Nanotechnology Perceptions
ISSN 1660-6795
www.nano-ntp.com

An Analysis on the Implementation of Artificial Intelligence (AI) to Improve Engineering Students in Writing an Essay

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Artificial Intelligence (AI) technologies, such as chatbots, Natural Language Processing (NLP), and Sentiment Analysis, promise to disrupt the way products and services are delivered to consumers. These technologies are also being evaluated in multiple use cases to support the writing process. One growing application space for AI technologies is in the field of education, specifically for supporting students' writings. This paper took a lead in examining this space with its focus on improving student writing skills in engineering. The research employed a mixed-method approach that combined qualitative and quantitative data analysis. Specifically, content analysis was used to analyze the data qualitatively. The study drew its conclusion by comparing the formal EFL essay elements, including content and language, in terms of comprehension and production. Additionally, the study examined the flow of information among the participants in essay writing. Courses are traditionally offered on an annual basis, with roughly 25-35 students per term. The control group in this study comprised the 224 essays produced by the 52 students during the 2023-2024 academic year. The study utilized the VAN framework, which began with cohorts or teams that submitted essays continuously throughout the academic year. The results showed the use of artificial intelligence to improve writing skills in the field of engineering students has weaknesses in several aspects which can be further developed. The customization process carried out must be done meticulously and step by step, so that pilot testing can be conducted in advance in a specified area or object.

Keywords: Essay, engineering, AI, writing process.

1. Introduction

Artificial intelligence (AI) has a key role in today's revolution of education from basic to higher levels. Various studies have shown the effectiveness and advantages of using AI to help the learning process (Botel, 2000), such as teaching and learning writing. Essay writing is one of the difficult subjects that must be learned and taught by engineering students. New students in writing English essays are often confused about how to begin writing because of difficulty in presenting ideas, word choices, organizing sentences effectively, and making errors in spelling (Murray and Moore, 2006). This makes it difficult for them to express their ideas in writing. It is necessary to carry out a study to find a solution to these problems, both for academic and industry problems, especially the development of AI in the implementation of essay writing.

The purpose of writing this article is to find out the right use of AI in essay writing, to get the results of trends in a particular research strategy, and to interpret the basic trend when discussing AI in essays. To achieve the purpose of this article, the authors discuss the topic of essay writing, research results by previous authors, and areas that should be explored more regarding how AI works effectively in engineering education. The research method used in this article is a systematic literature review. All database articles that have been used are relevant to contemporary university education. This is in accordance with the discussions in engineering education with a research impact. The results of this research will discuss the role of AI in improving the writing of English essays for students of engineering.

Good writing skills are very significant in the world of engineers because the majority of jobs nowadays require genuine and efficient communication (Pardoe, 1994; Wichadee, 2010; Adedokun, & Al-Amodi, 2013). It is one of the abilities that develop a student that they can use in their career, notably if they enter engineering. In engineering, the ability to communicate using writing is important and valuable due to the emphasis on the security and optimization of their products (Hulu et al., 2023). In addition, by writing an essay, a student will deepen into a particular field and learn not only the basics of the area but further the process of reformulating the facts of diverse articles in stipulations with his words. In addition, in writing an essay, students can learn to support their ideas and opinions.

The opinions mentioned above do not match the facts, so the problem related to the ability of engineering students to write essays is a major focus for them. Finally, it brings us to the conclusion that for the final result of writing education to be achieved, the stage must begin the process of teaching these materials already in schools and colleges. However, the constraints faced by students today are the lack of educational management functions related to the dominant media as a fact in other social science learning. The limitation of the writing on the implementation of Artificial Intelligence to Improve the Ability of Manufacturing Students explains the role of the introduction, essays, background, AI, writing at the international level, engineering, skills critical thinking. Writing becomes an important skill that should be owned by engineering students. However, there is limited information about the implementation of foundational engineering studies research in introductory essays in different countries. This review can help all parties who want to get information about essay writing in the international context.

