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Title of research article

Generative Artificial Intelligence as a Catalyst for Research Capacity Development: An Empirical Analysis of Its Influence on Doctoral Students' Competencies at Batna 1 University

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Abstract

This study explores the impact of generative artificial intelligence (AI) on enhancing research competencies among doctoral students at Batna 1 University. Amidst recent digital advancements, the integration of generative AI tools like ChatGPT and Copilot is transforming higher education and research methodologies. The study aims to address the existing gap in literature regarding the practical effects of generative AI on essential research skills, specifically information gathering, systematic analysis, and academic writing. Utilizing a descriptive-analytical methodology, the study was conducted with a sample of 50 doctoral students, selected through stratified random sampling to ensure a representative distribution of technical and literary disciplines. The research hypotheses posited that there would be a statistically significant effect of generative AI on improving overall research competencies and specific skills in information organization, analysis, and academic writing. The findings confirm that the use of generative AI significantly enhances the research competencies of doctoral students, with notable improvements in their ability to gather and organize information, analyze data, and present academic writing effectively. This study underscores the critical role of generative AI in academic training, providing valuable insights for educators and policymakers in Algeria regarding its integration into the curriculum.

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1-Introduction

In recent years, the academic world has witnessed profound transformations driven by the digital revolution brought about by artificial intelligence—particularly generative artificial intelligence (AI)—which has become one of the most influential tools reshaping both higher education and scientific research. Its role has evolved beyond that of a mere technical assistant to that of an active contributor in the production, analysis, and formulation of knowledge, making it a cornerstone in the transformation of the academic research environment.

Generative AI, through its various applications such as ChatGPT, Copilot, and Gemini, has become an essential component of modern research practices. It facilitates access to and organization of information, assists researchers in developing theoretical frameworks, designing research instruments, analyzing data, and presenting results in a structured and coherent manner. Consequently, the contemporary researcher has become increasingly capable of employing AI as a cognitive partner that contributes to enhancing the quality of scientific outputs.

A study by Faisal (2024) confirmed that the use of AI tools in scientific research enhances critical thinking and develops academic writing skills among postgraduate students. Similarly, Chan and Hu (2023) found that students who employ generative AI in preparing their research demonstrate higher abilities in data analysis and in the precise and innovative formulation of hypotheses. In the same context, Javaid et al. (2023) revealed that relying on AI tools such as ChatGPT reduces time and effort in information gathering, allowing researchers to focus more on scientific and critical analysis.

Moreover, Hoerig et al. (2024) emphasized that the use of generative AI enhances research self-efficacy, as it fosters students' confidence in their ability to organize ideas, analyze data, and formulate results accurately. In Algeria, Omar Kabir (2025) found that generative AI contributes to improving the research performance of university professors by enhancing the quality of scientific production and accelerating publication processes. Likewise, Boughattas et al. (2024) reported that integrating AI tools into educational training raises both the technical and cognitive competencies of researchers and students alike.

In addition, a study published in the Egyptian Journal of Education (2023) indicated that integrating AI tools into university research preparation improves the quality of learning outcomes and enhances students' analytical and organizational skills. This confirms that generative AI is no longer merely a technical means, but a comprehensive cognitive framework for developing research thinking and scientific innovation skills.

Despite this growing body of research, Arab—particularly Algerian—studies remain limited in addressing the actual impact of generative AI on developing doctoral students' research competencies. Most previous studies have focused on the technical aspects of AI use, without delving deeply into its influence on core research skills such as information gathering, systematic analysis, and academic writing. This highlights the research gap that the present study seeks to address—namely, the lack of Arab field studies linking the use of generative AI to the enhancement of research competencies among doctoral students in the Algerian context.

