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Introducing artificial intelligence (AI)-based digital writing assistants for teachers in writing scientific articles

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ABSTRACT

Artificial intelligence (AI) technologies have played essential roles in the development of teachers. In recent years, AI-based digital writing assistants have received increasing attention among teachers. Thus, this study aims to know the use of AI-based digital writing assistants to help teachers write scientific articles. It used a sequential explanatory mixed methods study to gain the research data. Descriptive analysis was completed for the quantitative data, and thematic analysis was used for the qualitative data. The instrument used was surveys, consisting of pre and post-survey. Interestingly, the pre-survey found that teachers are not very familiar with digital writing assistants. Some of the participants had no prior knowledge of AI-assisted writing tools, while others only had limited experience. This means that more people need to be aware of the potential that AI offers in facilitating scientific writing. Furthermore, it is essential to teach teachers how to use this technology, as it can help them save time and effort while they write their articles. The post-survey conducted at the end of the project found that teachers found the process of writing a scientific article to be easier and more enjoyable with the help of AI. The results suggest that AI-based digital writing assistants may be able to provide an alternative method for teachers to compose their scientific articles. This tool could help to reduce errors and enable more efficient writing with greater accuracy. Additionally, the feedback suggests that AI-based tools could aid in improving students' engagement and interest in writing.

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1. Introduction

Writing scientific articles has become a particular challenge for many teachers. A survey conducted by Poch et al. (2020) found that teachers are often faced with several problems that make it difficult for them to write effectively. These issues included having inadequate knowledge of the subject matter, insufficient research skills, and limited time to complete the task.

When writing, teachers often find it difficult to manage citations and references correctly (Bautista & Pentang, 2022). This is because proper citation requires an understanding of the different rules and conventions that govern each style guide, as well as how to format citations correctly in each particular writing format. Additionally, they struggle to ensure that their writing does not contain plagiarism (Liu et al., 2018). In light of these challenges, teachers need to have access to reliable and user-friendly citation and reference management tools that enable them to correctly integrate citations into their written work. To address these issues, teachers can use automated citation and reference management tools to streamline the citation process. To help

teachers, there are several tools and strategies available that can be used to write, avoid plagiarism, and correctly cite sources. Furthermore, teachers can rely on these online assistants in the scientific writing process. This is especially true when it comes to AI-based digital writer assistants (AI-based DWA).

1.1 Artificial Intelligence (AI)

Artificial intelligence (AI) is the capacity of a digital computer or robot operated by a computer to carry out actions frequently performed by intelligent beings (Nath & Sahu, 2020). The phrase is widely used to create artificial intelligence (AI) systems with human-like cognitive abilities like reasoning, meaning-finding, generalization, and experience-based learning (Cheng et al., 2016; Anantrasirichai & Bull, 2022). It has been proven that computers can be programmed to perform highly complicated tasks, for example, finding proofs for mathematical theorems or playing chess, with remarkable proficiency ever since the development of the digital computer in the 1940s.

Nevertheless, despite ongoing improvements in computer processing speed and memory space, there are currently no programs that can match human adaptability across a more extensive range of activities or those needing substantial background knowledge. On the other hand, some programs have reached the performance levels of human experts and professionals in carrying out specific tasks. Thus, in this constrained sense, artificial intelligence is present in various applications, including voice or handwriting recognition, computer search engines, and medical diagnosis (Dargan et al., 2020).

1.2 AI-Based Digital Writing Assistants

Artificial intelligence is used in writing assistant software to facilitate the writing process. AI-based DWA is readily available and covers many functions, including research, grammar, tone checking, and localization (Anantrasirichai & Bull, 2022). Others can be writing platforms where users can create the complete piece of content, while some are bots that offer suggestions or correct grammar in the submitted content.

1.3 Starting to Write

How to start writing has become one of the problems in scientific writing (Noom-Ura, 2013). Teachers often find it challenging to start writing a scientific paper. This is because they are not familiar with it. However, this problem can be solved by using artificial intelligence. This paper introduced a digital assistant that helps teachers. The AI-based DWA offered is called HyperWrite.

