

Examining the use of ChatGPT in scientific research: Enhancing Creativity or Hindering Originality?



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Abstract:

This study examines the use of artificial intelligence language model ChatGPT in scientific research, in order to explore whether its usage enhances the creativity or limits the originality of scientific works. A questionnaire was administrated to 61 researchers in Algeria from different backgrounds. A descriptive and a lexical approach were adopted to analyse the data. Descriptive Results were analysed via SPSS software and revealed that ChatGPT has the potential to enhance creativity by providing researchers with new ideas, perspectives and insights. However, it could also hinder originality by leading researchers to produce derivative or unoriginal work. The lexical approach analysis revealed two opposite opinions among the respondents regarding the role of ChaGPT in the future. Recommendations were outlined regarding the responsible and ethical use of ChatGPT by researchers, in order to enhance their creativity, productivity and impact.

Keywords: ChatGPT; scientific research; creativity; originality; ethics.

المخلص:

تتناول هذه الدراسة استخدام نموذج لغة الذكاء الاصطناعي ChatGPT في البحث العلمي، بهدف استكشاف ما إذا كان استخدامه يعزز الإبداع أو يحد من أصالة الأعمال العلمية. وقد تم توزيع استبيان على 61 باحثاً في الجزائر من خلفيات علمية مختلفة. تم تبني مقاربة وصفية ومعجمية لتحليل البيانات. وقد كشفت نتائج التحليل الوصفي باستخدام برنامج SPSS أن ChatGPT لديه القدرة على تعزيز الإبداع من خلال تزويد الباحثين بأفكار ووجهات نظر جديدة. ومع ذلك، يمكن أن يحول دون الأصالة البحثية عن طريق دفع الباحثين إلى إنتاج أعمال مشتقة أو غير أصلية. كما بينت نتائج التحليل المعجمي وجود وجهتي نظر متعاكستين للباحثين بخصوص دور ChatGPT في المستقبل. وقد تم تقديم توصيات بشأن الاستخدام المسؤول والأخلاقي لـ ChatGPT من قبل الباحثين من أجل تعزيز إبداعهم وإنتاجيتهم وتأثيرهم. الكلمات المفتاحية: ChatGPT؛ البحث العلمي؛ الإبداع؛ الأصالة؛ الأخلاقيات.

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Introduction:

It should be included in the introduction to the article: a brief introduction to the topic (please avoid loose and long introductory paragraph). The author then moves to formulate the central question of the study, the hypothesis / hypotheses that she/he intends to examine, the methodology used to answer the problem.

Artificial Intelligence (AI) has revolutionized numerous fields, and scientific research is no exception. Among the cutting-edge AI models, ChatGPT (Generative Pre-trained Transformer) has emerged as a powerful language model capable of generating human-like text. As its adoption grows in the scientific community, researchers have turned to ChatGPT as a potential tool to enhance creativity and streamline various aspects of their work. However, this technological advancement has also raised concerns regarding its impact on originality in scientific inquiry. In this paper, we examine the use of ChatGPT in scientific research, exploring whether it serves as a catalyst for creativity or acts as a hindrance to the generation of novel ideas.

Problematic :

The integration of ChatGPT in scientific research presents a dichotomy of perspectives. On one hand, proponents argue that the model's ability to generate coherent and relevant text can aid researchers in formulating hypotheses, summarizing findings, and even generating initial drafts of scientific papers, thus expediting the research process and fostering creativity. However, on the other hand, sceptics express apprehension that over-reliance on ChatGPT may inadvertently stifle researchers' originality and critical thinking, leading to a dependence on pre-existing information and ideas rather than developing novel insights. This paper critically examines both sides of the debate, delving into the potential benefits and drawbacks of employing ChatGPT in scientific research, aiming to shed light on its role in either enhancing creativity or hindering originality in the pursuit of scientific knowledge.

Objectives of the Study:

The main objectives of the study are summarized as follows:

- To assess the extent of adoption of ChatGPT in scientific research across various disciplines and research domains.
- To investigate the perceived benefits and drawbacks of using ChatGPT as a tool to aid creativity and originality in scientific inquiry.
- To explore the experiences and feedback of researchers who have utilized ChatGPT in their research endeavors.
- To investigate potential ethical implications and concerns arising from the use of ChatGPT in scientific research.