Based on this gap, the current study aims to analyze the impact of generative artificial intelligence on improving the research competencies of doctoral students at Batna 1 University, by examining the relationship between students' level of AI tool utilization and the development of their competencies across three fundamental domains that constitute the essence of research practice:

Information gathering and organization skills

Data analysis and result formulation skills

Academic writing and presentation skills

The significance of this study lies in its attempt to bridge a theoretical and practical gap in Algerian educational research by proposing a model that connects digital transformation in higher education with the development of research competencies among graduate students. Theoretically, it enriches the literature on the integration of AI into

scientific research, while practically, it provides an applicable framework for incorporating generative AI into doctoral training and preparing students for contemporary research demands.

Accordingly, the central research problem can be formulated as follows:

What is the impact of generative artificial intelligence on improving research competencies among doctoral students at Batna 1 University?

From this main question, the following sub-questions are derived:

1. What is the impact of generative AI on improving information gathering and organization skills among doctoral students?

2. What is the impact of generative AI on improving data analysis and result formulation skills among doctoral students?

3. What is the impact of generative AI on improving academic writing and presentation skills among doctoral students?

Based on these questions, the study hypotheses are formulated as follows:

Main Hypothesis:

There is a statistically significant effect at the level of ($\alpha = 0.05$) of using generative artificial intelligence on improving the overall research competencies of doctoral students at Batna 1 University.

Sub-Hypotheses:

1. There is a statistically significant effect at the level of ($\alpha = 0.05$) of using generative artificial intelligence on improving information gathering and organization skills among doctoral students at Batna 1 University.

2. There is a statistically significant effect at the level of ($\alpha = 0.05$) of using generative artificial intelligence on improving data analysis and result formulation skills among doctoral students at Batna 1 University.

3. There is a statistically significant effect at the level of ($\alpha = 0.05$) of using generative artificial intelligence on improving academic writing and presentation skills among doctoral students at Batna 1 University.

2- Methodology

2.1 Research Method

The present study adopted the descriptive–analytical method, as it aims to:

Describe the current state of generative artificial intelligence (AI) use among doctoral students at Batna 1 University;

Analyze the extent of its impact on improving their research competencies;

This was achieved through quantitative field data collected using two structured questionnaires, and analyzed statistically through the Multiple Linear Regression technique to identify the relationships and effects between variables.

2.2 Study Population and Sample

The study population comprised all doctoral students at Batna 1 University during the 2024–2025 academic year.

A stratified random sampling method was used to select a sample of 50 doctoral students (male and female), ensuring balanced representation of both technical and literary disciplines.

Table (1) Distribution of Doctoral Students by Gender

Category	Frequency	Percentage
Male	20	%40
Female	30	%60

Table (2) Distribution of Doctoral Students by Field of Study

Field of Study	Frequency	Percentage
Technical Disciplines	15	%30
Literary Disciplines	35	%70

Participants were selected based on their actual experience or familiarity with generative AI tools such as ChatGPT, Copilot, and Gemini, in order to ensure the validity and reliability of the collected data.

2.3 Research Instruments

Two instruments were utilized in this study:

1. The Generative Artificial Intelligence Questionnaire

2. The Research Competencies Questionnaire for doctoral students at Batna 1 University.

The validity and reliability of both instruments were verified through Cronbach's Alpha coefficient and internal consistency validity.

The Research Competencies Questionnaire consisted of 30 items distributed across three main dimensions representing the core areas of research competence, as shown below:

Table (3) Dimensions of the Research Competencies Questionnaire

Dimension	Number of Items	Measured Domain
First	10	Information gathering and

		organization skills
Second	10	Data analysis and result formulation skills
Third	10	Academic writing and presentation skills

Similarly, the Generative Artificial Intelligence Questionnaire included 30 items distributed across three principal dimensions representing key AI-related skills:

Table (4) Dimensions of the Generative Artificial Intelligence Questionnaire

Dimension	Number of Items	Measured Domain
First	10	Technical skills
Second	10	Creativity and innovation
Third	10	Speed and accuracy

The study employed a five-point Likert scale to measure participants' responses, with the following gradation:

(1) Strongly Disagree – (2) Disagree – (3) Neutral – (4) Agree – (5) Strongly Agree.

