

A Systematic Review of Trends and Educational Research Issues of Digital-Supported Writing: A Promising English Learning Environment for Thai Higher Education

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Abstract: Due to the rapid development of digital support for both Artificial Intelligence (AI) and non-AI technologies, the current and future English language education is required to deal with these advancements and particularly enabling writing skills needed for higher education at the university level. The reason is that writing tends to be a difficult task for most students since it combines cognition and language utilization. In higher education, students must practice and apply English writing skills for their writing exams, projects, and papers for graduation or publication and prepare themselves for future work. The assistance from AI and non-AI technologies has a revolutionary role in supporting the English writing skills of students as well as helping teachers during instruction. Therefore, this paper aims to review the academic papers which applied AI and non-AI technologies to enable English writing skills of university students, the reliability of these advancements, and their role of them as an assistant for writing skills, as well as guide how the features of AI technologies could use as learning strategies for university students in Thailand context.

Keywords: Quality education, higher education, technology-enhanced learning, language education, writing tools.

1. Introduction

The development of artificial intelligence and technology usage grew into the learning concepts of educational and writing skills in the English language with the utilization of Artificial Intelligence (AI) and technology platforms immersed in language learning. According to Su and Man (2019), AI has been extensively applied in numerous fields, including intellectual writing and evaluation in a second language. Writing skills is a challenging task for most students, and assistance from technology resources in higher education can help the learners be productive. Nickolaevna and Mekeko (2021) mention that even the traditional writing class is required technology resources for academic writing instruction.

The practice of AI and non-AI technology resources has become popular in various learning fields, and education in the 21st century could not escape from technology, especially in higher education studies. In the case of Klimova (2011), using information and communication technology (ICT) as a tool in students' English writing can improve their formal English academic writing since they are required to exploit Wikipedia as a reference source and expand the information to be published in a wiki website. This learning approach allows learners to acquire real academic writing experiences that they can learn and improve their writing simultaneously. Academic writing in English requires abilities to produce written works for graduating and publishing, which links applying to write professionally in the practical field of students' majors. Along with the advances of AI and non-AI technology, which can support academic writing for feedback, translations, and study sites, exploring AI and non-AI Technology enabled in academic English writing can be one issue to discuss in English writing education.

Integrating innovative techniques in digital literacy helps students in higher education's learning process and supports it as a resource for students to improve their academic writing that can link to professional life. Linking digital literacy with professional life, Klimova (2011) points out that digital literacy in acquiring writing skills can help students in tourism management, finance, and information career fields. Additionally, technology is crucial in promoting students' writing, which can help them in the writing process. Hosseinpour, Biria, Reza & Ehsan (2019) identifies that using Edmodomobile application for academic writing proficiency in journal paper can promote students' motivation, self-esteem, and writing achievement. Automated writing evaluation (AWE), which provides automated feedback to students for revision, focuses on the wide use of AI in English writing.

Additionally, Automated Essay Grading (AEG) is extensively used around the world, and Su, Miao & Man (2019) mentions that AEG is applied widely due to a crucial role in the evaluation part of the Test of English as a Foreign Language (TOEFL). In the process of students' learning Academic English writing, the assistance of AI, such as Grammarly or relevant automated writing evaluation systems, can support them in revising writing correctly. Moreover, non-AI technologies, such as google classroom applications and the Facebook group, can provide a communication session and peer feedback to assist instruction while practicing writing.

Additionally, AI Writing Software can guide students' writing styles and learning strategies and develop motivation, constructivism, and cognition (Su et al., 2019). AI Intelligence writing software's role is crucial in assisting students to develop production quality since writing combines cognitive and psychological processes. Along with the important role of AI in academic writing, technology platforms also include a vital part in analyzing relevant research papers. The quality of various genres in Academic English writing in higher education can be improved with digital support in terms of AI and non-AI technologies. Linking to the Thai universities' context in English writing skills, some learners are weak and find it difficult to English writing, especially in academic writing. According to Kawinkoonlasate (2021), by focusing on undergraduate students' English writing, learners face challenges in sentence structures, choices of words and vocabularies, and organization in paragraph structures, so utilizing AI or technology devices is vital for learners to promote learning results. Thus, to understand the practical trends in research of AI & non-AI technology in academic writing, insightfully updated literature on AI and technology platforms in Academic English writing from 2011 to 2022 is analyzed in this study leading to promising AI-enabled English writing skills in the Thailand context. In other words, this current study aims to promise a learning environment of English writing in the context of Thai higher education regarding the earlier trends and education research issues. The research questions have framed this study as follows:

- (1) From 2011 to 2022, what are the nationalities, authors, and journals conducting the AI & non-AI technology in academic writing?
- (2) From 2011 to 2022, what types of AI and technology devices are used in academic writing?
- (3) From 2011 to 2022, what are application domains implementing AI & non-AI technology in academic writing?
- (4) From 2011 to 2022, what are learning strategies applied to the AI & non-AI technology in academic writing?