HyperWrite is machine-learning-based. This technology is a type of artificial intelligence developed for writing. HyperWrite helps to improve scientific writing by assisting in the writing process. This tool does not copy or lift content from other sources like other tools. Instead, Creating effective and impactful content can be a difficult process, especially if teachers are unfamiliar with the latest technology and trends. But with the right tools, teachers can craft content that stands out from the rest. New and emerging technologies such as artificial intelligence, natural language processing, and cloud computing can help them create content that is both unique and impactful. These technologies are constantly evolving, so they can take advantage of the latest tools available to stay ahead of the curve and create content that will capture your audience's attention. HyperWrite is a novel writing technique. It is a tool that makes writing more accessible, quicker, and more effective. It enables writers to find words at the appropriate time and without obstruction (Zippe, 2022). Furthermore, anyone can use HyperWrite, whether a professional agency owner, a hobbyist blogger or a teacher with any idea (Writecream, 2022).

With the help of HyperWrite, it is hoped that teachers will be able to reduce the workload of writing their scientific articles. HyperWrite will allow teachers more time to focus on other essential tasks. Thus, it can become one of the factors that make teachers motivated to start to write.

1.4 Citing and Managing References

One of the essential parts of scientific writing is referencing. Teachers often find difficulties when they have to manage references (Nassaji, 2012). It is a common problem that is encountered. Furthermore, they still use the traditional ways when they want to manage references. In other words, they must keep a reference list and write down the references. It is difficult and time-consuming. Therefore, it is recommended to use the reference manager software.

Many software can help writers manage references. Among them are Mendeley and Zotero. These two reference managers are easy to use. They have many features that help writers organize and manage references. These two reference managers can save much time when writers want to use references. Therefore, it is recommended to use these two references.

Mendeley is a reference manager software that Elsevier develops. It can help teachers and researchers organize and manage their references quickly and conveniently. Mendeley can help writers manage references in a fast and efficient way (Haustein et al., 2014). It can provide writers with a helpful feature called the Mendeley Share. The Mendeley Share is a feature that allows writers to share their references with other Mendeley users. Zotero is another reference manager software developed by the Mozilla Foundation. It can help writers manage references easily too. Although the way of managing references in Zotero is not as simple as Mendeley, it is still easy to use. Zotero is also a good reference manager (Kim, 2011).

Thus, it is suggested that teachers use Mendeley and Zotero to help them manage references. The two reference managers can save teachers time. They can use either Mendeley or Zotero to organize and manage their reference sources. Teachers can also share their references with other teachers or students. It is hoped that by using Mendeley and Zotero, teachers will be able to do their job more efficiently. Finally, teachers can improve their writing skills.

1.5 Paraphrasing

Another skill a teacher should have while writing scientific articles is paraphrasing. Paraphrasing is becoming a problem for teachers when writing scientific articles (Sun & Yang, 2015). Many teachers find it challenging to paraphrase information clearly and concisely. It becomes a problem because scientific articles are often used as information sources in other study areas. Teachers often find it difficult to remember the information in a scientific article, mainly when they use traditional paraphrasing methods.

However, it is known that paraphrasing plays an essential role in scientific writing. Paraphrasing is crucial since it demonstrates that the writer comprehended the original material well enough to rephrase it (Hirvela & Du, 2013). Additionally, it offers the writer a potent substitute for the infrequently employed direct quotations.

Furthermore, AI significantly helps teachers in the academic world when paraphrasing scientific articles. AI has replaced the human translator when it comes to paraphrasing (Prentice & Kinden, 2018). It is because paraphrasing is time-consuming and requires much effort. However, teachers must use AI correctly to achieve the desired results.

