

Using Artificial Intelligence Tools in Scientific Research –chatGPT as a Model-

استخدام أدوات الذكاء الاصطناعي في البحث العلمي – chatGPT أنموذجاً –

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Abstract:

In recent years, the world has witnessed significant advancements in artificial intelligence tools, which have become essential aids for researchers across various fields, particularly the ChatGPT application. Developed by OpenAI, this AI model employs deep learning to generate intelligent responses to user queries through tasks such as writing articles and data analysis. This study aims to explore the impact of this application on scientific research and assess whether its use compromises academic integrity or constitutes academic misconduct. Ultimately, we concluded that while AI tools offer substantial benefits to research by enhancing quality and reducing time, their unregulated use constitutes academic dishonesty and undermines the role of researchers.

Keywords: Academic misconduct, artificial intelligence, ChatGPT application, research ethics, scientific research.

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Introduction

Scientific research plays a significant role in achieving progress and development across all fields, including the creation of new technologies such as artificial intelligence with its various tools. Consequently, there is a close relationship between technological advancement and scientific research; technology facilitates new research methods, while scientific research contributes to technological development.

Scientific research represents an intellectual human endeavor requiring substantial mental effort from the researcher. It relies on the work of previous researchers and paves the way for future scholars. This cognitive activity primarily aims to address phenomena and challenges in various fields, adhering to ethical standards, the most important of which is maintaining academic integrity. Researchers must ensure the integrity of their scientific work.

Like other fields, scientific research has been greatly influenced by the Fourth Industrial Revolution, characterized by the integration of artificial intelligence technologies into research through various tools, most notably ChatGPT. This AI tool, which simulates human cognition, has become essential for assisting researchers in drafting studies, providing references, and responding to inquiries, among other tasks that typically require significant time. ChatGPT performs these tasks swiftly and efficiently, as artificial intelligence (AI) and machine learning have transformed the nature of scientific research in recent years. Accordingly, artificial intelligence has developed the ability to think, learn, and innovate across various fields through its diverse tools and applications. Notably, the increased use of this application by researchers is driven by its ease of access to information and time-saving capabilities. However, this usage raises ethical concerns, particularly regarding academic misconduct.

Building on the above, we pose the following research question: To what extent does the ChatGPT application impact scientific research?

This study aims to shed light on the influence of AI tools on scientific research, specifically ChatGPT, and to assess whether its use constitutes academic misconduct. The goal is to establish guidelines for the responsible use of artificial intelligence in academic research.

Firstly : Scientific Research and Commitment to Academic Integrity

It is well established that scientific research has become a measure of a nation's progress. Many countries allocate substantial budgets to promote research across various fields. In return, researchers are required to adhere to research ethics, with academic integrity being one of the most fundamental principles.

1.The Essence of Scientific Research

Notably, numerous definitions of scientific research exist. One definition describes it as a systematic, methodical, and precise process of inquiry and

investigation aimed at discovering new relationships, phenomena, and information or analyzing and interpreting pre-existing data to develop solutions for existing problems by employing scientific methods and approaches (Marah, 2004, p. 64). Another definition refers to it as a means of study through which solutions to specific problems can be reached by thoroughly and meticulously examining all verifiable evidence and data related to a particular issue (Al-Mahmoudi, 2019, p. 14).

Accordingly, scientific research can be defined as a tool for systematically and accurately analyzing and interpreting knowledge and information to uncover new facts, develop and enhance existing information, and foster innovation. It is worth noting that the definition of scientific research varies depending on the types of studies, their fields, and the tools employed. From the preceding definitions, it can be concluded that the primary aim of scientific research is to address the research problem with precision and clarity, employing specific scientific methods and approaches.

2. Integrity in Scientific Research

Scientific research is founded on ethical principles that researchers must uphold, collectively known as research ethics. Research ethics refer to the values governing research practices and encompass a set of rules accepted by the research community. These ethics regulate researchers' conduct, fostering a research environment that encourages innovation and creativity while safeguarding researchers' rights (Lutfi, 2023, p. 12). Therefore, research ethics are the standards that guide and control a researcher's behavior during the research process.

