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Scientific Research in the Era of Artificial Intelligence: Applications and Implications

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ABSTRACT

Artificial intelligence (AI) is a multidisciplinary field concerned with the development of systems and AI-powered applications capable of performing tasks that normally require human intelligence, including natural language processing and recognition, and decision-making. AI has evolved rapidly and has increasingly influenced various sectors, including higher education and scientific research. In recent years, AI-powered tools have begun to reshape key stages of the research process, notably literature review, data collection, and data analysis. Despite this growing influence, the integration of AI into scientific research remains underexplored in the Moroccan academic sphere. This practice-oriented paper explores a wide range of AI-powered applications and how they can be effectively utilized to enhance research productivity and efficiency across different stages of the research process. This paper offers significantly crucial insights into how scientific research can be streamlined through the utilization of several AI-powered applications while maintaining the academically and methodologically agreed-upon standards and ethics.

INTRODUCTION

Over the past few decades, Technology has developed dramatically, and it will continue to revamp and evolve, particularly with the advent of Artificial Intelligence (AI). This latter is "a rapidly evolving field of technology that involves the development of intelligence that can perform tasks that typically require human intelligence, such as understanding natural language, recognizing patterns, and making decisions based on data" (Waly, 2024, p. 1). AI-powered tools are some of the most widely known representations of AI. Because of the power of artificial intelligence, AI-powered tools are revolutionizing and redefining many aspects of academia, and research is no exception. AI tools, which have numerous applications and implications such as perception, reasoning, and decision-making, have quickly become popular in distinct fields, and scientific inquiry is no exception (Jordan & Mitchell, 2015). Within this realm, the current paper aims to shed light upon several AI-powered applications and how these latter can be utilized in literature review, data collection, and analysis to improve productivity and assist Ph.D. students and researchers throughout the research process.

Kothari (2004) states, "In the research process, the first and foremost step happens to be that of selecting and properly defining a research problem" (p. 24). While this may seem easy, it is not so because the researcher has to survey the existing literature to clearly and 'properly' define the research problem under scrutiny. Yet, to do so entails a significant amount of time and energy for this multifaceted and complex task. Additionally, since the researcher chooses a topic for scrutiny, s/he has to walk through the many inevitable phases of the research process, from reviewing the existing literature to collecting and analyzing data to writing the final report, all of which make the process a bit challenging. This leaves room for the integration of AI tools, which are emerging and drastically reshaping research, that could benefit scientific research if used properly and, more importantly, ethically. AI-powered applications, which are enormously useful, facilitate the research process in a wide range of ways. AI-powered applications can extract specific information and answer questions based on a given book or article. In addition, these applications can analyze huge amounts of data, which is a daunting task for researchers to embark upon manually, in a matter of seconds. Furthermore, some AI-powered apps could help when it comes to identifying relevant and related literature. Nevertheless, this does not mean that AI applications could replace the human researcher, who is supposed to demonstrate methodological expertise and adhere to the ethics of doing scientific research. Therefore, this paper advocates for "a balanced approach to AI integration, where AI collaborates with human authors" (Malik *et al.*, 2023, p. 1). This involves paper, which was prepared and delivered as an oral presentation at the "International Conference on Planning, Understanding and Undertaking Research Projects: Tools and Methods" held in Fez, Morocco, 2024, divided into three main sections: AI-powered applications for literature review and data analysis, the implications of these applications for Ph.D. students and researchers, and concluding remarks and considerations.

MATERIALS AND METHODS

The present paper aimed to explore AI-powered applications and their implications for streamlining scientific research. To write this practice-oriented paper, a desktop methodology was employed. It is a research approach that relies primarily on secondary rather than collected data. As such, the researcher collected and

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analyzed data from existing or readily published sources. Desktop methodology is widely utilized across disciplines thanks to its various advantages, especially when the collection of primary data is impractical (Vernyuy, 2024; Willis, 2024). This approach has interestingly numerous advantages, including rapid access to information, a cost-effective technique, not time-consuming, and energy-saving (Willis, 2024). However, the desktop approach inevitably has some limitations, the most important of which are its reliance on the availability and quality of existing data, its context-sensitive research questions, and the potential for methodological gaps if not backed up by primary research (Kairo, 2024).

