

Challenges of Scientific Research in the Age of Artificial Intelligence

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Abstract:

The world today is witnessing an unprecedented scientific revolution driven by the development of artificial intelligence (AI), which has come to play a central role in various fields, particularly in scientific research. Researchers have increasingly come to rely on artificial intelligence tools to analyze data, detect patterns, and accelerate publication processes. Yet despite these advantages, this intelligent era raises numerous methodological, ethical, and epistemological challenges that call for a reflective and critical examination.

Keywords: Challenges of Scientific Research; Artificial Intelligence.

Introduction

Amid the digital revolution the world is witnessing today, artificial intelligence (AI) stands out as one of the greatest innovations that has transformed various fields, foremost among them the field of scientific research. Thanks to its ability to analyze enormous amounts of data, perform machine learning, and generate predictive models, artificial intelligence has become an indispensable tool for advancing discoveries and developing knowledge. However, this rapid technological progress is not without challenges; rather, it reveals a complex landscape in which opportunities intersect with risks, and innovation overlaps with ethical and methodological issues.

Scientific research has shifted from a purely elite process, based on precise human skills, to a hybrid system in which humans and machines work together. This raises fundamental questions about the credibility of the knowledge produced, the role of the researcher, the reliability of the results, and the extent of algorithmic neutrality. New challenges have also emerged, including AI-assisted scientific plagiarism, the inflation of publications lacking academic value, and the decline of critical thinking in favor of automated content generation.

In this context, the academic community faces growing pressure to redefine the concepts of originality and innovation and to build legislative and ethical frameworks that regulate the use of artificial intelligence tools. This stage also requires strengthening researchers' skills in the conscious use of technology and providing fair and open digital resources for everyone, in order to avoid widening the gap between advanced research centers and their counterparts in developing countries.

Discussing scientific research in the age of artificial intelligence is not merely a debate about new tools; rather, it is an existential question about the future of human knowledge, the limits of machine intervention, and the preservation of critical and methodological thinking amid the flood of artificially generated information.

1. The Concept of Scientific Research

1.1 Definition of Scientific Research

Linguistically the word research, refers to seeking, searching, or investigating a truth or a matter among various truths or matters.

As for the word scientific, it is a term derived from science, which means knowledge, study, or the perception of facts. Science also means familiarity with and comprehension of facts and everything related to them.

Terminologically, it is defined as the activity that produces knowledge, reveals facts, and provides solutions to problems. This requires the researcher to possess both theoretical and practical depth in two aspects: the subject matter or field of the research, and the methodological rules (Zayed, 1999, p. 05).

It is also defined as a method of study through which it is possible to arrive at a solution to a specific problem by means of a comprehensive and accurate investigation of all verifiable evidence and indications related to that specific problem. (Al-Mahmoudi, 2019, p. 14).

It is also defined as an organized scientific activity and a precise method of thinking and investigation that aims to discover facts by relying on objective methods, in order to understand the interrelationship among these facts and to derive general principles and explanatory laws (El-Sayed M. T., 2013, p. 12).

Thus, scientific research is an organized intellectual process carried out by a person called the researcher in order to investigate the facts of a particular issue or problem called the research topic, by following an organized scientific method called the research methodology, with the aim of reaching appropriate solutions or results that are valid for generalization to similar circumstances or problems, which are called the research results.

1.2 Objectives of Scientific Research

Any work carried out by a human being must be based on objectives that define the points he or she seeks to reach and achieve. There are three important points that represent the objectives of scientific research, on which scholars have agreed, as follows (Haidar, 2022, p. 19):

- Scientific research seeks to understand and explain the relationships between phenomena and the factors that led to their occurrence, as well as the results or other phenomena that arise from this relationship.

