

A Systematic Review on The Use of Artificial Intelligence in Writing

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Abstract

Artificial Intelligence (AI) has started making its impact in the education field recently. Although Artificial Intelligence (AI) has long existed in other fields such as medicine, engineering, journalism, and forensic analysis, it has only made its impact in the education field after the introduction of ChatGPT at the end of November 2022. Generative AI is seen as a tool that can assist teachers and students in the field of academics such as generating ideas, evaluating essays, storytelling, and providing feedback. It has even been considered as the co-author in students' manuscripts and essays. However, Artificial Intelligence (AI) is still under study in the field of writing as it has been introduced recently. Based on the gap indicating the rare usage of AI in writing, this study hopes to enlighten researchers, educators, and application developers to focus on developing AI applications for writing. This is done by providing a systematic review on the use of Artificial Intelligence (AI) in writing over the last 10 years.

Keywords: Artificial Intelligence, Writing, Technology in Education, Systematic Literature Review

Introduction

The emergence of Artificial Intelligence (AI) as one of the leading technologies nowadays has made a significant impact on human lives. It is the deepest technology we are working on today. Artificial Intelligence (AI) has been used in various fields including medicine, engineering, journalism, and forensics. Artificial Intelligence (AI) was first termed in 1956 by MacCarthy (Christiani, 2016) who followed up the work of Turing (Turning 1937, 1970). According to Turing (1970), "AI is described as the existence of intelligent reasoning and thinking that could go into intelligent machines." Since then, the definition of AI has grown and changed as there have been tremendous advancements in the field.

According to Popenici & Kerr (2017), "The current definition of AI is it is computing systems that can engage in human-like processes such as learning, adapting, synthesizing, self-correction and the use of data for complex process in tasks". Acemoglu & Restrepo (2019) defined AI as the study and development of machine-like software algorithms that interact with the environment. Although there are many different definitions given to AI, one thing is for sure. AI has made a significant impact on human lives, especially in recent years. AI has impacted many industries including manufacturing, transportation, architecture, design, television and film industry, as well as the medical sector. According to Popenici & Kerr (2017),

“AI has the ability of revolutionising the field of education and learning by offering customized educational experiences, and providing intelligent tutoring systems.

According to Boubker (2023), “Artificial Intelligence (AI) derives from developing computing technology capable of undertaking many activities that require a higher degree of human intelligence, including speech and visual recognition, as well as natural language processing and decision-making”. In other words, AI is an interdisciplinary discipline originating from the field of computing and engineering, and highly influenced by other fields including cognitive science, philosophy, neuroscience, and economics (Zawacki-Richter et. al, 2019). Although AI is a relatively young branch of technology in the field of education, there has been a significant interest in AI and its role in education, attracting increased academic, professional, and governmental interest (Zawacki-Ritcher et. al., 2019). This is further added on by Chiu et. al (2023) who stated that, “AI has significantly affected education and classroom practice recently”.

Artificial Intelligence in Education

AI has made remarkable impacts in the education field since the emergence of generative AI. According to Ray (2023), “Generative AI refers to the ability of online tools to create data from (past) repeated patterns as well as the ability to influence human cognitive abilities”. In other words, generative AI such as ChatGPT and Google Bard can synthesize information based on the corpus of data that has been keyed into them. Consequently, educators and students have used generative AI mainly ChatGPT to get the information that they want. Studies done by Sundar & Liao (2023); Hung & Chen (2023) have shown that ChatGPT has been used as the main source of information for students. According to Anderson (2023), “ChatGPT which was first introduced in November 2022 was pre-trained based on a vast corpus of human-generated text, and further extensively fine-tuned on specific tasks”. Thus, ChatGPT is excellent at using natural language, trained to guess the next word, generating highly human-like text, or performing other human language tasks like having a dialogue. According to Thorp (2023), “ChatGPT also serves as a communication source, a role typically held by humans”. In addition, scholars also use ChatGPT to assess their essay feedback and evaluate their performance.