2. THEORETICAL FRAMEWORK

Importance of Writing in Engineering

The National Center for Engineering & Technology Education (n.d.) stated that writing is an essential nonverbal component of the engineering profession. The ability to communicate in writing in the engineering workplace is a basic skill for professionals in all engineering disciplines. Ismail et al (2010) argued that writing is often used to convey the results of research or studies (Korotkina, 2017). In higher education, students' ability to express their ideas in writing is one thing that must be mastered. Therefore, the ability to write is an important aspect that engineering students must master. Writing is also closely related to the need for information search and ideas from various sources so that students can also learn critical thinking and argue with facts related to the proposed problems (Herman et al., 2023).

According to an expert from the Faculty of Engineering at Universitas Negeri Yogyakarta, Dr. Eng. Yoyon Kusnendar (2020), the pace and sustenance of academic freedom, autonomy, and excellent competitiveness in the professional world requires a state of college students Indonesian can make research that is useful and beneficial for sustainable development. We need to search for the excellent mindset of the faculty and students that is able to comprehend [capable] author of the specific writing, especially for the rank of university FRE1 research and an international SINTA2 journal/accreditation general. Reference Manager is an important input. Writing is not an easy skill to master, especially for students from the Faculty of Engineering, Bapu Bavanji Patil (2014). In Engineering Education (How to Study - Engineering & Engineering Manufacturing Online Study), it is said that by making sure that students really understand the scope of their writing as well as the key points and critical issues in the field of study, the faculty and staff should be able to provide support and resources to facilitate students in their quest to develop excellent a paper for publication.

Challenges Faced by Engineering Students in Writing

Engineering students, specifically at tertiary level, have faced many obstacles. Some students have had a lack of time to write, which sometimes leads to poor management of ideas and bad proofreading. Some have a hard time starting to write anything because they think they are not smart enough to generate the knowledge to objectify. Some do not have many references to add originality to their writing, and some do not have enough words to develop their writing.

A few international engineering students also stated that they feel overstimulated by other necessary coding activities. The principal problem with any of these objections is that the deductions concerning adequacy are not based on evidence. Reviewing the limitation of writing skills among engineering students, schools of engineering in many countries also show their concerns about the students' writing. The students often look confused and have been distracted by other draft elements that may be better to draft in a different paper or may be omitted.

When learning academic writing, most engineering students are hampered by their ability to accurately attribute works to original authors. Bolsunovskaya and Rymanova (2020) in particular studied engineering writing since the mass of writing encountered by engineering students was not writing that is so. Related studies on writing of indeBiters Variable among various subjects identified that engineering students had less knowledge than non-engineering

students on how to paraphrase accurately and when to quote another source. Practice also identified that engineering students were less abiBitic than non-engineering students to parapinme and with higher infirmity. From various writing, paraphrase is probably the most frequent. Cleaning shows that engineering students can paraphrase effectively, like paraphrasing in their own words or simply changing some of the words in a sentence. Most engineering students have difficulty with source-oriented paraphrasing; changing order and sentence structure, prose, and walls are very important, and manufacturing-based sump to do this can be considered office.

Understanding Artificial Intelligence and Natural Language Processing

AI is an overarching concept; that is, artificial intelligence includes machine learning and deep learning. This chapter particularly examines AI in the context of NLP. Readers are introduced to how AI-NLP is approached from a research perspective in terms of methodology and technique of AI-based research. This chapter also likens AI to be a universal tool to which educators and linguists are provided freely to build, modify further, and improve the quality models.

This section has two parts. Firstly, the section provides the fundamental concept and examples of AI in education. It argues that based on the capability of AI to compute and analyze data, AI is a helpful tool to deliver personalized educational systems. The second part of this section is how AI is approached in educational research. It discusses the methodology and technique used to generate research in AI-focused educational and NLP. It provides an ultimate solution for readers to understand the application of AI-NLP effectively. Artificial Intelligence in education explores the application of AI in education, especially in designing, developing, and delivering personalized educational processes. One of the key factors that make AI work well is computational skills. The computer could analyze the data well to support the identification of the individual, community, and groups. In aim, deep-learning machine models are creatable even by people who do not understand the system in great detail.