- Prediction: After the researcher understands the relationship between the phenomenon and the circumstances that led to its occurrence, he or she infers and predicts results that may occur in connection with this phenomenon. These conclusions are not considered valid unless they are supported by evidence, indications, and proofs, whether in the field through experimentation and observation, or through reports issued by official bodies, or through the results of previous studies.
- Regulation and control: The process of regulation and control is linked to understanding the phenomenon and predicting its possible outcomes, and consequently to the researcher's ability to regulate the influencing factors and control the effects that may result from them.

1.4 Characteristics of Scientific Research

Scientific research has certain characteristics that must be present for the submitted research to be of a high and scientific standard (Alyan, 2001, p. 22):

- First: It is an organized and precise process. Scientific research is an organized process that requires a precise and well-designed scientific method, which is the method of scientific research.
- Second: Objectivity. The researcher must be committed to precise scientific standards, presenting all the evidence and facts that support his or her point of view, reaching a logical conclusion, and acknowledging the facts that have been derived even if they contradict the opinion on which the research was originally based.
- Third: Scientific research must have an objective or purpose. This characteristic means that the researcher should study the problem being raised from all aspects and seek a solution to it, while using scientific and purposeful methods that help in reaching the required results.
- Fourth: Reliance on scientific rules as a foundation. The researcher must observe in the research the scientific methods that are based on essential scientific rules during the investigation of the subject, and the omission or neglect of any of these rules greatly undermines the results that the researcher will ultimately reach.
- Fifth: Intellectual openness. This characteristic requires the researcher to seek the truth without confusing it with personal ideas, commitments, or beliefs. In other words, the researcher should not be confined to presenting a single view based on one line of thinking, and the mind must remain open to all other ideas that may oppose it.
- Sixth: The use of research results later for predicting similar cases and situations.

1.5 Types of Scientific Research

Scientific research can be divided in different ways, as follows (Ahmed & Hay, p. 06):

- In terms of the field of research: there are educational, historical, literary, scientific, social, philosophical, and other types of research.
- In terms of methodology: there are historical, descriptive, experimental, predictive, survey-based, and other types of research.
- In terms of location: there are field studies and laboratory studies.
- In terms of the nature of the data: there are quantitative studies and qualitative studies.
- In terms of forms of reasoning: there are deductive studies and inductive studies.

- In terms of the approach to scientific research: there are studies based on a single approach and studies based on multiple approaches.
- In terms of those conducting the research: there are individual studies and collective studies.
- In terms of the level of research: there are academic studies and specialized studies.

1.6 Methods and Approaches of Scientific Research

They can be summarized in the following figure:

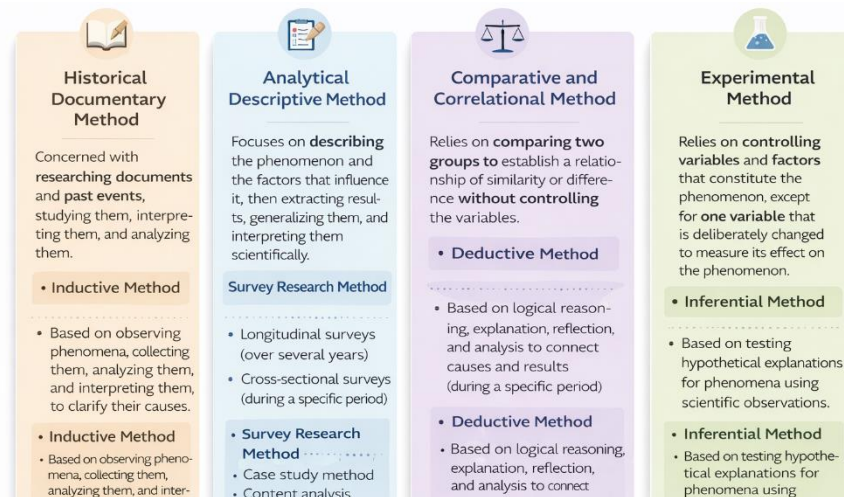


Fig 01. Methods and Approaches of Scientific Research

1.7 Qualities of a Successful Researcher

These include the researcher's dispositions and abilities, which are qualities that should be present in a successful researcher. The most important of them are as follows (Moneim & Hassan, 1996, p. 36):

