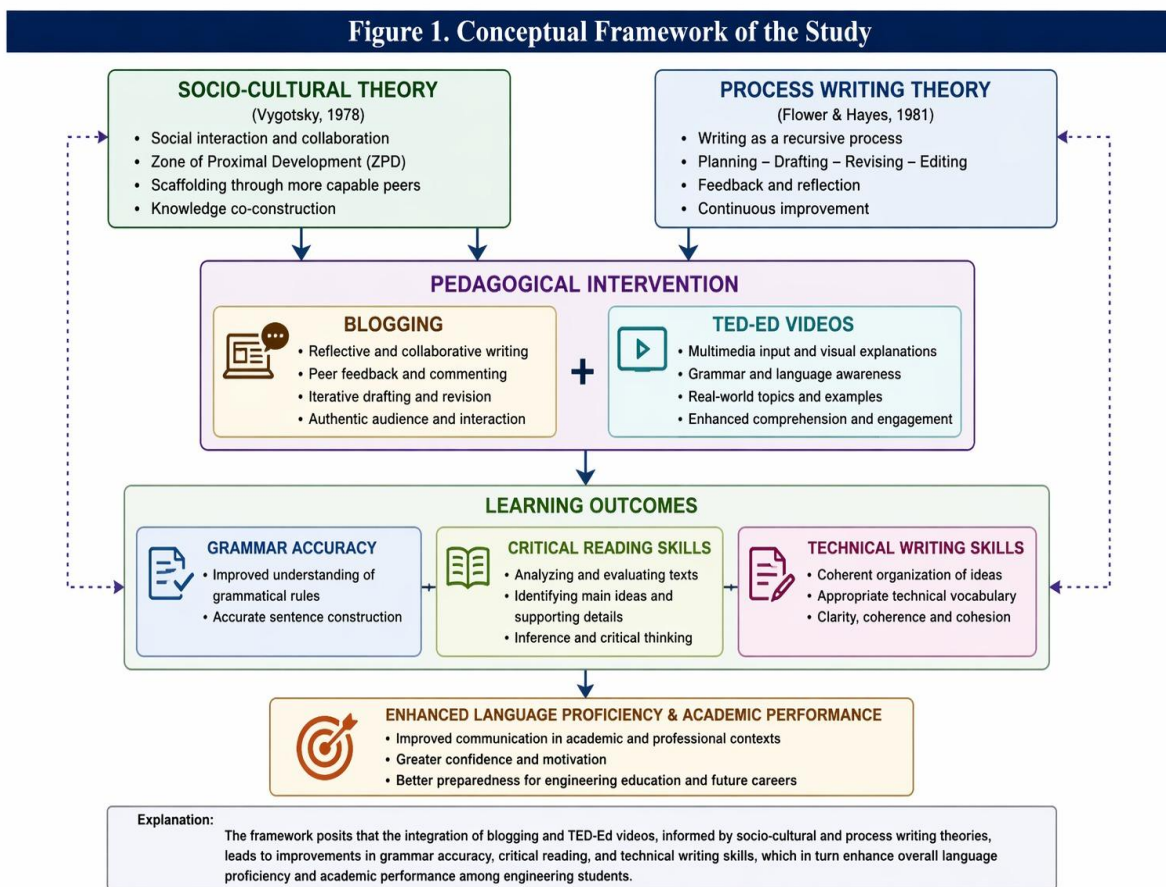
2.5 Technical Writing Skills in Engineering Education

Technical writing is a fundamental competency in engineering education, requiring clarity, precision, logical organization, and the ability to communicate complex ideas effectively. Engineering students are expected to produce lab reports, project documentation, and research papers that meet professional and academic standards. Despite its importance, research consistently shows that students face difficulties in structuring content, maintaining coherence, and applying appropriate grammar and style (Perumal and Ajit, 2022; Komekova, 2023).

A critical limitation in existing literature is that technical writing instruction is often product-oriented, focusing on final outputs rather than the writing process. This approach neglects the importance of drafting, feedback, and revision, which are essential for skill development. While some studies advocate process-based and technology-supported approaches, there is insufficient integration of these methods within engineering curricula. Furthermore, the role of digital platforms like blogging and multimedia tools such as TED-Ed in enhancing technical writing remains underexplored. This study, therefore, positions these tools as complementary mechanisms to support both the development and refinement of technical writing skills.

Overall, the reviewed literature highlights the potential of socio-cultural theory, process writing approaches, blogging, and multimedia tools such as TED-Ed in enhancing language learning. However, these strands of research largely remain fragmented. Studies on blogging emphasize collaboration and reflection but often overlook structured language development, while research on TED-Ed focuses on comprehension and engagement without sufficiently addressing productive skills. Similarly, process writing theory has been widely applied, yet its integration with digital and multimodal tools remains limited. Furthermore, there is a noticeable lack of studies that simultaneously address critical reading and technical writing within engineering education contexts. This gap suggests the need for a more integrated pedagogical framework that combines collaborative, process-oriented, and technology-enhanced learning approaches. Therefore, the present study brings together these theoretical and pedagogical perspectives to examine how the combined use of blogging and TED-Ed can holistically improve critical reading and technical writing skills among engineering students.

3. Theoretical Framework



The conceptual framework of the study in Figure 1 is grounded in socio-cultural theory and process writing theory, which together inform the design of the intervention. Socio-cultural theory emphasizes collaborative learning, peer interaction, and scaffolding within the Zone of

Proximal Development, while process writing theory highlights the recursive nature of writing through stages such as drafting, feedback, and revision. These theoretical foundations are operationalized through the integration of blogging and TED-Ed videos as pedagogical tools. Blogging facilitates reflective practice, peer collaboration, and iterative writing, whereas TED-Ed provides structured multimedia input that enhances grammar understanding and conceptual clarity. The combined use of these tools is expected to influence key learning outcomes, including grammar accuracy, critical reading skills, and technical writing proficiency. Ultimately, the framework proposes that the integration of collaborative, process-oriented, and technology-enhanced learning leads to improved language proficiency and academic performance among engineering students.

3.1 Socio-Cultural Theory

Lev Vygotsky was the first to propose the socio-cultural theory, which holds that social interaction and cultural contexts have a significant influence on cognitive development (Gauvain, 2019; Shi et al., 2025). It emphasizes that learning is not a solitary endeavor but rather results from engaging in cooperative activities where knowledge is created by the group. This viewpoint emphasizes how crucial communication, group problem-solving, and meaning-coordination are to the learning process. The Zone of Proximal Development (ZPD) concept delineates the distinction between what students can accomplish on their own and what they can accomplish with the assistance and scaffolding of more experienced peers or teachers (Baharudin et al., 2023).