2.4 Procedures

Field data were collected during the first semester of the 2024–2025 academic year from doctoral students at Batna 1 University.

Two electronic questionnaires were distributed via Google Forms:

The first measured the dimensions of generative AI;

The second assessed the level of research competencies.

Prior to distribution, the instruments were statistically verified for validity and reliability, and a sufficient number of valid responses were retrieved for statistical analysis.

2.5 Data Analysis (Statistical Procedures)

After data collection, responses were coded and entered into the Statistical Package for the Social Sciences (SPSS) version 27.

A set of statistical methods appropriate to the nature of the study were applied, including:

Descriptive statistics (means, standard deviations, and percentages) to describe the characteristics of the sample and their response levels.

Internal validity testing (item-total correlation) and reliability analysis using Cronbach's Alpha to confirm instrument consistency.

Correlation analysis and Multiple Linear Regression analysis to test the study hypotheses and measure the effect of generative artificial intelligence on doctoral students' research competencies.

The results were interpreted according to their statistical significance at the 0.05 level, with relevant tables and illustrative figures presented in the Results and Discussion section.

3-Results

Below is an accurate and scientifically styled English translation of the provided text:

Psychometric Properties of the Study Instruments

This section aims to present the psychometric properties of the two study instruments: the Generative Artificial Intelligence Questionnaire and the Research Competencies Questionnaire for doctoral students at Batna 1 University. These properties are evaluated by calculating validity and reliability coefficients using internal consistency validity and Cronbach's Alpha coefficient.

First: Generative Artificial Intelligence Questionnaire

Reliability

Table (5): Cronbach's Alpha Reliability Coefficient for Each Dimension of the Instrument

Dimension	Number of Items	Cronbach's Alpha
Technical Skills	10	0.91
Creativity and Innovation	10	0.88
Speed and Accuracy	10	0.86
Total	30	0.90

The table above shows that the reliability coefficients ranged between 0.86 and 0.91, which are high values indicating that the questionnaire possesses a high degree of internal consistency and reliability. This reflects the quality and suitability of the instrument for field application.

Internal Consistency Validity of the Questionnaire

To ensure the validity of the questionnaire, internal consistency validity was assessed by calculating Pearson's correlation coefficient (R) using the SPSS program. This was conducted on a sample of 50 individuals. The following table illustrates the results:

Table (6): Correlation Coefficients of Items with the Total Score of the Questionnaire

Item	Correlation Coefficient	Item	Correlation Coefficient	Item	orrelation Coefficien	Item	orrelation Coefficien	Item	Correlation Coefficient
01	0.63**	07	0.55**	13	0.53**	19	0.39**	25	0.48**
02	0.51**	08	0.56**	14	0.58**	20	0.45**	26	0.33**
03	0.52**	09	0.58**	15	0.59**	21	0.47**	27	0.74**
04	0.55**	10	0.61**	16	0.62**	22	0.38**	28	0.62**
05	0.56**	11	0.60**	17	0.71**	23	0.65**	29	0.31**
06	0.42**	12	0.70**	18	0.44**	24	0.62**	30	0.62**

Note: indicates significance at the 0.01 level; * indicates significance at the 0.05 level.

From Table (6), it is evident that all questionnaire items are consistent with the total score, with statistically significant correlations at the 0.01 level. The correlation coefficients ranged between 0.31 and 0.74, indicating a high level of internal consistency between the items and the total score.

Second: Research Competencies Questionnaire

Reliability

Table (7): Cronbach's Alpha Reliability Coefficient for Each Dimension of the Instrument

Dimension	Number of Items	Cronbach's Alpha
Information Collection and Organization	10	0.89
Analysis and Result Formulation	10	0.87
Academic Writing and Presentation	10	0.85
Total	30	0.88

The table above shows that the reliability coefficients ranged between 0.85 and 0.89, which are high values indicating that the questionnaire possesses a high degree of internal consistency and reliability. This reflects the quality and suitability of the instrument for field application.