- Love of learning: This is considered the driving force behind the researcher's continued pursuit of research and study in order to uncover information and knowledge.
- Clarity of mind: This is a quality that leads to strong observation, accurate perception, and freedom from emotional bias.
- Patience and perseverance: These are considered essential qualities so that the researcher does not stop conducting research when faced with problems, which are often many.
- Scientific integrity: This is an absolute necessity in scientific research. Scientific integrity differs from unconscious bias. Scientific integrity is rooted in a living conscience and upright moral character, and it involves a conscious sense of honesty and the practice of responsibility, whereas unconscious bias resides in the unconscious mind.
- Intuition: It is the source of the emergence of ideas in the mind, and imagination may be the means through which such ideas are created, which may contribute to solving a certain problem. These ideas come to the individual's mind and must be recorded quickly, because they often disappear from the mind as quickly as they arise. They must also be tested, because they may be either correct or incorrect.

- Imagination: The practice of imagination contributes to increasing ideas and broadening one's horizon. Many researchers believe that imagination is a guide to scientific research. Thinking must therefore be deliberate and organized, with continuous reflection on the subject and careful contemplation, and no idea should be accepted without thorough examination.
- Purposeful criticism: This means that the researcher critiques works and studies for a specific purpose or in order to reach a particular conclusion, and not merely for the sake of being critical.
- Breadth of knowledge: The researcher should strive to expand knowledge and broaden culture, and should work hard so that others may benefit from that knowledge.
- Not exploiting situations: The researcher should not exploit situations for the benefit of the research by distorting or misinterpreting the statements of the research subjects in an attempt to reach results that serve the research.

2. Challenges of Scientific Research in the Age of Artificial Intelligence

2.1 The Concept of Artificial Intelligence

Artificial intelligence refers to the ability of computer systems to perform tasks that are usually associated with human intelligence. Artificial intelligence aims to develop and program systems that can think, learn, and make decisions based on data and experience. Techniques such as machine learning and artificial neural networks are used to enable artificial systems to analyze data, recognize patterns, and make decisions (Aghouni, 2023, p. 02).

Charniak and Mark Dermot defined it as the study of human mental abilities through computer programs that simulate these abilities (Ezzedine, 2005, p. 49).

It is also defined as that branch of computer science through which computer programs can be created and designed to simulate the style of human intelligence, so that the computer can perform certain tasks instead of humans, tasks that require thinking, understanding, hearing, speaking, and movement. Its beginnings date back to the shift from traditional programming after the Second World War to the development of computer programs characterized by simulating human intelligence in playing games and solving certain puzzles, which in turn led to larger systems of simulation that later evolved and became a system of artificial intelligence (Al-Sharqawi, p. 23).

Artificial intelligence is also defined as a science that includes a set of new methods and techniques in programming computer systems, used to develop systems that simulate some elements of human intelligence and allow them to carry out inferential operations on facts and rules represented in computer memory. In other words, artificial intelligence is the science concerned with how to make the machine, that is, the computer, perform operations comparable to human mental abilities (Al-Shawadfi & Haggag, 2013, p. 574).

Elaine Rich sees artificial intelligence as the science that investigates how to make the computer perform tasks that humans perform, but in a better way than they do. In another definition provided by Avron Barr and Edward Feigenbaum, artificial intelligence is a part of computer science that aims to design intelligent systems that exhibit the same characteristics we identify as intelligence in human behavior (Abdel Hamid Bassiouni, 1994, p. 18).

John McCarthy, known as the father of artificial intelligence, coined this term in 1956. According to him, artificial intelligence is the science and engineering of creating intelligent machines, especially computer programs. That is, it is the science of creating computer devices and programs capable of thinking in the same way the human brain works, learning as we learn, deciding as we decide, and acting as we act (Khalifa, 2019, p. 40). We should also not overlook the contribution of the British mathematician Alan Turing, who worked on artificial intelligence and sought to make the machine capable of thinking and solving problems like humans in terms of complex mental abilities and human consciousness.