According to Popenici & Kerr (2017), “AI in education refers to computing systems that are able to engage in human-line processes such as learning, adapting, synthesizing, self-correction and the use of data for complex processing tasks.” These tools have the ability to revolutionise the field of education and learning by offering customized educational experiences, and providing intelligent tutoring systems. Some examples of AI tools used in education and learning including Chatbots, intelligence tutoring systems, learning analytics, automated grading, and many others. According to Buriak et al (2023); Kim (2023), AI can be a very useful tool that can assist L2 researchers by gathering necessary information such as the writing structure, relevant sources, and new insights about the topic. AI also can provide feedback on the paper. Generative AI such as ChatGPT and Google Bard have the ability to generate a variety of content, written and unpublished, which is generally distinguished by a high degree of uniqueness, consistency of ideas, and depth of existing scientific understanding (Quintas-Junior et al., 2023).

However, there are many issues regarding the use of AI such as ChatGPT and Google Bard in education. The use of these tools often leads to cheating during online exams and plagiarism in research papers. Thus, there is a need for educators mainly lecturers and teachers to guide students on the correct usage of these AI tools. It is the responsibility of

teachers to make sure that students are well-prepared with knowledge of using AI. As supported by Lodge et. al (2023), "One of the challenges for preparing students for a world where generative AI exists is ensuring that they have the necessary skills and knowledge to work alongside and with the technology effectively.

Research Questions

Although there is a lot of research on the usage of Artificial Intelligence, research on Artificial Intelligence in the field of education, particularly writing, remains lacking.

Hence, this study was carried out to conduct a systematic review of the use of Artificial Intelligence in the field of writing. The investigation of Artificial Intelligence in writing will provide insights for researchers and practitioners in using Artificial Intelligence to reduce the mundane tasks of writing as generative AI not only helps in automated tasks, content generation, and research assistance, but also helps in improving the quality and consistency of our writing through enhanced clarity and flow, consistent tone and voice. Finally, AI can also function as a co-author or a tool in our writing by providing real-time feedback, personalised writing support, and provides multilingual communication. Therefore, the following research questions were addressed in this study:

1. What is the distribution over time of the articles examining Artificial Intelligence utilization in writing?
2. What are the learner types commonly selected for the research?
3. What are the AI technology types used in writing?
4. What are the learning theories applied to examine AI utilization in writing?
5. What are the research designs commonly employed to examine the use of AI in writing?

Methodology

Systematic reviews have been used as a scientific method to gain a comprehensive insight into a specific research domain and aided future researchers in bridging the research gap and identifying the trends in the current study. Therefore, a systematic review attempted to organise the relevant data matching pre-determined eligibility criteria in answering a specific research question.

The ways of review reporting were governed by the principles of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Moher, D. et. al., 2015) where researchers explained the eligibility criteria, information sources, data-collection processes, data items, and synthesis of the results. For example, this study reviewed publications indexed in recognized and reputed journals to obtain an overview of AI utilization, specifically in learner types, the AI technology used, research design, the theories underpinning AI applications in the field of writing.

Selection of Criteria

The scientific articles published in journals indexed in the Social Sciences Citation Index (SCCI) and SCOPUS databases on AI utilization in the field of writing were obtained for this review. The two databases were chosen as they are widely known as reputable and highly-cited journals in the academic world (Bar-Ilan, 2018). Besides that, they are the main resources of many review studies. Additionally, the field tags or indexed articles were easily accessible and customizable based on the researcher's needs.

For SSCI-indexed articles, the Web of Science (WOS) was the access point in using advanced search functions, with the input search items 'artificial intelligence', and 'writing'. Also, the parameters were set, whereby: language was limited to English; document types were limited to articles and proceeding papers, and the period was from 2013-2023. A duration of 10 years was deemed adequate to observe the AI trends in writing and the contemporary use of AI. As such, the search yielded 8 results.

