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Text Chatbot Assisted Edublogs for Enhancing the EFL Technical Writing Performance among Computer and Informatics Students

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Abstract

This research aimed to enhance the EFL technical writing performance among Computer and Informatics Students. The research design was one group pre and post-test quasi-experimental design. The participants were 69 2nd year students at Ismailia Faculty of Computer and Informatics in Suez Canal University. To address students' needs of the EFL technical writing for their future career in different fields of work, text chatbot assisted edublogs were prepared and oriented towards the participants' practice of the EFL technical skills of writing computer software guides, writing technical reports on network problems and writing technical evaluations of websites. There were two text chatbot assisted edublogs for each writing skill so that there were two tasks for each writing skill and there was one edublog for each writing task. Four tools were developed, validated and implemented by the researcher. They were: 1) Needs Assessment Questionnaire, 2) EFL Technical Writing Test, 3) Scoring Rubric for the EFL Technical Writing Performance and 4) Online Reflection Paper for students to provide written responses to open-ended questions about their satisfaction and the benefits of text chatbot assisted edublogs. The findings revealed that text chatbot assisted edublogs had a high positive impact on enhancing Computer and Informatics students' EFL technical writing performance as those text chatbot assisted edublogs were satisfactory, credible, authentic and beneficial to their future career.

Key Words: Chatbot, Edublog, EOP, Technical Writing, English for Computer & Informatics and EFL Writing Performance.

مدونات تعليمية بمساعدة المحادثات الآلية النصية لتدعيم أداء الكتابة الفنية باللغة الإنجليزية كلغة أجنبية لدى طلاب الحاسبات ونظم المعلومات

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أستاذ المناهج و طرق تدريس اللغة الانجليزية المساعد

هدفت الدراسة إلى تدعيم أداء الكتابة الفنية باللغة الإنجليزية لدى طلاب الحاسبات ونظم المعلومات. وكان التصميم التجريبي للدراسة هو تصميم المجموعة الواحدة. وكانت عينة الدراسة مجموعة من (٦٩) طالب بالفرقة الثانية بكلية الحاسبات ونظم المعلومات بالإسماعيلية (جامعة قناة السويس). ولتلبية إحتياجات الطلاب من الكتابة الفنية باللغة الإنجليزية لمهنتهم المستقبلية بمجالات العمل المختلفة، تم إعداد مدونات تعليمية بمساعدة المحادثات الآلية النصية لتدريبهم على مهارات اللغة الإنجليزية التالية للكتابة الفنية: كتابة دليل المستخدم لبرامج الحاسب وكتابة تقارير فنية عن أعطال الشبكات وكتابة تقييم فني عن مواقع الإنترنت. وتم تخصيص مدونتين تعليميتين بمساعدة المحادثات الآلية النصية لكل مهارة بحيث يوجد نشاطين لكل مهارة ومدونة تعليمية بمساعدة المحادثات الآلية النصية لكل نشاط. وهناك أربعة أدوات من إعداد الباحث وهى إستبيان تقييم الإحتياجات ، إختبار الكتابة الفنية باللغة الإنجليزية كلغة أجنبية ، معايير تقدير أداء الكتابة الفنية باللغة الإنجليزية لقياس مستوى أداء الطلاب لمهارات الكتابة الفنية بإختبار الكتابة ، وورقة خطاب تأملى أونلاين يكتبها الطلاب للإجابة عن أسئلة مفتوحة حول إستفادتهم من تلك المدونات التعليمية بمساعدة المحادثات الآلية النصية. وأسفرت نتائج الدراسة عن أن المدونات التعليمية بمساعدة المحادثات الآلية النصية لها تأثير إيجابي مرتفع على تدعيم أداء الكتابة الفنية باللغة الإنجليزية كلغة أجنبية لدى طلاب الحاسبات ونظم المعلومات حيث كانت تلك المدونات التعليمية مرضية وإعتمادية ومفيدة لمهنة الطلاب المستقبلية فى مجال العمل بعد التخرج.

الكلمات المفتاحية: المحادثات الآلية ، مدونات تعليمية ، اللغة الإنجليزية لأغراض وظيفية ، الكتابة الفنية ، اللغة الإنجليزية للحاسبات ونظم المعلومات ، أداء الكتابة باللغة الإنجليزية كلغة أجنبية.

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Background

English for Occupational Purposes (EOP) is getting increased as a universal demand since English is the lingua franca language in our global labor market nowadays and, in turn, needed by the university alumni as employees in their fields of work (Rautenbach, 2016). It is commonly recognized that English for Academic Purposes (EAP) cannot successfully guarantee EOP oriented skills (Haghighi, 2012). In this respect, students of computer and informatics, urgently need English as a Foreign Language (EFL) technical writing skills oriented for occupational purposes in addition to the faculty's EAP-oriented technical writing course that helps them study their academic subjects in English. This is because EFL writing skills are an essential component in technical communication at workplace (Pringle & O'Keefe, 2009, p.29) where proficient writing skills ensure the accuracy, clarity, informative content and organization of technical documents in free-error format (DuPuis, 2021).

As for teaching EOP courses, traditional teaching of EFL writing in higher education do not cater for students' needs since it focuses on individual tasks to duplicate writing models (Wang, 2014). As a shift from such traditional way to online-based technologies, digital techniques are recommended to be used in order to foster language learning in higher education EFL writing classes (Linh & Ha, 2021). Such digital techniques should involve students in an interactive learning experience. Of such digital techniques, blogs are created for educational purposes. Use of blogs has become popular in higher education as useful tools for providing and sharing information

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among students since the blogging architecture became more simplified and teachers realized the instructional potential of blogs as an online resource (Morris, 2019). EduBlogs are a powerful digital tool that fosters communication and critical thinking for collaborative learning (Lhakpa, 2020).

To enhance a more online personalized assistance with collaborative learning experiences, chatbots could be used as conversational and interactive agents in order to provide students with instant responses individually (Cunningham-Nelson et al., 2019; Okonkwo & Ade-Ibijola, 2020; Smutny & Schreiberova, 2020). Since chatbots facilitates learning via oral and/or written communication in form of human-like conversations (Clarizia et al., 2018), chatbot systems should be integrated for educational purposes with online platforms (Okonkwo, 2021).

In this respect, text chatbot was integrated with edublog platform in this research as an attempt to enhance the computer and informatics students' EFL technical writing performance by allowing them to practice the target technical writing skills collaboratively as online engaging participants via edublogs with personalized instant assistance via text chatbot.

Context of the Problem

Ismailia Faculty of Computer and Informatics in Suez Canal University (SCU) is committed to prepare graduates who are capable of competing in computer science and information technology in the labor market fields of work such as Information Technology (IT) companies, Banks, Private & Governmental Institutions, Information & Telecommunications Institutes (ITI), Shipping & Airlines Agencies as well as Technological solutions' companies (Suez Canal University Portal, n.d.). Accordingly, students of Ismailia Faculty of Computer and Informatics can have the opportunity to work as computer science and IT specialists in international institutions (e.g., banks), companies (e.g., Telecommunication Companies) and corporations (e.g., IBM and

Microsoft) inside or outside Egypt. To promote such opportunity, students need to enhance their EFL technical writing performance by acquiring the writing skills necessary for their future jobs after graduation.

Here, pilot open interviews were carried out with 142 2nd year students at Ismailia Faculty of Computer and Informatics by the end of the 2nd semester of the academic year 2020-2021 in order to figure out how beneficial the faculty's official technical writing course for the students' future career. The results revealed students' dissatisfaction with the usefulness of this course for their fields of work after graduation. They were also dissatisfied with the way they practiced the academic EFL writing skills included in the faculty's technical writing course either face-to-face or online. As claimed by students in such interviews, their dissatisfaction with the course delivery was due to the systematic face-to-face individual writing assignments that always asked them to duplicate the technical writing formats displayed via non-interactive online talks.