LITERATURE REVIEW

AI-Powered Applications for Identifying Related Literature

In academic research, numerous AI-powered applications can be utilized in the review of literature. Pinzolits (2023) categorized these AI-powered applications into two primary categories: applications to search literature and applications to analyze research. The former (applications for literature search) use AI algorithms to help researchers efficiently search for relevant papers/literature and visually map the link between papers. These AI-powered apps can analyze content, extract specific information, and aid in comprehensive literature reviews. The latter (applications for analyzing the literature) is used to facilitate reading academic papers. This type of apps, which make complex academic papers more accessible and understandable, can provide "summaries, extract key insights, and offer a conversational interface for asking questions" (Pinzolits, 2023, p. 39). Some of these applications, which are enormously useful and make reviewing the existing literature easier, are outlined below.

• **Consensus**: Consensus is an AI-powered search engine that provides evidence-based answers from scientific research. It uses AI to extract key findings from peer-reviewed sources and present them in a distilled and easily digestible format. Consensus is a valuable resource for accessing knowledge.

• **Elicit**: Elicit is an AI-powered research assistant that uses language models to find relevant academic papers, even without a perfect keyword match. It can also summarize and extract key information, support various research tasks, and integrate with citation managers.

• **Inciteful**: Inciteful is a free and open-source research tool that uses citations to help users explore and discover relevant academic literature. Its unique features include the literature connector tool for interdisciplinary studies and integration with Zotero. The platform is expanding rapidly and currently consists of two different tools, with more under development.

• **Litmaps**: Litmaps is a tool that streamlines the literature review process by generating a visual map of relevant articles. It analyzes citation patterns to find the most relevant and related articles, reducing the time it takes to complete a literature review while enhancing its quality. Litmaps seems to be popular among PhD candidates, science communicators, and universities, and offers benefits such as finding overlooked articles, keeping users informed about new publications, and facilitating effective communication and collaboration among colleagues.

• **Research Rabbit**: Research Rabbit is a digital platform that simplifies the search and management of the literature for researchers. It offers personalized recommendations, interactive visualizations, and collaboration options, and it integrates with citation managers. The platform is of benefit to researchers and has received positive feedback for its intuitive interface and features.

• **Scite**: Scite is an AI-powered research assistant that helps researchers, students, and writers by searching through millions of research papers and articles to provide reliable answers to questions and aid in writing tasks. It can also find competing evidence, summarize content, and help find sources for specific statements

• **Semantic Scholar**: Semantic Scholar is an AI-powered research tool that provides access to a vast database of scientific literature. The Semantic Reader, which is a feature of Semantic Scholar, is an augmented reader that aims to transform scientific reading by providing enhanced context and accessibility. As AI applications continue to emerge and develop, it is particularly important to note that other applications that serve, more or less, the same purposes might already have been put into use by the time this paper was written.

AI-powered Applications for Literature Analysis & Synthesis

• **Humata** supports researchers in reading and understanding complex academic papers. It uses AI to provide a conversational interface, allowing researchers to ask questions about the paper and receive answers instantly. A chat-based interface makes it easy to get information and answers from PDF documents.

• **ChatPDF** is an app that allows researchers to read intricately complex academic papers. ChatPDF uses AI to provide a conversational interface, and this makes it possible for researchers to ask questions about the paper and receive answers instantly. A chat-based interface makes it easy to get information and answers from the documents uploaded by the researcher.

• **ChatDoc** is similar to the previously mentioned apps, given that it also helps researchers read and understand complex academic papers. It also uses AI and provides a conversational interface. ChatDoc allows researchers to ask questions and get answers instantly from the paper they have uploaded to the app. A chat-based search makes it easy to get credible information and answers from PDF documents since the researcher would certainly choose reliable sources.

• **Explain Paper** is an online tool designed to make reading and understanding research papers faster and easier. Users can upload a research paper to the platform,

highlight any text, and receive an explanation. This functionality aims to make research papers, which often contain dense and complex language, more accessible. It provides clear and concise summaries of academic papers.