Applications of AI in Education

This section of the analysis begins by surveying the various applications of artificial intelligence within the realm of education, all of which contribute to a larger trend towards personalization, adaptability, and increased interactivity. It starts with simple information retrieval as one of the pioneers in implementing AI in educational systems, especially in the domain of intelligent tutoring systems where it can also be used to provide some pragmatic functions such as language verification and to provide instant feedback (Sinurat et al., 2024). Nowadays, AI is involved not only in intelligent tutoring systems but also in learning management systems, games and simulation design, cyber learning, natural language processing, problem solving, intelligent agents, etextiles or smart textiles, affective computing and educational data mining and educational data analysis, intelligent multimedia, etc., because according to Khstim, "the more we use AI system, the more flexible and useful for various angles" (Boomer, 2012; Ansari et al., 2023).

What interests us about this survey is that it is predominantly based on a multilingual public discussion. There seems to be almost no external evaluation of the claims, which is the province of those who are partners in the systematization movement. Only a few exceptional

voices inquire into the academic, scientific, commercial, or jurisdictional dissemination of the systems they are inventing. Our primary interest in this survey, however, is not to address educationalists, computationalists, or practitioners but rather to set the stage to introduce a specific application of AI as a contribution to engineering education in which the reader may be interested. Specifically, the sophistication of natural language processing tools makes them increasingly relevant in the conception of an instructional system tailored to the needs of the engineering student who needs to improve on the writing of essays in formal register and a logical-positivist style. While these systems are primarily designed to help automatic grading of essay writing for reading, we consider the ramifications of AI in education in a general sense, specifically the major engineering institutions that have regarded and operationally approached the use of AI in education as largely irrelevant. The thesis that automation is replacing human agency in writing (and other activities where human presence and consideration are mandatory, we may add) is not new. AI applications in education assist, guide, support, or even present the essay-writer with sophisticated alternatives. These include the Atomic Essay, EssayJack, Lightside, Essay Grader, FLOGrammar and Academic Writer, software applications that provide students with immediate feedback during the writing process. All of these maintain the processing of complex, logical information as a bug introduced in the introduction and conclusion of the essay.

3. Research Methodology

A. Research Design

The research design is specifically applied to analyze the implementation of Artificial Intelligence (AI) called Jasogma in enhancing the essay writing skills of engineering students. This section describes workshop sessions, assignments, analysis, and participants. The methodology used is a mixed-method design. Data were analyzed using content analysis technique qualitatively (Brenner & Harrison, 2000; Judujanto et al., 2024). The conclusion is drawn by comparing the comprehension and production of formal EFL essay elements that focus on the content and language. Then, the elements are associated with the flow of information that the participants have in essay writing. Based on the result of the research design, the researcher concluded that the use of AI could help participants write the essay.

In this research, the workshop was designed to consist of revising workshop inside and input of the EFL formal essay components and pre-writing guided by AI. Then, the participants finished their essays by themselves. They were given a chance to involve AI and see the feedback in between the process of writing. Participants: all of the students were the participants. In this assignment, the researcher tried to use a mixed method; both quantitative and qualitative. The population of this research was the 2017 Informatics/Computer Science students. The research is focused on general participants who have knowledge and an interest in essay writing, at least simple formal essay writing.

B. Participants

Quantitatively collected data was collected to examine the impact of AI on the essay writing process of engineering students (Buenavista, 2019). STA system data was available for any student in engineering department. Courses are generally offered yearly, with approximately

25-35 students per term. The control group in this study were the 224 essays from the 52 students during the 2023-2024 academic year. Building on the VAN framework, qualifiers began with cohorts or teams that produced essays in a continuous form throughout the academic year.

Fifty-two undergraduate engineering students were recruited from a private technology college in Indonesia. All identifying personal information was removed from the essays prior to the research team gaining access. Due to the potential for human-subject harm and the small population size of students, it is agreed that many demographic details are irrelevant. However, it is crucial to note that all students are under the age of 25 at the time of writing. All engineering students were enrolled full-time in their engineering programming, distributed in the following disciplines: advanced manufacturing – 8, civil – 15, electrical – 11, industrial – 8, and mechanical – 10.