On the other hand, advanced search functions were also used in the Scopus database, with the same query as the WOS database, except for a slight difference from WOS. For example, there was no 'Topic' function, but 'Topic' in WOS was equivalent to the 'Title, Abstract, and Keyword' function in SCOPUS. However, 'keyword' in this review was not included in the query string to bring more validity to the results (Bar-Ilan, J., 2018). Similar parameters were applied-whereby: language was limited to English; document types were limited to articles and proceeding papers, and the time span was from 2013 to 2023. The research yielded 71 results, with the last search conducted on 22 December 2023. The approach to the paper selected is shown in Figure 1.

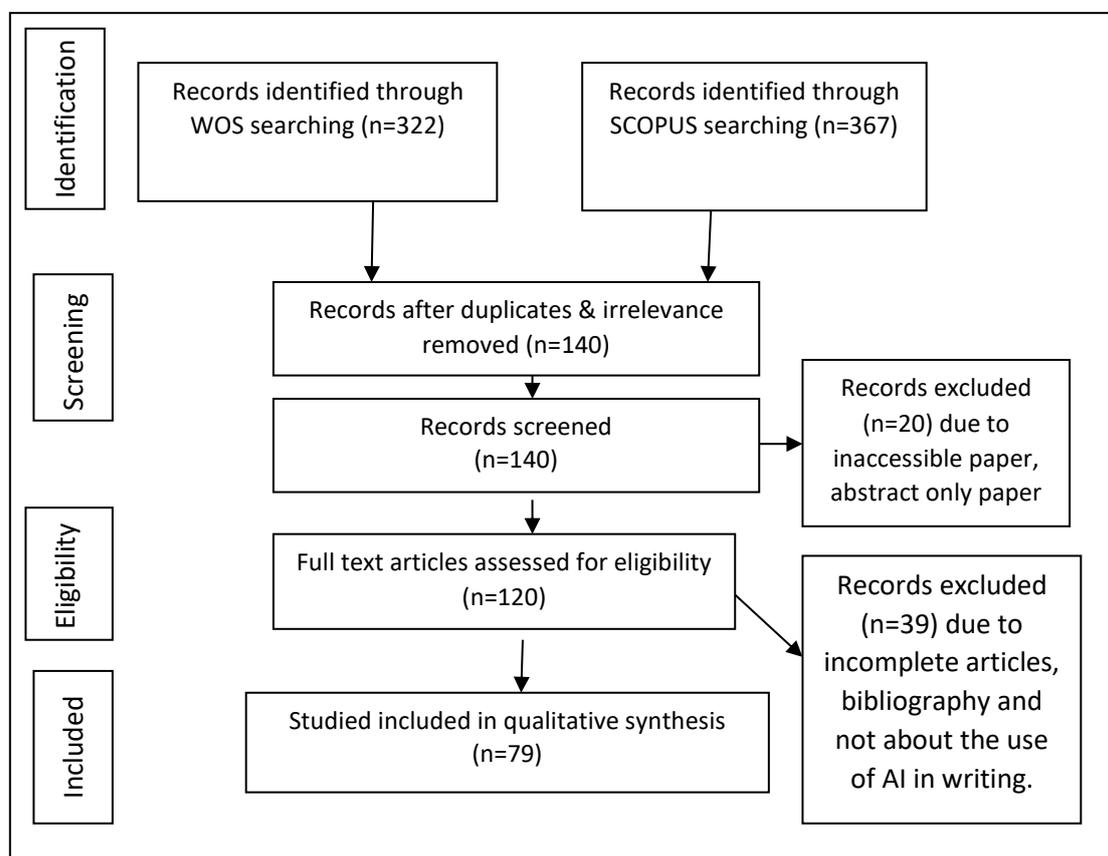


Figure 1. The systematic review process

A set of inclusion and exclusion criteria were adapted during the systematic review process (refer to Table 1). Following the criteria applications, 79 articles were found to be relevant to the study's purpose.