Researchers must adhere to the principles of academic integrity to ensure the quality and originality of their work, as well as to maintain their reputation within the research community. In our view, academic integrity involves the researcher accurately and fairly citing and referencing the sources used in their work. This means the researcher should conduct their study conscientiously, as this is an indicator of the authenticity and quality of the research.

2.1 The Concept of Academic Misconduct:

Academic misconduct, commonly known as plagiarism, is an unlawful form of transferring information and ideas. It refers to taking someone else's work and presenting it as one's own, effectively claiming ownership of another's work. This is unethical behavior, whether intentional or unintentional. Researchers are expected to trace sources and exercise diligence when using the work of others (Hissam, 2024, p. 1169). Therefore, researchers must adhere to research ethics and properly cite and reference the sources and materials they use.

Academic misconduct can also be defined as the act of reproducing the work of others without proper attribution, meaning failing to reference the original source. This includes copying terms or ideas from others, appropriating their intellectual efforts, and exploiting their work without acknowledging the original creator. One common method of this misconduct is "copy-pasting," which is a clear form of

plagiarism or academic dishonesty, especially in the field of humanities (Taleb, 2017, p. 87).

The definition of academic misconduct is also outlined in Ministerial Decision No. 1082/2020, dated December 27, 2020, in Article 3, which states: "Academic misconduct, as defined in this decision, includes any action by a student, researcher, university faculty member, or permanent researcher who engages in plagiarism, falsification of results, or cheating in required scientific work or in any other scientific or pedagogical publications." Thus, academic misconduct can simply be defined as a researcher's use of sources and references in their work without proper documentation or citation, attributing the efforts of others to themselves without justification.

2.2 Forms of Academic Misconduct:

According to Article 3 of Ministerial Decision No. 1082/2020, the forms of academic misconduct include the following:

- Complete or partial quotation of ideas, information, texts, paragraphs, or excerpts from published articles, books, journals, studies, reports, or websites, or rephrasing them without citing the original source and authors.
- Quoting excerpts from a document without placing them in quotation marks and without citing the source and authors.
- Using specific data without identifying the source and original authors.
- Using a particular argument or reasoning without citing its source and authors.
- Publishing a text, article, or report created by an organization or institution and presenting it as personal work.
- Using specific artistic work or including maps, images, graphs, statistical tables, or diagrams in a text or article without referencing the source and original authors.
- Translating from one language to the language used by the student, researcher, or academic without mentioning the translator or the source.
- A researcher, academic researcher, or permanent researcher including their name in a study or scientific work without contributing to its preparation.
- The primary researcher adding the name of a researcher who did not participate in the work, either with or without their consent, to help publish the work based on their scientific reputation.
- A researcher, academic researcher, or permanent researcher assigning students or others to complete scientific work to adopt it for a research project, scientific book, pedagogical publication, or scientific report.
- A researcher, academic researcher, or permanent researcher using student work and theses as inputs for national and international conferences or for publishing articles in journals and periodicals.

- Including names of experts and reviewers as members of the scientific committees for national or international conferences or journals to gain credibility, without their knowledge or consent, or without their actual participation in the work.

Academic misconduct also includes replication, which refers to presenting another researcher's entire work as one's own without attribution, commonly known as "copy-pasting," especially through the use of AI tools. Additionally, copying refers to presenting a large portion of another researcher's work without attribution, substitution involves taking a part of a research work and replacing certain words while maintaining the core ideas without citing the original source, and mixing refers to combining parts of several scientific studies into one research paper without proper documentation of sources and references (Jadidi, 2019, pp. 331-332).

Secondly: The Impact of ChatGPT Usage on Scientific Research

Artificial intelligence has become a pivotal subject in many fields due to its ability to influence various domains, including scientific research, through its diverse tools such as ChatGPT. In this section, we will first define artificial intelligence and ChatGPT, then examine the extent to which this application affects the field of scientific research.