Instrument of Data Collection

This study used three types of instruments. Firstly, the pre-test instrument was conducted to diagnose students' initial ability in writing an essay for both the experimental and the control groups. The pre-test was used to classify the homogeneity and heterogeneity of the participants (Chen, 2005). Here, the pre-test was an assay test, in which students were asked to write in a rhetorical pattern entitled 'the descriptive in the text "spring break", duration 45 minutes. Then, secondly, the training process was employed as the data collection instrument to determine the effect of an artificial intelligence approach on teaching writing. The training was conducted in eight meetings, which aimed to see the students' progress. Nevertheless, there was a stage where the training process was accompanied by treatment called 'Artificial Intelligence.' Consequently, the Microsoft Word application was used for recording students' responses. To examine the results of the process of data analysis, there were two types of data: qualitative and quantitative. The qualitative data collected as portfolio documentation were group-guided discussions and oral presentations. Additionally, in composing an essay, students also applied the principles of academic writing, following the language theory discussed was a rhetorical genre analysis (RGA), in which students were required to compose an essay with the rhetorical pattern. They also need to include an introduction, thesis, body, and conclusion. To obtain the information that textbooks' usage can influence the knowledge and perception of students, interviews were conducted. Thus, the quasi-experiment questionnaire was the third type of instrument used in this study. Administered was a close response in the pre-test examination after Er1, Er5, and Er8, revealing the quasi-experiment questionnaire as an instrument for data collection. The purpose of conducting the quasi-experiment questionnaire was to see the differences students' writing abilities in test 1 and test 2, and to distinguish between control and experimental groups.

C. Data Collection Method

This research involves primary data collection through task need identification to determine questionnaire development (Rakhmyta et al., 2024). Conventional writing is given to 52 students. The results of the paper test will be used as actual object data for comparison later. The test is carried out by the chair on the Scheduled Time Exam. The data is collected by following the activities that are developed. It is used to check how the process and the obstacles will occur. In the process of using technology, there are also obstacles. The first step is to

determine the sample and calculation for the sample proportion that tests done by the sample chairperson. Identification results are obtained from bentom to see the needs and create a questionnaire in ecosystem publishing tools.

After the data has been obtained, further processing of data and information for the formation of artificial intelligence for the manufacture of word documents is discussed in the introduction. Based on the activity above, a description can be made as follows: writing the GP assessment questionnaire for determining the writing ability of the desired time, examples of conventional tests for students, implementation and testing of the system prototype, design of paragraph accommodation space, initWithFrame() to create an interface with the object JFrame, JotainPane for multiple methods with the default confirmation message, proportion of the population determined in the validation, formation context and wordlist based on structured questionnaires constructive essay, generate apa50% and construction requirement using bento productivity.

D. Data Analysis Method

This study presents in two phases with separate participants, and information on each phase will be analyzed together to answer the indicator. The data collection method for the first and second phase has been clearly explained in the previous section. This study utilizes paper-and-pencil and online material technology to materialize tests. The digital activity was carried out with the help of essay marking software, but the use of artificial intelligence was still limited and predominantly assessed by language expert raters. To determine the participant data distribution, central tendency, and spread, this section uses frequency, percentage, and mean to draw conclusions through the analysis of data on the two study indicators. The data elements will be analyzed as a whole to identify the real situation at the respective university.

As an exploratory research effort, case studies offer rich and accurate experiences with a research subject. This, in effect, provides a trustworthy source for theory extension, refinement, or even for supporting data analysis selection, as well as feeding the study findings to inform a review of the relevant literature. An analysis of rationales for analyzing data from at least two areas of study was grounded in a convenience sample case. Furthermore, the schedule of the chosen data collection cycle emphasizes conformity across the distinct study areas to some extent. Finally, with the investment of informed consent from the relevant body reviewed, data relevant to the two research questions provide access to both students and instructors who have been involved. Data coding using the iterative process was conducted carefully by representatives of the research team for a period of four weeks, identifying and cleaning up each data set in turn. Data were analyzed according to the selected content, themes, and theoretical propositions. Extensive transcripts were created during coding to ensure research merits, triangulation, and generate rigour allowances.