- (5) From 2011 to 2022, what are research methods conducted in AI & non-AI technology in academic writing?
- (6) From 2011 to 2022, what are the results from research issues using AI & non-AI technology in academic writing?

2. Literature Review

The learning concept of academic writing in English with AI and technology platforms contributes immensely to a 21st-century education. As Lirola (2022) mentioned, practicing the written skill on a social media platform of the Facebook group not only enhances learning English writing but can also support obtaining social competencies for communication and cooperation. The role of English writing classes nowadays is not just teaching and giving students knowledge, but also the writing classes need to prepare students to develop writing skills. In order to progress written skills, AI, technology platforms, and tools take an important role as a part of the methodology in learning. It is why social media platforms and information and communication technology (ICT) situate as the main role in pedagogical purposes for updating education (Lin et al., 2016; Rwozi et al., 2020).

Continuing the study of promoting academic writing with the usage of technology tools, the study by Saqr et al. (2021) uses the ENA web tool to analyze the writing strategies of students along with self-regulated learning (SRL) from the private Facebook group, which demonstrates how learners manage SRL in writing tasks for academic writing. The result of this study reveals that computer-supported collaborative learning in the context of academic writing can show the different SRL tactics of students in their argumentative essays. With the facilitation of technological applications and learning English writing, learners can realize their prior knowledge and obtain the new knowledge that supports their writing structures. Furthermore, Chong (2021) indicates that testing students' prior knowledge through Google Forms with an online multiple-choice quiz can also reflect on the writing of the International English Language Testing System (IELTS).

Besides, giving feedback in learning English writing plays a significant role, and Taskiran & Goksel (2022) explore how feedback from the Write and Improve Software tool supports learners' writing achievement, along with the teacher's guidance, and feedback can be more effective for students writing. The important goal of applying AI and technology tools in students' writing can help learners learn the correct writing structures from peers, and automated feedback assists teachers in guiding students for effective feedback. In addition, to guide for writing different academic essay genres and research papers, scholars also describe how technology software and applications can be used to foster academic writing (Mcculloch, 2017); Hosseinpour, Biria, & Rezvani (2019). The literature analysis is relatively scant based on the research analysis of AI and non-AI technology applications that enabled English academic writing. Therefore, to deliver a detailed literature analysis on AI and non-AI technology-enabled writing, the paper analyzes the literature to understand the findings of writing skills with AI & technology from eleven years ago and current research issues.

3. Research Methods

3.1 Resources

The journal papers related to digital support in English academic writing between 2011 and 2022 were searched in the Scopus database, including "academic writing" and "higher education" in the paper title, abstract, or keywords list. There were 76 papers published in International Journals and conferences relevant aiming to higher education. Among them, 14 papers were related to analyzing digital writing support for academic English. Three experienced researchers then read and categorized the papers based on the coding scheme to conclude the used papers, and there are 11 papers for this study, excluding policy-maker papers.

3.2 Data Distribution

The publication in digital support for AI and non-AI technology to assist in writing academic English papers from 2011 to 2022 is reviewed. It was found that, since 2011, the prospective action of Information and Communication Technology (ICT) as a tool can support and improve students' formal English writing in higher education (Klimova, 2011). In 2019, an investigation of the usage of AWE in a conference paper and argumentative writing was published by (Su, Miao, Liu & Man 2019). In addition, Quasi-experimental research with the mobile application Edmodo for blended learning of academic writing classes was discussed by (Hosseinpour, Biria, & Rezvani, 2019). Due to the improvements in technology, related papers in this field seem to appear more since English academic writing in higher education cannot escape from digital support as the tools of AI and non-AI technologies to gain and practice writing knowledge effectively anytime and anywhere. In 2022, three papers about the utilization of AWE and web-based argumentative writing to know students' behavior were explored by Talebinamvar and Zarabi's study. The research on using Facebook groups as learning management systems to learn grammar for academic writing and discussions for oral presentations is discussed by Martinez (2022). Besides, a study by Taskiran and Gokse (2022) applied to write and improve software along the social networking platform Facebook for descriptive writing tasks. The rapid growth of usage of digital support for both AI and non-AI technology seems to become the learning equipment of English writing for higher education.