1. Definition of Artificial Intelligence and the ChatGPT Application

As previously mentioned, the world has witnessed a technological leap with artificial

intelligence and its tools, which significantly assist researchers in every phase of their research.

1.1 Definition of Artificial Intelligence:

Before addressing the concept of artificial intelligence, it is essential to first discuss the general concept of intelligence. Intelligence refers to the ability to learn and apply appropriate techniques to solve problems and achieve goals in alignment with the context, particularly in an uncertain and constantly changing world (Al-Deeb, A., 2024, p. 22). Artificial intelligence is a term coined in 1955 by Stanford University professor John McCarthy, who defined it as "the science and engineering of making intelligent machines." Many current studies focus on programming machines to act in intelligent ways, such as playing chess. However, more importantly, machines can now learn in ways that are at least similar to how humans learn new things (Manning, 2020). It is also defined as software capable of performing behaviors that are considered intelligent when carried out by humans. In other words, it is the ability to process information and make decisions in a manner similar to that of humans (Al-Deeb, A., 2024, p. 26).

Additionally, artificial intelligence is defined as the process of replicating human intelligence through computer systems and programs (Samoili, 2020, p. 7). Thus, artificial intelligence can be understood as a science or method of simulating human cognitive abilities, enabling machines to perform specific tasks in a manner akin to human activity, often referred to as AI (Artificial Intelligence). The role of

artificial intelligence in scientific research is evident through its numerous tools and applications, as well as the remarkable advancements in this field. The primary objective of artificial intelligence has become the development of systems that match or even surpass human intelligence.

1.1 .1 Characteristics of Artificial Intelligence :

Artificial intelligence is distinguished by several key characteristics, which can be summarized as follows (Ibrahim, 2023, p. 373):

- Utilizing intelligence to solve problems even in the absence of complete information.
- The ability to learn and understand through past experiences.
- Capacity for reasoning and perception.
- The ability to acquire, absorb, and apply knowledge effectively.
- Quick responsiveness to new situations and circumstances.
- Capability to handle complex and challenging cases.
- Competence in addressing ambiguous situations despite incomplete data.
- The ability to assess the relative importance of elements in presented scenarios.
- Visualization, creativity, and the ability to interpret and comprehend visual information.
- Providing information to support administrative decision-making.
- The ability to explore different issues through trial and error.
- Applying previously acquired knowledge to new situations.

These characteristics highlight the significant importance of artificial intelligence, demonstrating its efforts not only to replicate human intelligence but also to surpass it. AI systems continuously adapt by learning from new data and improving their performance over time, as exemplified by applications such as ChatGPT.

1.2 Definition of the ChatGPT Application:

ChatGPT is one of the most important and widely used tools of artificial intelligence in scientific research. It is an AI model developed by OpenAI that relies on deep learning architecture and utilizes a text-generating algorithm known as the "Transformer." This algorithm mimics human language and provides responses to questions or commands posed by users.

The name of the application, "ChatGPT," can be broken down as follows: "Chat" refers to the application's ability to engage in interactive conversations, while "GPT" stands for Generative Pre-trained Transformer, which signifies that the model is pre-trained to generate text. In essence, ChatGPT is a model that can autonomously generate text and has been trained on a vast dataset, employing an advanced neural network algorithm capable of understanding and processing text more effectively (OpenAI, 2023).

This application is also considered a chatbot system launched by OpenAI, showcasing the power of artificial intelligence through text generation, language

translation, and answering questions. It further demonstrates the ability to derive intellectual conclusions based on logical evidence and arguments, as well as to detect linguistic errors in texts, including grammatical, syntactic, and spelling mistakes.

All these functions are carried out using a deep learning model to generate responses to user inputs. The system is trained on large datasets of conversations, enabling it to process user inputs and generate responses based on the context of the dialogue. The response is created using a probabilistic approach, meaning the system generates multiple possible responses and selects the most likely one based on its understanding of the conversation (Al-Razzazi, 2022).