• **Scholarcy** is an AI tool that summarizes scholarly content, extracts structured data and knowledge summaries, and saves the time required to extract key information from an article. It creates summary flashcards in Word or PDF format and supports collaborative note-taking and annotation. It also offers a browser extension and is continually improving its algorithms for summarization techniques.

• **SciSpace** is a research platform designed to simplify research discovery and learning. It offers an end-to-end workspace that automates repetitive tasks and aids in the quick discovery of information. The platform contains metadata of over 200 million papers and 50 million open-access full-text PDFs.

• **Paper digest**: This is an AI-powered tool used for summarizing literature (essays, articles, books…).

• **DeepSeek** is an AI-powered application that could "curate answers from authoritative sources (e.g., peer-reviewed journals) and provide synthesized summaries, reducing information overload" (Kumar, 2025, p. 2).

• **ChatGPT** is a large language model developed by OpenAI. It was trained on human-human conversation data to generate humanlike text on numerous topics. It can also answer questions based on a specific document, article, for instance (Khlaif *et al.*, 2023). In addition, it can help in brainstorming and organizing ideas and improving academic writing in terms of vocabulary choice, grammar, and coherence, especially for non-native users of English. However, ChatGPT should be used to assist, not replace, the researcher, and its deployment should be guided and regulated by clear guidelines and policies (Sabour & Lehfid, 2026).

AI-Powered Applications for Reference Management

While there are numerous applications for searching literature and its analysis and synthesis, there are some useful applications for managing citations, which form an important cornerstone of scientific research. Some of these useful applications are presented in Table 1 below.

"AI-powered applications can be utilized in literature review, data collection, and analysis to improve productivity and assist Ph.D. students and researchers in several ways." In the context of literature review, AI-powered applications can efficiently search for relevant papers and visually map the links between them, thereby streamlining the literature review process and enhancing its quality. These applications can also analyze content, extract specific information, and provide summaries, making complex academic papers more accessible and understandable. Additionally, AI-powered tools can aid in data collection by automating repetitive tasks, simplifying research discovery, and providing access to a vast database of scientific literature. In terms of data analysis, AI applications can extract structured data and knowledge summaries, saving time required to extract key information from an article and offering enhanced context and accessibility for scientific reading. The use of AI-powered applications in literature review, data collection, and analysis has the potential to significantly improve productivity and assist Ph.D. students and researchers throughout the research process by streamlining tasks, providing valuable insights, and facilitating collaboration and communication among colleagues.

AI-Powered Applications for Data Analysis

ChatGPT

"ChatGPT is a variant of the GPT language model developed by OpenAI, and is a tool designed to generate humanlike text in a conversational style that can engage in conversations on various topics. Trained on human-human conversation data, ChatGPT can generate appropriate responses to questions and complete discussions on its own, making it a valuable tool for natural language processing research" (Khlaif *et al.*, p. 2).

ATLAS.ti

It is an AI-powered application used for qualitative data analysis. ATLAS.ti offers numerous tools that help " code and predict outcomes" from the collected data. It utilizes AI and machine learning in analyzing qualitative data, including survey data, blog/social media comments, interview transcripts, and texts (Sybing, 2024).

Table 1: AI-Powered Tools for Citation

AI tool	Description
Citefast	This is an AI-powered application used for citation.
Citation Machine	This is an AI-powered application used for citation.

MonkeyLearn

MonkeyLearn is a "text analysis platform that uses AI to extract and process data from text sources such as surveys, social media, and customer feedback. It provides tools for sentiment analysis, keyword extraction, and categorization, enabling researchers to derive valuable insights from unstructured data" (for more, see: https://monkeylearn.com/).

The Implications of AI-Powered Applications for Scientific Research

The implications of AI-powered applications in academia, in general, and scientific research, in particular, are many and significant. These applications have the potential to

revolutionize, redefine, and reshape various aspects of higher education, particularly in the realm of scientific research, which is not an exception. AI-powered tools offer numerous implications for scholarly endeavors, notably in the areas of literature review, data collection, and analysis. The implications of AI-powered tools are visually mapped in Figure 1 below.