To investigate about the missing EFL technical writing skills for occupational purposes, the content of the provided language courses was analyzed. According to the regulations of Ismailia Faculty of Computer and Informatics in SCU, there are three English language courses. By analyzing the content of these courses, there is only one of them which is an English for specific purposes (**ESP**) course. This ESP course is a technical writing course provided to all students in the 2nd term of the 2nd year since specialization starts in the 3rd year when students are divided into two main departments: Computer Science Department and Information Systems Department. This technical writing course is just an English for Academic Purposes course (**EAP**). It focuses on helping students study their academic courses in English and provides the EFL technical writing skills for academic purposes rather than occupational purposes (**EOP**). Thus, it does not help students develop the EFL technical writing skills necessary for their future career.

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For further problem analysis, an EFL technical writing test was piloted with 142 2nd year students at Ismailia Faculty of Computer and Informatics by the end of the 2nd semester of the academic year 2020-2021 as a preliminary measurement for their performance in EFL technical writing for occupational purposes. Students' scores in the test showed their poor technical writing performance and, in turn, their lack of the EFL technical writing skills for occupational purposes.

Hence, a complementary EOP-oriented technical writing section should be integrated with the computer and informatics faculty's EAP technical writing course in order to help students acquire the EFL technical writing skills for their future fields of work and, in turn, enhance their EFL technical writing performance for occupational purposes.

Statement of the Problem

The findings of the pilot technical writing test showed the 2nd year computer and informatics students' poor performance in the EFL technical writing skills needed for their future career as specialists in the fields of Computer Science and Information Technology. According to the preliminary content analysis, this might be due to the fact that the official technical writing course of Ismailia Faculty of Computer and Informatics, is almost void of the EFL technical writing skills required for occupational purposes by students after graduation (e.g., writing technical reports on network problems) as it primarily focuses on the EFL technical writing skills for academic purposes within the context of students' field of study (e.g., writing term papers).

Questions

This research sought to find answers to the following questions:

1. What are the EFL technical writing skills mostly needed by the 2nd year students of Ismailia Faculty of Computers and Informatics in their future career?

2. What are the features of the text chatbot assisted edublogs for enhancing the EFL Technical Writing Performance among 2nd year Computer and Informatics Students?
3. What is the effect of those text chatbot assisted edublogs on enhancing the EFL Technical Writing Performance among 2nd year Computer and Informatics Students?
4. To what extent are the text chatbot assisted edublogs beneficial to the 2nd year Computer and Informatics Students?

Hypotheses

1. There is a statistically significant difference between the mean scores of the 2nd year Computer and Informatics students' skill of "Writing Computer Software User Guides" in the pre- and post-administrations of the "computer software guide writing" assessment task in the EFL technical writing test in favor of the post-administration.
2. There is a statistically significant difference between the mean scores of the 2nd year Computer and Informatics students' skill of "Writing Technical Reports on Network Problems" in the pre- and post-administrations of the "technical report writing" assessment task in the EFL technical writing test in favor of post-administration.
3. There is a statistically significant difference between the mean scores of the 2nd year Computer and Informatics students' skill of "Writing Technical Evaluations of Websites" in the pre- and post-administrations of the "technical evaluation writing" assessment task in the EFL technical writing test in favor of the post-administration.
4. There is a statistically significant difference between the mean scores of the 2nd year Computer and Informatics students' overall technical writing performance in the pre- and post-administrations of the EFL technical writing test in favor of the post-administration.

5. Text Chatbot assisted Edublogs have a high positive impact on the target EFL technical writing skills among 2nd year Computer and Informatics students.

Objective

Enhancing the 2nd year Computer and Informatics Students' EFL Technical Writing Performance for the future fields of work after graduation.

Delimitations

1. 2nd year students at Ismailia Faculty of Computer and Informatics in SCU.
2. Online text chatbot was created by the researcher via “Actions on Google” platform. So, the created text chatbot is triggered via: <https://bot.dialogflow.com/dad04522-c07e-42dd-bab5-37b9eaae6116>
3. Edublogs were created by the researcher via the online “edublogs.org” platform.
4. Three EFL technical writing skills with their inherent components as follows:
 - a. Writing Computer Software User Guides:
 - Describing software features.
 - Listing the software setup recommended & minimum requirements.
 - Sequencing instructions on the use of the software.
 - Providing troubleshooting options for errors with installing, launching and using the software.
 - b. Writing Technical Reports on Network Problems:
 - Writing the subject line.
 - Writing a brief summary on the problem.
 - Writing a conclusion for the actions required.
 - Writing recommendations.
 - c. Writing Technical Evaluations of Websites:
 - Evaluating the design of a website.
 - Evaluating the usability of a website.

They were highly recommended in common by the three main sources of the needs assessment questionnaire: the specialists (university staff members in the fields of TEFL and IT in SCU), the labor Market (Head managers and staff members in the recruitment department of IT international corporations in Egypt) and the majority of 2nd year students at Ismailia Faculty of Computer and Informatics. These skills and their inherent components were also identified in light of the reasonably justified modifications that were noted in the top ranked skills by the majority of the specialists and labor market staff regarding the merge of some skills and the exclusion of others as well as the inclusion of suggested essential components.

Review of literature and related studies

1. EFL Technical Writing

1.1 Features

Technical writing is a type of writing done at workplace and characterized by its quality of communicating specialized topics within the context of computer and informatics, communicating via digital technologies online or offline as well as providing instructions for technical tasks (DuPuis, 2021). It also should be characterized by clarity in a way that explains complicated concepts and terminology in an understandable format as well as organization in a way that gathers data in coherent clusters within the writing format or layout (Pringle & O'Keefe, 2009, pp. 25-26). To enhance the technical messages, technical writing may include visual elements and the structure of the document usually gives the readers an idea of its type (Smith-Worthington & Jefferson, 2011, pp. 7-12). Accordingly, the writing scoring rubric for students' technical writing performance encompasses the four main criteria of Content, Organization, Terminology and Structure in addition to the Mechanics of writing.

1.2 Stages of Technical Writing Process

According to Pfeiffer & Boogerd (2007, pp. 16-21); Pringle & O’Keefe (2009, pp. 37-38); Smith-Worthington & Jefferson (2011, pp. 83-91); Tebeaux & Dragga (2015, pp. 20-28); EFL Magazine (2016); DuPuis (2021), the following are four main stages of technical writing process with their inherent steps:

1. Planning

In this step, the students brainstorm with peers to generate ideas in light of the writing topic with its determined purpose. After that, the students list the generated ideas and group them in clusters to complete the outline by recording the ideas randomly, and then identify the relationships between them in order to connect the related ideas by:

- a. Marking the main points that will become main sections.
- b. Connecting each main point with its supporting ideas using lines or arrows. Here, infographic designs could be used for ideas’ organization.
- c. Deleting the materials that are irrelevant to the writing topic or purpose.

2. Drafting

The initial writing starts here as students begin to write their draft in light of the planned outline by making sure that every main point has enough subpoints that can be developed thoroughly in the draft body section. After drafting the body, a summary section is provided in order to conclude, provide solutions and/or make recommendations.

3. Revising

In this stage the students should have left their written draft for some time before revising. Revision should go through the following:

- a. Adjusting and reorganizing the content:

Content is adjusted for clarity. Students should check out the appropriate word choice, define technical terms, shorten sentences, use active-voice sentences as well as add headings,

lists or graphics. For well-developed paragraphs, students should reorganize the content by expanding the sections that deserve more attention, shorten those of less attention as well as change the location of sentences, paragraphs or entire sections if necessary.

b. Editing for structure:

Students should revise the layout format to check its accordance with the template of the document type. The templates of manuals, user guides, emails, memos, technical reports and technical evaluations structurally differ in layout format.

c. Editing for writing conventions:

Using the word processing programs like Microsoft Word made this step considerably easier. Also, students should revise for punctuation errors, missing illustrations and misplaced pages.

d. Peer-reviewing:

Students exchange their work with their colleagues and assess each other's written product for peer-correction.

4. Publishing

After making the necessary modifications in light of peer reviewing, students submit the final work to the teacher for assessment and teacher feedback-based discussions.

1.3 EFL technical Writing Skills

Technical writing skills are technical skills of the specialized field combined with language writing skills that can be never overlooked for a technical writer (Writing Assistance Inc, n.d.). Hereby, the EFL technical writing skills that are EOP oriented and mostly needed by the students within the context of computer and informatics, were reviewed in order to prepare a checklist of the EFL technical writing skills for the needs assessment questionnaire.