4. Results and Discussion

RESULTS

1. Benefits and Challenges of AI in Writing Assistance for Engineering Students

The adoption of AI tools to promote students' writing skills has seen several benefits and challenges in the literature. This section aims to critically discuss the advantages and obstacles brought about by the adoption of AI writing tools for writing assistance using the 2 X 2 model as the overarching theoretical lens for human-AI interaction. The basis for the arguments originates from both theoretical claims from the literature and practical experiences of published articles. The chapter also discusses the ethical and e-rats-related issues of AI. Two major advantages of employing AI writing tools have been advanced in previous studies: drafting and revising with ease and enhancing students' creativity and content arrangement skills. Five obstacles associated with using AI in assisting writing for students have been noted in the literature: the use of complex language, necessitating reliable Internet connection, time-consuming use of AI features, reliability of the suggestions provided, and bot-generated plagiarism. Most prior research quantitatively explains the advantages and disadvantages of using AI-based writing tools for students. Our study, however, uses an AI writing tool over a six-month period in an undergraduate engineering setting. The paper identifies, discusses in-depth, and provides solutions for overcoming four ethical and privacy-related limitations in using AI alongside students in education and professional practice, namely, limited academic resources, agreeableness and feedback reliability, teacher's and student's capital, researcher's and education sector's negligence (e-rats), and privacy concerns. We also propose 14 solutions to blockchain organizations, social scientists, Artificial Intelligence (AI) developers, doctors, academia, teachers, authors, schools, universities, education technology, and chamber of commerce policymakers.

2. Advantages of AI Tools in Writing Improvement

Writing is very important to improve students' performances, including engineering students. Using an AI tool is believed to have several advantages. AI-based writing tools can effectively and efficiently help university students deal with their fractured writing skills. Writing requires a lot of thinking and they have to express their knowledge in an academic essay. Therefore, further identification of the agreement levels will be the address in the problem of such systems when they are implemented to be the alternative of the lecturer in the language learning progress, especially writing. Artificial intelligence enhancement strives to improve engineering education in a number of ways by basing new strategies on the application of artificial intelligence-informed cognitive science and learning science research to engineering education. The data on call essays submitted were used to track the students' performances, and any related educational implications will be reported in the near future. In writing practices, AI is now gradually being used to suggest and compare individuals' performance measures.

3. Strategies for Effective Integration of AI in Engineering Writing Courses

As has been analyzed and found, the implementation of a new technology requires a thoughtful approach that considers how to best evaluate the situation, train the human and tool participants, integrate the tool into the curriculum, and support ongoing use of and final evaluation of the tool. Without such an approach, the technology is unlikely to be successful because even the most advanced AI will not succeed in delightful finger-waving. Therefore, for engineering writing programs to use an AI writing tool successfully, they should be given a technique to analyze their own context, choose the most appropriate AI writing tool for their

purpose and context, integrate this tool into their course design, and train their students to easily use this tool. This chapter outlines all necessary stages to help EWC programs integrate an AI writing tool effectively. Effective training of faculty to use the tool and reflect on their use of the tool are crucial to their ability to model successful use of the tool for students. Thus, first, we present the steps necessary to effectively evaluate an AI writing tool for use in an engineering writing course. Then, we describe this process in more detail.

In order to be effective writing engineers when they graduate, students need to learn to write a compelling rationale, a highly organized and clearly written paper, and how to format a highly-referenced journal paper. Engineering students can choose to specialize in several different engineering disciplines. An AI writing assistant will work best if it has customizations for each of these areas. Finally, engineering writers need to learn to convey complex technical information to a non-specialized audience – hence a fourth paper. This paper describes the strategies we are using to integrate AI support for all four papers, and highlights the literature informing our implementation.