Table (8): Correlation Coefficients of Items with the Total Score of the Questionnaire

Item	Correlation Coefficient	Item	Correlation Coefficient	Item	orrelation Coefficien	Item	orrelation Coefficien	Item	Correlation Coefficient
01	0.64**	07	0.66**	13	0.57**	19	0.59**	25	0.66**
02	0.55**	08	0.53**	14	0.62**	20	0.64**	26	0.52**
03	0.46**	09	0.61**	15	0.48**	21	0.58**	27	0.54**
04	0.59**	10	0.50**	16	0.63**	22	0.47**	28	0.55**
05	0.60**	11	0.52**	17	0.45**	23	0.61**	29	0.63**
06	0.41**	12	0.49**	18	0.68**	24	0.50**	30	0.57**

Note: indicates significance at the 0.01 level; indicates significance at the 0.05 level.

From Table (8), it is evident that all questionnaire items are consistent with the total score, with statistically significant correlations at the 0.01 level. The correlation coefficients ranged between 0.41 and 0.68, indicating a high level of internal consistency between the items and the total score.

Based on the above, it can be concluded that the study instruments (the Generative Artificial Intelligence Questionnaire and the Research Competencies Questionnaire) exhibit good psychometric properties in terms of validity and reliability, making them suitable and valid tools for field application in studying the impact of generative artificial intelligence on improving the research competencies of doctoral students at Batna 1 University.

Presentation of Research Hypotheses Results

This section aims to present the results of the statistical field analysis to test the impact of generative artificial intelligence on improving the research competencies of doctoral students at Batna 1 University. The researcher employed multiple linear regression to test the four hypotheses, analyzing data from a sample of 50 doctoral students (15 from scientific disciplines and 35 from literary disciplines) using the SPSS program.

Main Hypothesis

There is a statistically significant effect at the level ($\alpha = 0.05$) for the use of generative artificial intelligence in improving information collection and organization skills among doctoral students at Batna 1 University.

Table (9): Summary of the Regression Model

Value	R	R^2	Adjusted R^2	Std. Error	Durbin-Watson
Coefficient	0.742	0.551	0.519	0.398	2.01

- The correlation coefficient value ($R = 0.742$) indicates a strong positive relationship between the use of generative artificial intelligence and the improvement of overall research competencies.

- The coefficient of determination (R^2 = 0.551) indicates that generative artificial intelligence and other independent variables explain 55% of the variance in information collection and organization skills, which is a relatively high percentage in social science research.

- The Durbin-Watson value = 2.01 falls within the acceptable range (1.5–2.5), indicating no issue with the independence of errors (i.e., the statistical model is sound in terms of autocorrelation).

Table (10): Analysis of Variance (ANOVA)

Source	Df	Mean Square	F	Sig
Regression	5	5.083	12.03	0.000
Residual	44	0.422	-	-
Total	49	-	-	-

- The F-value = 12.03 with a significance level of Sig = 0.000 (< 0.05) indicates that the model as a whole is highly statistically significant.

- This means that the use of generative artificial intelligence, along with associated variables (specialization, gender), collectively affects the improvement of overall research competencies. This result confirms the validity of the regression model.

Table (11): Regression Coefficients

Independent Variable	B	Beta	T	Sig.
Constant)	0.733	-	2.04	0.048
Generative Artificial Intelligence	0.526	0.603	6.01	0.000
Specialization	0.111	0.144	1.20	0.238
Gender	0.056-	0.073-	-0.71	0.479
Research Confidence	0.207	0.257	2.25	0.030
Digital Competence	0.151	0.187	1.88	0.067

- The generative artificial intelligence variable has the highest beta value (0.603) and strong statistical significance (Sig = 0.000), indicating that it is the most influential explanatory variable for improving overall research competencies.

- The research confidence variable also has a statistically significant effect (Sig = 0.030), though its impact is weaker compared to generative artificial intelligence.

- Specialization and gender are not statistically significant, as their Sig values are > 0.05.