Equipment documentation is a technical writing skill involving maintenance procedures, troubleshooting help, equipment setup as

well as product functions and controls (Hollett & Sydes, 2010, p. 34). In this regard, Kumar (2021) pinpoints three skills for writing technical manuals: writing precautions to warn the user about the hazards, writing technical specifications of a product and writing policies and warranty statement showing the company's responsibility in case of malfunction.

User guides are shorter than manuals and more concise documents that contain instructions for end users on how to use a particular product, software or process (Fechter, 2020). Olejniczak & Bonamy (2011, pp. 12-64); Hill & Bonamy (2011, pp. 14-64) and DuPuis (2021) handle the following two types of user guide writing skills:

1. Writing computer software user guides involving browser problems, steps in developing a website and data processing, software requirements as well as OS installation.
2. Writing computer hardware user guides including advantages of mobile devices, sequences of system administration tasks, causes of faults in IT products as well as suggested solutions for probable problems.

Regarding the technical reports, Fechter (2020) claims that they maintain complex information about specific products or faults in understandable format. From this perspective, Hollett & Sydes (2010, pp. 60-80); Alred, Brusaw & Oliu (2015, p. 469); Tebeaux & Dragga (2015, pp. 181-255) and DuPuis (2021) manipulate two types of technical report writing skills for workplace communication: writing reports on problems such as network glitches and writing progress reports on the development history of an IT process or product.

As for the descriptive technical writing skills, Hill & Bonamy (2011, pp. 30-36) refer to the writing skills of describing website architecture and how to use databases as well as comparing IT products and contrasting the pros and cons. In addition, Glendinning

& McEwan (2003, pp. 18-110) mention the writing skills of describing systems, functions and technical processes.

Descriptions of technical processes should be converted into instructions so the reader can use the technical written document to perform them (Pfeiffer & Boogerd, 2007, p. 168). Here, Hill & Bonamy (2011, p. 14); Tebeaux & Dragga (2015, p. 274) and Fechter (2020) confirm the vital role of the technical writing skill of writing instructions for using specific detailed steps and providing procedures as guidelines for performing a task in understandable technical communication with end users.

Evaluating the creative design of websites is a very significant technical writing skill at workplaces depending primarily on online technologies (Glendinning & McEwan, 2003, p. 96; Esteras, 2008, p. 115; Smith-Worthington & Jefferson, 2011, pp. 172-173; Evans, Dooley & Wright, 2011, p. 29).

Based on the literature review of EFL technical writing skills used at workplace, a closed-ended list of five main categories involving 21 skills. They were included in a needs assessment questionnaire with a three-level gradual scale (not needed, needed and mostly needed). This gradual scale was developed and submitted to the specialists (SCU staff members in the fields of TEFL and Computer & Informatics), the students (2nd year computer and Informatics) as well as the fields of work (IT workplaces). They made their decisions on how each of these EFL technical writing skills was essential for the students' technical writing communication in their future fields of work.

2. Chatbot

1.1 Definition

There are several definitions for chatbots and they all indicate that chatbots:

1. are developed software applications that simulate natural communication either orally via speaking or in text via writing.

2. support human-machine interaction.
3. work independently without human intervention
4. could be voice-based or text-based when replicating human patterns of interactions to achieve specific purposes.
5. are either rule-based that can comprehend a limited range of choices or Artificial Intelligent (AI)-based that uses machine learning algorithms to understand open-ended queries.

(Acadaimy, 2020; Huang, Hew & Fryer, 2020; Okonkwo & Ade-Ibijola, 2020; Satar, 2021; Maruti Techlabs, 2021)

Since the current research aimed to enhance writing performance, text-based chatbots were adopted. Also, owing to the limited use of chatbot as a personal assistant in a writing discipline mixed with edublogs for collaborative writing and face-to-face classroom for tutor discussion and formative assessment, rule-based chatbot was the selected type of chatbots. Accordingly, the procedural definition of chatbot is “A text rule-based software application developed to support student-machine interaction to provide personalized instant assistance while practicing writing skills via edublogs in order to enhance the EFL technical writing performance among computer and informatics students”.

1.2 Benefits of chatbot for language learning

Chatbot is increasingly used as language learning assistants for its ability to communicate orally and in writing in form of natural conversations with students (Huang, Hew & Fryer, 2020). In this respect, Satar (2021) conducted a study on bots for language teaching and learning. The findings revealed the four basic benefits of chatbots for language learners. First, chatbots provide invaluable resources related to the students’ target language practice. Second, they respond to students’ repeated content, mistakes and/or questions patiently. Third, they promote an anxiety-free language learning environment while performing the target language tasks. Finally, they give immediate feedback whether for correcting errors or clarifying purposes.

In addition to such benefits, Chen et al (2020) investigated the effect of chatbot for learning a foreign language on students' achievement and technology acceptance. The results indicated that chatbots can promote students' vocabulary learning since chatbots support one-on-one environment that may lead to better outcome than what could be achieved in a face-to-face language classroom. Moreover, Vazquez-Cano et al (2021) analyzed the functionality of chatbot to improve learning punctuations in different syntactic patterns in foreign language writing. They pinpointed the chatbot's positive value as great support companion and immediate feedback provider.

1.3 Chatbot and EFL writing

In case of EFL technical writing, Pereira and Barcina (2019) extrapolated from their research results that chatbot works as a useful assistant for writing good quality technical reports in English with free grammar and spelling errors. Even the simplest chatbot is an efficient English writing learning assistance and it is effective on word usage and self-revision as proved by Nagata et al (2019). The findings of the study also proposed the combination of chatbot with other methods for more productive writing performance.

For hybrid chatbot-based systems that are integrated with other methods, Thompson, Gallacher and Howarth (2018) attempted to examine the impact of chatbots as conversation partners in language classrooms via research project. The project data suggested that chatbots should be an assistant in the language teaching and learning and not an entire replacement for student-student and teacher student interactions; otherwise, students would lose interest in the language task. Here, Lin and Chang (2020) attempted to determine the impact of chatbot-guided instructions on post-secondary students' writing skills by mixing chatbot with classroom peer reviewing. The findings showed students' proficient writing with the development of thesis statement for their essay outlines due to chatbot's role as a personal digital assistant in refining students' peer reviewing.

To conclude, chatbot should be introduced as part of a disciplinary writing practice to refine peer reviewing since it has two main functions. First, it works as a patient writing assistant giving instant response endlessly and individually to every single student's clarification inquiry as in case of finding reliable resources and comparing drafts' structures with written models. Second, it helps students correct mistakes throughout the language learning process such as punctuation mistakes. Accordingly, it was integrated, in this research, with edublogs as an online student-student interaction platform for collaborative writing practice and a student-teacher interaction via tutor's posts of commentary tips.

3. Edublogs

1.1 Definition

Bloch (2018) refers to edublogs as online asynchronous journal for mediated-communication that can be continuously updated with students' own words, ideas and thoughts through online platform. Edublogs are internet-based free platforms created for educational purposes in order to allow students to post their ideas and share information in the form of blogs (Riswandi et al., 2019). Lhakpa (2020) defines edublogs as online collaborative learning tools for efficient mutual communication among students and as online instructional scaffolding for providing students with topics, materials and activities. Lisbdnetwork (2021) pinpoints edublogs as online blogs created, monitored and edited by the teacher to post relevant information so as to communicate and enhance classroom teaching among students for doing group tasks or projects.

In light of the definitions of edublogs, they can be procedurally defined as "Online blogging platform created, monitored and edited by the tutor for collaborative EFL technical writing practice among computer and informatics students in a way that helps them exchange ideas and instructional resources as well as peer review

their drafted writing in order to perform their technical writing tasks successfully”.

1.2 Educational merits

Edublogs are powerful tools for shared learning resources, that help in new knowledge construction, provide detailed information to students at a time, develop high order thinking, engage students in active learning as well as improve flexibility in teaching and learning (Singh et al., 2016). They can also be used to provide links for suggested readings and recommended online resources for related instructional materials as well as to post announcements notifications, classroom instructions, schedules and assignments for students (Lhakpa, 2020). Edublogs can consider diversity in terms of learning styles and individual preferences, encourage critical, creative and analytical thinking, expand participation as well as maximize access and exposure to quality information (Lisbdnetwork, 2021).