3.3 Coding Schemes

The coding schemes of this study are adapted from the previous study of Chang & Hwang (2018), analyzing trends and research issues in nursing field education relevant to higher education in this paper. The coding schemes were adjusted because the coding scheme includes the nationality, authors, journals, adopted types of AI and technology-enabled writing, application domains with academic essay writing genres, learning strategies in technology used for accessing or measuring students' writing, research methods, and independent variables.

(1) Nationalities, authors, and journals: The purpose of discussing the basic information, including authors, nationality, and journals, is to realize who and which countries have more frequently published papers about AI and technology-enabled English writing in higher education.

(2) Adopted types of AI and technology devices: As suggested by Ouyang & Jiao (2021), the AI and technology here focus on (1) behaviorism of learners as the recipient, (2) cognitive and social constructivism of learners as a collaborator, (3) connectivism, and adaptive system of the learner as a leader is AWE tool and technology platforms in this study are, google classroom platform, Edmodo mobile application, Facebook group, and Wikipedia platforms.

(3) Application domains: The domains in this study refer to the genre of essays written in academic English, such as argumentative essays, descriptive writing tasks, opinion essays, conference papers, journal papers, and research papers.

(4) Learning strategies: The strategies of learning writing here focus on how many devices of AI and technology-enabled English writing are used for accessing or measuring students' writing. Wikipedia refers to accessing academic writing, supporting writing, and avoiding plagiarism. Automated writing evaluation (AWE) is a computerized assessment of written works utilizing natural language processing technologies for evaluating and analyzing students' writing. Epistemic Network Analysis (ENA) is a method for assessing and quantifying the relatedness of elements in coded data and restructuring them in dynamic network models to analyze students' self-regulated learning tactics for English academic writing. Blended learning through Edmodo mobile application is a teaching technique that combines the usage of technologies with traditional instructor-led classroom activities for accessing students' academic writing. Google Classroom is a blended learning platform developed by Google for educational purposes to facilitate students' academic writing. Facebook group is accessing students' writing and discussing among peers. An automated feedback system from writing and improving software is used for measuring students' writing. Online multiple-choice quiz refers to the type of online assessment in which respondents are asked to choose correct answers from the options offered for testing students' knowledge.

(5) Research methods: This study reviewed research methods and participants and researched issues in AI and non-AI technology-enabled writing in Academic English of higher education. Research method categories are based on the methods explored by the researchers in this related field.

(6) Results from research issues: The cognition, effects, psychomotor and causal analysis are categorized in this study. Cognition refers to receiving knowledge from learning and affects the participants' feelings about learning. Besides, psychomotor present to the professional skills from writing and causal analysis means relationships or effectiveness in AI and non-AI technology-enabled writing.

4. Research Results

4.1 Nationalities, Authors, and Journals

There were many researchers from nine countries applying AI& technology-enabled writing in the field of higher education for academic English. The authors of the published papers are counted along with the nationalities of participants in each journal. From the data results, countries from Iran and Hong Kong have published two papers per each, and two journals from Iran (2019, 2022) were published in

Language testing in Asia and Turkish Online Journal of Distance Education-TOJDE. Two papers from Hong Kong (2021) were published in the Asian-Pacific Journal of Second and Foreign Language Education and web of science. One paper from the Czech Republic (2011) was issued in Procedia computer science, and after a gap of five years, another journal from the UK (2017) was published in emerald insight.

Moreover, two years later, one paper from China (2019) was published in IOP Conference Series: Materials Science and Engineering. There was no related paper in 2020, and one journal paper from Finland (2021) was published in research and practice in technology-enhanced learning. Furthermore, another paper was issued in Indonesia's journal of Studies in English Language and Education in 2021. In 2022, one article from Turkey was distributed in the Turkish Online Journal of

Distance Education-TOJDE, and another journal paper from Spain was published in Contemporary Educational Technology. Therefore, it is worth conducting digital support for AI and non-AI technologies for writing skills in Thailand.