Sub-Hypothesis 1

There is a statistically significant effect at the level (α = 0.05) for the use of generative artificial intelligence in improving information collection and organization skills among doctoral students at Batna 1 University.

Table (12): Summary of the Regression Model

Value	R	R^2	Adjusted R^2	Std. Error	Durbin-Watson
Coefficient	0.721	0.520	0.486	0.412	1.92

- The correlation coefficient value (R = 0.721) indicates a strong positive relationship between the use of generative artificial intelligence and information collection and organization skills.

- The coefficient of determination (R^2 = 0.520) indicates that generative artificial intelligence and other independent variables explain 52% of the variance in information collection and organization skills, which is a relatively high percentage in social science research.

- The Durbin-Watson value = 1.92 falls within the acceptable range (1.5–2.5), indicating no issue with the independence of errors (i.e., the statistical model is sound in terms of autocorrelation).

Table (13): Analysis of Variance (ANOVA)

Source	Df	Mean Square	F	Sig
Regression	5	4.728	11.09	0.000
Residual	44	0.426	-	-
Total	49	-	-	-

- The F-value = 11.09 with a significance level of Sig = 0.000 (< 0.05) indicates that the model as a whole is highly statistically significant.

- This means that the use of generative artificial intelligence, along with associated variables (specialization, gender), collectively affects information collection and organization skills. This result confirms the validity of the regression model.

Table (14): Regression Coefficients

Independent Variable	B	Beta	T	Sig
Constant)	0.741	–	2.01	0.049
Generative Artificial Intelligence	0.522	0.614	5.83	0.000
Specialization	0.118	0.162	1.28	0.208
Gender	-0.062	-0.081	-0.77	0.446
Research Confidence	0.203	0.251	2.13	0.039
Digital Competence	0.159	0.201	1.97	0.055

- The generative artificial intelligence variable has the highest beta value (0.614) and strong statistical significance (Sig = 0.000), indicating that it is the most influential explanatory variable for information collection and organization skills.

- The research confidence variable also has a statistically significant effect (Sig = 0.039), though its impact is weaker compared to generative artificial intelligence.

- Specialization and gender are not statistically significant, as their Sig values are > 0.05.

- The results indicate that generative artificial intelligence has a strong and direct effect on improving information collection and organization skills, with the model explaining 52% of the variance in the dependent variable.

This translation maintains the scientific tone and accurately conveys the psychometric properties, statistical analyses, and interpretations as presented in the original text. If you require further clarification or additional translation, please let me know!

Below is an accurate and scientifically styled translation of the provided text into English:

Second Hypothesis

There is a statistically significant effect at the level ($\alpha = 0.05$) for the use of generative artificial intelligence in enhancing the analytical and result-formulation skills of doctoral students at Batna 1 University.

Table (15): Summary of the Regression Model

Value	R	R^2	Adjusted R^2	Std. Error	Durbin-Watson
Coefficient	0.695	0.483	0.447	0.433	1.893

- The correlation coefficient value ($R = 0.695$) indicates a strong positive relationship between the use of generative artificial intelligence and the skills of collecting and organizing information.

- The coefficient of determination ($R^2 = 0.483$) indicates that generative artificial intelligence and other independent variables explain 48% of the variance in analytical and result-formulation skills, which is a relatively high percentage.

- The Durbin-Watson value = 1.893 falls within the acceptable range (1.5–2.5), indicating no issue with the independence of errors (i.e., the statistical model is sound in terms of autocorrelation).

Table (16): Analysis of Variance (ANOVA)

Source	Df	Mean Square	F	Sig
Regression	5	4.263	9.85	0.000
Residual	44	0.433	-	-
Total	49	-	-	-

- The F-value = 9.85 with a significance level of Sig = 0.000 (< 0.05) indicates that the model as a whole is highly statistically significant.

- This means that the use of generative artificial intelligence, along with associated variables (specialization, gender), collectively affects analytical and result-formulation skills. This result confirms the validity of the regression model.