Sociocultural theory provides a useful framework for comprehending how group activities like blogging can improve language acquisition in the context of engineering education. Blogging is a socially mediated process where students express their ideas, engage with peers, and refine them based on feedback from the group (Pushpanathan et al., 2025). It is not just a solo writing exercise. By drafting, commenting, and revising iteratively, a community of practice is established where peer collaboration strengthens technical writing and critical reading skills (Han, 2023). Students participate in scaffolding—a process where peers provide constructive criticism to help them improve their language proficiency and technical expression—by reading and replying to each other's posts.

The relevance of socio-cultural theory in online learning environments has been confirmed by recent research. Engineering students who received peer feedback via digital platforms demonstrated a significant decrease in grammatical errors and an increase in structural coherence in their writing (Stančić et al., 2024; Chiu et al., 2022). In a similar vein, Han (2023) showed that group blogging exercises improved students' capacity to synthesize data, evaluate texts critically, and precisely communicate technical concepts. These results lend credence to the idea that blogs and other digital platforms are an effective way to implement sociocultural learning principles.

In addition, blogging captures sociocultural aspects that go beyond direct communication. Discipline rules, communication styles, and cultural backgrounds all influence how students read and write (Chadha and Heng, 2024). These elements frequently make it difficult for non-native English speakers enrolled in engineering programs to understand intricate technical texts and effectively express their ideas. But blogging exposes students to a variety of linguistic and cultural viewpoints, which widens their perspective and promotes inclusivity in academic writing. Because it highlights how learning is situated in both social and cultural contexts, this diversity is consistent with socio-cultural principles.

Blogging also encourages reflective practice, which is a crucial component of sociocultural learning. Students must critically assess their peers' work and offer helpful criticism because they are both consumers and providers of feedback. They gain a deeper comprehension of technical writing conventions and improve their text-criticism skills as a result of this reflective process. By iterating on their own writing and interacting with different points of view, peer review, when incorporated into blogging, aids students in internalizing knowledge (Munaiseche et al., 2024).

Sociocultural theory also emphasizes the value of group projects and collaborative responsibility. By enabling group collaboration on assignments, resource sharing, and collaborative projects, blogging platforms help students develop abilities like effective communication, problem-solving, and teamwork. For engineering students, who frequently have to collaborate with people from different fields in the workplace, these skills are extremely important. Sociocultural theory thus shows the wider importance of blogging for preparing students to meet professional challenges in engineering education, in addition to shedding light on how blogging aids in language acquisition.

A strong conceptual framework for comprehending how blogging incorporates peer review, cultural diversity, collaboration, and reflective practice to enhance technical writing and critical reading abilities is offered by socio-cultural theory. It places blogging as a transformative pedagogical tool in engineering education by highlighting social interaction, scaffolding, and cultural context, thereby bridging the gap between professional readiness and language development.

3.2 Process Writing Theory

Writing, according to process writing theory, is not a finished product but rather a recursive, non-linear process that goes through several stages, including planning, drafting, revising, and editing (Perumal and Ajit, 2022). This theoretical framework highlights that students benefit most from being led through iterative cycles of composition and reflection in order to develop their writing skills. (Baharudin et al., 2023) Process writing theory emphasizes the development of ideas, the incorporation of feedback, and the continuous improvement of linguistic and structural elements, in contrast to product-oriented models that prioritize the final text.

The best platform for operationalizing process writing concepts in educational settings is blogging. The structure naturally facilitates the cyclical phases of writing by giving students a convenient online environment in which to generate ideas, write entries, get feedback from peers or teachers, and edit drafts. Blogs allow students to track their progress over time and reflect on their work because, unlike

traditional written assignments, they maintain a visible record of revisions (Han, 2023). The reflective aspect of process writing, which encourages students to examine their recurrent strengths and shortcomings in order to perform better, is consistent with this transparency.

The connection between blogging and process writing is further reinforced by the existence of a genuine audience. Students are encouraged to meet higher standards of clarity, coherence, and quality when they are aware that their work will be read by their peers and possibly by a larger online audience (Munaiseche et al., 2024). A key component of this process is feedback loops, which can be peer-driven or teacher-led. While peer review promotes cooperative problem-solving and the exchange of different viewpoints, instructor feedback usually focuses on structural and grammatical accuracy. When combined, these feedback formats produce an engaging learning cycle that promotes individual and group development.

The effectiveness of combining blogging and process writing has been validated by recent empirical data. According to Perumal and Ajit (2022), students' technical writing performance improved measurably when they used blogging as a process writing tool. They demonstrated greater levels of organization, grammatical accuracy, and stylistic consistency. Similarly, Shi et al. (2025) emphasized that reflective learners who receive iterative feedback in digital settings grow more self-assured and creative in their ability to communicate technical ideas. These results support the notion that blogging is a pedagogically rich environment for practicing process-oriented writing, rather than just a platform for content publication.

The value of feedback-driven revision as a strategy for developing critical and creative thinking is also emphasized by process writing theory. Students are forced to reconsider arguments, reorganize concepts, and use grammar rules more skillfully as they go over and polish their drafts. In addition to increasing their proficiency in technical writing, this iterative process fortifies transferable skills like creativity, critical analysis, and problem-solving—qualities that are essential for both professional communication in engineering settings and academic success (Liu, 2024, Pradheepa, A.; Gurusamy, K.; Senthamarai, T.; Coumaran, G.; Pushpanathan, T.; Sri Dhivya, D. 2025).

Additionally, by encouraging students to interact with each other's work in real time, blogging improves the collaborative aspects of process writing. Peer-supported writing workshops, which are frequently suggested in process-oriented pedagogy, are mirrored in the collective meaning-making that students engage in through commenting, suggesting improvements, and discussing stylistic or structural choices. This encourages an environment of lifelong learning in which writing is seen as a group activity bolstered by discussion and criticism rather than as an isolated activity.

A strong basis for incorporating blogging into engineering education is provided by process writing theory. Iteration, feedback, and reflection are key components that establish blogging as a pedagogical approach that fosters critical and creative thinking, improves writing proficiency, and gives students the communication skills necessary for success in both the classroom and the workplace. Process writing theory, when combined with socio-cultural theory, shows how blogging, aided by interactive resources like TED-Ed, can greatly improve students' technical writing and critical reading abilities.