2.2 Objectives of Artificial Intelligence

There are two fundamental objectives of artificial intelligence: first, to achieve a deep understanding of human intelligence by simulating it; second, to make the best use of computers and to exploit all of their capabilities (Boden, 2024, p. 06). This is especially important in light of the rapid development of computer capabilities, their declining cost, and their programming languages, including Lisp, which is a List Processing Language, and Prolog, which is a Logic Programming language. These languages provide programmers with extensive capabilities for writing programs (Al-Shawadfi & Haggag, 2013, p. 575).

2.3 Fields of Artificial Intelligence

These can be summarized as follows (Aghouni, 2023, p. 04):

- Machine Learning: This is a central concept in artificial intelligence that enables machines to learn patterns from data and improve their performance over time without the need for explicit programming.
- Artificial Neural Networks: These networks simulate the neural structures of the human brain and are used in many deep learning applications.
- Deep Learning: This is a field within machine learning that relies on deep neural networks to process complex data and recognize patterns.
- Natural Language Processing: This aims to enable machines to understand and interpret human language, allowing them to interact with humans through language.
- Computer Vision: This allows machines to understand and analyze images and videos. Its applications include facial recognition, classification, and the extraction of information from images.
- Reinforcement Learning: This is another type of machine learning that depends on training systems through the outcomes of their actions in a particular environment, where rewards or penalties are given based on performance.
- Creative Content Generation: Artificial intelligence techniques can generate textual, audio, visual, and even artistic content. These techniques are used in a wide variety of fields such as industry, medicine, commerce, entertainment, scientific research, and many other areas.

2.4 Artificial Intelligence Tools

Hundreds of artificial intelligence applications are now being released every week. However, only a few of them are designed for academic purposes. Here are some AI-supported applications that can enhance your academic writing and reading skills (Tuaima, pp. 93–94):

2.4.1 Sci Space

It is an AI-supported tool designed to enhance the understanding of scientific research papers and to provide simplified explanations of academic texts. It can explain and clarify complex academic content in simple language, which facilitates a deeper understanding of research papers. It also enables users to conduct hours of research in minutes, with a focus on efficiency, information retrieval, and comprehension. This tool is specifically designed for researchers and writers and serves as a valuable resource for those dealing with complex scientific literature. It appears to be a promising tool for simplifying scientific literature, which may streamline the research process for academics and writers alike.

2.4.2 Scholarcy

It generates summaries of research papers, with unfamiliar terms linked through hyperlinks to Wikipedia entries. As an article summarization tool, Scholarcy creates a summarized flashcard for any article, report, or document in Word or PDF format. It also creates links to open-access versions of the cited sources, and it can be configured to extract figures, tables, and images. Scholarcy helps users read articles quickly, follow arguments, and extract key points within minutes.

2.4.3 Chat PDF

It is a versatile tool that allows users to interact with PDF documents using natural language. It works globally, accepts files in any language, and provides responses in the same language. It can identify essential information and provide concise summaries, functioning as a chatbot for PDF documents. It is also used to summarize documents, answer questions instantly, and enhance research understanding through artificial intelligence. This program is available free online and provides summaries and translations.

2.4.4 Research Rabbit

It is a free online tool that helps researchers find relevant scientific papers by using a citation-based literature mapping tool. This means that a user can start with one or more research papers, called seed papers, and the application will find more papers related to the topic of interest. Research Rabbit AI simplifies the management of citations and references and can automatically generate citations in various formats such as APA and MLA, among others. It also helps organize references, ensuring accuracy and consistency throughout the research work. For non-native speakers of English or those facing language barriers, it provides language assistance and can help improve grammar, enhance sentence structure, and improve the overall quality of written content, thus ensuring the clarity and coherence of research papers.