Importance of the Study:

Examining the use of ChatGPT in scientific research from the creativity and originality perspective holds significant importance, due to its exploration of a critical aspect of artificial intelligence (AI) integration in scientific endeavors. The importance of the study can be explained by:

- **Advancing Research Methods:** By examining the potential effects of ChatGPT on creativity and originality, the study offers valuable insights into how AI technologies can support or hinder the development of innovative scientific approaches.
- **Informing Research Community:** Findings from this study can guide researchers and institutions, in making informed decisions about the appropriate and responsible use of ChatGPT in scientific investigations.
- **Ethical Considerations:** The study addresses ethical concerns related to the use of AI in research, promoting responsible AI adoption in the scientific community.
- **Fostering Debate:** The article stimulates constructive discussions among researchers, academics, and AI developers about the role of AI in shaping scientific practices and encourages critical thinking about the potential consequences of AI integration.

1. Literature Review

The use of artificial intelligence (AI) in scientific research is a growing trend, with ChatGPT being one of the most promising AI tools in this domain.

ChatGPT is an artificial intelligence language model introduced in November 2022 providing generated conversational responses to question prompts. The model is trained with a blend of reinforcement learning algorithms and human input on over 150 billion parameters (Dowling & Lucey, 2023, p. 1).

ChatGPT is a large language model that can generate text, translate languages, write different kinds of creative content, and answer questions in an informative way. It has the potential to revolutionize scientific research by automating tasks, generating new ideas, and facilitating communication between researchers.

The use of ChatGPT in scientific research has garnered attention, particularly in the context of its impact on creativity and originality. Previous studies have examined this theme, providing insights into the advantages and potential challenges associated with employing ChatGPT in scientific endeavors.

A review by (Ray, 2023) entitled: “ChatGPT : A comprehensive review on background , applications , key challenges , bias , ethics , limitations and future scope” offers valuable insights for researchers and developers interested in the landscape of AI-driven conversational agents. It sets the stage for understanding the broader implications of ChatGPT in research. The review discusses that ethical implications of ChatGPT extend beyond the current focus on authorship, highlighting the need to apply established ethical frameworks to emerging technologies. Furthermore, the analysis explores potential consequences and interventions, emphasizing the importance of considering the entire AI ecosystem rather than isolating specific issues. Addressing these challenges effectively will require

multi-level societal engagement, encompassing individual software engineers and international policymakers, to ensure that AI's benefits, particularly those of large language models like ChatGPT, are harnessed while minimizing harm. Ultimately, this article advocates for a holistic ethical approach to guide ongoing discussions and actions surrounding these transformative emerging technologies.

Another review by (Roumeliotis & Tselikas, 2023) entitled: « ChatGPT and Open-AI Models : A Preliminary Review” demonstrates the potential of ChatGPT as a helpful research tool, emphasizing its role in conducting analyses and generating articles across various fields. However, challenges are acknowledged. This article provides a comprehensive overview of ChatGPT, covering its history, training process, and potential applications. It also presents an extensive literature review of 47 academic articles on ChatGPT, categorized into 11 distinct research domains. Additionally, the article systematically extracts and tabulates strong statements from these articles along with their domain and citation count. Finally, it discusses the advantages and disadvantages of ChatGPT and suggests areas for further research. Overall, this article serves as a valuable resource for anyone seeking to understand ChatGPT.

An analysis by (Terano et al., 2023) synthesizes data using an "introductory literature review," revealing multifaceted aspects of ChatGPT's impact on academic research, potentially influencing the creativity of researchers. This purpose of the study was to examine the practical application of ChatGPT in academic research, providing valuable recommendations and insights. The findings revealed that ChatGPT offers several advantages for researchers, particularly in generating new ideas, outlining research topics, and even crafting abstracts based on prompts. Additionally, the researchers suggest that ChatGPT can be effectively employed by academic researchers to summarize extensive texts and identify key findings from the literature. However, the study also highlights several limitations of ChatGPT in academic writing. For instance, ChatGPT occasionally generates misleading research problems, questions, and gaps, as it produces hypothetical problem statements and research gaps with made-up references. Furthermore, ChatGPT's usage should be restricted to specific sections of the literature review, as it lacks the ability to synthesize literature and generates made-up citations and references. Moreover, ChatGPT is incapable of conducting statistical analysis due to its lack of access to datasets. Consequently, the researchers strongly advise against using ChatGPT solely to write research articles; human oversight and intervention are essential. Instead, ChatGPT can serve as a valuable e-research assistant, complementing various researcher tasks and enhancing work efficiency. Considering the paramount importance of accountability and research integrity in academic publishing, researchers must assume full responsibility for ChatGPT's usage in research and clearly disclose its use in their articles. As one of the first studies to evaluate ChatGPT's application in academic research, the findings hold significant implications for both theory and practice, providing valuable guidance for researchers and institutions alike.