Deep learning refers to the use of artificial neural networks—large, multi-layered systems that compute continuous representations, such as real numbers. These networks are designed to resemble the hierarchical organization of neurons in the human brain (Al-Deeb, A., 2024, p. 30).

1.2.1 Development of ChatGPT:

The first version, GPT-1 (2018), was developed and released by OpenAI in 2018. Its primary goal was to test the capacity of neural models to understand human language. Although this model was simple, it demonstrated the feasibility of creating a language model based on transformations. However, it was not capable of providing accurate responses to complex questions. The next iteration, GPT-2 (2019), showed a significant improvement in generating more logical text and producing language in a more natural, human-like manner, though it was still prone to bias in its output. In 2020, GPT-3 (2020) was launched, marking a qualitative shift. This version was highly capable of understanding complex language and responding to questions, as well as generating entire articles. However, it still lacked the necessary accuracy and exhibited noticeable bias. Following this, an improved version was released in ChatGPT (GPT-3.5, 2021), which offered better interaction and more accurate responses, though some bias remained. The most recent and powerful version is GPT-4 (2023), which includes comprehensive improvements, allowing the application to handle multimodal inputs, enhance accuracy, and adapt to various languages and dialects. This current version is widely used in various applications (OpenAI, 2023; Singh, 2023, p. 2.3).

2. Roles of ChatGPT in Scientific Research:

From the evolution of the different versions, it is evident that ChatGPT plays a multifaceted role in scientific research. These roles include:

- Idea Generation and Suggestions: ChatGPT can generate new ideas and offer suggestions based on available data and information from the internet, making it a valuable tool in various research domains.

- Assistance in Academic Studies: ChatGPT aids researchers by providing clarifications, rephrasing research papers, and correcting spelling and grammatical errors, which enhances the quality and clarity of their work. Furthermore, it is capable of writing entire articles based on user requests and performing translation

tasks, particularly in the latest version, which can handle text, images, and upload various types of documents. This significantly saves time for researchers. Along with providing recommendations to enhance the quality of scientific research.

- Performing translation tasks: The application translates research papers into the language desired by the researcher with a high level of accuracy.

- Providing researchers with various sources and references: The application offers and suggests sources and references to help researchers explore their topics in greater depth if requested. However, these sources are not always accessible, as they are sometimes fabricated by the application. This limitation is considered one of its drawbacks, as will be discussed later. Thus, ChatGPT is a powerful tool that greatly aids researchers across all fields, helping them avoid wasting time due to its speed and accuracy.

The GPT Chat technology offers numerous advantages that make it a valuable tool in academic research. Its ability to process vast amounts of textual data in a short period saves researchers significant time and effort. Additionally, it can perform many tasks that were traditionally done manually by researchers, such as analyzing research papers through scanning and extracting key details.

It is based on natural language understanding, meaning it can comprehend natural language and respond to user inquiries in a conversational manner. Furthermore, it demonstrates contextual understanding, enabling it to comprehend the context of a conversation and respond accordingly. The system is also customizable to match the user's preferences and interests.

- Multi-platform support: ChatGPT can be integrated with various platforms such as websites, mobile applications, and messaging services like Slack and Facebook Messenger, among others. It allows developers to customize the responses generated by the system based on their specific needs.

In recent updates, the application has improved its writing quality, focusing on language and style. Additionally, it can now generate citations in various citation styles, prepare surveys, conduct statistical analyses, and even propose new research topic ideas (<https://openai.com/>, 2023).

Thus, the primary applications of artificial intelligence in scientific research are evident through tasks such as data analysis, pattern recognition, image and signal processing, and language processing. AI algorithms can analyze and interpret images and signals across various scientific disciplines, as well as handle translation tasks effectively.

2.1 Features of GPT Chat in Scientific Research

- Increased Efficiency: GPT Chat can automate customer service tasks, allowing humans to focus on more complex activities and save time for other tasks.