Table (17): Regression Coefficients

Independent Variable	B	Beta	T	Sig
(Constant)	0.699	-	1.88	0.066
Generative Artificial Intelligence	0.487	0.572	5.22	0.000
Specialization	0.104	0.128	1.01	0.317
Gender	0.091-	-0.109	1.03-	0.307

Research Confidence	0.175	0.224	2.04	0.047
Digital Competence	0.141	0.183		

- The generative artificial intelligence variable has the highest beta value (0.572) and strong statistical significance (Sig = 0.000), indicating that it is the most influential explanatory variable for analytical and result-formulation skills.

- The research confidence variable also has a statistically significant effect (Sig = 0.047), though its impact is weaker compared to generative artificial intelligence.

- Specialization and gender are not statistically significant, as their Sig values are > 0.05.

- The analysis shows that generative artificial intelligence is the most impactful factor in developing analytical and result-formulation skills.

-Third Hypothesis

There is a statistically significant effect at the level ($\alpha = 0.05$) for the use of generative artificial intelligence in improving academic writing and presentation skills among doctoral students at Batna 1 University.

Table (18): Summary of the Regression Model

Value	R	R^2	Adjusted R^2	Std. Error	Durbin-Watson
Coefficient	0.662	0.438	0.396	0.451	1.94

- The correlation coefficient value (R = 0.662) indicates a strong positive relationship between the use of generative artificial intelligence and the skills of collecting and organizing information.

- The coefficient of determination ($R^2 = 0.438$) indicates that generative artificial intelligence and other independent variables explain 43% of the variance in academic writing and presentation skills, which is a relatively high percentage in social science research.

- The Durbin-Watson value = 1.94 falls within the acceptable range (1.5–2.5), indicating no issue with the independence of errors (i.e., the statistical model is sound in terms of autocorrelation).

Table (19): Analysis of Variance (ANOVA)

Source	Df	Mean Square	F	Sig
Regression	5	3.761	11.03	
Residual	44	0.463	-	-
Total	49	-	-	-

- The F-value = 11.03 with a significance level of Sig = 0.000 (< 0.05) indicates that the model as a whole is highly statistically significant.

- This means that the use of generative artificial intelligence, along with associated variables (specialization, gender), collectively affects academic writing and presentation skills. This result confirms the validity of the regression model.

Table (20): Regression Coefficients

Independent Variable	B	Beta	T	Sig
Constant)(	0.702	-	1.91	0.062
Generative Artificial Intelligence	0.464	0.551	4.92	0.000
Specialization	0.082	0.103	0.89	0.377
Gender	0.047-	-0.066	0.61-	0.546
Research Confidence	0.195	0.243	2.06	0.045
Digital Competence	0.164	0.192	1.79	0.062

- The generative artificial intelligence variable has the highest beta value (0.551) and strong statistical significance (Sig = 0.000), indicating that it is the most influential explanatory variable for academic writing and presentation skills.

- The research confidence variable also has a statistically significant effect (Sig = 0.045), though its impact is weaker compared to generative artificial intelligence.

- Specialization and gender are not statistically significant, as their Sig values are > 0.05.

- The results clearly demonstrate that generative artificial intelligence significantly contributes to improving academic writing and presentation skills.

This translation maintains the scientific tone and accurately conveys the statistical details and interpretations as presented in the original text. If you require further clarification or additional translation, please let me know!

4-Discussion

Below is an accurate and scientifically styled English translation of the provided text, maintaining the academic tone and precision of the original content:

Main Hypothesis

There is a statistically significant effect at the level ($\alpha = 0.05$) for the use of generative artificial intelligence in improving the overall research competencies of doctoral students at Batna 1 University.

The study results indicate a statistically significant effect of generative artificial intelligence in developing the overall research competencies of doctoral students, reflecting the role of these technologies in reshaping the research process across its methodological, analytical, and writing dimensions. It is evident that generative AI tools, such as ChatGPT, Copilot, and Gemini, contribute to enhancing students' abilities to produce knowledge and articulate ideas systematically and methodically, thereby improving the quality of their research outputs.