One of the famous paraphrasing methods is called Quillbot. It is a software developed specifically for paraphrasing scientific articles and has become the first AI software to be used in any language. It makes it perfect for writing scientific articles. By using this software, it is hoped that teachers can paraphrase scientific articles quickly and accurately.

Several studies have been conducted on Quillbot's paraphrasing capabilities. The results showed that Quillbot is an excellent tool for paraphrasing (Dale, 2020; Hammad, 2022). Another study found that this software can help users paraphrase scientific articles quickly and accurately. It is more accurate than other AI software (Wang et al., 2021). The results from these studies showed that Quillbot is a reliable and accurate tool for paraphrasing. Furthermore, Quillbot's ability to aid with paraphrasing may lead to a more efficient and accurate research process for teachers and professionals alike (Chen et al., 2020). This is significant as it could drastically reduce the amount of time taken to write research papers.

1.6 Finalizing Process

The last step of writing articles is to ensure that the writing has been written systematically and correctly. This task can be done by reading the paper aloud or having someone else read it. It is essential because it allows the writer to catch any errors that may have been made (Egecioglu & Chanfreau, 2011). It is also necessary to have someone else read the article because they may see mistakes that the writer did not. However, this may not always be possible because having someone else read the article may take time and money.

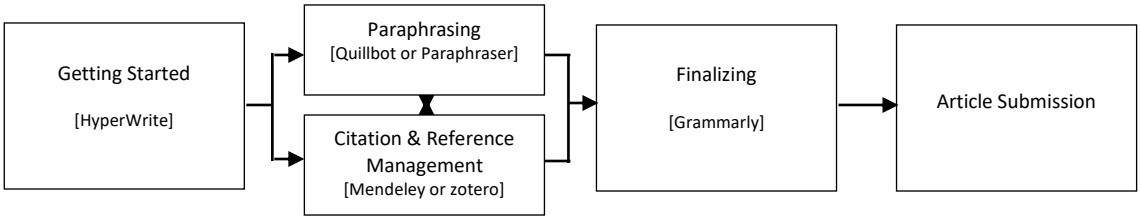
Thus, finalizing the papers can be done using a spell checker and a grammar checker. These tools can help writers ensure that their writing is error-free. Additionally, writers can use a style checker to ensure that their paper follows the proper scientific style. Style checkers are tools that will check the grammar and punctuation of the writing and make sure that the article is correct. This tool will also check the writing format and ensure it follows the proper scientific format.

The famous tool to finalize the scientific process, especially in proofreading, is Grammarly. It is a tool that can be used to ensure that the writing is correct. Grammarly has valuable features that can help writers do their writing (Barrot, 2020). It is checking the grammar of the paper and the spelling, punctuation, and formatting of the paper. Thus, Grammarly can be beneficial in ensuring that scientific writing is correct.

Previous research found that Grammarly is beneficial for scientific writing. For example, Grammarly can help writers ensure that their writing is correct and that they do not waste time correcting errors (Koltovskaia, 2020). Writers are delighted with the tool because it makes writing much more accessible (Wrigley, 2019). Research also found that Grammarly makes writing becomes better (Thi & Nikolov, 2021).

1.7 The Conceptual Framework

Fig. 1. Conceptual Framework



2. Methodology

This was a sequential explanatory mixed methods study, where the qualitative phase was informed by quantitative data (a survey). A descriptive analysis was conducted for the quantitative data, and a theme analysis was employed for the qualitative data. Next, the researcher would like to explore the methods to gain further insights into the data. To gain further insights into the data, the researcher could consider triangulating the qualitative and quantitative data by analyzing both together. This would involve analyzing the qualitative data for themes and patterns that could inform an interpretation of the quantitative results. Additionally, the researcher could look for inconsistencies between the qualitative and quantitative results and consider their implications

2.1 Paticipants and Settings

The participants were English teachers of various levels of experience. They come from 45 different schools with different levels of teaching experience at the state junior high schools in Surabaya. The teachers had a variety of backgrounds, with some having as little as two years of experience and others have been teaching for over 20 years. They were asked to complete surveys about their experience and methods in writing scientific papers.