Table 1

Inclusion and Exclusion Criteria

| Inclusion | Exclusion |
|---|--|
| <p>Research must include empirical study.</p> <p>Must involve AI as primary or additional component in learning language.</p> <p>The articles present results of the application of AI for academic writing and the instruments used in evaluation of AI involved,</p> <p>Types of documents included journal articles, and conference proceedings, written in English.</p> <p>The target language can be either in English or other languages.</p> | <p>Articles do not address the actual application of AI in writing.</p> <p>Symposium, editorial writings, meeting abstracts, book, book chapters, master thesis, PhD thesis, biographical items are excluded.</p> <p>Articles that mention the term 'artificial intelligence', but are about other topics.</p> <p>Abstract only paper</p> <p>Design-based research</p> <p>The study does not present the results clearly and the instruments used in the evaluation of AI.</p> |

Procedures

All 79 articles were downloaded as full texts on laptops. Each article was examined and read thoroughly to determine the inclusion eligibility in the final review. The inclusion and exclusion criteria presented in Table 1 were applied during the stage. Also, the articles were selected during the study's discussion on AI usage in teaching of writing.

Nonetheless, the articles mentioning AI elaborated on writing, with no discussion on the effects of using AI, design-based studies, conceptual and theoretical frameworks, and abstract-only papers were omitted. The relevant information was organized and presented in the form of a table using Microsoft Excel. In addition, the data collected from the articles were determined using the qualitative content analysis method, which allowed for more systematic and objective categorizations of qualitative data (Akçayir & Akçayir, 2017).

All the articles were analysed, synthesized, and presented in relevant diagrams based on the outlined research questions. Some of the information was derived from the articles with word searches to find keywords, such as paper distribution according to time, learner types, and research designs. However, other areas, including AI types, AI display devices, the theory underpinning the study, and writing skills required more detailed and careful analysis.

Categories

The year of the journal publications ranged from 2013 to 2023 in this review. The 10-year span was adequate to observe the research trends using AI, specifically in the direction of academic writing concerning AI technology. Learners types were divided into 4 main groups: preschool or kindergarten, primary school, secondary school, college or tertiary students, in-service teachers and senior citizens. The AI tools used were divided into tools for idea generation that include Wordtune, ChatGPT and Google Bard and tools that provide corrective feedback such as Grammarly and Turnitin. For the research design, three categories were selected: quantitative, qualitative, and mixed-method (Creswell & Creswell, 2018). Learning theories were based on the paper and not pre-determined. The findings of the study are summarized in the following section.

Findings

Distribution Over Time Examining AI Usage in Writing

The first article about AI in writing was published in the year 2018. The articles gradually increased starting from the year 2019 with 3 articles, 5 articles for the year 2020, 8 articles for the year 2021, 13 articles for the year 2022 and 49 articles for the year 2023. This shows that there is a growing demand on the use of AI in writing since the last five years. Many researchers are attracted to carry out research regarding the use of AI in writing particularly in the year 2023. There is a growing demand on the use of AI in writing as there are many areas regarding the use of AI in writing that are under-studied.