1.3 Edublogs and EFL writing

Edublogs can have positive impacts on the skills of EFL writing since they can foster expansion and collaborative development of skills as indicated in the study that was conducted by Singh et al in 2016. In 2017, a study was carried out by Estrelita in order to find out the impact of implementing project-based learning by using edublogs on vocational students’ writing in Cimahi. The results showed significant improvement in students’ writing performance.

An action research study was designed by Riswandi et al in 2019 in order to improve the writing skills through edublogs among senior high school students in Indonesia. The results showed students’ enthusiasm while practicing English writing as their writing skill improved significantly through blogging activity. In addition, students’ problems in writing were reduced by using edublogs in teaching-learning process and by applying the stages of writing process through edublogs.

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Edublogs provide a supportive environment for writing (Singh et al., 2016) since they allow the teachers to provide tips for improving the writing skill. From this perspective, Riswandi et al (2019) listed five main features for the use of edublogs that help provide authentic writing practice in language classrooms. First, materials can be shared by teachers and become accessible to the students anywhere and anytime. Second, online discussions are facilitated so that students can easily respond to their classmates' comments, posts and topics of discussion. Third, students can easily publish their language products via class publication created by edublogs. Fourth, students share their thoughts and language outputs by blogging. Here, Lisbdnetwork (2021) clarifies that students can express and exchange their ideas about the writing topics via edublogs by reacting to thought-provoking questions and using newly acquired vocabulary and idioms. Fifth, information is gathered smoothly and feedback is received constructively.

As for narrative writing skills, Baharuddin's and Mohammad's study (2020) aimed to integrate edublogs in the teaching of narrative writing in Malaysian primary schools. The findings revealed that learning narrative writing via edublogs significantly improved pupils' ability to generate better content as well as fostered their vocabulary development and retention.

Regarding the unity and structure skills of writing, Alshamy (2020) administered a study to determine the effect of using edublogs to enhance these skills among students at Benha Faculty of Education in Egypt. It was concluded that using edublogs had a high impact on improving these writing skills.

2. Text Chatbot Assisted Edublogs

2.1 Definition

In light of the procedural definitions of chatbot and edublogs, text chatbot assisted edublogs can be defined as "Online blogging platform created for collaborative writing to allow for exchanging ideas, sharing information and peer reviewing with the support of a

text rule-based software application as a personal digital instant assistant while practicing the writing skills in order to enhance the EFL technical writing performance among computer and informatics students”.

2.2 Rationale for the proposed pedagogy

Integrating text chatbot with edublogs into EFL technical writing practice helps avail the features of chatbot and edublogs and, in turn, provides a collaborative learning environment supported by one-to-one, endless and instant guide. While the **I**ntended **L**earning **O**utcomes (**ILOs**), instructions of the writing task and the topic of writing are posted via edublogs, the text chatbot provides students with the rationale for practicing the target skills and the links for the related visual resources and language materials that work as inputs for students’ technical writing skill. Such inputs include listening audios and videos, reading texts as well as visual illustrations like images and graphs. These language and visual inputs trigger the brainstorming performed by students to exchange ideas and share information via edublogs. The generated ideas are listed and clustered in groups via edublogs to be organized and written in a correct layout format according to the template provided by text chatbot. While the initial draft’s structure is self-revised in terms of the layout format by comparing it against the written model provided via text chatbot for the document type of writing task, it is peer-reviewed in light of the organization, content and terminology criteria via edublogs. For writing conventions, the revised work is proofread for grammar & spelling mistakes by the word processing software included in edublogs, and for punctuation errors via tips provided by the text chatbot.

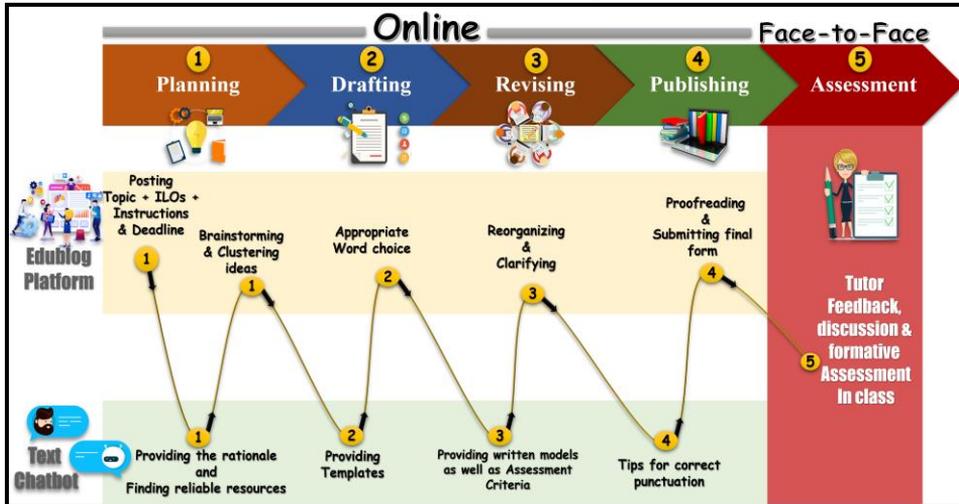
2.3 Framework

The framework, in the following figure, shows the features of the text chatbot assisted edublogs for enhancing the EFL technical writing performance among computer and informatics students.

Text Chatbot Assisted Edublogs for Enhancing the EFL Technical Writing Performance among Computer and Informatics Students

Figure (1)

Text Chatbot Assisted Edublogs for Practicing EFL Technical Writing Skills



According to the figure above, there are five main stages for applying the text chatbot assisted edublogs to each writing task in the target EFL technical writing skills. For each writing task, there is one edublog created by the tutor via an online edublog platform. As a support to students while practicing writing via edublogs, text chatbot is created and integrated. In the first four stages, students work collaboratively via edublogs with the online personal assistance of text chatbot. Tutor assessment lies face-to-face in the last stage.

1. Planning:

This stage takes place online and it aims to help students generate and organize their ideas. Here, the tutor creates an edublog for the writing task via an edublog platform and then posts the ILOs, writing topic, task instructions and notification about the deadline for publishing their writing via edublog. When students are informed about the writing topic, they personally ask the chatbot to provide them with the rationale for practicing the skill and to locate web links for relevant language and visual inputs such as videos for

listening and/or text for reading. Here, students read the provided reasons for practicing the skill and then browse the internet individually using such links to get information on the writing topic. Such information works as language and/or visual inputs that are used by students for brainstorming to generate and share ideas via edublog platform. Visual inputs can also be used by students to take screenshots of displayed images and/or videos to support their written document. Finally, students blog posts as they work together and react to each other's thought-provoking questions. Meanwhile, the tutor comments on students' blogs and posts writing improvement tips for the patterns of outlining the ideas in order to group the related ideas in clusters and arrange them accordingly.

2. Drafting:

Writing initial drafts occurs online where every student uses the text chatbot to get the templates related to the writing structure (the layout format of the document type). They do so by writing the target type of writing in the text chatbot followed by the word "template" such as "technical report template". After that, they start to write the draft individually by using the provided template. Finally, students exchange the blog posts via edublog for using the related technical terms and for appropriate word choice that supports the meaning of the provided technical terms. Meanwhile, the tutor comments on students' blogs and posts writing improvement tips for the use of related terminology to help students with appropriate word choice.

3. Revising:

Revision takes place online in two forms. First, students self-revise the structure of their initial draft individually via text chatbot. Here, students write the target type of writing followed by the word "model" such as "technical evaluation writing model" and the text chatbot immediately provides written models to be used by each student to compare these models with their drafts. Second, students exchange their self-revised drafts for peer reviewing via edublog. Here, students move on to the text chatbot link and ask in personal for the assessment criteria of content, organization, terminology and

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structure to read them. They use such criteria to assess each other's written products and post the necessary modifications for reorganizing and clarifying via edublog. Meanwhile, the tutor comments on students' blogs and posts writing improvement tips for reorganizing and clarifying the content.