2.4.5 Litmaps

It is a tool that helps researchers and academics review the literature. It creates a map of the most relevant articles related to the seed paper, allowing users to easily find the articles and studies they need to complete the literature review. The most recent articles appear on the right, the most cited articles appear at the top, and the lines display the citations between them. Users can click on the points to explore articles, add new terms to expand their search, and allow Litmaps to find articles they did not know they needed to know about.

2.4.6 Consensus

It is an AI-powered search engine that enables users to:

- find relevant research papers using machine learning;
- extract and derive findings directly from scientific research;
- search only scientific results from published peer-reviewed sources.

2.4.7 Write sonic tool

It is used for text generation, article writing, and analysis. It is one of the most important artificial intelligence tools, containing a set of significant options for researchers, academics, and specialists, including (Ahmed Shaker, 2024, p. 121):

- Create a new document.
- Start a new chat.
- Write an article.
- View all templates.
- Generate a new image.
- Text to human-like speech.

2.4.8 ChatGPT

It is an AI chatbot through which the following can be done:

- generating text, translating languages, and answering questions;
- deriving intellectual conclusions based on logical evidence and proof;
- detecting linguistic errors in presented texts in terms of morphology, grammar, and spelling.

2.5 The Role of Artificial Intelligence in Scientific Research

It is reflected in the following:

2.5.1 Artificial Intelligence as a Tool for Data Analysis

Artificial intelligence can provide advanced methods for data analysis and for extracting complex patterns and trends that are not visible to the naked eye. For example, in the field of life sciences, artificial intelligence can be used to analyze the genome and identify correlations between genes and diseases at a very high speed, enabling researchers to direct treatment strategies more effectively in chemistry and physics, and to predict physical behaviors and chemical interactions based on the available data. In addition, artificial intelligence can help researchers design more cost-effective and efficient experiments and improve methods of measurement and analysis. This enables researchers to achieve better and faster results, thereby accelerating the pace of scientific progress. This makes artificial intelligence an essential tool in advancing scientific research by enabling researchers to reach new levels of analysis and understanding across various academic disciplines (Hussein Y. , 2024, p. 258).

Artificial intelligence also contributes to the analysis of educational data and the evaluation of students, as AI-supported systems use advanced algorithms to collect data from multiple sources, such as test results and assessments, and analyze them to provide insights that help improve teaching strategies and curricula. According to a study conducted by Renuka Tantri and others in 2024, this research indicates that integrating machine learning with data methods may lead to the development of intelligent educational platforms that meet the needs of each student (Hussein, 2024, p. 45).

2.5.2 Artificial Intelligence in Hypothesis Generation

This occurs through the analysis of a large quantity of scientific literature and the formulation of research questions based on the existing literature and data. Artificial intelligence can also suggest a research question or hypothesis related to a given topic, then evaluate and improve it, or explore new hypotheses by creating reasonable explanatory conversations, presenting counterarguments or alternative explanations, suggesting ways to test or criticize the hypothesis, identifying potential errors and limitations, and improving the validity and reliability of the research. Researchers can engage in an open dialogue with an artificial intelligence system to explore new concepts and theories in their fields of interest (Tuaima, p. 30).

2.5.3 Artificial Intelligence and Predictive Modeling

It contributes to enhancing efficiency, modeling, and prediction, allowing researchers to gain deeper insights into the topics they study.

Artificial intelligence-based analysis and prediction models help improve the accuracy of predictions and data management in various fields by using complex algorithms such as neural networks and deep learning. Predictive models contribute, for example, in education to understanding student behavior and academic needs, which helps in developing specialized learning strategies and improving outcomes. Prediction models are also used in the field of health, where artificial intelligence helps analyze patient data and identify patterns associated with diseases. Techniques for predicting appropriate treatment can improve healthcare outcomes (Hussein, 2024, p. 54).