- Improved Customer Experience: GPT Chat can offer a more personalized experience by understanding customer needs and providing relevant information quickly and accurately.

- **Cost Savings:** Automating customer service tasks with GPT Chat can reduce costs associated with hiring additional staff or outsourcing customer service operations.

- **Scalability:** GPT Chat can quickly scale to meet the demands of an increasing customer base, allowing businesses to grow without needing to invest in additional resources or employees (Al-Razzazi, 2022).

Additionally, ease of use allows users to directly ask questions and receive immediate, quick, and straightforward answers through the chat interface.

3. Issues Surrounding the Use of ChatGPT in Scientific Research

Researchers are divided on whether using ChatGPT in scientific research constitutes plagiarism and whether it is feasible to rely on it for producing research work. Some researchers believe that the application is beneficial for researchers. For example, studies conducted on students have shown that those who used ChatGPT produced more comprehensive, deeper, and accurate reviews compared to those who used traditional methods (Haisam, p. 1179). In addition, the application now provides the electronic references from which it has derived its information. On the other hand, there is a concern that research generated by artificial intelligence (AI) threatens the integrity of science, with particular attention to biases in ChatGPT's responses. Additionally, ChatGPT sometimes suffers from what is referred to as "AI hallucinations" (Haisam, p. 1178).

However, it can be argued that using ChatGPT in research constitutes scientific plagiarism. Why? Simply because the application generates answers based on other sources and references, but it does not cite or acknowledge them, which constitutes plagiarism. Furthermore, the researcher may engage in a copy-paste process, replicating what the application provides without attribution, which is also a form of plagiarism, as previously discussed in the types of scientific theft. In this regard, voices have risen within the academic community expressing concerns that "non-human" production could have serious implications for the integrity and authenticity of scientific publications. This could lead to an increase in academic plagiarism, which was already prevalent even before the advent of ChatGPT. In this context, prestigious scientific journals such as *Nature* and *JAMA Network Science* have decided that they will never accept papers or articles generated by ChatGPT, while others have called for a disclosure to accompany any use of it in content (Mohammad, 2023).

The journal *Science* views any manuscript produced by artificial intelligence software as "scientific misconduct, equivalent to plagiarism," asserting that scientific publishing should remain "an exclusively human endeavor." This issue is not confined to scientific journals alone but extends to universities as well. For instance, *Hong Kong University* banned the use of ChatGPT by students in February 2023, equating it to plagiarism (Mohammad, 2023). We strongly agree with this stance due to the potential consequences of using such applications, along with other artificial

intelligence tools, without proper regulation. This raises significant concerns regarding the researcher, the scientific research itself, and the legal issues that accompany it, particularly regarding intellectual property rights—who owns these rights?

Another issue arises in the reliance on ChatGPT and similar technologies, which will inevitably lead to a significant increase in publications by some researchers. However, this would not be accompanied by a corresponding increase in their expertise in the field (Taima, p. 92). Consequently, the researcher would not play any active role, and their personal contribution would be absent from the formulation of results and recommendations. We assert that the researcher is the cornerstone of scientific research to ensure the quality of their work.

Furthermore, the problem of biases inherent in artificial intelligence tools undermines the quality of scientific research due to inaccurate data, leading to unrealistic and incorrect results.

Despite this, we do not deny the benefits of ChatGPT or other AI tools in scientific research. However, relying on such tools raises significant issues regarding intellectual property rights. On the one hand, the answers provided by the application are drawn from various sources, which constitutes a violation of copyright and, thus, plagiarism. On the other hand, there is the question of authorship: who owns the intellectual property of the content generated by the application—the researcher or the application itself?

When we asked ChatGPT whether its responses could be considered plagiarism, it responded that some may argue that this is not theft by explaining that it relies on algorithms to analyze and process large amounts of information, providing answers based on the knowledge it has been trained on. It further clarified that it draws from open sources and does not directly quote or copy text, but rather uses integrated knowledge to generate original responses, which are not directly copied from any source.