An experimental study by (Urban et al., 2023) investigated the impact of ChatGPT on creative problem-solving performance in university students. Participants were tasked with creating product improvements, and those who used ChatGPT produced more original, elaborated, and higher-quality solutions. They also reported higher task self-efficacy and perceived the task as easier and requiring less mental effort. However, ChatGPT did not make the task more interesting or improve the accuracy of self-evaluations. The researchers suggest that ChatGPT may enhance divergent thinking and support the iterative development of ideas, leading to more elaborate and original solutions. They also note that students with greater prior experience of ChatGPT may benefit more from its use.

Our research builds upon the foundations laid by the aforementioned studies, providing an additional layer to the current discussions surrounding the utilization of ChatGPT in scientific research. In doing so, we aim to enrich the ongoing discourse by presenting a comprehensive exploration of ChatGPT's role in the Algerian scientific research landscape. Through our study, we aspire to examine the intricate dynamics of ChatGPT's influence, shedding light on its nuanced effects on creativity and originality within the specific context of Algerian scientific research. By offering this detailed examination, we seek to contribute valuable insights that will further enhance the understanding of how it shapes the creative and original aspects of scientific works in the unique context of Algeria.

2. Methodology:

a. Data collection and sample:

The targeted respondents of this study were researchers in different domains in Algeria. The diffusion of the online questionnaire was performed using Google forms on social media platforms (mainly Facebook) and via email between August and October 2023. The sampling method consisted on convenience sampling since the targeted respondents were selected among pages and groups dealing with scientific research content. A total of 61 questionnaires were collected and analysed using SPSS.26 software.

b. Measures:

A self-administrated online questionnaire was developed and adapted with reference to the extant literature. The questionnaire contained multiple choice questions and open questions. It was divided into three parts, the first included questions about the usage of ChatGPT in scientific research. The second part was about the influence of ChatGPT on research creativity and originality. While the last one targeted exploring respondents' vision and opinion about the ethical use of ChatGPT in the future.

3. Results:

a. Respondents' academic/ professional background

Below is described the academic and professional background of the respondents.

Table 1: Respondents' academic/ professional background

Respondents 'Domains	Frequency	Percentage
Natural Sciences (e.g., Biology, Chemistry, Physics)	7	11.47%
Social Sciences (e.g., Psychology, Sociology, Economics)	13	21.31%
Engineering and Technology	30	49.18%
Humanities (e.g., History, Literature, Philosophy)	11	18.03%
Total	61	100%

Source: Elaborated by the authors via SPSS.26

The results illustrate that the majority of the respondents are from the Engineering and Technology domain with a percentage of (49 %), while Social Sciences and Humanities also have notable representation (21%). Natural Sciences, however, have the least number of respondents among the surveyed fields (11%).

b. Usage of ChatGPT in Scientific Research

The respondents were asked about their frequency of use of ChatGPT in scientific research, in order to estimate their reliance on this tool at a first place.