2.2 Data Collection Techniques

This study involved a pre-survey and post-survey administered to the participants. The purpose of the pre-survey was to gain an understanding of the participants' background knowledge and experience before the study. The post-survey was administered after the study to understand the impact of the study on the participants. Through the use of both pre-and post-surveys, this study was able to provide a comprehensive evaluation of the participants' behavior throughout the duration of the study. Furthermore, during the study, teachers are taught how to use AI-based DWA to help them write scientific articles. The study, an experimental study of several teachers was conducted,

who was taught how to use AI-based DWA in their paper-writing process. The data gathered during the experiment revealed that the use of AI-based DWA tools could help improve the accuracy, speed, and overall effectiveness of document writing. Furthermore, teachers were found to be keen to use the tools to ensure the quality of the written scientific articles. Finally, the data from the surveys were collected and analyzed.

1) Pre-Survey

The researcher created a 16-item survey to gain a description of this study. The survey consisted of 14 closed-ended items using dichotomous questions and rating scales type, focusing on the experience of using digital writer assistants. One open-ended survey was designed to know the elicit perception of participants about the problems of writing scientific articles. The survey was administered online using the Zoho Survey platform.

The purpose of the pre-survey was to use minor data. It was to determine whether or not the participants already knew how to use the software during the writing process. It is essential because it allows the researcher to choose if the participants learned how to use the software before they were allowed to use it. If the participants did not know how to use the software, the researcher would explain it in more detail.

2) Post-Survey

The post-survey consisted of nine items; five closed-ended and four open-ended questions. The closed-ended questions were divided into four dichotomous questions and one rating scale question. Furthermore, the open-ended questions were designed to elicit participants' perceptions of using digital writing tools while writing scientific articles. Revisions were made accordingly. The survey was administered online using the Zoho Survey platform.

Furthermore, the purpose of the post-survey was to determine if the participants used the software after they had been taught to use it. In the end, the participants were asked to express their feeling after learning about the AI-based digital writer assistants.

2.3 Data Analysis Techniques

The data from the closed-ended questions were compiled using descriptive statistics, such as frequencies and percentages. The quantitative results were used as guidance for the post-survey questions, in keeping with the analytical procedures of the mixed methods sequential designs. The descriptive statistics for the closed-ended questions were also used to evaluate the survey results.

Data collection and preliminary analyses were co-occurring. Transcripts were coded independently by the researcher who piloted the coding techniques surveys to establish a similar coding frame. The analytical process included a constant and iterative data review guided by questions to identify coherent narratives and themes. An open coding process was done at the paragraph and statement level of the transcripts. Open codes were then grouped into overarching themes. Visual representations of the codes and themes were arranged onto storyboards. Numerous iterations of analysis were performed, which involved repeatedly asking questions such as "Do you use ...?" and "Why do you use (do you not use) …?" to identify coherent narratives rather than lists of descriptive categories. Analysis was concluded when the coding represented the data collected.

3. Findings and Discussion

The researcher employed a pre-survey and post-survey to answer the questions about the teachers' knowledge of the AI-based DWA and how AI-based DWA helps teachers write scientific articles. The pre-survey was intended to answer the first question, and the post-survey was created to gain the answer to the second question.

The results of the pre-survey showed that the teachers had a moderate level of knowledge regarding AI-based DWA, while the post-survey revealed that AI-based DWA helped them improve their writing quality in terms of coherence and fluency and also made the task of writing scientific articles much easier for them. The findings of both the pre-survey and post-survey showed that AI-based DWA was beneficial to teachers in terms of improving their writing quality and helping them save time in completing scientific articles. Overall, the researcher's study demonstrated that AI-based DWA was an effective tool for teachers in improving their writing quality and productivity.