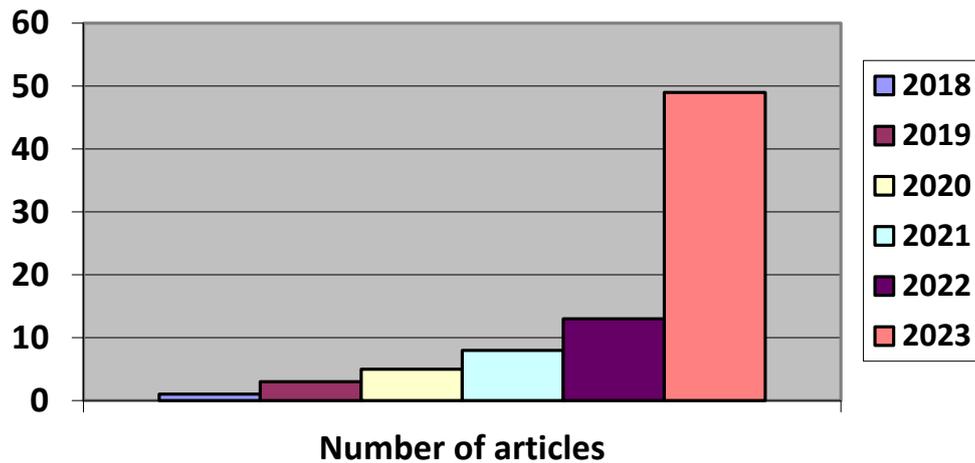


Figure 2. Number of articles published by year

Research Question 2: Types of Learners Commonly Selected for The Research

From the 32 samples involved in this study, 23 samples or 71.9%, of the respondents were from high school, 2 samples or 6.25% of the respondents were from secondary school while another 3 samples 9.38 % from kindergarten. 1 sample or 3.12% of the respondents were elderly people and lastly, 3 samples or 9.37% of the respondents were in-service teachers. This shows that AI have been used extensively in higher education institutions for writing but not in other education institutions. Thus, there is a need to carry out studies regarding the use of AI in other educational institutions as well.

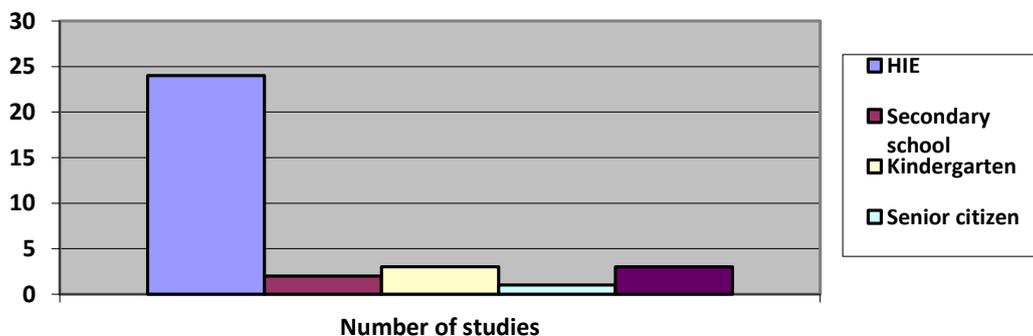


Figure 3: Types of learners commonly selected for the research

Research Question 3: Types of AI Tools Used in Writing

The studies conducted show that the AI tools used for writing can be divided into three main categories: AI based platforms, tools for writing, tools for evaluation or correction and tools for grading. The main tools involved in AI for writing are AI tools for writing. These tools help users in ideas generation. Some of them can also provide feedback or evaluation for users' writing. There are many types of AI tools for writing. However, the main AI tool for writing is ChatGPT. It was mentioned in 20 articles, followed by Google Bard 3 times and Perplexity 2 times. Other AI tools for writing mentioned in the studies include BLOOM, ChatSonic, Cloude, Whisper, Jasper Chat, AJET Digital, Dream Writer, Jenni, Kuai Bi Xiao Xi, Inspire, Xiao Ming, A Tong and A Le.

The second most studied AI tools for writing are automated written corrective Feedback tools with Grammarly as the most frequent studied tool. Grammarly occurred in 4 of the studies conducted. Other automated written corrective feedback tools include in the study are Worldvice AI Proofreader, Perfect It and Prowriting Aid. The third most studied AI tools are automated scoring tools or automated essay scoring (AES). It occurred 4 times in the studies conducted. In addition, automated grading tool or automated evaluation tool have occurred twice in the studies conducted. Besides, AI Translator Baidu, was also involved in one of the studies conducted. Finally, AI based platforms such as Sudo Writer, Jasper, Shortly AI and Idealthon were also involved in the studies conducted.