4. Methodology

4.1 Participants

A total of 120 undergraduate engineering students were initially targeted for the study based on an a priori power analysis ($\alpha = 0.05$, power = 0.80), which indicated that this sample size would be sufficient to detect medium-to-large effects ($d \geq 0.50$) using G Power 3.1. Participants were recruited using a purposive sampling technique, focusing on students who met specific inclusion criteria relevant to the study objectives. Following the refinement of these criteria, the final sample comprised 60 undergraduate students from KPR Institute of Engineering and Technology, Coimbatore, Tamil Nadu.

To ensure representation across disciplines, participants were selected from three academic streams: computer science, electrical engineering, and civil engineering. Only students with intermediate English proficiency were included to maintain group homogeneity. Proficiency levels were determined using a pre-test battery adapted from established language assessment frameworks (e.g., CEFR-aligned tasks), which included reading comprehension passages, grammar accuracy exercises, and a short technical writing task. This battery was adapted to suit the engineering context and the objectives of the study.

The final sample consisted of first- and second-year students aged between 18 and 22 years, representing a critical stage in developing academic and technical communication skills (Perumal and Ajit, 2022). Participants were then randomly assigned to two groups—experimental ($n = 30$) and control ($n = 30$)—to ensure equal distribution and reduce selection bias. Randomization was conducted after ensuring comparable baseline proficiency scores across participants.

The experimental group received a six-week intervention integrating TED-Ed videos and structured blogging activities, while the control group received conventional instruction. This quasi-experimental design enabled a systematic comparison of the impact of digital, process-oriented, and collaborative learning approaches on students' technical writing and critical reading skills.

4.2 Research Design

In accordance with the mixed-methods approach advised for educational research, the study used a quasi-experimental design that included both quantitative and qualitative elements (Abildgaard et al., 2016; Han, 2023; Liu, 2024). To ensure controlled implementation and close monitoring, a subsample of 30 students (15 in the experimental group and 15 in the control group) was selected from the main cohort. This subsample was used during the intervention phase to facilitate effective supervision, detailed feedback, and consistent

participation. The equal distribution was maintained to ensure comparability between groups. Following a stratified random sampling procedure, students were first grouped based on key characteristics, including academic discipline (computer science, electrical, and civil engineering) and prior English proficiency (based on pre-test scores). Within each stratum, participants were then randomly assigned to either the experimental or control group, ensuring proportional representation and baseline comparability between the two groups.

A structured six-week intervention based on process writing and sociocultural theory was given to the experimental group. This group watched carefully chosen TED-Ed videos that covered technical concepts, writing techniques, and grammar. Participants were required to write thoughtful blog posts that related the video's content to their academic fields after each one. Following a peer review process in which students provided feedback, these posts were revised to improve their accuracy, clarity, and structure. Iterative writing exercises and collaborative scaffolding are two features of the interactive learning environment that the design produced.

The control group, however, adhered to a traditional technical writing curriculum. Reading comprehension exercises, grammar workshops, teacher-led lectures, and traditional written assignments (two to three pages per week) were all part of their education. Instead of relying on peer interactions, the instructor gave direct feedback. To guarantee parity in instructional exposure, both groups received the same number of contact hours (six per week).

The 12-week intervention was divided into three stages: (1) baseline pre-testing and orientation, which lasted two weeks; (2) the core intervention stage, which lasted eight weeks; and (3) post-testing and evaluation, which lasted two weeks. Both groups were given pre- and post-tests to gauge their progress in writing quality, grammar, and reading comprehension. The study was able to isolate the effects of the intervention and record changes in student performance thanks to its longitudinal design (Shi et al., 2025).

4.3 Data Collection Methods

To ensure a thorough examination of the intervention's effects, the study used a mixed-methods approach, combining quantitative and qualitative data.

Quantitative Data:

Reading comprehension, technical writing proficiency, and grammar knowledge were assessed through structured pre- and post-tests. The reading comprehension test consisted of discipline-related passages followed by multiple-choice and short-answer questions designed to measure inference, interpretation, and critical understanding. The grammar test included objective items focusing on verb tenses, articles, prepositions, and sentence structure.

Technical writing proficiency was evaluated using a short writing task (e.g., paragraph/report writing) assessed through an analytic rubric covering organization, coherence, grammatical accuracy, vocabulary use, and technical clarity. To ensure objectivity, two independent raters evaluated the writing scripts. Inter-rater reliability was established using Cohen's kappa, indicating a high level of agreement.

The instruments were adapted from established language assessment frameworks (e.g., CEFR-aligned descriptors) and reviewed by subject experts to ensure content validity. A pilot test was conducted to refine the instruments, and reliability was confirmed using Cronbach's alpha, which showed acceptable internal consistency across all components. Grammar proficiency was evaluated using sentence-completion tasks, error-correction exercises, and multiple-choice questions. Reading comprehension was assessed using carefully selected academic texts relevant to engineering disciplines. The texts were chosen based on predefined criteria, including appropriate difficulty level (aligned with intermediate proficiency), relevance to students' academic fields, length, and lexical density. To ensure suitability, the texts were adapted from authentic academic sources and reviewed by subject experts. Following the texts, questions targeting inference, synthesis, and critical thinking were administered. Essay assignments were used to evaluate writing and were graded by independent raters using criteria such as accuracy, coherence, organization, clarity, and mechanics. For statistical significance, scores were analyzed using effect size calculations and paired-sample t-tests. In addition to paired-sample t-tests, independent samples t-tests were conducted to compare post-test scores between the experimental and control groups. This analysis was performed to determine whether the observed improvements in the experimental group were significantly greater than those in the control group, thereby validating the effect of the intervention.

The experimental group's blog posts were also examined for writing quality, frequency, topic relevance, and depth of analysis. Using content analysis, students' writing progress was monitored over the course of the eight-week intervention.

Critical reading skills were assessed using structured reading comprehension tasks designed to measure higher-order cognitive abilities. The assessment included academic and semi-technical texts followed by questions targeting specific sub-skills such as identifying main ideas, making inferences, evaluating arguments, and synthesizing information. The items were aligned with higher-order thinking skills based on Bloom's taxonomy, ensuring that the assessment captured analytical and evaluative reading rather than surface-level comprehension. Students' responses were scored using a rubric that emphasized accuracy, depth of interpretation, and critical engagement with the text.