3.1 Pre-Survey

Table 1. Teachers' Writing Scientific Articles Experience

No.	Survey Items	Percentages		Number	
		Yes	*No*	*Yes*	*No*
1	Are you required to publish scientific articles?	66.67%	33.33%	30	15
2	If so, have you done it before?	34.09%	65.91%	15	29
3	Are you having difficulty writing scientific articles?	100.00%	0.00%	45	0

From this table, it can be seen that 45 teachers (100%) have difficulties writing scientific articles. Most teachers (66.67%) said they must publish scientific articles, while the others (33.33%) said no. Furthermore, 15 teachers (34.09%) have already published any scientific article, while 29 others (65.91%) have not done so. The results from this table demonstrate that there is a lack of knowledge among teachers about how to properly write and publish scientific articles. This is in line with Crusan et al., (2016) in their research, it was found that the lack of knowledge could be due to the lack of training and guidance provided to teachers in this area, as well as their busy work schedules, which do not leave much time for personal growth and development. Furthermore, it is important to note that the majority of teachers who responded to the survey (66.67%) expressed a strong desire to publish scientific articles. Therefore, educators need to create initiatives that focus on providing teachers with the resources and knowledge necessary to write and publish scientific articles.

Table 2. Teachers' Knowledge of AI-Based Digital Writer Assistants

No.	Survey Items	Percentages		Number	
		Yes	*No*	*Yes*	*No*
1	Have you ever heard of the HyperWrite platform?	13.33%	86.67%	6	39
2	If so, have you ever used it?	0.00%	100.00%	0	41
3	Have you ever heard of Google Scholar?	53.33%	46.67%	24	21
4	If so, have you ever accessed Google Scholar?	26.83%	73.17%	11	30
5	Have you ever heard of Mendeley or Zotero apps?	20.00%	80.00%	9	36
6	If so, have you ever used it?	7.32%	92.68%	3	38
7	Have you ever heard of Quillbot or Paraphraser apps?	15.56%	84.44%	7	38
8	If so, have you ever used it?	2.50%	97.50%	1	39
9	Have you ever heard of the Grammarly app?	57.78%	42.22%	26	19
10	If so, have you ever used it?	20.00%	80.00%	9	36

The above survey items dealt with the teachers' knowledge of AI-based DWA. The table shows that most teachers do not become familiar with AI to assist them. The majority of teachers chose the NO choice for every item. For instance, they are related to teachers' knowledge of the AI-based DWA, HyperWriter 39 teachers (86.67%), Mendeley or Zotero 36 teachers (80%), Quillbot or Paraphraser 38 teachers (84.44%). There are only two applications that teachers are familiar with. There are only two applications that teachers are familiar with. They are Google Scholar, 24 teachers (53.33%), and Grammarly, 26 teachers (57.78%). Even though some teachers know the AI-based DWA, most have not used it. For instance, HyperWrite has 0 teachers (0.00%), Google Scholar 11 teachers (26.83%), Mendeley or Zotero 3 teachers (7.32%), Quillbot or Paraphraser 1 teacher (2.50%), and Grammarly 9 teachers (20%). Even though DWA has the potential to improve efficiency and accuracy in academic writing, most teachers are not familiar with its usage. These statistics indicate that even though AI-based writing assistants are becoming increasingly popular, they are still relatively new and have not been widely adopted.

Table 3. Teachers' Perceptions toward Writing of Scientific Articles

No.	Survey Items	Percentages					Number				
		1	*2*	*3*	*4*	*5*	*1*	*2*	*3*	*4*	*5*
1	How important is writing scientific articles for your career development?	2.22%	0.00%	35.56%	28.89%	33.33%	1	0	16	13	15
2	Writing scientific articles is easy and fun.	0.00%	13.33%	51.11%	15.56%	20.00%	0	6	23	7	9

The open-ended question of the pre-survey was about the teachers' difficulties in writing scientific articles. After analyzing the post-survey, surprisingly, it was found that five teachers had never written any scientific article while they were teaching. 26 teachers shared that they have difficulties in starting to write scientific articles. At the same time, the other seven teachers had difficulties in finding and also managing the references. After analyzing the responses, it became clear that while some teachers had difficulties starting their articles and found it challenging to build a structure for the article, others faced difficulty organizing references and citing them correctly. This evidence suggests that there is a need for improved guidance and mentorship to enable teachers to produce scientific articles.