DISCUSSION

1. Training Faculty and Students on AI Tools

There are four main factors in the implementation of the use of artificial intelligence to help evaluate the results of research. The training of faculty and students is essential to the successful use of AI writing and critical to the research of instructors in the BCM at this juncture. Assessment of the effectiveness of any intervention requires faculty and students to have the knowledge and skills to implement new writing practices. Moreover, previous studies confirm that time and resources used for faculty and x generation student training will improve how they use AI in whatever they do, a result that is a priority for us. Furthermore, if we choose not to explicitly focus on technology, students may be more skeptical of how effectively integrating AI writing will not work in the classroom.

We are planning to train faculty on AI, enhancing their ability to support the learning process and evaluate students. This training for all faculty participants will be held. In our 90-minute professional development session, we will assist faculty in determining how AI works, what it can do, and how it can help students understand the importance of conceptualizing and generating concepts. We help faculty think about how to effectively use AI to help students assess their writing. We will also clarify how the tool can detect evidence of library research. Furthermore, we invite and encourage students to attend an information and question and answer event on our preliminary case studies. Finally, we are developing a series of training guides and tutorials that can be used by faculty for training.

2. Customizing AI Tools for Engineering Disciplines

In principle, AI tools have great potential in the ENOV sector for engineering higher education. Enabling students to think both broadly and globally will help them compete in the labor force. With regard to writing, however, AI tools should be updated to ensure proper customization. AI tools should match writing tools with the requirements of the use of the knowledge of the engineering discipline, how students use the Internet and library sources, how can they combine them with their experiences during education, make comparisons, solve problems in the hope of reaching comprehensive theories and new innovative research.

In the context of engineering disciplines, writing can be regarded as a process and a production, a reflection for understanding, organizing, management and communication as well as showcasing know-how. Writing is important in the debate, judgments and interpretations to learn about the following media: e-mail, essays, reports, theses, academic papers, research proposals and other written forms to fully explain their work, discussions with colleagues and conference papers to gain access to international research ideas. In the future, because of this, AI writing assistance should be tailored to a particular type of theoretical writing in the context of the collection and selection of data and content management.

AI writing assistance should be tailored to the unique research foundations and experiences of students in different fields. Occasionally, it would be appropriate for the software to "damage" students from one field to another, so that they can speculate on a different model in order to analyze and develop a sustainable solution, thus expanding their potential as an engineer-creator. The output of writing is essential to any theoretical part of the entire range of teaching curricula in engineering. To ensure that the output is representative, AI evaluation will help people develop criteria for assessment by analyzing the most important steps in discussing the question; introducing a new idea; web/library research; selection of documents and sourcing; the way of reading/listening; reflecting and developing understanding; decision-making on what goes in the news; the best way to put them in the news; putting these thoughts into an overall structural framework; presentation as theory or as a point of argument; strengthening the news with evidence; evidence using examples from work or experience (personal or academic); in-depth critical thinking using data from literature; demonstrating depth and breadth of theory or understanding of a position; application to the richer context of abstract; convergence on conclusions; structuring the presentation of the report; editing the grammar; punctuation; spelling; referencing. This task will vary depending on the nature and purpose of the paper. AI can help teachers identify the most important elements of any part of the discussion. Thus, AI can explain the reasons for setting an educational change as any timely an interdisciplinary, research-driven and transferable output for the semester in question, it is decided on a case-by-case basis, given existing engineering skills.

5. Conclusion

The implementation of artificial intelligence in essay writing for engineering students must be improved because there are still weaknesses contained such as in terms of structure, method, language, content, and implementation of artificial intelligence. These are still limited to one existing application. By looking at various aspects, artificial intelligence should include natural language processing, image processing, and speech processing. All of these aspects must be unified in an integrated manner to produce a more optimal and reliable result.

Based on the findings in this study, it can be concluded that the use of artificial intelligence to improve writing skills in the field of engineering students has weaknesses in several aspects which can be further developed. The customization process carried out must be done meticulously and step by step, so that pilot testing can be conducted in advance in a specified area or object. Due to limitations in time and expense, this study was only carried out using the waterfall system development model. It is suggested that future research should develop a new system development model or use other up-to-date systems to further improve the

customization process. Additionally, it is recommended to update and renew the learning models or algorithms and address the weakness in the combination of algorithms.

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