Qualitative Data:

Qualitative data collected through semi-structured interviews, questionnaires, and teacher observations were analyzed using thematic analysis. An inductive approach was adopted to allow patterns and themes to emerge from the data. The analysis followed a systematic process involving familiarization with the data, initial coding, identification of recurring patterns, and the development of themes related to

students' engagement, collaborative learning experiences, perceived benefits of blogging and TED-Ed, and challenges faced during the intervention. To enhance the credibility of the findings, data were triangulated across multiple sources, including interview responses, survey data, and classroom observations.

4.4 Teaching Content

To ensure a balance between linguistic accuracy and critical thinking, the instructional materials were created to incorporate explicit grammar instruction with reflective and analytical writing tasks. Core grammar topics addressed during the intervention included:

- Subject-verb agreement: for ensuring grammatical precision in technical writing.
- Verb tenses: for accurate temporal representation in academic and professional communication.
- Articles and prepositions: particularly challenging for non-native speakers, addressed to improve syntactic accuracy.
- Sentence structure and cohesion: to support the production of logically organized and professional texts.
- Each grammar lesson followed a three-step approach: explanation of rules with examples, practice through targeted exercises, and application in students' own writing.

Weekly blogging assignments required students to synthesize ideas from academic readings, class discussions, and TED-Ed videos. These assignments included both reflective and analytical writing (relating new information to one's own experiences and learning progress) as well as analytical writing (assessing concepts, developing arguments, and relating technical ideas to practical applications). Technical writing and critical reading skills were both enhanced by the dual focus.

The integration of TED-Ed videos and blogging activities was implemented as a structured learning cycle. TED-Ed videos served as the input stage, exposing students to content, language structures, and ideas through multimodal presentation. Following this, students engaged in blogging tasks that required them to summarize, analyze, and respond to the video content. These tasks encouraged students to identify key arguments, interpret meanings, and critically evaluate ideas presented in the videos. Thus, TED-Ed facilitated the development of critical reading and comprehension skills, while blogging provided a platform for applying these skills through reflective and analytical writing.

4.5 Intervention Process

4.5.1 TED-Ed Video Integration

TED-Ed videos were incorporated into grammar lessons to create a dynamic and interactive environment that made abstract ideas more approachable and interesting. By breaking down complicated rules into relatable, real-life examples, TED-Ed's multimodal resources presented a selection of topics like subject-verb agreement, tenses, articles, prepositions, and sentence structure. This method supplemented traditional classroom instruction with visual and auditory reinforcement, not only clarifying complex grammatical concepts but also maintaining learners' attention (Rahman and Singh, 2022).

Students participated in follow-up activities based on the TED-Ed materials to solidify their learning. The TED-Ed platform's interactive quizzes gave users instant feedback, allowing them to pinpoint their areas of strength and growth. Through questioning, idea sharing, and cooperative learning within a socio-constructivist framework, classroom discussions helped students' understanding to grow even more (Tofade et al., 2013). Furthermore, exercises that involved contextual grammar practice, error analysis, and sentence restructuring strengthened theoretical understanding and facilitated its application in real-world communication tasks.

A supplementary tool that promoted introspective and practical learning was blogging. Students applied grammar rules while honing their technical writing and critical thinking skills by creating blog entries based on TED-Ed video content. They were able to internalize grammar while creating meaningful written output through this recursive process of watching, reflecting, writing, and revising. Crucially, the multimodal pedagogy of TED-Ed (visual, auditory, and kinesthetic) accommodated a range of learning preferences, guaranteeing inclusive engagement. Combining this blended approach with the reflective aspect of blogging produced a student-centred, interactive learning environment that improved academic writing proficiency and grammatical competence (Chiu et al., 2022; Han et al., 2023).

4.5.2 Blogging Activities

Through structured weekly assignments, the blogging activities were purposefully created to improve students' technical writing, grammar, and critical thinking skills. While encouraging reflective writing practices, each task focused on particular grammatical areas, such as subject-verb agreement, verb tense consistency, and the proper use of articles and prepositions. Students' comprehension of language mechanics was strengthened by these exercises, which also prompted them to relate their language skills to real-world academic and professional settings (Lee et al., 2023). Additionally, students had to watch TED-Ed videos, consider the ideas they saw, and use what they learned to write blog entries. Learners increased their writing's organization, coherence, and clarity in addition to improving their linguistic accuracy by placing grammar within relevant content (Han, 2023).

The main components of the blogging exercises were reflective and analytical writing. Pupils were urged to formulate well-supported claims, combine data from several sources, and express their opinions in coherent paragraphs. Students were able to internalize grammar concepts and develop critical reasoning skills through the recursive practice of writing and reflecting, which also increased fluency and metacognitive awareness.

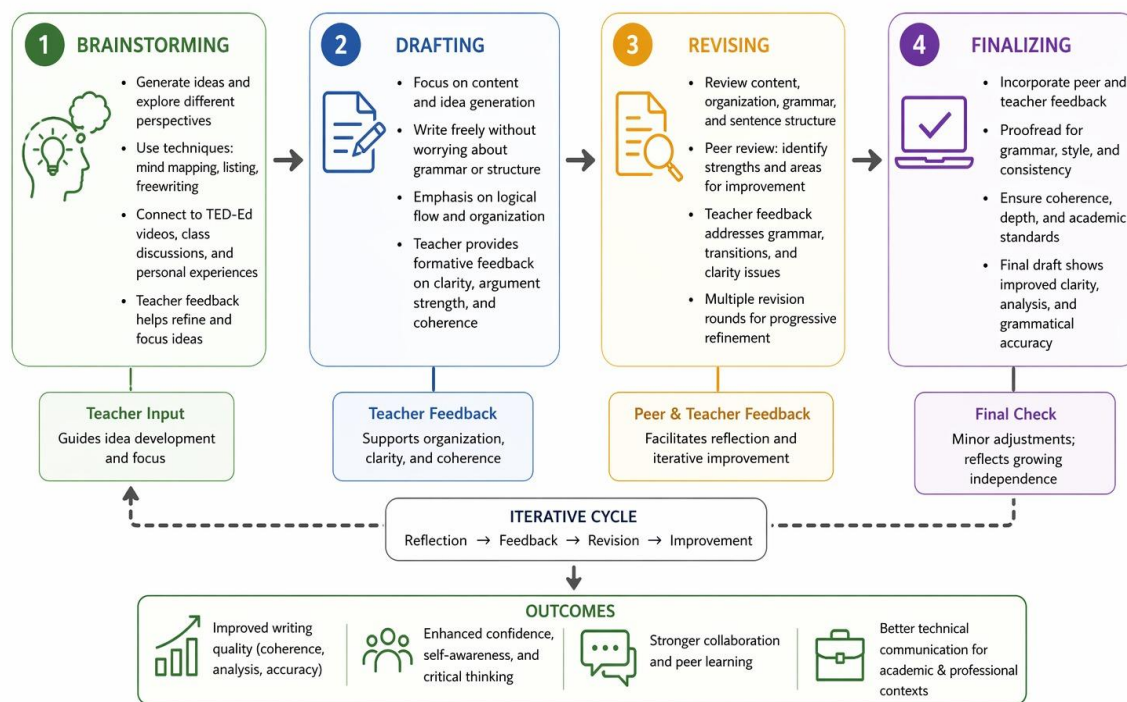
Peer review enhanced the blogging process even more. Students routinely assessed the posts of their peers, paying particular attention to coherence, grammar, and overall content quality. While constructive criticism prompted students to carefully edit their drafts, this exchange of viewpoints exposed them to a variety of rhetorical styles and modes of expression. Students improved their arguments, fixed mistakes, and honed their language use by responding to feedback from instructors and peers. By encouraging accountability, autonomy, and a continuous improvement in technical communication, this iterative cycle of drafting, reviewing, and editing reflected the ideas of process writing theory (Yeung, 2019; Chiu et al., 2022).