3.2 Post-Survey

Table 4. Teachers' Preferences on Using AI-Based Digital Writer Assistants

No.	Survey Items	Percentages		Number	
		Yes	*No*	*Yes*	*No*
1	Do you use HyperWrite to help you write scientific articles?	84.09%	15.91%	37	7
2	Do you use Mendeley or Zotero to help you write citations and compile references in your scientific article?	81.82%	18.18%	36	8
3	Do you use Quillbot or Paraphraser to help you paraphrase quotations in scientific article writing?	88.64%	11.36%	39	5
4	Do you use Grammarly to help you proofread your scientific article writing?	88.64%	11.36%	39	5

The table shows that most teachers use AI-based DWA when they write scientific articles. For instance, HyperWrite 37 teachers (84.09%), Mendeley or Zotero 36 teachers (81.82%), Quillbot or Paraphraser 39 teachers (88.64%), and Grammarly 39 teachers (88.64%). Additionally, the researcher provides open-ended questions to better understand teachers' reasons for using those tools. The questions were about why they use digital writer assistants. Most of the teachers who participated in the study indicated that using AI-based DWA enabled them to save time, improve the accuracy and readability of their writing, and detect errors quickly. The results of this study demonstrate that teachers are well aware of the benefits that AI-based DWAs can bring to their writing. Furthermore, the teachers were more likely to use AI-based DWAs if they had a clear understanding of the potential benefits that such tools could offer.

Here are the survey results. The first question is: What is the reason to use HyperWrite when writing scientific articles? Most teachers answered that HyperWrite helps them construct the idea. At the same time, they write the article, such as "Although I did not take 100% of the sentence recommendations, at least I can find a variation of the suggested writing or sentence." Furthermore, HyperWrite can make the job of writing scientific articles easier. The participant responded: "Because HyperWrite can help develop our writing, I use a HyperWrite app to help me make my writing job more manageable." The participant appreciated HyperWrite for its ability to help develop their writing, particularly in scientific contexts. In particular, the participant valued

HyperWrite for its ability to provide a range of sentences and writing styles that could be applied to their work, which allowed them to quickly adapt their writing and create unique content.

The second question is the reason for using Mendeley or Zotero to manage citations and references in scientific articles. Most teachers answered that Mendeley or Zotero help them compile and organize the references better, such as: "Using Mendeley helps write citations and compile references in scientific article writing; based on my experience, files organized in Mendeley are more organized and easy to find if we need to go back." "Not only does Mendeley help organize the references, but it also allows writers to collaborate with other writers online." The participant responded: "It helps me organize research and collaborate with other researchers online." Additionally, the participant noted that Mendeley or Zotero helps save time by automating some of the reference management tasks and also mentioned that it is a valuable tool for writers to improve the accuracy and quality of their citations and references. The participants agreed that the use of Mendeley or Zotero helps them better organize and manage their references, saving time in the process.

The third question is: What is the reason to use Quillbot or Paraphraser to paraphrase quotations in scientific article writing? It was found that, with the help of Quillbot, plagiarism could be avoided. Participants said: "Because Quillbot can help us paraphrase writing so it does not get plagiarized, I use it to avoid plagiarism by providing indirect quotes from the original text." Another participant mentioned that Quillbot can not only help to avoid plagiarism but also save time." For instance, this tool helps me shorten the time spent writing scientific articles and avoid plagiarism. The participants found that Quillbot was an incredibly useful tool, both in helping them avoid plagiarism and in saving their time. Quillbot provides a quick and convenient way for students, scholars, and other authors to ensure their work is original. Furthermore, it allows users to quickly and efficiently check their work for plagiarism and ensures that their writing is error-free.