2.5.4 Improving the Quality of Education

Artificial intelligence helps make education more effective by providing powerful educational analysis tools. These tools can assess student progress and identify their strengths and weaknesses. These data are useful in improving the quality of education because they help in making fact-based decisions. Artificial intelligence also helps provide a better understanding of learning concepts and promotes interactive environments that encourage creativity, critical thinking, and self-directed learning.

It also contributes to identifying problems in educational performance and providing teachers with information to enhance outcomes. In addition, it helps increase educational efficiency by facilitating classroom management and reducing burdens on teachers. Systems can also provide customized educational materials to support each student, which helps improve understanding and increase engagement with academic content.

2.6 The History of Artificial Intelligence in Scientific Research

The history of artificial intelligence in education dates back to 1960, when computers were first introduced into classrooms. At the beginning, artificial intelligence was used in administrative tasks such as record keeping, grading, and scheduling. As technology advanced, educators began to see the potential of artificial intelligence to revolutionize the way students learn. One of the earliest examples of adaptive learning was the Intelligent Teaching System, which was developed in 1970 by John Anderson and his team at Carnegie Mellon University. The Intelligent Teaching System used algorithms to analyze student performance and provide

personalized feedback and guidance. This paved the way for AI-supported personalized learning, which tailors instruction according to the unique needs and abilities of each student.

In 1980, assessment and grading tools were developed to help teachers evaluate student performance more efficiently and accurately. These tools used natural language processing and machine learning algorithms to analyze student responses and provide immediate feedback. The emergence of the Internet in the 1990s also led to the development of AI-based adaptive learning platforms, as these platforms could analyze student data to identify knowledge gaps and adjust instruction accordingly.

In recent years, educational chatbots have emerged as a powerful tool to support students. These chatbots use conversational natural language processing and machine learning to provide immediate answers to students' questions and concerns. Artificial intelligence has also played a role in curriculum development, and AI-supported student guidance and counseling programs have emerged through the use of machine learning (Jaber, 2024, p. 86).

2.7 Challenges of Artificial Intelligence

The integration of artificial intelligence into the process of scientific research is an important issue. Academic educational institutions often face difficulties in introducing intelligent tools into their research methodologies, because these tools are still evolving, which hinders their use in preparing accurate and reliable scientific research. These challenges can be summarized as follows:

2.7.1 Lack of qualified human resources

University institutions need qualified personnel and teaching staff capable of using artificial intelligence tools, keeping pace with new developments, and generating high-quality knowledge. Any shortage in artificial intelligence technologies leads to a failure to make full use of the available tools, which in turn hinders scientific progress. Many researchers, especially in developing countries, lack the technical skills necessary to use artificial intelligence tools effectively.

In addition, many educational curricula remain traditional and still lack updates that integrate artificial intelligence concepts into academic training, which leaves new graduates not fully prepared to deal with the requirements of research in this field.

Overcoming this challenge requires profound reform in higher education policies and continuing training, as well as the development of educational curricula that emphasize the importance of artificial intelligence. It also requires effective partnerships between universities, research centers, and the industrial sector in order to strengthen researchers' training and prepare them to face the complexities of scientific research in the digital age.

The use of artificial intelligence requires familiarity with concepts such as machine learning, data science, and algorithm analysis, all of which are still beyond the reach of many researchers, especially in developing countries (Alaa Abdel Khaleq, Israa, & Najm, 2025, p. 55).

2.7.2 Resistance to change in research communities

Resistance to change constitutes a fundamental challenge in the path toward developing scientific research in the age of artificial intelligence. Despite the enormous possibilities offered by artificial intelligence technologies, there are still wide groups of researchers,

professors, and administrators who show hesitation or implicit rejection toward adopting these technologies, either out of fear of losing control over traditional research processes or because of a lack of understanding of how to employ these tools effectively. The forms of this resistance appear first in doubts about the effectiveness of new technical tools and in continued adherence to traditional research models.