4. Publishing:

Students use the text chatbot individually to help them correct any mistakes in punctuation. For grammatical errors and misspellings, students can proofread their revised written products via edublogs with the help of a word processing software. Finally, students post their final writing via edublog to be published for tutor assessment. The tutor and other two teaching staff members score students' works and post the average scores on the edublog platform.

5. Assessment:

This is the final stage and it is face-to-face in the class where the tutor provides feedback on the scored written products by discussing the common points of weakness and strength. Finally, the tutor gives students a digital formative writing test on the target skill. For internal mastery, students can only move on to the next writing skill if they get 90% or more as an average score of three raters.

Method

1. Participants

Recommended by the teaching staff members of the faculty, the participants were a group of 69 committed students who were enrolled in the 2nd year at Ismailia Faculty of Computer and Informatics in the academic year 2021-2022. Their ages ranged between 18 and 19 years old. Resitters were excluded. The reason for selecting participants from the 2nd year was that the target EFL technical writing skills for occupational purposes in the current research were proposed to be a complementary section in the technical writing course officially provided in the 2nd semester of

the 2nd year according to the regulations of Ismailia Faculty of Computer and Informatics.

2. Instruments

a. Needs Assessment Questionnaire

Prepared by the researcher to answer the first research question, this questionnaire aims to identify the EFL technical writing skills that 2nd year students at Ismailia Faculty of Computer and Informatics mostly need to enhance their EFL technical writing performance for future fields of work after graduation. It was developed according to review of literature and related studies. It consists of a closed-ended list of 5 main categories of 21 EFL technical writing skills for occupational purposes. There is a gradual scale of three levels (not needed, needed and mostly needed). The questionnaire was conducted in the 1st semester of the academic year 2021-2022 on three main sources for needs analysis. They were seven university staff members as specialists. Three of those specialists were in the field of TEFL. The remaining four specialists were in the field of Computer and Informatics so that two of them were computer science majors and the other two were information technology majors. 376 2nd year students at Ismailia Faculty of Computer and Informatics as well as the labor market including 10 international IT Corporations in Egypt. It was administered in paper and pencil form to the students as well as submitted online via WhatsApp to the university staff members and by email to the international IT corporations in Egypt. All sources of needs analysis were allowed to write down extra notes, further recommendations as well as additional suggestions for components underlying the technical writing skills.

b. EFL Technical Writing Test

It is a digital writing test prepared by the researcher to provide answer to the third research question. It aims to assess the target three EFL technical writing skills. The test duration is 90 minutes. There are three main assessment tasks so that there is one

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assessment task for each of the three target writing skills. In each assessment task, students write on a topic in light of the provided language inputs (audios and videos as listening materials as well as text as reading materials) and/or visual inputs (visual illustrations like animations, graphs and images).

The test validity was checked by a checklist submitted to a jury committee of university TEFL staff members with a three-level scale of consistency (Inconsistent, consistent and very consistent) between each of the three target skills with its ILOs and test questions. The test's reliability was established as the value of the reliability coefficient in Alpha (α) formula was (86.7%).

Finally, it was administered in three days before (21-23/2/2022) and after (10-12/4/2022) the treatment in the 2nd semester of the academic year 2021-2022 so that almost 23 participants were tested per day. It was individually submitted via students' own digital devices (Notebooks, Laptops or Tablets with physical keyboards) in the lecture hall at the faculty or in the faculty's computer lab with a few students in case of unavailability of the digital devices with the minimum requirements of running the test application.

Students' written responses, in the test, were assessed by three TEFL staff members using the writing scoring rubric. The score gained by each student was the average score of three raters. The total score of the test is 45 points so that there are 15 points for each task.

c. Scoring Rubric for the EFL Technical Writing Performance

It is a grading rubric which includes five criteria (Content, Organization, Terminology, Structure and Mechanics) with their descriptors and indicators for students' writing performance in a three-level rating scale (Poor=1, Mediocre=2 and Proficient=3). Content criterion is related to the use of language and visual inputs to support the message with use of visuals, examples and/or explanations. Organization criterion deals with the coherence and

logical progression of ideas. Terminology criterion tackles term consistency, definition intelligibility to end-users or non-specialized readers as well as illustration of the used abbreviations and acronyms. Structure criterion helps assess students' written products in terms of how document's layout format indicates its type as well as how legible the document's font size and type are. For mechanics, correct punctuation, grammar and spelling should be considered.

d. Online Reflection Paper

A reflection paper was to be written and submitted online via email by the students at the end of the treatment. It aimed to determine how the text chatbot assisted edublogs were beneficial to enhance the students' EFL technical writing performance for occupational purposes by having students answer three main open-ended questions about their impression, the text chatbot assisted edublogs' credibility, their satisfaction with the provided materials and the learning experiences acquired via text chatbot assisted edublogs. It was administered in the 2nd semester of the academic year 2021-2022. All participants fully responded and submitted their reflection paper online. Data were gathered for qualitative analysis so as to answer the fourth question.

3. Design

- a. Quasi-experimental method (One Group Pre and Post Test Design) was used to test the hypotheses.
- b. Descriptive method was used for literature review as well as the discussion of students' writing in light of the criteria of the writing scoring rubric and the findings of data analysis collected via students' online reflection paper.

The EFL technical writing sessions via text chatbot assisted edublogs as well as face-to-face

There are two writing tasks for each technical writing skill with one text chatbot assisted edublog created for each task. There are three sessions per task so that there are two online sessions via text

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chatbot assisted edublogs and one face-to-face session for tutor discussions and formative assessment. The three sessions are weekly with two hours per session as indicated in the following table:

Table (1)

EOP-oriented Tasks on EFL technical writing Skills via Text chatbot assisted edublogs

Tasks on EFL Technical Writing Skill	Intended Learning Outcomes (ILOs)	Weekly Sessions per a writing task	Online		
			Text chatbot	edublogs	
Two Tasks on the skill of Writing Computer Software User Guides	To write a computer user guide that includes: <ul style="list-style-type: none"> • Software features. • Software setup minimum and recommended requirements • Instructions on the use of the software. • Troubleshooting options for errors with installing, launching and using the software. 	Session 1	Planning	Providing Rationale and Finding reliable resources	Posting Topic Brainstorming Clustering ideas
			Drafting	Providing Template	Word choice
		Session 2	Revising	Providing Models to compare	Reorganizing Clarifying
			Publishing	Tips for Correct Punctuation	Proofreading & Submitting final form
		Session 3	Assessment	Face-to-face Tutor Feedback, discussion & formative assessment	
Two Tasks on the skill of Writing Technical Reports on Network Problems	To write a technical report on network problems by using these components in order as follows: <ul style="list-style-type: none"> • Subject line. • A brief summary on the problem. • A conclusion for the actions required. • Recommendations. 	Session 1	Planning	Providing Rationale and Finding reliable resources	Posting Topic Brainstorming Clustering ideas
			Drafting	Providing Template	Word choice
		Session 2	Revising	Providing Models to compare	Reorganizing Clarifying
			Publishing	Tips for Correct Punctuation	Proofreading & Submitting final form
		Session 3	Assessment	Face-to-face Tutor Feedback, discussion & formative assessment	
Two Tasks on the skill of Writing Technical Evaluations of Websites	To write a technical evaluation of a website in light of the design and usability criteria.	Session 1	Planning	Providing Rationale and Finding reliable resources	Posting Topic Brainstorming Clustering ideas
			Drafting	Providing Template	Word choice
		Session 2	Revising	Providing Models to compare	Reorganizing Clarifying
			Publishing	Tips for Correct Punctuation	Proofreading & Submitting final form
		Session 3	Assessment	Face-to-face Tutor Feedback, discussion & formative assessment	

Treatment

An introductory session was administered with the participants face-to-face at the very beginning of the treatment on the 24th of February 2022 in order to provide them with an overview for the EOP-oriented technical writing skills and instruct them on how to practice such skills via text chatbot assisted edublogs. The treatment

took place in the second semester of the academic year 2021-2022 and lasted for six weeks starting from the 26th of February 2022 until the 7th of April 2022. Holidays were excluded. There were two writing tasks for each of the three EFL technical writing skills. Students practiced each skill in two weeks so that they performed one writing task per week in three sessions with 2 hours per session. The first two sessions were online and the third one was face-to-face.