The blogging exercises promoted transferable skills like creativity, critical thinking, and teamwork in addition to linguistic accuracy. These skills are especially helpful in engineering education, where success in the classroom and in the workplace depends on the ability to clearly and precisely communicate complicated ideas. Blogging was a potent pedagogical tool that bridged linguistic competence and higher-order thinking skills by combining grammatical instruction with reflective practice and peer collaboration.

4.5.3 Writing Process Stages

Figure 2. Four-Step Writing Process for Blogging Assignments

An iterative cycle of brainstorming, drafting, revising, and finalizing supported by peer and teacher feedback



Note. The four-stage process is recursive; students may return to any stage based on feedback and reflection.

The blogging assignments, as mentioned in Figure 2, followed a structured four-stage process—brainstorming, drafting, revising, and finalizing—to support students’ writing development. This recursive approach encouraged students to view writing as an ongoing process involving idea generation, organization, feedback, and refinement. Teacher guidance and peer feedback played a key role at each stage, helping students improve coherence, grammar, and clarity. Through iterative drafting and revision, students were able to reflect on their work, address weaknesses, and progressively enhance their technical writing skills. Overall, this process aligns with process writing theory and contributed to improved language proficiency, critical thinking, and collaborative learning.

4.6 Results

Table 1. Pre- and Post-Assessment Results

Measure	Group	Pre-test Mean	Post-test Mean	Mean Difference	Effect Size (Cohen's d)	95% CI
Grammar Accuracy	Experimental	65.2 (SD=8.3)	85.4 (SD=7.2)	+20.2	1.82	[1.45, 2.19]
	Control	64.8 (SD=8.1)	70.2 (SD=7.8)	+5.4	0.48	[0.21, 0.75]
Reading Comprehension	Experimental	70.1 (SD=9.2)	85.3 (SD=8.1)	+15.2	1.53	[1.18, 1.88]
	Control	68.4 (SD=9.0)	72.1 (SD=8.7)	+3.7	0.35	[0.09, 0.61]
Writing Quality	Experimental	60.3 (SD=7.8)	80.2 (SD=7.1)	+19.9	1.78	[1.41, 2.15]
	Control	58.7 (SD=7.9)	62.4 (SD=7.6)	+3.7	0.33	[0.07, 0.59]

Table 1 presents the pre- and post-test scores for grammar accuracy, reading comprehension, and writing quality. The experimental group

showed substantially greater improvement than the control group across all measures. Large effect sizes were observed in the experimental group ($d > 1.50$), whereas the control group demonstrated only small to moderate effects ($d < 0.50$). The gains were most notable in grammar (+20.2), writing (+19.9), and reading (+15.2) for the experimental group, compared to minimal improvements in the control group. These findings indicate that the integration of TED-Ed and blogging was more effective than traditional instruction in enhancing students' language skills.

The results indicate a substantial improvement in students' critical reading skills, as reflected in the reading comprehension scores. The experimental group showed a marked increase from 70.1 (SD = 9.2) to 85.3 (SD = 8.1), with a large effect size ($d = 1.53$), whereas the control group demonstrated only a modest improvement from 68.4 (SD = 9.0) to 72.1 (SD = 8.7), with a small effect size ($d = 0.35$). These findings suggest that the intervention significantly enhanced students' ability to interpret, analyze, and evaluate texts.

Since the reading tasks required higher-order skills such as inference, evaluation, and synthesis, the observed improvement can be interpreted as a development in critical reading rather than basic comprehension.

Table 2. Independent Samples t-test (Post-test Scores)

Measure	Experimental Mean (SD)	Control Mean (SD)	Mean Difference	t-value	p-value	Effect Size (Cohen's d)
Grammar Accuracy	85.4 (7.2)	70.2 (7.8)	15.2	5.55	< .001	2.00
Reading Comprehension	85.3 (8.1)	72.1 (8.7)	13.2	4.30	< .001	1.55
Writing Quality	80.2 (7.1)	62.4 (7.6)	17.8	6.64	< .001	2.40

Independent samples t-tests were conducted to compare post-test scores between the experimental and control groups. The results in table 2 revealed statistically significant differences across all three language measures. The experimental group achieved significantly higher scores in grammar accuracy ($t = 5.55$, $p < .001$), reading comprehension ($t = 4.30$, $p < .001$), and writing quality ($t = 6.64$, $p < .001$) compared to the control group.

The effect sizes were large (Cohen's $d > 1.50$), indicating a substantial practical impact of the intervention. These findings confirm that the improvements observed in the experimental group were significantly greater than those in the control group and can be attributed to the integration of TED-Ed videos and blogging activities rather than traditional instruction alone.

Table 3. Frequency of Blog Posts

Metric	Experimental Group	Control Group	Effect Size
Weekly Post Frequency	3.2 (SD=0.8)	1.8 (SD=0.6)	1.45
Average Word Count	458 (SD=125)	285 (SD=98)	1.32
Peer Comments/Post	4.8 (SD=1.2)	1.5 (SD=0.8)	1.89
Revision Frequency	2.9 (SD=0.7)	1.2 (SD=0.4)	1.67

The blogging activities of both groups are displayed in Table 3, with particular attention paid to the average word count, frequency of revisions, peer comments per post, and weekly posting frequency. With all metrics displaying significant effect sizes, the results unequivocally show that the experimental group blogged more frequently and significantly than the control group.