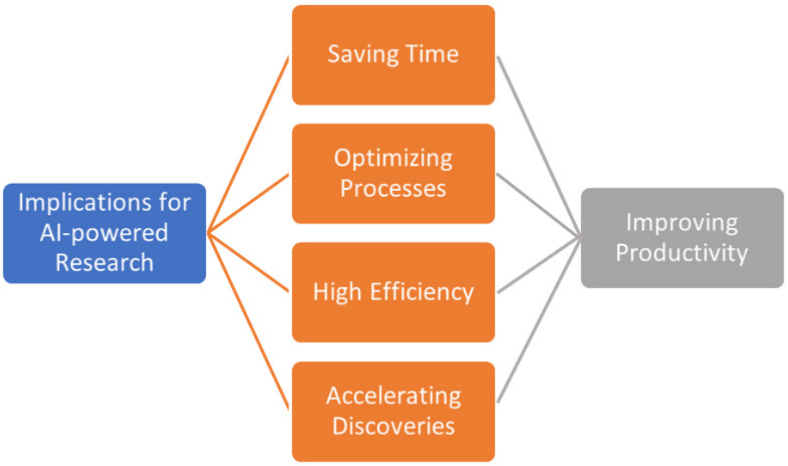

Figure 1: Implications for AI-powered Research

amounts of time, which is, alongside its management, a precious commodity. Time allows for developing efficient, intricately complex, and interpretive research activities, which is very possible with AI-powered applications. Nevertheless, lack of time can drastically change an enjoyable research activity into 'an unbearable one" (Gisbert and Chaparro, 2020, p. 545; Sybing, 2024). As a way of illustration, AI tools, ChatPDF, for instance, can be used to answer questions based on the given article or book. In this regard, Chan *et al.* (2024) and Burger *et al.* (2023) report that AI tools largely reduce the time devoted to abstract (and article) review as far as systematic reviews are concerned, thereby reducing the overall workload compared to traditional methods. As such, AI tools allow the rapid identification of relevant and influential studies in the field, data management, and writing (Perez-Lopez *et al.*, 2024). However, the human/expert aspect is critically significant, and, for this reason, AI tools should complement and support but never replace the work of the researcher. In this line of thought, Khlaif *et al.* (2023) urge that "Researchers must exercise caution when relying on AI-generated text, critically evaluating the information provided. Human expertise and judgment remain indispensable to ensure the validity and ethical considerations of research findings" (p. 3). Consequently, reflecting critically and double-checking would be inevitable to verify the reliability and accuracy of the results of AI-powered applications, which can sometimes provide inaccurate and/misleading information, hence lessening the interference of algorithmic bias. Doing so would maintain quality and the academically agreed-upon considerations and save time, thereby contributing to improved productivity.

Saving Time

In research, AI tools can automate many time-consuming tasks, including reading literature, extracting data, and generating summaries, and this, in turn, saves important

Accelerating Discoveries

AI-powered applications can analyze huge amounts of data in seconds and identify patterns or relationships that may not be immediately apparent to human researchers. This ability to process data at a rapid pace can lead to the discovery of new insights and phenomena in a fraction of the time, unlike using traditional methods (Pigola *et al.*, 2023). This, in turn, allows researchers to dive deeper into the knowledge base and beyond reading critically and synthesizing papers to establishing connections, identifying patterns, and highlighting gaps, hence addressing overlooked issues.

Optimizing processes

AI can optimize various processes in scientific research, such as materials synthesis, for instance. By utilizing AI tools responsibly, researchers can identify the most efficient and effective approaches to achieving their research objectives, leading to better outcomes and resource utilization (Pigola *et al.*, 2023). This not only accelerates discovery but also improves the quality of research results, making the research manageable and less challenging when it comes to planning, collecting data (materials), analyzing data, and writing the whole paper.