This rejection is sometimes attributed to attachment to classical methodologies and concern that digital transformation may undermine established research standards or reduce the position of the researcher in favor of algorithms. The absence of appropriate training and the scarcity of initiatives that integrate artificial intelligence into education and research training also contribute to reinforcing this resistance (Alaa Abdel Khaleq, Israa, & Najm, 2025, p. 57).

Overcoming this resistance requires a profound cultural change within academic institutions by raising researchers' awareness of the importance of artificial intelligence as a supportive tool rather than a substitute, and by gradually integrating modern technologies into research and training paths while respecting authentic academic values. Providing technical and educational support is also an essential element in facilitating this transition and building researchers' trust in artificial intelligence tools.

2.7.3 The ease of violating privacy

Global data input is expected to grow from 33 trillion gigabytes in 2018 to 175 trillion gigabytes in 2025. These are extremely massive amounts of structured and unstructured data for companies to modify and process. Personal privacy will therefore become more difficult to protect in light of the spread of artificial intelligence. When data leaks or breaches occur, the resulting consequences can cause major damage to a company's reputation and may constitute legal violations, especially as many legislative bodies are now passing regulations that restrict how personal data may be processed. This also facilitates espionage, access to individuals' private matters, and violations of their freedoms, which warns of harm, security disturbances, theft of money, exposure of secrets, and violations of privacy (El-Sayed & Ramadan, 2025, p. 16).

2.7.4 From a security perspective

One of the serious implications posed by artificial intelligence technologies is their threat to the human right to life. This is evident in the case of autonomous combat systems, such as weaponized drones or robots deployed on battlefields to perform specific functions. The danger here lies in the fact that these devices are fundamentally designed for destruction. What happens if they fall into the hands of the wrong person, or are hacked because of deficiencies or human error in security procedures, and the algorithms controlling them are manipulated? In that case, the results would be catastrophic (Khalifa, 2019, p. 47).

2.7.5 Risks in medicine and health

Many scientists and experts advise against relying on or placing trust in artificial intelligence for medical matters, and they warn against seeking medical advice from artificial intelligence. They also warn of eight major health risks associated with it. A report published by *The New York Times* stated that artificial intelligence information is inaccurate and that this technology may invent non-existent diseases, make diagnoses without proper knowledge, provide inaccurate information, fabricate certain facts, and offer advice that does not benefit

the patient and may even contradict medical guidelines, thereby posing a danger to health. At times, it also relies on non-specialized sources. Some specialists have also said that it has indeed been proven that artificial intelligence tools produce poor answers, as they appear to rely on non-specialized sources. As Karandeep Singh, head of health at Amnesty International, stated, one cannot trust everything received from these tools. They also do not disclose the source of the information and often behave inconsistently in retrieving information, which may come from non-medical sources such as Wikipedia and electronic commerce websites (El-Sayed & Ramadan, 2025, p. 21).

2.7.6 Destabilizing social foundations

This is reflected in the fact that the increasing use of artificial intelligence systems may create a kind of social conflict, as workers and employees may be dispensed with because of the capability, efficiency, and skill of these systems, leading to unemployment and causing the poor to become poorer and the rich to become richer. It also poses a threat to human centrality (Jaber, 2024, p. 23).

If the field is left open to artificial intelligence technologies, this may cause humans to lose control over the devices and machines that use such technologies. It may also lead to mental dullness and intellectual laziness, causing human beings to retreat before the machine and resulting in a decline in mental capacities. This is because people used to transmit knowledge and learning among themselves and relied on memorization for storing them. In addition, artificial intelligence technologies lack awareness of ethics and human values, as they are designed to carry out the tasks for which they were created and programmed without considering standards of right and wrong or taking into account the circumstances and changes that may occur. Consequently, they are unable to create or innovate in dealing with such circumstances (Shuweita, 2025, p. 57).