This shows that there is a variety of AI tools that can help in the process of essay writing such as ideas generation, evaluation of essays or essay grading. Furthermore, AI can also be integrated into platforms to assist students in learning writing.

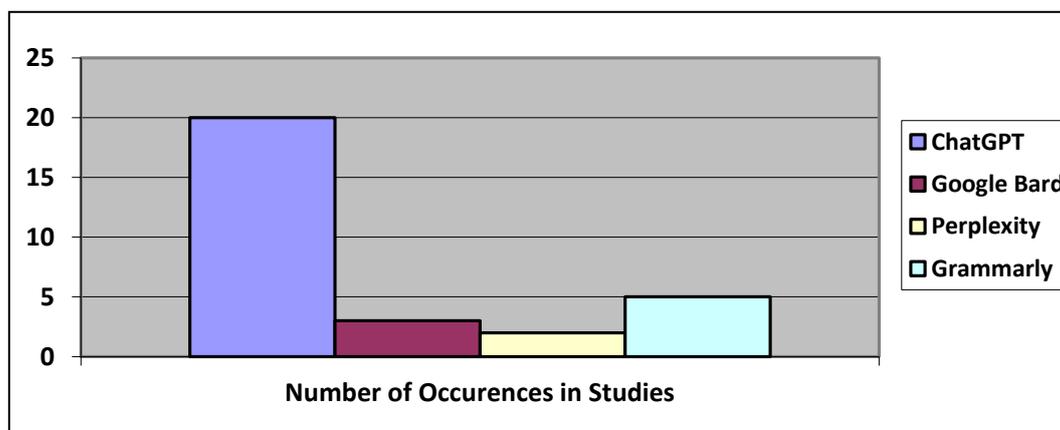


Figure 4: Number of AI tools commonly studied in research

Research Question 4: Theories or Concepts Mentioned in The Studies

In total, there were 12 learning theories or concepts mentioned with the use of Artificial Intelligence in writing. Learning theories that are only mentioned once in this study include Theory of Planned Behaviour Model, Self-Determination Theory, Item-Response theory, CALL, complex thinking, connectivism and Social Constructive Theory. On the other hand, the learning theories that are mentioned more than once in this study include constructivism, social constructive theory, social cognitive theory, TAM model, 21st century learning skills and AI literacy framework.

Table 2

Theories or Concepts Mentioned in the Studies

| Learning Theories/Concepts | Total |
|------------------------------|-------|
| Constructivism | 2 |
| Social cognitive theory | 4 |
| TAM model | 2 |
| 21st-century learning skills | 2 |
| AI literacy framework | 2 |

Research Question 5: Types of Research Design and Data Collection Methods Applied to Examine AI Usage in Writing

The analysis indicated qualitative method was the most frequent research design used (13 studies). Most of the studies were conducted mainly using qualitative approach as it can provide a richer description of the AI tools mentioned. The qualitative approach instruments used in the studies are document analysis and follow-up interview. Field notes are also included in some of the studies conducted. Apart from the qualitative approach, quantitative approach is the second most preferred research method used. There were 10 studies conducted using quantitative approach. Finally, mixed mode design was also used by some of the researchers to get the information for the studies. The most frequently used mixed-mode design is explanatory sequential design.

The studies conducted show that there are many different instruments used to collect the data. Since most of the studies conducted were using qualitative approach, the main instrument used to collect data is analysis of previous documents. There were a total of 13 studies that include document analysis as their main data collection instrument followed by interviews that were included in 11 studies. Other types of data collection instruments used are log note and journal. The use of these data collection instruments aimed to provide a rich description of the research. For quantitative studies, questionnaires were the main type of instrument used to collect data for the studies on AI in writing. There were a total of 9 studies using questionnaires as their main collection instruments. There were only 2 studies using pre and posttest. Thus, more research should be carried out using pretest and posttest to investigate the effectiveness of AI tools in improving writing performance.

