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Evaluation of the Impact of ChatGPT on the Development of Research Skills in Higher Education

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Abstract. In the context of higher education, many students struggle to develop strong research skills due to insufficient methodological training and limited academic support. Advances in artificial intelligence offer new opportunities to foster autonomous learning and improve academic writing. This study evaluates the impact of ChatGPT on the development of research skills among undergraduate nursing students in Trujillo, Peru, during the 2024 academic year. A quasi-experimental design was employed, involving 100 students divided into two groups of 50. Participants were selected through non-probabilistic convenience sampling, and group equivalence was verified through a pre-intervention diagnostic assessment. The experimental group completed a structured 15-session intervention focused on six dimensions: Problem Formulation; Information Analysis; Methodological Design; Data Analysis & Interpretation; Academic Writing; and Ethical Information Management. ChatGPT was integrated as a pedagogical support tool to facilitate idea generation, improve information retrieval, and assist with structuring academic texts. Quantitative data were collected through pretest and posttest evaluations and analyzed using Mann-Whitney U, Friedman, Bonferroni

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post hoc, ordinal regression, and principal component analysis. Results showed a statistically significant improvement in the experimental group ($U = 95.4$, $p < .05$), with notably increased numbers of students reaching the Very High level across all dimensions. The Bonferroni test highlighted differences among skills, and the ordinal regression model demonstrated strong predictive power (Nagelkerke $R^2 = 0.924$). These findings support the integration of ChatGPT into higher education as a strategic tool for enhancing research skills, especially in environments with limited access to traditional academic resources.

Keywords: Artificial intelligence; autonomous learning; ChatGPT; higher education; research skills

1. Introduction

In the current era of rapid technological advancement, artificial intelligence (AI) has emerged as a transformative force across multiple sectors, including education. Among its most influential innovations is ChatGPT, a generative language model developed by OpenAI, known for processing information, generating coherent texts, and supporting academic tasks (Atchley et al., 2024). In the context of higher education, integrating AI tools such as ChatGPT presents both opportunities and challenges, particularly in terms of fostering academic competencies such as research skills. In particular, the COVID-19 pandemic accelerated the use of digital technologies, exposing disparities related to digital literacy and access (Castagnola Rossini et al., 2025). Research skills—including critical thinking, information analysis, and academic writing—are undoubtedly essential for academic success and lifelong learning (Banihashem et al., 2024). However, many students are struggling to develop them effectively, especially without guidance on the use of such AI tools as ChatGPT (Johnston et al., 2024; Funda & Mbangeleli, 2024).

In Latin America, and particularly in Peru, over 60% of university students exhibit deficiencies in research skills, negatively affecting their academic work (Tomanguilla Reyna et al., 2024). According to the Ministry of Education in Peru (2024), 55% of students lack the necessary skills to use digital tools academically; moreover, 72.9% of educators lack the appropriate training to integrate technologies into teaching. Low connectivity, socioeconomic inequality, and insufficient methodological training compound these limitations (OECD, 2024). According to Palacios Huaraca et al. (2024), such gaps limit scientific productivity and restrict student participation in academic communities. Moreover, students often face motivational barriers and uncertainty when engaging with digital tools (Zhang & Li, 2024), which widens the gap between technological innovation and academic competencies.

Despite the alluring potential of ChatGPT in facilitating learning—by supporting writing, structuring ideas, and retrieving information (Guo & Lee, 2023)—educators have expressed concerns regarding academic integrity, the erosion of critical thinking, and increasing dependency on AI-generated content (Essien et al., 2024). Depending on its pedagogical use, ChatGPT can either scaffold or hinder skill development (Klimova & Luz de Campos, 2024; Rasul et al., 2023).

For example, recent studies suggest that, when guided by instructors, the integration of ChatGPT can enhance critical thinking and argumentative capacity (Medina et al., 2024).

Indeed, ChatGPT has been praised for its ability to enhance learning by facilitating access to information, supporting idea generation, and assisting in academic writing (Guo & Lee, 2023). Nevertheless, concerns have arisen regarding its impact on academic integrity and the potential for cognitive overdependence (Essien et al., 2024). While ChatGPT can serve as a cognitive scaffold that supports students in structuring their arguments and refining their writing (Medina et al., 2024), there remains a risk that it may also encourage superficial learning and hinder the development of independent critical thinking (Rasul et al., 2023). Perceptions of ChatGPT vary among both students and institutions, with some universities promoting its responsible integration, while others adopt restrictive policies to mitigate such risks as plagiarism and content generation without verification (Wang et al., 2024). As a result, inconsistencies in its use and the lack of clarity in terms of ethical guidelines contribute to the challenge of fostering AI literacy in academic settings (Castillo et al., 2024).