In the online sessions, students practiced writing via text chatbot assisted edublogs where there was one edublog created for each task via “edublogs.org” platform and supported by a link for the created text chatbot via “Actions on Google” platform. In the face-to-face session of the first week for each writing skill, there was 2-hour tutor-managed discussion on the common points of weakness and strength in the students’ written responses. In the face-to-face session of the second week for each writing skill, there was 60-minute tutor-managed discussion followed by 60-minute two individual formative assessment writing tasks for internal mastery. Students could only move to the practice of the next skill once they got an average score of three raters 90% or more in the two formative assessment tasks of the current skill. Otherwise, they had to practice the skill all over again. In total, there were 18 writing sessions with 36 hours of EFL technical writing practice.

Results

To answer the third question, the hypotheses were statistically examined via EFL technical writing test as follows:

Hypothesis One stated that “ There is a statistically significant difference between the mean scores of the 2nd year Computer and Informatics students’ skill of “Writing Computer Software User Guides” in the pre- and post-administrations of the “computer software guide writing” assessment task in the EFL technical writing test in favor of the post-administration”. The paired samples t-test was used to check this hypothesis. The following table shows the results related to the 2nd year computer and informatics students’ skill of Writing Computer Software User Guides.

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Table (2)

Paired Samples t-test value of the difference between the mean scores of the skill of Writing Computer Software User Guides in the pre- and post-administrations of the EFL Technical Writing Test

		N	Mean	St. Deviation	t	Significance
Hypothesis I	Pre-administration	69	4.6522	1.34849	-49.06	.000
	Post-administration		12.8551	0.79104		

Table (2) shows that there is a difference between the mean scores of the listening comprehension skills in the Pre-and Post-administrations of the listening comprehension test in favor of the post-administration. It was statistically significant ($t=-49.06$, $p<0.05$).

Hypothesis Two stated that “ There is a statistically significant difference between the mean scores of the 2nd year Computer and Informatics students’ skill of “Writing Technical Reports on Network Problems” in the pre- and post-administrations of the “technical report writing” assessment task in the EFL technical writing test in favor of post-administration”. The paired samples t-test was used to check this hypothesis. The following table shows the results related to the 2nd year computer and informatics students’ skill of Writing Technical Reports on Network Problems.

Table (3)

Paired Samples t-test value of the difference between the mean scores of the skill of Writing Technical Reports on Network Problems in the pre- and post-administrations of the EFL Technical Writing Test

		N	Mean	St. Deviation	t	Significance
Hypothesis II	Pre-administration	69	2.2319	1.05920	-29.45	.000
	Post-administration		10.4928	1.94500		

Table (3) shows that there is a difference between the mean scores of the skill of Writing Technical Reports on Network

Problems in the Pre-and Post-administrations of the EFL Technical Writing Test in favor of the post-administration. The difference was statistically significant ($t = -29.45, p < 0.05$).

Hypothesis Three stated that “There is a statistically significant difference between the mean scores of the 2nd year Computer and Informatics students’ skill of “Writing Technical Evaluations of Websites” in the pre- and post-administrations of the “technical evaluation writing” assessment task in the EFL technical writing test in favor of the post-administration” in the pre- and post-administrations of the “technical report writing” assessment task in the EFL technical writing test in favor of post-administration”. The paired samples t-test was used to check this hypothesis. The following table shows the results related to 2nd year computer and informatics students’ skill of Writing Technical Evaluations of Websites.

Table (4)

Paired Samples t-test value of the difference between the mean scores of the skill of Writing Technical Evaluations of Websites in the pre- and post-administrations of the EFL Technical Writing Test

		N	Mean	St. Deviation	t	Significance
Hypothesis III	Pre-administration	69	4.4058	1.01921	-37.5	.000
	Post-administration		12.7391	1.29083		

Table (4) shows that there is a difference between the mean scores of the skill of Writing Technical Evaluations of Websites in the Pre-and Post-administrations of the EFL Technical Writing Test in favor of the post-administration. The difference was statistically significant ($t = -37.5, p < 0.05$).

Hypothesis Four stated that “There is a statistically significant difference between the mean scores of the 2nd year Computer and Informatics students’ overall technical writing performance in the pre- and post-administrations of the EFL technical writing test in

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favor of the post-administration”. The paired samples t-test was used to check this hypothesis. The table (5) shows the 2nd year computer and informatics students’ overall technical writing performance.

Table (5)

Paired Samples t-test value of the difference between the mean scores of the overall technical writing performance in the pre- and post-administrations of the EFL Technical Writing Test

		N	Mean	St. Deviation	t	Significance
Hypothesis IV	Pre-administration	69	11.2899	2.20362	-64.97	.000
	Post-administration		36.0870	2.14709		

Table (5) shows that there is a difference between the mean scores of the overall technical writing performance in the Pre-and Post-administrations of the EFL Technical Writing Test in favor of the post-administration. The difference was statistically significant (t= -64.97, p<0.05).

Hypothesis Five stated that “Text Chatbot assisted Edublogs have a high positive impact on the target EFL technical writing skills among 2nd year Computer and Informatics students”. The effect size (η^2) was estimated to check this hypothesis. The following table shows the values of (η^2) for the 2nd year computer and informatics students’ each of the target writing skills as well as the overall EFL technical writing performance:

Table (6)

The Effect Size level of Text Chatbot Assisted Edublogs on the computer and informatics students' EFL technical writing skills

Independent variable	Dependent variable	t ²	DF	η ²	Effect Size
Text Chatbot Assisted Edublogs	Skill of Writing Computer Software User Guides	2406.88	68	0.97	Large
	Skill of Writing Technical Reports on Network Problems	867.30		0.92	Large
	Skill of Writing Technical Evaluations of Websites	1406.25		0.95	Large
	Overall EFL technical writing performance	4221.10		0.98	Large

According to table (5), Eta-squared was used to calculate the effect size of Text Chatbot Assisted Edublogs on the EFL technical writing performance among the 2nd year computer and informatics students. The effect sizes were large ($\eta^2 = 0.97, 0.92, 0.95$ and 0.98). Thus, Text Chatbot Assisted Edublogs had a high positive impact on the EFL technical writing performance among computer and informatics students.

Discussion of results

The results indicated the role played by the proposed pedagogy of text chatbot assisted edublogs on optimizing an interactive collaborative online learning environment for the 2nd year computer and informatics students to practice the target EFL technical writing skills. It allowed for students' successful technical writing as shown by students' proficiency in the performance of each of the three EFL technical writing skills in the writing test as well as the overall performance.

As confirmed by Thomposon's, Gallacher's and Howarth's study (2018), chatbot's integration with other methods could be a powerful assistant in language learning and teaching. Hence, integrating text chatbot into edublog platform was beneficial for the students. The text chatbot worked as an online patient personal guide for the students as it replied to their automated requests,

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repeated questions and frequent inquiries. This is in agreement with the findings of the studies by Satar (2021) and Chen et al (2020).

Chatbot provided privileges to students before, while and after writing. Such privileges may have resulted in students' proficient writing performance. Students were not confused about selecting the resources required as a language and/or visual inputs to plan their writing since text chatbot provided links for finding reliable resources related to the writing task. This is approved in Satar's study (2021). While writing the initial draft, the chatbot provided students with the writing template appropriate to the layout format of the document type in the writing task. Here, students managed to stick to the structure layout of the document writing whether it was a Software User Guide, a Report on Network Problems or even a Technical Evaluation of Websites. After writing the draft, chatbot helped students self-revise their drafts' structure by providing written models for the students to compare with the layout format of their draft. In addition, tips for correcting punctuation errors were provided for proofreading before publishing the final draft. This goes in line with the study by Vazquez-Cano et al. (2021) in which chatbot helped students use the correct punctuation in their writing.