Table 2: Respondents' Usage of ChatGPT in Scientific Research

ChatGPT Usage	Frequency	Percentage
Daily	12	19,7%
Weekly	8	13,1%
Monthly	4	6,6%
Occasionally	17	27,9%
Rarely	11	18,0%
Never	9	14,8%
Total	61	100%

Source: Elaborated by the authors via SPSS.26

The findings indicate a varied pattern in the utilization of ChatGPT for scientific research. A notable portion utilizes it occasionally (28%) or rarely (20%), while a smaller yet significant percentage incorporates it into their daily (16%) or weekly (13%) scientific research activities. The results suggest diverse reliance levels on ChatGPT within the scientific research domain, with a significant portion using it infrequently (20%) or not at all (16%).

c. ChatGPT research aspects used by the respondents

In order to explore the aspects where respondents have employed ChatGPT, we asked the question that follows:

Table 3: ChatGPT research aspects used by the respondents

ChatGPT research aspects	Frequency	Percentage	Observed Percentage
Formulating hypotheses	6	7,8%	11,5%
Literature review and summarization	17	22,1%	32,7%
Data analysis and interpretation	7	9,1%	13,5%
Manuscript preparation	11	14,3%	21,2%
Generating research questions	17	22,1%	32,7%
Other (please specify)	19	24,7%	36,5%
Total	77	100%	148,1%

Source: Elaborated by the authors via SPSS.26

The analysis of respondents' ChatGPT usage in research can be categorized as follows:

- **Regarding formulating hypotheses, a small portion of respondents (7.8%)** use ChatGPT for hypothesis formulation, indicating a niche application. While a significant number (**22.1%**) found value in ChatGPT for literature review and summarization, showcasing its potential in information synthesis. However, a limited proportion utilize ChatGPT for data analysis and interpretation (**9.1%**). A notable percentage (**14.3%**) employ ChatGPT in manuscript preparation, demonstrating its role in content generation. Similar to literature review, a substantial portion used ChatGPT for generating research questions (**22.1%**), indicating its assistance in idea generation.
- **Regarding the other Aspects which represent (24.7%),** a diverse set of responses were mentioned by the researchers additionally to the above-mentioned usage categories, including linguistic correction, paraphrasing, translation, problem-solving, search tool, code improvement, academic writing, summarizing scientific articles, and understanding relationships between topics.

d. ChatGPT possible contribution to more creative and innovative research outputs:

Table 4: ChatGPT possible creative contribution

ChatGPT innovative contribution	Frequency	Percentage
Yes	15	24,6%
No	19	31,1%
Not sure	27	44,3%
Total	61	100%

Source: Elaborated by the authors via SPSS.26.

The results indicate a varied perception of ChatGPT's contribution to creative and innovative research outputs: A quarter of respondents (24.6%) acknowledge that ChatGPT has positively contributed to creative and innovative research outputs. On the other hand (31.1%) of them, express skepticism, believing that ChatGPT has not significantly contributed to creative and innovative research outputs. While the majority representing almost half (44.3%) are unsure about ChatGPT's impact on creative and innovative research outputs.

To explore the positive responses regarding the previous questions, respondents were asked to provide an example of how ChatGPT facilitated a creative aspect of their research. Among the examples we cite:

- *Helps me organize my thoughts and provides a systematic starting point;*
- *Formulation and correction of programming codes;*
- *Having more or less precise ideas about a scientific research domain;*
- *Reduce linguistic errors and improve writing style;*
- *Professional translation;*
- *Presenting new ideas from another perspective, thanks to its ability to take on various roles;*
- *I use it in the agricultural sector, a rarity in Algeria. It opens up numerous possibilities in the same sector or in other sectors;*
- *Speed and quality of formulation, but human intervention is necessary for writing and incorporating revisions. It is used to organize thoughts only;*
- *interpreting the results professionally.*

e. ChatGPT possible limitations or hindrance to research creativity

Table 5: ChatGPT possible limitations or hindrance to research creativity

ChatGPT limitations or hindrance to research creativity	Frequency	Percentage
Yes	7	11,5%
No	32	52,5%
Not sure	22	36,1%
Total	61	100%

Source: Elaborated by the authors via SPSS.26

The results suggest diverse perspectives on the impact of ChatGPT on research creativity: A minority of respondents (11.5%) acknowledge limitations or hindrance to their research creativity due to the use of ChatGPT. On the other hand, the majority (52.5%) do not. However, a substantial portion (36.1%) remains unsure about whether ChatGPT has led to limitations or hindrance in their research creativity.