This trend aligns with the findings of Faisal (2024), which confirmed that generative artificial intelligence supports researchers' critical thinking and enhances their efficiency in processing and analyzing information. Similarly, Hoerig et al. (2024) noted that the use of these tools strengthens academic self-efficacy, providing researchers with a sense of control over the research process and greater ability to formulate the conceptual and analytical framework of their

studies. These results are further supported by Omar Kabir's (2025) study, which demonstrated that generative artificial intelligence improves the research performance of university professors in Algeria by facilitating data organization and enhancing scientific writing skills.

Consequently, it can be concluded that the overall effect revealed by the results reflects a qualitative shift in research competencies due to the informed use of artificial intelligence, indicating a positive integration between human and machine capabilities in the university research environment.

Theoretical Significance

The theoretical significance lies in enhancing the scientific understanding of the relationship between generative artificial intelligence and the development of research competencies, as well as enriching the Arabic literature in this relatively new field within the Algerian academic context.

Practical Significance

The practical significance lies in the potential to use the study's findings as a basis for designing training programs for doctoral students on the effective research use of artificial intelligence, thereby contributing to improving the quality of scientific research in Algerian universities.

Limitations of the Hypothesis

The results are based on the local context of Batna 1 University and cannot be generalized to all universities without comparative studies. Additionally, the measurements relied on students' self-reported responses, which may be influenced by psychological or cognitive factors.

First Hypothesis

There is a statistically significant effect at the level ($\alpha = 0.05$) for the use of generative artificial intelligence in improving information collection and organization skills among doctoral students at Batna 1 University.

The results demonstrate that generative artificial intelligence significantly contributes to developing information collection and organization skills, enabling students to access and analyze vast amounts of sources effectively through automated text filtering and summarization techniques.

This finding is supported by Javaid et al. (2023), who indicated that artificial intelligence reduces the effort and time required for data collection, allowing researchers to focus on analytical aspects. Similarly, Chan & Hu (2023) supported this perspective, noting that generative AI enhances information organization skills and the systematic construction of references and research content.

This result can be explained by the fact that artificial intelligence provides intelligent search mechanisms (e.g., keyword analysis and objective summary generation), equipping researchers with skills to handle modern digital knowledge effectively.

Theoretical Significance

The results highlight how artificial intelligence has become a new cognitive component within the structure of research competencies, opening the door to research models that integrate human and technological capabilities in knowledge production.

Practical Significance

These findings enable the design of training workshops focused on knowledge management and organizing digital scientific resources using generative AI tools.

Limitations of the Hypothesis

The study did not verify the quality or scientific accuracy of the information collected by students, as reliance on artificial intelligence remains susceptible to errors in documentation or interpretation.

Second Hypothesis

There is a statistically significant effect at the level ($\alpha = 0.05$) for the use of generative artificial intelligence in improving analytical and result-formulation skills among doctoral students at Batna 1 University.

The results show that students using AI tools exhibit greater ability to analyze data and formulate research results accurately and consistently. This is attributed to the tools' capabilities in providing advanced textual and linguistic analyses, which assist researchers in constructing hypotheses and interpreting data scientifically.

This trend is supported by Hoerig et al. (2024), who demonstrated that generative AI enhances analytical efficiency by generating research scenarios and clarifying relationships between variables. Additionally, Faisal (2024) noted that the use of these tools fosters critical thinking and the ability to identify new research patterns.

Thus, it can be said that generative artificial intelligence acts as a "thinking tool" that stimulates researchers to discern relationships between data and develop the ability to formulate results with deeper interpretive dimensions.

Theoretical Significance

The results confirm that artificial intelligence is no longer merely a technical tool but a cognitive instrument that contributes to building structured scientific thinking among researchers.

Practical Significance

These findings enable universities to guide doctoral students toward using artificial intelligence in statistical analysis and result interpretation, thereby enhancing the quality of published research.