3.1 Challenges of Using ChatGPT in Scientific Research

The use of ChatGPT in scientific research faces several challenges, which can be summarized as follows:

- **Privacy and Security:** This issue is present in all artificial intelligence tools, as they are vulnerable to cyberattacks and hacking, particularly concerning data privacy and protection. Additionally, there is the concern of misuse in some cases.

- **Bias:** As mentioned earlier, bias remains a significant issue in all versions of ChatGPT. This bias primarily arises from the data the application is trained on. The AI can inadvertently reflect the biases inherent in the datasets it learns from, leading to skewed or biased responses.

- **Accuracy of Information:** ChatGPT relies on historical data, which may not always be accurate or up to date. This limitation poses risks for researchers who

depend on the application to generate reliable information, as outdated or incorrect data could be incorporated into their research.

- **Ethics:** The ethical concerns surrounding ChatGPT involve its impact on academic integrity, particularly the potential for scientific plagiarism, as discussed earlier. This raises the need for researchers to carefully document and cite any answers or content generated by the AI to ensure proper attribution.

- **Copyright Ownership:** This raises the question of whether the application can be considered a co-author, or whether it can be considered an author at all, given that its information is based on pre-existing data it is trained on.

3.2 Regulations for Using ChatGPT

- The researcher must verify the reliability of the data by ensuring its accuracy and proper citation, attributing it to its original source, and documenting it. The researcher should demonstrate their own contribution in rephrasing the information and data, properly referencing the source, and confirming its existence.

- The researcher should maintain transparency and avoid using ChatGPT as a substitute for writing; otherwise, the researcher may lose their status as a researcher.

- The researcher must adhere to scientific integrity and avoid plagiarizing data from the application, instead documenting it properly. This includes citing artificial intelligence tools.

This is what Magdalena Skerby, Editor-in-Chief of *Nature* in London, addressed, stating: "Attributing texts to their authors carries with it the responsibility for the work, which cannot be effectively applied to large language models." She further added that authors using these models when preparing a research paper, no matter the form of use, must acknowledge this in the methodology section or in the acknowledgments if applicable (Hissam, 2024, p. 1182).

Despite many researchers encouraging the use of AI tools like ChatGPT in scientific research, these challenges make it difficult to fully rely on such applications. The primary concern arises when a study requires deep analysis or the researcher's own opinion—should AI replace the researcher's input? If so, this leads to the diminishing role of the researcher, which calls into question the purpose of scientific research itself. After all, one of the key objectives of research is to foster the personal and intellectual development of the researcher. If AI takes over the researcher's responsibilities, it undermines this goal.

Conclusion

It is evident that technology and scientific research have become essential for the survival of nations in the present era. Undoubtedly, artificial intelligence and its tools, particularly the ChatGPT application under study, have a significant impact on scientific research by saving time and providing a valuable tool to assist researchers in improving their performance. However, this does not mean that there are no drawbacks to its use. It is crucial to use AI tools ethically, as utilizing them without

ethical guidelines can lead to scientific plagiarism. Based on our study, we have concluded the following results and recommendations:

Results

- ChatGPT helps researchers enhance and support their research capabilities by providing generated content and saving time.
- Using ChatGPT without adhering to the ethics of scientific research constitutes scientific plagiarism.
- ChatGPT is not entirely reliable for scientific research, primarily due to its inherent bias based on the data it was trained on, as well as its data inaccuracies, which require constant updating. Additionally, it may suffer from AI hallucinations.
- Relying on AI tools could completely eliminate the researcher's role, making it essential to reconsider giving AI full responsibility for conducting scientific research without attributing it to the researcher.

Recommendations

- Researchers must maintain scientific integrity by documenting the work completed by AI tools on their behalf.
- Adherence to the ethics of scientific research must be ensured in the age of AI by providing guidelines for researchers using AI, which include verifying sources, ensuring the accuracy of data, and proper citation.
- Intellectual property rights must be respected throughout all stages of scientific research.

Margins

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