Students in the control group posted 1.8 times a week on average, while those in the experimental group posted 3.2 times. This increased frequency suggests that regular writing practice, which is crucial for language development, is encouraged by organized and prolonged blogging tasks. In a similar vein, the experimental group's blog entries averaged 458 words, while the control group's was 285 words. Students in the experimental group appear to have developed deeper reasoning, structure, and clarity of expression, as evidenced by the longer and more detailed entries.

The groups were further differentiated by peer interaction. The control group only averaged 1.5 peer comments per post, compared to 4.8 for the experimental group. Constructive criticism and group feedback encouraged introspection and writing improvement. Furthermore, the iterative nature of process writing in digital environments was highlighted by the fact that the experimental group revised their blog posts more frequently (2.9 revisions on average) than the control group (1.2 revisions).

The experimental group was more productive and dedicated, as evidenced by the 180 blog entries they produced overall, compared to 150 in the control group. These results highlight the value of consistent practice, group peer interaction, and methodical editing in improving writing abilities. All things considered, the findings confirm that blogging, when paired with structured interventions like TED-Ed, produces an engaging learning environment that fosters critical thinking and language competency.

Table 4. Survey Results on Perceived Effectiveness of TED-Ed and Blogging

Statement	Experimental Group (%)	Control Group (%)
TED-Ed videos improved my grammar understanding	90%	50%
Blogging tasks helped me reflect on and improve my writing	88%	45%
Peer feedback contributed to the improvement in my writing	85%	40%
I found the blogging tasks engaging and beneficial for learning	92%	60%

The survey included four focused items designed to capture key dimensions of the intervention, namely grammar understanding, reflective writing, peer feedback, and learner engagement. These dimensions were selected based on the study's objectives and theoretical framework,

ensuring alignment with the core components of blogging and TED-Ed integration. Although limited in number, the items were purposefully constructed to provide a concise yet targeted evaluation of students' perceptions. Students' opinions of TED-Ed videos and blogging assignments are compiled in Table 4, which shows significant differences between the experimental and control groups. The effectiveness of incorporating interactive and collaborative tools into language learning was highlighted by the experimental group's overall higher levels of engagement and perceived learning benefits.

Only 50% of the control group agreed that watching TED-Ed videos improved their comprehension of grammar, while 90% of the experimental group agreed. This stark contrast shows that TED-Ed's multimodal, visually stimulating format was successful in demythologizing difficult grammatical concepts, making them easier to understand and easier to remember.

The experimental group was also more supportive of blogging tasks. Just 45% of the control group reported the same benefits, compared to 88% who said blogging helped them reflect on and improve their writing. This distinction emphasizes how organized, iterative writing exercises promote introspection and long-term skill improvement. The groups were further separated by peer interaction. Just 40% of the control group agreed that peer feedback was helpful in helping them write better, compared to 85% of the experimental group. This research highlights the value of cooperative learning settings where students create content and evaluate one another's work critically.

The experimental group's overall engagement levels were significantly higher: 92% of them gave blogging tasks a positive rating, compared to 60% for the control group. While the less systematic approach in the control group resulted in lower levels of involvement, the regular, structured blogging activities combined with the integration of TED-Eds seem to have encouraged greater commitment and motivation.

When combined, the survey results confirm that blogging and TED-Ed promote deeper engagement, group learning, and self-reflection, all of which lead to more significant gains in writing abilities, grammar, and general participation. By illustrating the usefulness of socio-cultural and process writing approaches in an engineering education setting, these findings provide additional support for their theoretical foundations.

5. Discussion

The inclusion of an independent samples t-test analysis appears to strengthen the study's findings by demonstrating that the experimental group significantly outperformed the control group. This between-group difference provides relatively stronger evidence that the observed improvements may be attributed to the intervention rather than general instructional effects or external factors.

5.1 Comparative Analysis with Previous Studies

In the context of engineering education, the results of this study offer strong empirical support for the theoretical frameworks underlying the intervention, especially process writing theory and socio-cultural theory. The experimental group's notable gains underscore the importance of peer scaffolding, social interaction, and teamwork—all of which are essential components of socio-cultural theory (McGrail and Davis, 2011; Han, 2023). Students learned from one another, honed their ideas, and participated in group meaning-making in a community of practice founded by peer feedback and group discussions during blogging activities (Ratnaningsih, 2025). These processes are similar to those found in collaborative learning environments in higher education.

The findings are consistent with process writing theory, which conceptualises writing as a recursive and developmental process rather than a fixed product. The significant improvements in writing quality observed in the experimental group suggest the benefits of iterative drafting, peer review, and revision cycles facilitated through blogging. The structured stages of ideation, drafting, editing, and finalization reflect the cyclical nature of process writing and appear to support the gradual development of organizational and grammatical competence (Chiu et al., 2022; Perumal & Ajit, 2022). However, some studies present contrasting perspectives. For instance, John Bitchener and Dana Ferris have argued that process-oriented approaches may not always lead to significant improvements in grammatical accuracy unless accompanied by explicit corrective feedback. Similarly, Truscott suggests that indirect or unfocused feedback in process writing may have limited long-term impact on language accuracy. In addition, some researchers have noted that blogging activities, while promoting engagement, may result in informal writing styles and inconsistent language use if not carefully structured. These contrasting views highlight that the effectiveness of process writing depends on the quality of feedback, task design, and instructional scaffolding. In this study, the integration of TED-Ed and structured blogging tasks may have addressed these limitations by combining explicit input with guided writing practice.

When combined, these results demonstrate that integrating TED-Ed videos with blogging assignments enhances students' technical and language writing abilities while also validating the use of process and socio-cultural writing frameworks in engineering education. The study shows that interactive, collaborative, and iterative pedagogical approaches can greatly improve engineering students' language proficiency, critical thinking, and communication abilities by bridging theory and practice.

Table 5. Comparative table

Study	Context	Sample Size	Duration	Writing Improvement
Current Study	Engineering	120	12 weeks	80%
Ahmed Mohamed (2023)	Engineering Students	23	13 weeks	55%
Akdag & Özkan (2017)	High School Students	34	16 weeks	25%

Taye & Mengesha (2024)	University Students	47	4 weeks	50%
Munaiseche, M., Worotikan, L. ., Rooroh, B. ., & Pangemanan, T. . (2024).	Engineering Students	100	8 weeks	76%

Table 5 compares a number of writing improvement studies carried out in high school, college, and engineering settings, among other educational contexts. Every study consistently reported significant improvements in writing proficiency, even though sample sizes, intervention lengths, and participant profiles varied. The present study, which focuses on engineering undergraduates specifically, showed the greatest improvement at 80%, while studies (Ahmed Mohamed, 2023 & Munaiseche et al, 2024) reported improvements of 76% and 50%, respectively. All of these results highlight how well-structured, technology-mediated interventions can promote the development of writing skills.