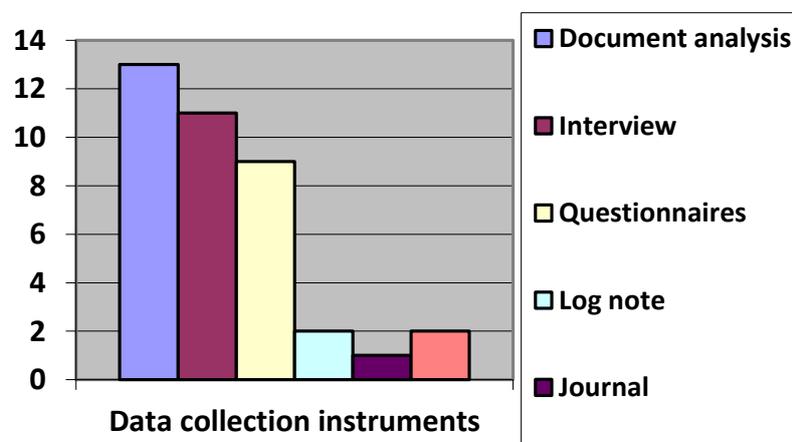


Figure 5: Data collection instruments used in the studies

Discussion

The findings show that AI was first used for writing starting the year 2018. However, there was only one study conducted at that time by Ismail et. al (2018) among Higher Education Institution (HIE) students in Malaysia. In the year 2019, there was another study conducted by Kantasalo & Riihiaoho (2019) using intelligence-based poetry writing on a group of children aged 9 to 10 years old. The demand for the use of AI in writing gradually increased starting the year 2020 and has reached its peak in the year 2023. However, majority of the studies were conducted on HIE students. 60% of the studies were implemented in HIE and only a few were conducted with other age group of students. Thus, more studies should be conducted to investigate the use of AI in writing with other age group of students. One of the reasons most of the studies were conducted with HIE students is due to the fact that there are sufficient facilities provided at the HIE compared to primary and secondary schools.

Besides that, the most commonly studied AI tools used for writing are categorised as writing tool with ChatGPT as the main writing tool studied recently. In total, ChatGPT occurred in 20 studies compared to other writing tools. This is due to the benefit of ChatGPT that are not only able to generalise ideas but it can also provide feedback for students' writing.

The second most studied tool is Grammarly, an AI automated written corrective feedback tool followed by Google Bard. Compared to ChatGPT, Google Bard has just been introduced recently by one of the largest IT companies, Google that has been used in majority of the IT applications such as Gmail, Google Form, Google Maps. Thus, Google Bard might have a bigger impact compared to ChatGPT in the future. Thus, more studies should be carried out regarding the use of Google Bard, an AI writing tool in the field of writing. This is supported by Nazari et. al (2021) who emphasized that the AI research in second language writing is still lacking.”

Concerning the research design of AI, most of the studies utilised qualitative based study using followed up interviews with respondents. This is because qualitative studies provide a richer description of the problem studied as AI is relatively new in the field of academic writing. Thus, a thorough study is needed to investigate the use of AI tools in the field of writing.

Conclusion

This paper presented a systematic review of utilising AI in writing within the span of 10 years starting from the year 2013 to 2023. A total of 80 papers were evaluated for this purpose, encompassing a diverse range of educational needs, research design and types of AI used in the field of academic writing. Based on the analysis conducted, the number of researchers in this field has increased significantly in the last 2 years since the emergence of ChatGPT and most studies employed qualitative types of studies. This paper has enlightened researchers and practitioners on the use of Artificial Intelligence (AI) in the field of writing. It has provided areas that are still under studied such as the lack of the use of AI among other types of learners besides from Higher Education Institution (HEI) students. Apart from that, this study also calls on the examination of more AI tools apart from ChatGPT in teaching essay writing to students as Alharbi (2023) asserted that future research should concentrate on using different AI tools to evaluate writing performance.

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