Monitoring students' progress in each stage of the technical writing process was a possible reason for students' successful practice. The tutor used to give tips for improving writing performance via edublogs based on students' comments and responses. This was asserted by Singh et al in their study in 2016. Owing to tutor's time and efforts saved by the personal endless assistance of the text chatbot, the tutor focused more on providing comments on students' posts via edublogs in order to make sure that they were on the right track. For instance, the tutor provided tips for the patterns of outlining ideas in the planning stage.

Providing feedback via face-to-face tutor managed discussions could have promoted students' EFL technical writing performance in the target writing skills. After assessing students' written

products, the tutor did not just inform the students about their scores; however, the common points of weakness and strength were tackled in order to help them treat the shortcomings and promote the mastered skills.

Collaborative practice of writing via edublogs could have contributed to enhancing students' EFL technical writing performance in accordance with the results of the study by Singh et al (2016). As clarified by Lisbdnetwork (2019), edublogs helped students interact with peers, overcome any obstacles and get motivated for intensive practice via thought-provoking questions.

Edublogs also allowed students to share information before writing and, in turn, fostered thought-provoking brainstorming and expanded students' participation in outlining the generated ideas. Peer reviewing the initial drafts helped enrich students with feedback on the drawbacks of their writing that were related to word choice for intelligible terminology as well as organization and content for clarity. As shown by Lin's and Chang's study (2020), integrating chatbot with peer reviewing helped students develop proficient writing performance.

The WordPress technology in edublogs, as indicated in Pereira's and Barcina's study (2019), automatically improved students' proofreading as it helped students spot any grammatical or spelling errors and provided options for corrections accordingly.

Discussion of students' writing

This section describes students' written products in the pre and post measurements in light of the criteria of the writing scoring rubric. It also discusses some examples of their writing in the EFL technical writing test before and after the treatment in order to give a partial answer to the fourth research question by showing to what extent students' writing performance progressed from the poor level to the proficient one in each of the target EFL technical writing skills.

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In terms of mechanics, the pre-measurement revealed students' poor EFL technical writing performance as they produced text in illegible font size and type as well as with major errors in grammar, punctuation and spelling that obstructed reader's comprehension. On the other hand, the post-measurement indicated students' proficient writing level which generally showed students' well-proofread written products in legible font size and type. There were very few minor punctuation mistakes as some sort of lapses that did not hurdle the written communication.

As for the content, students produced text that was related to the topic but without any details from the provided language and visual inputs before practicing writing via text chatbot assisted edublogs. In the skill of writing computer software user guides, for example, students ignored the information provided in the listening videos about the instructions on using the software and in the reading text of the leaflet about its new features. In addition, they extrapolated too much from their previous experiences about the software setup recommended & minimum requirements as well as the troubleshooting options for errors with installing the software.

Students' mean scores in the post-administration showed their proficient level at producing text that encompassed all important ideas in the provided language and visual inputs. In the skill of writing technical reports on network problems, students, for example, managed to extract the information related to the problem type and issues such as IP address misconfiguration and network overload problems from the reading text and summarize them in a separate section of the report as a brief summary on the problem. They also elicited the technical solutions from the listening videos and grouped them in the report as a conclusion for the actions required. Based on the provided listening and reading materials, they wrote the subject line of the report and provided the recommendations accordingly.

Regarding organization and structure, students' writing, in the pre-test, was poorly organized in terms of coherence and

progression of ideas and it did not consider the layout format of the document type in the assessment task of writing. In the skill of writing technical reports on network problems, for instance, students' writing was fragmented as they did not cluster the causes of the technical network problem in theme-based paragraphs and they did not group the possible solutions in a separate section for concluding. Above all, their writing did not conform to the layout format of technical reports since they ignored the relevant components of the subject line and the recommendations.

Having the test after the treatment, students proficiently produced well-organized text that indicated the type of the document in the writing task with coherent development of ideas. In the skill of writing computer software guides, students stuck to the layout format of user guide by considering all the relevant components of user guide in their correct order. They started the guide by writing software features followed by setup requirements and then instructions of use. They ended the guide with troubleshooting options for errors with installing, launching and using the software. They extracted the information to write the user guide from the provided language and visual inputs, and grouped the ideas under their related components accordingly.

From the perspective of terminology, students either used the technical terms inconsistently or without clear definitions when they had the writing test before the treatment so that their writing was not understandable by end users or normal readers. In the skill of writing technical evaluation on websites, students did not use the term "Navigation Map" consistently. They often replaced it with other synonyms such a "Transition Map", "Scenario Map" and "Storyboard Map". Moreover, they did not provide clear definitions for technical terms that are vague to normal readers or end users such as "500 Internal Server Error", "401 Unauthorized" and "400 Bad Request". Also, they used abbreviations and acronyms vaguely. They used acronyms for technical terms without being illustrated and fully written in the document's footnote or attachment such as

“API” which stands for Application Programming Interface and “OS” which stands for Operating System.

When tested after the treatment, students used the terms consistently. For example, they used the terms “Wi-Fi”, “Cyber Security” and “Workstation” consistently. They gave clear definitions for technical terms like “Microfilter”, “Fiber Modem”, “Gateway” and “Ethernet Port”. They provided full illustrations for the acronyms of the technical terms such as “VPN” standing for Virtual Private Network, “DNS” standing for Domain Name System, “VLAN” standing for Virtual Local Area Network and “WPS” standing for Wi-Fi® Protected Setup.

To sum up, there was a noticeable progress in the students’ performance of the target EFL technical writing skills for occupational purposes after the treatment.

Discussion of the qualitative data from the online reflection paper

This section discusses students’ responses to the three open-ended questions of the online reflection paper in order to answer the fourth research question. As for the first question “What was your impression about the provided writing materials via text chatbot assisted edublogs? Was it positive, negative, or neutral? Why?”, all students (n=33) confirmed their positive impression. 87.8% of students (n=29) provided various justifications but in three main themes as shown in the following table:

Table (7)

Students' responses for the first question in the online reflection paper

Themes of students' responses	Samples of students' responses
Novelty	<ul style="list-style-type: none"> • "New way of practicing writing because it was unlike the autonomous writing assignments" • "Never learnt English like this before as we used to have boring writing tasks" • "It was something unique as we used to practice writing individually and in paper and pencil" • "I have never tried something like this before since we had never received any real feedback on our work in language lectures"
Genuity and Authenticity	<ul style="list-style-type: none"> • "Materials were useful for practicing technical writing skills because they were related to our work after graduation" • "The way I practiced technical writing simulated the way we could perform such writing tasks in our future jobs" • "The content of writing via chatbot and edublogs was based on our real-life future career because it was exactly like the writing tasks required from us as IT specialists" • "Materials were practical as we use such skills in real IT companies" • "I think all of us will need to write about having such skills in our CV when we apply for the job as IT specialist in different institutions" • "I learnt writing skills that I really needed for my CV to apply for a job" • "I practiced something via useful materials because they were related to my job in the future"
Positive Learning Experience	<ul style="list-style-type: none"> • "It was fun as I loved to interact in writing with a text chatbot" • "I enjoyed the interactive way to improve my writing as I worked with my colleagues via edublogs" • "I positively changed my mind about learning English because the bot and edublogs made me feel like practicing without getting bored of the tedious writing tasks" • "Materials were very creative as I reacted to thought-provoking questions & gave ideas in edublogs" • "I cooperated skillfully with my colleagues on the edublog platform" • "Materials were very useful because the target of learning was the elaboration of the writing skills" • "Learning Materials were constructive owing to the interesting, motivating and useful interaction with the professor, colleagues and chatbot"

According to table (7), students indicated their positive impression with text chatbot assisted edublogs for practicing EFL technical writing. Students who provided reasons claimed that their positive impression was due to the fact that the provided materials and assigned tasks matched their needs and were presented through novel, authentic and positive pedagogical experience via text chatbot assisted edublogs.