4.2 Types of AI and Technology Devices

The functionality of AI and technology devices could be effective for English academic writing in higher education since students from higher education need to do writing for their projects, journals, and publications. According to the result of this study, 11 papers are adopting AI and technology devices in English writing tasks. Starting from the study of Klimova (2011), this study applied online e-learning and wiki for academic writing to produce a Wikipedia text. The paper of McCulloch (2017) applied AWE to evaluate academic writing practices, and the paper from Su, Miao, Liu & Man (2019) also utilized AWE to evaluate English writing. Additionally, the article from Talebinamvar & Zarrabi

(2022) used AWE to cluster students' writing behaviors with web-based, based on argumentative writing.

Web-based mobile application Edmodo used in blended learning by Hosseinpour, Biria, Reza & Rezvani (2019) is another platform for practicing English academic writing. Rosyada & Sundari (2021) applied the google classroom application for the academic writing course. Similarly, Chong (2021) used google Forms to test students' prior knowledge of IELTS writing. Lopez's (2021) study employed online-related writing exercises to support students writing. The Facebook group also applied to support the learning process of students' academic writing, which was used by Saqr, Peeters, & Viberg (2021), and Martinez (2022). A study from Taskiran & Goksel (2022) also employed the Facebook group as a learning process using write and improve the software.

4.3 Application Domains

The application domains of this study are defined by reviewing the genre of related eleven papers and perceiving which kinds of writing types are utilized with AI and non-AI technology devices in academic English of higher education. The analysis result identifies that there are argumentative essay writing types solely from two studies. One study employs an argumentative essay and an authentic Wikipedia article. On the other hand, two studies exploited research papers, argumentative essay writing, and a conference paper, as well as argumentative writing. Other domains in genre writing type of Academic writing applied through the discussions for both writing and oral presentation are done by one paper, and the main focus of the essay writing task is also found in one journal. Furthermore, IELTS writing, cause and effect essay writing, descriptive writing tasks, and journal paper are utilized by another four journals correspondingly. Thus, there are 10 genres of academic writing from the finding of this study, such as argumentative essay writing, the essay writing task, authentic article for Wikipedia, IELTS writing, research paper, cause and effect essay writing, conference paper, descriptive writing tasks, academic writing, and journal paper.

4.4 Learning Strategies

Learning strategies in this part tend to emphasize the technology used for accessing or measuring students' writing. Firstly, the usage of the wiki for accessing academic writing in supporting writing and avoiding plagiarism is found in the study (Klimova, 2011). By studying the usage of AWE with learning strategy along web-based, a study from Talebinamvar & Zarrabi (2022) used keystroke logging with student cluster and writing quality to realize students' pausing behaviors in their writing and how they respond. Another study by Saqr, Peeters, & Viberg (2021) applied the ENA web tool to analyze the self-regulated learning tactics of students in their writing to observe how students develop their essential skills in academic writing. A study from Chong (2021) utilized an online multiple-choice quiz for preworkshop to test students' prior knowledge in IELTS writing and post-workshop to test students' knowledge again. The application of the google classroom platform can facilitate students' academic writing (Rosyada & Sundari, 2022).

Moreover, blended learning through the Edmodo mobile application is also one strategy for accessing students' writing (Hosseinpour, Biria, & Ehsan, 2019). The automated feedback system for writing and improving the software to measure students' writing (Taskiran & Goksel, 2022) and Facebook group for accessing writings and discussing among peers is also effective strategy in academic writing (Lirola, 2022). These results might be conveyed that blended learning through the Edmodo mobile application could be applied with AI-based writing tools.

4.5 Research Methods

The research methods in this paper refer to the method from 11 related papers exploring the utilization of AI and technology devices in Academic English writing in higher education. Among the 11 papers, 3 applied the qualitative method in 2017, 2021, and 2022. Experimental design methods are found in two-journal papers in 2019 and 2022, and quasi-experimental studies are issued from two papers in 2019 and 2022. Exploring the potential benefit of ICT as a tool for students' formal written English skills is found in one article in 2011, and another method of analyzing and summarizing students' academic writing in the genre of argumentative essays is explored in one paper in 2021. Besides, one study which applied explanatory sequential research design was founded in 2021, and a case study method was used in one journal in 2021. That is to say. The experimental research design could be a transparent methodology for conducting educational research in AI and non-AI technologies in writing skills.