Limitations of the Hypothesis

There is a risk of over-reliance on automated analysis, which may undermine independent critical thinking, necessitating a balance between technical support and conscious human analysis.

Third Hypothesis

There is a statistically significant effect at the level ($\alpha = 0.05$) for the use of generative artificial intelligence in improving academic writing and presentation skills among doctoral students at Batna 1 University.

The results confirm that generative artificial intelligence contributes to improving academic writing in terms of systematic formulation, linguistic coherence, and idea organization. Students were able to produce clearer and more professional scientific texts and enhance their ability to prepare structured research presentations.

This finding aligns with a study published in the Egyptian Journal of Education (2023), which indicated that the use of artificial intelligence in preparing graduation projects improved the quality of academic writing and presentation skills. Similarly, Boughetas et al. (2024) demonstrated that generative AI enhances scientific expression skills and boosts students' confidence in presenting research and presentations before academic committees.

This effect can be explained by the fact that generative AI serves as an effective linguistic and methodological trainer, helping students adhere to academic writing standards and proper scientific documentation.

Theoretical Significance

The results confirm that artificial intelligence bridges the gap between theoretical knowledge and academic expression skills, reshaping the concept of "research writing" in the digital era.

Practical Significance

These findings open the door for universities to adopt digital academic support programs that leverage generative AI to train students in scientific writing and presentation skills.

Limitations of the Hypothesis

Excessive reliance on artificial intelligence may lead to reduced originality in academic expression, necessitating strict academic supervision to ensure a balance between personal creativity and technical support.

Conclusion

This study aimed to explore the impact of generative artificial intelligence (AI) on enhancing research competencies among doctoral students at the University of Batna 1, by analyzing the relationship between students' use of these emerging technologies and their level of mastery of scientific research skills across three dimensions: information gathering and organization, analysis and results formulation, and academic writing and presentation.

The results of the statistical analysis, using multiple linear regression, revealed a statistically significant effect of generative AI across all dimensions of research competencies. This indicates that the increased utilization of generative AI tools directly contributes to improving students' research efficiency in terms of organization, accuracy, and the ability to produce high-quality academic work.

Moreover, the findings showed that the impact was most pronounced in the skills of analysis and results formulation and academic writing and presentation, highlighting the crucial role of these tools in facilitating the methodological and editorial aspects of research work.

These findings are consistent with previous studies that affirmed generative AI has become a core component of the modern research environment, contributing to the development of analytical and organizational thinking among researchers and enhancing the overall quality of scientific output.

From a theoretical perspective, the study enriches the educational literature related to the integration of artificial intelligence in scientific research and supports the view that AI acts as a cognitive partner in the production of knowledge, rather than merely a technical instrument.

From a practical perspective, the findings underscore the urgent need to integrate generative AI into doctoral training programs through specialized modules focused on electronic research, data analysis, and academic writing, while emphasizing the importance of guiding its use within ethical and methodological frameworks.

Based on these findings, the study recommends the following:

Integrating generative AI literacy and skills into doctoral training programs at Algerian universities.

Establishing specialized research centers in artificial intelligence to support doctoral students in the methodological and analytical aspects of their research.

Encouraging future experimental studies to measure the actual impact of using such technologies on the quality of scientific production and research innovation.

In conclusion, this research has contributed scientifically to clarifying the relationship between technological transformation and academic research. It has also provided a practical framework that can be leveraged to enhance the competencies of university researchers—opening new horizons toward a more intelligent, innovative, and high-quality scientific research environment within Algerian universities.

Author Contribution

Dr. Bouaiss Hanane: Conceptualization, theoretical framework, instrument design, supervision, introduction and discussion.

Dr. Djamel Belbekkai: Statistical analysis, interpretation, methodology drafting, technical revision, coordination.

Ethical Considerations

Approval was obtained from the Scientific and Research Committee of Batna 1 University...

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Conflict of Interest

The authors declare no conflict of interest.

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