Despite the growing literature on the use of ChatGPT in higher education, few studies to date have implemented structured and pedagogically guided interventions that comprehensively target research skill development. Most prior research has focused on isolated skills such as academic writing (Polakova & Ivenz, 2024) or critical thinking (Guo & Lee, 2023), without addressing the broader spectrum of research competencies. Therefore, this study responds to this research gap by designing a 15-session intervention that strategically integrates ChatGPT as a learning support tool to enhance the following six core dimensions of research skills: Problem Formulation; Information Analysis; Methodological Design; Data Analysis & Interpretation; Academic Writing; and Ethical Information Management. The research aims to evaluate the program's impact on student performance in these areas, thereby generating empirical evidence that can inform pedagogical strategies for promoting the responsible use of AI in education. The study is guided by three questions: (1) To what extent does ChatGPT usage influence the development of research skills in higher education students? (2) Which specific research competencies are most affected by ChatGPT use? (3) What pedagogical strategies can optimize ChatGPT use to support research skill development while ensuring academic integrity?

2. Literature Review

2.1. Research Skills in Higher Education

Research skills are essential academic competencies that enable university students to formulate research questions, design methodologies, analyze data, and communicate findings effectively (Bukar et al., 2024; Grájeda et al., 2024). These skills are closely linked to critical thinking, creativity, and the ethical use of information, all of which contribute to academic autonomy and knowledge production (Duong, 2024; Saleem et al., 2024). Not only does their development foster participation in evidence-based learning but it also enhances the quality of

academic output (Smith & Roberts, 2024; Nazari & Saadi, 2024). Core components include problem formulation, information analysis, methodological design, data interpretation, and academic writing—dimensions that underpin scientific inquiry in higher education (Nabavi & Farajollahi, 2024; Fütterer et al., 2024).

Despite their importance, studies reveal that students often lack adequate training to acquire these skills. George-Reyes et al. (2024) observed that participation in research projects improves academic independence and critical thinking. However, other studies—such as that by Goh and Sandars (2024)—highlight persistent gaps in information literacy and scientific writing, particularly in Latin America, where challenges are worsened by limited resources and weak research cultures (Gouia-Zarrad & Gunn, 2024). In Peru, the Ministry of Education (2024) reports that over half of university students struggle to design research proposals, a finding echoed in the OECD's (2024) diagnosis of digital and methodological shortcomings. With a view to addressing these gaps, recent research has advocated for targeted interventions, policy reforms, and institutional initiatives to expand training access and research infrastructure (Han et al., 2024).

2.2. Use of ChatGPT in Higher Education

Recently, the integration of artificial intelligence (AI) in higher education has reshaped teaching and learning dynamics, with ChatGPT emerging as a powerful tool for supporting text generation, idea structuring, and problem-solving (Hidayat et al., 2024). Its interactive interface assists students with academic writing, research tasks, and information analysis, promoting autonomous learning (Guo & Lee, 2023). Theoretical frameworks such as constructivism and self-directed learning view ChatGPT as a cognitive mediator that facilitates knowledge construction and autonomy (Iqbal & Rahman, 2024). Additionally, cognitive load theory supports its role in reducing mental effort by simplifying complex tasks. Empirical applications range from essay drafting and research question formulation to problem-solving in STEM disciplines (Johnston et al., 2024; Essien et al., 2024), often enhancing student performance and engagement.

Despite these benefits, various challenges persist. Studies show that while ChatGPT can improve students' organization and critical thinking (Wang et al., 2024; Rasul et al., 2023), misuse may lead to dependency and superficial understanding (Klimova & Luz de Campos, 2024). Concerns regarding academic integrity and information accuracy require careful validation and ethical guidance (Liu et al., 2024). From a theoretical standpoint, self-determination theory and social constructivism advocate using AI as a support—not a replacement—for human reasoning and reflection (De Jesús et al., 2024; Mustopa et al., 2024). Effective implementation demands clear pedagogical principles that integrate digital literacy, active methodologies, and academic ethics (Murtiningsih et al., 2024; Alnasib, 2024). Indeed, recent research confirms ChatGPT's potential to personalize and enrich research competency development when integrated holistically and responsibly (Almulla & Ali, 2024).

3. Methodology

This study employed a quasi-experimental design with a quantitative approach to evaluate the impact of ChatGPT on undergraduate research skills. Conducted at the School of Nursing of Universidad César Vallejo (Peru), the research involved two groups of students—experimental and control—who were assessed using pretest and posttest measures. This design enabled a comparison between students exposed to the ChatGPT-supported intervention and those following traditional instruction.