4.6 Results from Research Issues

After analyzing the related 11 papers, the outcomes from research issues of AI and technology-enabled writing are gathered. The consequences have four aspects: cognition to ascertain students'

knowledge from learning; affection to notice participants' feelings about learning; psychomotor to distinguish professional skills that students acquire from writings; and, finally, causal analysis to identify the relationships or effectiveness in AI-enabled writing. For the cognition aspect, AI & technology-enabled writing can not only practice new academic writing and recognize the usefulness and necessity of the formal writing aspects but also can promote reading skills that students can learn from other writing posts used in the Facebook group, receive task achievement, coherence, and cohesion, lexical resource, grammatical range, and accuracy. In addition, students acquire metacognitive and factual knowledge, which can raise their confidence in expressing one's perspectives along with the nature of the scholarly writing process.

In the aspect of affection part to realize feelings of participants about learning, students can reflect on weaknesses and strengths from their writing performance, raise confidence in writing, promote social competencies in communication & cooperation from Facebook's discussion, and have positive attitudes towards learning English motivation, and engagement in online learning activities. Furthermore, lessons were more accessible, and technology usage and writing anxiety could also be controlled while dealing with academic writing standard pressure.

Linking to the psychomotor aspect, which distinguishes professional skills that students acquire from writing, it was found that the acquisition of writing skills can support the fields of information, finance, and tourism management. For the last aspect of Causal analysis in this paper that identifies the relationships or effectiveness in AI and non-AI technology-enabled writing, software feedbacks help learners to be better writers and get high-quality learning materials. Furthermore, an AI evaluation system can better observe students' learning processes and characteristics and formulate a more detailed analysis of learning conditions and feedback opinions. The process can also control and evaluate academic writing skills, which promote English writing achievement and enhance the writer's motivation and self-esteem.

5. Promising using Digital-supported English Writing Skills in Higher education in Thailand

This study conveyed a meta-review to analyze digital support as AI and non-AI technology-enabled writing in academic English of higher education from the published academic journals from 2011 to 2022. It was found that many studies testified how useful are AI and non-AI technology in academic English writing for participants' performance and improving writing. Most studies mentioned the prospective usage of AI and non-AI technology to support English academic writing and social competencies. Due to the rapid development of technology, the role of academic English writing with AI and non-AI technology tools is becoming more important in higher education. Since writing in higher education is quite critical, AI and non-AI Technology tools include supporting and knowledge- building parts of students' writing. Amazingly, based on the results analysis of this study, there is no study about digital game-based learning or gamification that supports higher education academic

English writing to build students' knowledge and confidence in improving English writing.

On the other hand, the studies seldomly describe how academic English writing and the usage of AI and non-AI technology can support the professional life of students in their future careers. Most studies focus on how students develop their writing skills and perceptions of using AI and non- AI technology-enabled writing. Therefore, it is worth investigating the potential and possibility of integrating AI and non-AI technologies to assist the academic writing of university students. From the above concerns, promising digital support for academic writing for Thai university students in the future study are listed as follows:

- (1) Linking with higher education, which focuses on the university level of Thailand in English-writing skills, the sector of AI could not be ignored in applying or improving English writing. Lamjuanjit, Prachannant, & Jarat (2022) presented how AI's benefits in English writing can be effective from the pedagogy approach. Therefore, it plays a decisive role in language learning by scholars based on the Thailand context. Thus, this paper would like to propose the contribution from some learning strategies and AI features of eleven reviewed papers that enable the writing skills of Thai university students, especially in undergraduate programs. Among the results, the google classroom platform can facilitate students' academic writing. Blended learning through

Edmodo mobile application for accessing students' writing, Facebook group for accessing writings and discussing among peers, and measuring students' writing through automated feedback system from write and improve software could be applied in Thai context to enable students' writing.

(2) The Edmodo application in both mobile and computer-based versions could be applied to access students' writing and provide feedback to the writer from teachers and peers in both regular and blended classes.

(3) With the challenges of automated writing evaluation (AWE) to provide feedback on students' writing using natural language processing (NLP) technology, the current AI tool about natural language processing (NLP), as suggested by Wambsganss et al.'s (2020) study can be diffused to Thai university students in future language education of Thailand, especially for effective writing of students. It has served as a writing tool, including various features such as grammar and spelling suggestions and general feedback on specific aspects of the text (e.g., readability, persuasiveness of arguments, degree of formality, consistency).

This paper presents educational research on how digital support as AI and non-AI-based technologies could assist university students in English writing skills that can link to the Thai university context. Consequently, this will bring the practical usage of AI and technology features to enable students' English writing skills in Thailand's university education.

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