The last question is the reason for using Grammarly to proofread scientific articles. Participants expressed that Grammarly helps them to be more confident with the grammatical correctness of their writing, such as "Frankly, there are many grammatical errors in my writing; I feel my grammar is still imperfect, so I use Grammarly." Furthermore, it was also found that Grammarly checks the grammar, structure, and word choices. Participants mentioned that using Grammarly checked the correctness and accuracy of the grammar: "We use it in scientific articles." "I use Grammarly to check grammar and spell check sentence structure in English and correct typos." The use of Grammarly was found to be a valuable tool for participants when it comes to improving the quality of their written work. Grammarly is a useful tool for people when it comes to improving the quality of their written work.

Table 5. Teachers' Perceptions toward the Use of AI-based DWA

No.	Survey Items	Percentages					Number				
		1	*2*	*3*	*4*	*5*	*1*	*2*	*3*	*4*	*5*
1	With the help of machines, writing scientific articles is easier and more fun.	0,00%	0,00%	6,82%	22,73%	70,45%	0	0	3	10	31

The above table shows that participants feel encouraged to write scientific articles with the help of AI-based DWA. 31 participants (70.45%) chose the highest score (5), 10 participants (22.73%) chose 4, and the rest 3 participants (6.82%) chose 3. No one chose scores of 2 and 1. This indicates that the majority of participants have a positive attitude towards using AI-based DWA to help write scientific articles.

Although most AI-based DWAs have obvious functionality, users may be ignorant of settings or sophisticated functions (Rosell-Aguilar, 2017). In line with it, the pre-survey shows that many teachers do not know AI well. It finally led them to become unmotivated to write scientific articles. Furthermore, the findings of the survey demonstrated that some teachers do not have enough experience or confidence to utilize AI-based DWA. This lack of knowledge and confidence

ultimately leads to a decrease in the number of teachers who are willing to write scientific articles. The findings of the survey point to a need for improved teacher training and support when it comes to AI-based DWA.

Having seen the problems found in the pre-survey, the researcher introduced AI-based DWA to the participants. The AI-based DWA was designed to simulate the problems found in the pre-survey, allowing the researcher to evaluate participant responses and make adjustments to the study accordingly. Furthermore, the results of the introduction showed that AI-based DWA could help teachers construct their scientific article sentences. It also helps teachers paraphrase sentences and manage citations and references. AI-based DWA can also help teachers manage sentence structure and grammar. Furthermore, the findings are consistent with previous research on the roles and research issues of artificial intelligence in education (Hwang et al., 2020; Anantrasirichai & Bull, 2022).

4. Conclusion and Limitation

AI-based DWA helps teachers throughout the writing process of scientific articles by offering sentence suggestions, rewriting or paraphrasing options on their original text, and checking grammar and word choices. This tool can help teachers write better and express their thoughts in English more effectively. Additionally, it can encourage users as they write and keep them from becoming bogged down by tricky English words or phrases. AI-based DWA is an exciting application for teachers who want to write better scientific articles. However, it is found in this research that many teachers have not used it well. While AI-based DWA could be of tremendous assistance to teachers in improving their writing, this research found that many teachers have not utilized the tool effectively. This could be due to a lack of knowledge on how to use the tool correctly, or because of difficulty trusting the tool's output. Thus, sharing knowledge should be conducted regularly to inform and train teachers about the technological developments in digital writing assistants that continue over time. To ensure that teachers get the most out of AI-based DWA and its benefits, educators need to learn how to use these tools properly. Finally, it does have some restrictions. However, the utility is currently only used when a user is connected to the internet. The rewriting alternatives may also be less accurate if your original text is overly complex. Despite these limitations, it is undeniable that digital writing assistants can be a great aid for teachers to help improve written communication. As such, these digital writing assistants should not be seen as a one-stop solution to all written communication needs, but rather as an additional tool to help create an overall improved writing experience.

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