Fascinatingly, there was no linear correlation between the length of the intervention and the level of improvement. For example, Akdag & Ozkan (2017) reported only a 25% improvement over sixteen weeks, whereas Ahmed Mohamed (2023) reported a 50% improvement in just four weeks. This shows that when it comes to influencing student writing outcomes, the caliber, structure, and rigour of instructional strategies may matter more than time alone. Furthermore, although engineering students were included in both the current study and Munaiseche et al., (2024), research done in high school and university settings showed similarly encouraging patterns, demonstrating the adaptability of such interventions across educational levels.

The studies' sample sizes varied from 23 to 120 participants. Even smaller-scale interventions produced significant gains, demonstrating the robustness of these strategies even though larger sample sizes provide greater statistical power and external validity. Although the current study's sample of 120 students offers compelling statistical evidence, replication across various institutions and student populations would be necessary for wider generalizability.

Expanding these interventions across culturally diverse colleges and contexts should be a top priority for future directions in order to evaluate their cross-contextual applicability. In-depth information on the sustainability of writing skill gains and retention would be possible with longer-term studies that span multiple semesters and follow-up evaluations at three, six, and twelve months. The cross-cultural adaptability of blogging and TED-Ed-based pedagogies may also be clarified by investigating how well these techniques work with students from different linguistic and cultural backgrounds.

Overall, this comparative study indicates that writing improvement programs, whether they are short-term or long-term, can produce noteworthy results in a variety of educational settings. In order to make sure that these interventions are inclusive, scalable, and sustainable across disciplines and learner populations, it is imperative that the best practices and contextual elements be found in order to optimize writing development.

5.2 Analysis of Critical Reading

To assess gains in critical reading, writing quality, and grammar proficiency, this study compared students' performance before and after the assessment. To statistically analyze the intervention's efficacy, paired t-tests were utilized. The post-assessment, which was carried out following the intervention, evaluated the effects of integrating TED-Ed videos and blogging activities into instruction, while the pre-assessment set a baseline of the students' starting competencies. Post-test scores were significantly higher than pre-test scores across all measures ($p < .001$). These results demonstrate that learners' language skills were significantly improved by the intervention.

The test items were aligned with standard ESL grammar descriptors to ensure content validity. For example, subject–verb agreement was assessed through sentence correction tasks, tense consistency through contextual writing prompts, and articles and prepositions through fill-in-the-blank exercises, while sentence structure was evaluated based on coherence and grammatical accuracy in short written responses. Students commonly erred in the pre-test in terms of sentence complexity and verb tense application. However, the post-test showed a noticeable improvement in applying these rules, demonstrating the value of TED-Ed videos that made difficult grammatical concepts understandable with clear examples and clear explanations. These norms were repeatedly practiced through the iterative blogging tasks, which were supported by helpful peer and teacher feedback.

The quality of the writing also greatly improved. Blog posts prior to the assessment were frequently disjointed, flimsy, and inconsistent in their reasoning. However, post-assessment writings showed more critical thinking, logical coherence, and in-depth analysis. Students presented arguments more convincingly, backed up by more organized and lucid reasoning. In order to encourage students to participate at higher cognitive levels, blog assignments were graded not only for grammatical correctness but also for the caliber of analysis, reasoning, and argument development.

The iterative writing process worked particularly well. Students gained the capacity to logically arrange ideas and use suitable transitions through cycles of drafting, revising, and finalizing, which produced blog posts that were cohesive and well-structured. Instructor feedback offered expert advice for fixing recurrent mistakes and improving clarity, while peer evaluations exposed students to a variety of viewpoints, allowing them to hone their arguments. Both the socio-cultural framework of learning, which emphasizes knowledge co-construction through interaction, and the tenets of process writing theory, which place an emphasis on iterative development and reflection, are best illustrated by this collaborative and feedback-rich environment (Han, 2023; Chiu et al., 2022).

As demonstrated by both quantitative (paired t-test) and qualitative analyses, the combination of TED-Ed and blogging activities consequently led to notable improvements in writing proficiency, grammatical accuracy, and reading comprehension. Along with improving language proficiency, the intervention promoted critical thinking, self-assurance, and the capacity to clearly express difficult

concepts. These results highlight the effectiveness of methodical, technologically advanced, and feedback-focused teaching strategies in fostering students' growth as academic writers, especially in engineering education.

5.3 Impact of Socio-Cultural Interaction

The findings suggest that the extensive social interactions facilitated through structured peer feedback and collaborative blogging may have enhanced the educational impact of the intervention. It appears that these interactions not only supported improvements in students' writing skills but also contributed to the development of a more reflective and encouraging learning environment (Cheng et al., 2021; Han, 2023). Peer feedback, in particular, seems to have played a meaningful role in shaping students' learning processes by highlighting areas related to grammar, coherence, and organization, thereby potentially increasing learners' awareness of their own strengths and weaknesses. Engagement in constructive criticism may have enabled students to address their shortcomings more systematically, while exposure to diverse viewpoints through peer review could have enhanced their understanding of grammatical rules and rhetorical styles. This reciprocal process of giving and receiving feedback can be interpreted as reinforcing the reflective cycle central to process writing theory.

In addition, blogging appears to have provided a valuable platform for intellectual and intercultural exchange. Regular blogging activities may have encouraged students to extend discussions beyond the classroom, allowing them to share ideas, perspectives, and language use in more authentic contexts. Such interactions could have contributed to refining writing skills through ongoing dialogue, ranging from stylistic choices to grammatical accuracy. Furthermore, engaging with peers' blog posts may have exposed learners to diverse linguistic and cultural perspectives, thereby supporting the development of critical reading and analytical skills. As students participated in this collaborative environment, it is likely that a sense of shared responsibility and community of practice was fostered (Chiu et al., 2022).