High efficiency

AI-powered applications can operate continuously without fatigue and can handle repetitive tasks. This makes it possible to achieve a high level of efficiency, allowing researchers to streamline their workflows and achieve their objectives on time (Forero and Moore, 2016). In a similar vein, Alaa (2024) argues that AI-powered applications, which can be used for writing,

enhance efficiency by assisting researchers in developing and editing manuscripts more quickly. When AI-powered tools are integrated, they offer recommendations for improving grammar, style, and structure, for example. Additionally, collecting and analyzing data is a crucial aspect of scientific research, and, in this regard, AI tools can enhance efficiency when it comes to analyzing vast amounts of data. Doing so would make it easier to identify patterns, similarities, and differences, thereby improving research efficiency by reducing manual tasks (Waly, 2024). Nonetheless, while making the research process efficient, researchers should safeguard methodological quality and ethics to the maximum, which are instrumentally significant building blocks of scientific research.

Improving productivity

AI-powered applications can automate various tasks in scientific research, such as data analysis, literature review, and more. In so doing, researchers can save time and focus on more complicated tasks, which presumably entail expertise. Besides, this can lead to increased productivity as more work can be accomplished in less time (Pinzolits, 2023). AI-powered tools contribute greatly to improving research productivity in many areas, as shown in the table below.

Table 2: Contributions of AI Tools to Productivity in Scientific Research

Productivity Area	**AI Tools Contribution**
Literature Review	Automated and focused search, summarizing, paraphrasing, synthesizing, and translating (Khlaif *et al.*, 2023; de la Torre-López *et al.*, 2023; Rolnik, 2024)
Data Analysis	(Rapid) processing of large volumes of data, categorizing (recognizing) patterns, and analyzing data (Xu *et al.*, 2021; Padakanti *et al.*, 2024)
Manuscript Preparation	Drafting, editing, refining, and improving language issues, useful especially for foreign language users (Polonevych, 2024)
Research Methodology	Research objectives, questions, and hypotheses refining (Xu *et al.*, 202)
Writing	AI tools can assist in writing and improving language for clarity and readability

CONCLUSION

While AI has several merits for scientific research, it puts forward indispensable challenges for research and researchers. The use of AI raises concerns regarding academic integrity (Rudolph *et al.*, 2023). This latter (academic integrity) is crucially important in scientific inquiry and beyond. Integrity is adhering to moral and ethical principles and is characterized by the soundness of moral character and honesty, hence abiding by the academically agreed-upon standards and principles (Maxwell and Dorman, 2013). The integration of AI-powered applications in academic research presents both opportunities and challenges for researchers and academicians. By using AI-powered applications, researchers can enhance efficiency and productivity and save some time for demanding tasks, while also addressing ethical considerations and the need for critical interpretation of AI-generated insights. In this AI era, all walks of life have been influenced, and the way scientific research is conducted is no exception (Sabour & Lehfid, 2026).

AI would continue to play an increasingly integral role in (re)shaping the future of research and scientific inquiry. Therefore, the argument of this paper is neither for nor against the use of AI in scientific inquiry, but it stresses what Malik *et al.* (2023) referred to as "a balanced approach to AI integration, where AI collaborates with human authors" (p. 1). This perspective stresses the significance of responsible and ethically aligned AI incorporation for research purposes.

AI-powered applications can be utilized in literature review, data collection, and analysis to improve productivity and assist Ph.D. students and researchers in several ways. In the context of literature review, AI-powered applications can efficiently search for relevant papers and visually map the links between them, thereby streamlining the literature review process and enhancing its quality. These applications can also analyze content, extract specific information, and provide summaries, making complex academic papers more accessible and understandable. Additionally, AI-powered tools can aid in data collection by automating repetitive tasks, simplifying research discovery, and providing access to a vast database of scientific literature. In terms of data analysis, AI applications can extract structured data and knowledge summaries, saving time required to extract key information from an article and offering enhanced context and accessibility for scientific reading. The use of AI-powered applications in literature review, data collection, and analysis has the potential to significantly improve productivity and assist Ph.D. students and researchers throughout the research process by streamlining tasks and providing valuable insights. However, AI-powered applications should not be utilized at the expense of the

researcher, as these tools are to be used in alignment with the ethics of scientific research.

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