Regarding the second question "Did you find the text chatbot assisted edublogs credible? Why?", all students (n=33) agreed on the credibility of text chatbot assisted edublogs. Reasons, provided

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by 93.9% of students (n=31), are grouped in three main themes together with samples of students' responses in the table below:

Table (8)

Students' responses for the second question in the online reflection paper

Themes of students' responses	Samples of students' responses
Promoting writing practice	<ul style="list-style-type: none"> • <i>"It gave me time to think about my written draft as I exchanged it with others to review"</i> • <i>"I successfully planned my writing ideas because of the questions that incited my thoughts before writing the draft"</i> • <i>"Chatbot's models of writing were very helpful as I managed to compare and self-revise my work"</i> • <i>"I easily exchanged ideas with my colleagues as I could think about ideas based on the bot's relevant online resources"</i> • <i>"Planning writing was easier than I expected. I used to various resources provided by the bot to generate ideas"</i> • <i>"Writing the draft was more flexible. I used bot's templates to organize my writing in a layout format appropriate to the type of writing in the task"</i>
Availability of reliable help	<ul style="list-style-type: none"> • <i>"I enjoyed working with the bot which neither got bored nor tired of my frequent questions"</i> • <i>"I was too shy to ask the professor; but chatbot encouraged me to ask whenever I want"</i> • <i>"Whenever I needed help it was available by both the tutor via edublogs and the chatbot"</i> • <i>"I could reflect on my work by the help of the chatbot because it provided me with the related assessment criteria"</i> • <i>"I could find the related resources easily by the help of the bot"</i> • <i>"I knew what was expected from me as I was informed by posts via edublogs about the ILOs"</i> • <i>"Posting the writing topic and task instructions were a great help as a starting point for successful writing"</i> • <i>"Chatbot helped me write a precise document in terms of layout format because it displayed the templates of the document type of the writing task"</i> • <i>"Chatbot was my personal digital assistant"</i>
Providing constructive feedback	<ul style="list-style-type: none"> • <i>"Professor's posted comments on our work via edublog platform were very useful as they made our writing better"</i> • <i>"I became more critical as I review my classmates' writing"</i> • <i>"My colleagues posted comments via edublogs on my writing. They were very helpful because my performance improved"</i> • <i>"The professor spotted our points of weakness and strength precisely after I and my friends published our writing on the edublog platform"</i> • <i>"Classmates' and professor's feedback via edublogs were helpful. They made me create a much better writing in terms of content, organization and terminology"</i> • <i>"It was useful to know about the criteria of scoring and assessing our writing tasks as I used them to revise my draft and the writing of others"</i> • <i>"There were mutual benefits. I posted my writing via edublogs to others to review and others posted their writing for me to revise too"</i>
User-friendly Interface	<ul style="list-style-type: none"> • <i>"Edublog platform was easy to use as I could discover the functions of tools"</i> • <i>"Chatbot caught my attention as I could easily interact with it in writing"</i> • <i>"It was easy to exchange drafts with friends in edublogs"</i> • <i>"It was very flexible to add, delete and replace posts in edublogs"</i> • <i>"I could easily use the tools in the edublog platform"</i>

According to table (8), students revealed their satisfaction with the text chatbot assisted edublogs. Students, who justified such

satisfaction, attributed the text chatbot assisted edublogs' credibility to the user-friendly interface of the chatbot and edublogs, the support of intensive and extensive writing practice as well as the availability of reliable help and constructive feedback.

Students' responses to the third question "What have you learned from the provided materials via text chatbot assisted edublogs?" are displayed in two main themes in this table:

Table (9)

Students' responses for the third question in the online reflection paper

Themes of students' responses	Samples of students' responses
Text Chatbot's Personal Assistance	<ul style="list-style-type: none">• "I could generate ideas in light of the chatbot web links"• "I moved on to intensive practice of writing because of the sources given by the bot that were very informative"• I practiced writing successfully because of the chatbot' provided writing templates, assessment criteria and tips for correct punctuation"• "Chatbot provided websites that included texts, videos, and other visuals like pictures related to the writing task"• "Materials provided by chatbot were very beneficial to perform the writing task successfully"• "I could compare between my draft and a written model for self-revising the structure of my writing"• "Chatbot provided me with the assessment criteria. So, I managed to review others' writing and mine too"• "I could use punctuation correctly according to Chatbot's tips for using the target punctuation patterns"
Edublogs' Expansive Collaboration	<ul style="list-style-type: none">• "I learnt a lot and more easily as professor was providing us via edublogs with tips along with our writing from the beginning till the end"• "I could correct grammar and spelling mistakes via WordPress technology in the edublogs"• "I could criticize the technical writing of others as I used to do so with my colleagues via edublogs"• "My classmates' posts on my work helped me choose words appropriately while writing and revising my draft"• "I was blogging for peer reviewing"• "I posted ideas to exchange with others via edublogs"• "I practiced deeply as I worked with my colleagues via edublogs to plan ideas by questioning, select the appropriate words to support the meaning and review on another's work"

According to table (9), students benefited from the materials provided by text chatbot as well as those provided via edublogs.

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Students' responses (n=33) pinpointed the advantages and essential roles of text chatbot and edublogs for efficient practice of writing skills. Their responses indicated the beneficial combination of text chatbot assisted edublogs as a proposed pedagogy of integration and delivery of the learning materials necessary for enhancing the EFL technical writing performance collaboratively with personal assistance.

As a result of analyzing students' responses in the online reflection papers, the following were possible reasons for students' proficient performance level in the EFL technical writing skills:

1. The target EFL technical writing skills were oriented for students' future career in their fields of work after graduations. Hereby, students were convinced of what they learnt and highly motivated as the writing practice matched their real needs.
2. As an online individual and patient assistant, text chatbot provided a stress-free learning environment particularly for shy students who were often anxious about asking the tutor. As a result, they were encouraged to ask the chatbot for help as long as needed. Consequently, students' engagement was broadened in the intensive practice of the target writing skills. This goes with the findings in Satar's study (2021) about the use of chatbots.
3. Providing materials as language inputs in different forms like audio, video, images, graphs, text and illustrations might help students visualize their thoughts on the writing topics and generate more ideas in relation.
4. Integrating writing with reading, listening and/or visual inputs could have made the writing tasks authentic so that students practiced for language performance rather than competence. This integrative practice simulated the real writing tasks that should be performed in the fields of work. This authentic writing practice was confirmed by the use of edublogs in a study by Riswandi et al in 2019.

5. Integrating chatbot for personal assistance with peer and tutor interaction via edublogs might help provide comprehensive and integrated learning materials for successful EFL technical writing performance.
6. Spotting students' common points of weakness while practicing writing via edublogs helped the tutor provide face-to-face discussions that were meaningful enough to promote students' writing performance.
7. Tutor's comments on students' posts via edublogs together with the chatbot's personal assistance helped students work successfully on the right track without getting delayed nor confused nor frustrated.

In conclusion, text chatbot assisted edublogs had a high positive impact on their EFL technical writing performance as they were satisfactory, credible, authentic and beneficial to the 2nd year students at the Ismailia Faculty of Computers and Informatics in SCU.

Recommendations and Suggestions

Recommendations

The following are the recommendations of the current research:

1. Chatbot supports self-pacing by providing a more personalized learning environment, which, in turn, considers the individual differences regarding learning speed. promotes students' deeper comprehension as it
2. When created edublogs for collaborative EFL writing practice, they should consider the following:
 - a. Tutor's posts for improvement tips to students' writing in each of the stages of the writing process to help them work on the right track.
 - b. Providing links for authentic language and visual inputs within the target context of students' major.

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- c. Face-to-face classroom discussions should be administered by the tutor in order to provide constructive feedback on students' published writing via edublogs.
3. For a successful writing practice via edublog platform, chatbot is integrated in order to provide:
 - a. language and visual inputs for the students to generate ideas on the writing topic.
 - b. answers to students' endless inquiries and repeated questions as a patient assistant.
 - c. a writing scoring rubric for the students to peer review each other's work in light of specific criteria.

Suggestions

Here are some suggestions for possible further research:

1. The Effect of Artificial Intelligence Based Chatbot on Improving the EFL Speaking Skills among English Majors at Faculties of Education.
2. The Impact of Edublogs on Improving the EFL Essay Writing Skills among Students at Faculties of Medicine and Engineering.
3. Replicating the current study on:
 - a. Developing EFL Oral Argumentative Writing Skills among ELT Researchers.
 - b. Enhancing the Structure and Mechanics of Writing among Preparatory Students.
 - c. Developing the EFL Critical Writing Skills among Students of English at the Faculty of Education.

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