From a socio-cultural perspective, students' dual roles as writers and reviewers appear to have encouraged greater autonomy and reflective learning. While drafting and revising supported their development as authors, reviewing peers' work may have enhanced their evaluative judgment and self-awareness. This form of reciprocal participation aligns with the notion that knowledge is constructed through interaction, scaffolding, and shared meaning-making (Mafarja et al., 2023; Lee et al., 2023). However, the extent to which these improvements can be attributed solely to peer interaction cannot be determined with certainty, as factors such as teacher guidance, task design, and individual learner differences may also have influenced the outcomes. Overall, the findings indicate that the socio-cultural dimension of the intervention is likely to have contributed to improvements in grammar, engagement, and reflective capacity, although further research is needed to isolate its specific effects in engineering education contexts.

5.4 Application of Process Writing Theory

The findings suggest that the application of Process Writing Theory may have contributed to the development of students' writing competencies by framing writing as a cyclical and reflective process. Rather than treating writing as a one-time task, this approach appears to have encouraged students to engage critically with their work through stages such as prewriting, drafting, revising, and editing (Perumal & Ajit, 2022). It seems that each stage supported different aspects of writing development, allowing both technical accuracy and rhetorical effectiveness to improve progressively. During the prewriting phase, students may have organized their ideas using techniques such as mapping and freewriting, while the drafting stage appears to have facilitated content generation and self-expression. The revision stage, supported by peer and teacher feedback, seems to have played a particularly important role in improving grammar, coherence, and logical flow (Han, 2023), whereas the editing phase may have enhanced clarity and stylistic consistency.

Blogging, in this context, appears to have provided a practical platform for implementing process writing, enabling students to revisit drafts, incorporate feedback, and reflect on their progress over time (Chiu et al., 2022). This recursive cycle of writing and revision may have helped students identify recurring errors, refine their strategies, and develop a greater sense of ownership over their work. The observed improvements in grammar, sentence structure, and coherence can therefore be interpreted as outcomes of this iterative process, which also seems to have encouraged deeper critical thinking and self-awareness (Lee et al., 2023).

However, these improvements may not be solely attributed to process writing alone, as other factors such as structured blogging tasks, multimedia input from TED-Ed, and instructional guidance could also have influenced the outcomes. Overall, the integration of blogging with process-oriented pedagogy appears to offer a promising approach for enhancing writing development in engineering education, although further research is needed to examine its long-term impact and isolate its specific effects.

6. Conclusion

6.1 Summary of Findings

The findings of the study indicate that the integration of blogging and TED-Ed videos resulted in significantly greater improvements in grammar, reading comprehension, and writing quality compared to traditional instruction, as evidenced by both within-group and between-group statistical analyses.

This study emphasizes how incorporating blogging and TED-Ed videos into engineering education can improve students' language skills. When these tools were used together, reading comprehension, writing quality, and grammatical accuracy all significantly improved. TED-Ed videos, especially those on grammar, used multimodal presentations to make abstract ideas more approachable and interesting. In turn, blogging strengthened technical writing, reflective practice, and critical thinking by giving students an organized platform to apply and expand their knowledge.

The intervention encouraged cooperation, introspection, and iterative development by incorporating the ideas of process writing theory and sociocultural theory. Students were encouraged to polish their work, increase coherence, and strengthen their cognitive and metacognitive abilities through peer review and revision procedures. These results highlight the value of collaborative, process-oriented methods in helping engineering students develop their academic writing abilities, grammar awareness, and general communicative competence.

6.2 Implications for Education

The study's conclusions have a number of ramifications for language training in engineering and related fields. By incorporating both blogging and TED-Ed into well-organized lesson plans with distinct learning objectives, educators can use them as complementary teaching resources. Institutions should host faculty development workshops centred on creating meaningful assignments, running online resources, and providing insightful feedback in order to optimize their efficacy (Darling-Hammond et al., 2019).

Establishing a collaborative and encouraging learning atmosphere is crucial. Through blog-based discussions, feedback exchanges, and group projects, instructors can promote peer interaction and build rapport, teamwork, and accountability. Constructive criticism combined with acknowledgment of students' efforts can boost their confidence and motivation. To further enhance the classroom learning experience, online platforms also offer peer review, collaborative writing, and resource sharing opportunities.

Curriculum modifications and routine monitoring are equally crucial. Iterative improvements to the teaching methodology can be guided by ongoing assessment of students' performance and feedback loops. In addition to enhancing language proficiency, activities that prioritize communication, creativity, problem-solving, and reflective writing will develop professional competencies that are essential in engineering settings. By increasing grammar awareness and improving comprehension, TED-Ed videos, with their captivating and multimodal format, can enhance traditional instruction. Together, TED-Ed and blogging emerge as powerful tools in contemporary educational systems, bridging traditional and digital pedagogies to enrich student learning.

6.3 Future Research Directions

Although the study showed that blogging and TED-Ed are beneficial for enhancing writing, grammar, and reading comprehension, there are still a number of areas that need further research. Further investigation into their effects on speaking and listening abilities could provide a more thorough grasp of how these resources support all-encompassing language learning. Future research could also look into how these approaches might be modified for use in secondary schools, vocational training, or non-engineering fields, examining their cross-contextual suitability.

To evaluate whether improvements are sustainable, more long-term studies are required. Three, six, and twelve-month follow-up studies following the intervention may shed light on ongoing language development and long-term retention. Furthermore, investigating how TED-Ed and blogging can be integrated with other teaching strategies like flipped classrooms, gamification, or mobile-assisted learning could result in creative language teaching models. In addition to validating the current findings, this kind of research would increase the potential for inclusive, scalable, and technologically advanced learning environments in a variety of educational systems.

6.4 Limitations of the Study

While the findings provide valuable insights, certain limitations should be acknowledged. The relatively small and context-specific sample may restrict the broader applicability of the results. Additionally, the short duration of the intervention does not allow for conclusions regarding long-term learning outcomes. Although appropriate statistical analyses were conducted, future studies may benefit from employing more robust techniques such as ANCOVA to control for baseline differences. The reliance on self-reported qualitative data may also introduce potential bias. Furthermore, the limited number of survey items may constrain the depth of understanding regarding learners' perceptions.

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Author contributions

KS contributed to the conceptualization of the study, literature review, research design, data collection, data analysis, and drafting of the manuscript. Prof.SLV contributed to the conceptualization, methodology, supervision, interpretation of findings, and critical revision of the manuscript. Dr.TPN contributed to the literature review, methodology, interpretation of results, academic writing, and critical review of the manuscript. Dr VS contributed to manuscript review and revision. All authors contributed to the finalization of the manuscript, critically reviewed the article, and approved the final version for publication.

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No additional data are available.

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