Respondents who perceive limitations of ChatGPT to research creativity in the previous question, were asked to explain how they think it might limit the originality in their research. Some responses were as follows:

- *It may lead to scientific laziness and the ease of research, lacking in-depth exploration;*
- *It encourages scientific plagiarism and hinders creativity;*
- *You may become lazy, not thinking critically, always seeking shortcuts;*
- *I have developed a kind of dependency on it;*
- *Relying less on oneself for the sake of research and analysis.*
- *Errors*

f. Possible concerns about the ethical implications of using ChatGPT in scientific research

Table 6: Respondents possible concerns about the ethical implications of using ChatGPT in scientific research

Possible concerns about the ethical implications of using ChatGPT	Frequency	Percentage
Yes	23	37,7%
No	17	27,9%
Not sure	21	34,4%
Total	61	100%

Source: Elaborated by the authors via SPSS.26

The responses can be divided into two categories:

Optimistic responses, we cite:

- *ChatGPT will play a significant role in scientific research in the future.*
- *It will be a tool for researchers to communicate with each other and share their findings.*
- *It will be a powerful tool for generating new ideas and hypotheses.*
- *It will help to streamline research processes and make research more efficient.*
- *It will make research more accessible to a wider range of people.*

Pessimistic responses:

- *ChatGPT could be misused to generate fake or misleading research results.*
- *It could lead to a decrease in the quality of scientific research.*
- *It could make it more difficult to distinguish between real and fake scientific research.*
- *It could lead to job losses in the scientific research community.*

The majority of respondents have an optimistic view of the future of ChatGPT in scientific research. They believe that it has the potential to revolutionize the way that research is conducted and communicated. However, there are also some concerns about the potential for misuse and negative consequences. It is important to be aware of these concerns and to develop safeguards to mitigate them as ChatGPT becomes more widely used in scientific research.

4. Discussion

The study results revealed that the overall impact of ChatGPT on scientific creativity and originality is likely to be mixed. On the one hand, ChatGPT has the potential to enhance creativity by providing researchers with new ideas, perspectives, and insights. On the other hand, ChatGPT could also hinder originality by leading researchers to produce derivative or unoriginal work.

Respondents exhibited varied usage patterns, emphasizing ChatGPT's role in information synthesis, content generation, and assistance in diverse research tasks. The findings suggest a need for further exploration of ChatGPT's potential and address concerns related to authenticity in academic contexts.

The key to maximizing the positive impact of ChatGPT while minimizing its negative impact is to use it responsibly. Researchers should be aware of ChatGPT's limitations and use it in a way that complements their own creativity and expertise. For example, ChatGPT can be used to generate new hypotheses, identify potential research directions, and automate repetitive tasks. However, researchers should always carefully evaluate ChatGPT's output and ensure that it is original and accurate.

a. Recommendations:

- Based on the study results, some recommendations are pointed out for using ChatGPT responsibly in scientific research:
- **Transparency about ChatGPT use.** When publishing research results generated with the help of ChatGPT, researchers must disclose this in the paper. This will help to ensure transparency and accountability.
- **Critical evaluation of ChatGPT's output.** Researchers shall not simply accept ChatGPT's output at face value. They need to carefully evaluate each piece of output to ensure that it is original, accurate, and consistent with their own understanding and expertise.
- **Using ChatGPT to complement researchers own creativity and expertise.** ChatGPT is a powerful tool, but it is not a replacement for human creativity and judgment. Researchers should use ChatGPT to generate new ideas and perspectives, but they have to always be the final arbiter of what is included in their research.
- **Developing guidelines for the responsible use of ChatGPT in research group.** If the researcher is working with a team, it is important to develop a set of guidelines for the responsible use of ChatGPT. These guidelines should cover topics such as transparency, data privacy, and the potential for bias in AI-generated outputs.

b. Conclusion

Given the potential for ChatGPT to be misused, it is important to develop safeguards and best practices for its use in scientific research. For example, journals could require researchers to submit a statement describing how they used ChatGPT in their research and how they mitigated the risk of plagiarism and other forms of misuse. Additionally, universities and research institutions could develop training programs to educate researchers on the responsible use of ChatGPT and other AI tools.

Overall, the use of ChatGPT in scientific research is a complex issue with both potential benefits and risks. It is important to be aware of both the upsides and downsides of ChatGPT and to use it in a responsible and ethical manner. ChatGPT is a powerful new tool that has the potential to revolutionize scientific research. By using it responsibly and ethically, researchers can enhance their creativity, productivity, and impact.

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