2.7.6 Legal challenges

There are technical and legal challenges facing the use of artificial intelligence in scientific research. This requires researchers to ensure that the tools they use comply with local and international laws and regulations related to privacy and data protection. In addition, there must be clear controls regarding the intellectual property rights of the results obtained through artificial intelligence, especially if the tools used rely on databases that include works protected by copyright. Local academic institutions must establish clear policies governing the use of artificial intelligence and guiding researchers in its uses, including guidelines on how to indicate the use of these tools in published research, mechanisms for verifying academic integrity, and measures to combat scientific plagiarism that may result from the unethical use of artificial intelligence (Muntazar Jihad, 2024).

2.7.7 Electronic viruses

Among the models of electronic weapons is the Stuxnet virus, which is one of the most dangerous types of cyber weapons discovered in 2009. It is considered a qualitative shift in the danger of cyber warfare. Through Stuxnet, warfare moved from destroying and stealing data to destroying the physical components themselves and operating systems, not just the data. Another example is the Duqu virus, which was discovered in September 2011 by the Laboratory of Cryptography and System Security, CrySyS Lab, at the Budapest University of

Technology and Economics. There is also the Flame virus, which was discovered in 2012 by the Iranian Computer Emergency Response Team, in addition to Kaspersky and the Laboratory of Cryptography and System Security at the Budapest University of Technology and Economics. These entities explained that the Flame virus is the most complex virus ever found, and the United Nations issued a warning describing it as one of the most dangerous viruses (Khalifa, 2019, p. 119).

2.7.8 Ethical challenges

This represents the primary concern regarding the use of artificial intelligence applications. The main points of weakness lie in scientific theft and the possibility of plagiarism and cheating when researchers use it in writing articles, because the tools currently available are not effective in detecting literary theft (Ramadan, 2024, p. 219).

Today, it has become possible to write scientific articles, generate fake data, or even fabricate complete scientific experiments through artificial intelligence. In 2023, more than 50 scientific articles were withdrawn from prestigious journals after it was discovered that they had been written or partially edited by artificial intelligence without disclosure. Algorithmic biases can also cause biased data to produce unfair or misleading results, which poses a danger to the credibility of research.

It has become possible to generate complete scientific articles using artificial intelligence tools without any real human effort, which has led to an explosion in the number of fake or partially copied studies. Some artificial intelligence programs are used to paraphrase or translate texts in ways that are difficult to detect through traditional plagiarism detection methods. This undermines the principle of originality in scientific research and creates an unfair competitive environment.

Scientific theft has now taken on new and more complex forms, which poses a serious threat to the credibility of academic research. Plagiarism is no longer limited to traditional copying; it now includes the use of artificial intelligence tools to generate complete texts or to rephrase stolen content in ways that are difficult to detect, making discovery more difficult even with classical detection programs. Techniques such as automatic text generation tools like ChatGPT are used to produce research that is not based on genuine scientific effort, while translation and paraphrasing algorithms are used to conceal the original source of the content, leading to the spread of what is known as intelligent scientific theft.

This situation imposes major challenges on universities and scientific journals, which are now required to develop new monitoring mechanisms and update plagiarism detection tools, in addition to promoting a culture of scientific integrity among researchers and students.

Conclusion

In light of the accelerating digital revolution, it is no longer possible to speak of scientific research as being isolated from artificial intelligence tools. The real issue lies in how to integrate this technology with awareness and integrity. Preserving ethical standards, strengthening critical thinking skills, and establishing strict legal frameworks are essential steps to ensure that scientific research remains human in its essence, fair in its results, and productive in its outcomes. It is also necessary to promote a culture of dialogue about artificial intelligence,

in addition to establishing scientific committees to monitor research and encourage scientific creativity and original scientific research.

If artificial intelligence represents the computational mind, the researcher still represents the conscience that guides it. Therefore, if it has become necessary to introduce artificial intelligence into scientific research in order to achieve advanced technical skills, then it is equally necessary to establish an ethical framework governing the use of these technologies, to build an advanced technical infrastructure, to enact laws related to data protection, and to work on integrating traditional teaching methods with artificial intelligence in order to achieve efficiency and innovation in scientific research.

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