The quasi-experimental approach was selected for its relevance in real classroom contexts, in which random assignment is not feasible. As noted by Anand (2024), such designs yield valid comparative results when implemented with groups occurring naturally in educational settings.

3.1. Participants

The sample included 100 undergraduate nursing students, evenly divided into an experimental group and a control group (n = 50 each). Participants, aged 22–25 (M = 23.5, SD = 1.1), were selected through non-probabilistic convenience sampling. To ensure group equivalence, all students were enrolled in the same semester and subject. A standardized diagnostic test was used to assess six research skill dimensions prior to group assignment, allowing for adjustment in terms of comparable averages and distributions. Age, gender, and academic performance were also considered in order to maintain homogeneity and internal validity.

3.2. Study Design

A quasi-experimental design, including pretest and posttest measures, was used to compare an experimental group, which integrated ChatGPT into research activities, with a control group that followed traditional methodologies without using AI tools. Lasting for eight weeks (October–November 2024), the intervention consisted of two-hour weekly sessions focused on developing research skills.

3.3. Experimental Procedure

The study followed a structured three-phase approach. First, both groups completed a pretest to assess the students' baseline research skills across six key dimensions. A standardized questionnaire was applied to identify initial strengths and weaknesses.

In the second phase, the experimental group underwent a guided intervention program using ChatGPT to support tasks such as bibliographic searches, outlining, data analysis, and academic writing. Emphasizing critical thinking and ethical AI use, the sessions included workshops on formulating research questions, validating AI-generated content, and discussing results. A total of 15 sessions (120 minutes each) were delivered over eight weeks, combining theoretical instruction with practical tasks aligned to each research skill dimension (see Table 1).

Meanwhile, the control group followed the regular curriculum without AI support, allowing for comparative evaluation. Instructors were briefed on the protocol and followed equivalent syllabi and assessments. Informal monitoring tools—teacher observations, student self-checks, and in-class feedback—ensured fidelity to the intervention. Each group was taught in a separate classroom by equally qualified instructors, which strengthened internal validity.

Table 1. Detailed description of the intervention sessions

Session	Learning Objective	Main Activities
1	Introduction to research and ChatGPT	Overview of research skills; ChatGPT demo; student reflections
2	Formulating research questions	AI-assisted brainstorming; peer review of research questions
3	Scientific information retrieval	Database navigation; ChatGPT keyword optimization
4	Evaluating academic sources	Source comparison using ChatGPT; relevance and credibility criteria
5	Research design basics	Discussing methodology types; ChatGPT for outlining approaches
6	Drafting a research proposal	Guided development using AI-generated outlines
7	Writing introduction and objectives	Writing support via ChatGPT; group editing activity
8	Methodological section writing	Selecting methods; AI-based paragraph modeling
9	Designing instruments	Constructing surveys/forms with ChatGPT assistance
10	Data analysis (quantitative simulation)	Dataset interpretation; basic statistics guided by AI
11	Data analysis (qualitative simulation)	Textual analysis using AI-generated themes and codes
12	Results discussion	Linking results to theory; critical interpretation exercises
13	Academic writing and citation	APA formatting with ChatGPT; academic integrity discussion
14	Ethics and responsible AI use	Debates on academic ethics; evaluating AI limitations
15	Final project presentations	Group presentations with AI-assisted visuals; peer feedback session

3.4. Program Duration

The intervention lasted eight weeks (October–November 2024) and included 15 sessions lasting 120 minutes each. These sessions were delivered in hybrid format and organized into five thematic units aligned with the research process as follows: problem formulation, information analysis, methodological design, data interpretation, and academic writing. Each unit integrated hands-on activities with guided ChatGPT use to reinforce learning outcomes.

3.5. Instruments

Data collection was conducted using a research skills questionnaire adapted from Roll and Ifenthaler's (2021) framework and aligned with the intervention's academic objectives. Despite being developed prior to 2024, this remains one of the most validated and widely applied models for assessing research skills in higher education. The instrument comprised 40 items across six dimensions—Problem Formulation; Information Analysis; Methodological Design; Data Analysis and Interpretation; Academic Writing; and Ethical Information Management— which were measured using a five-point Likert scale (1 = Strongly disagree, 5 = Strongly agree).

Content validity was confirmed by five educational research experts using Aiken's V (V = .94). a method still widely used in current educational research (Collantes Robles, 2024). Construct validity was established through Principal Component Analysis, with communalities ranging from 0.879 to 0.883. Reliability was measured using Cronbach's alpha, which yielded $\alpha = .934$, indicating excellent internal consistency.

The full version of the adapted instrument, including the 40 items grouped by dimension, is available in Supplementary File 1 (Appendix A).

3.6. Data Collection and Analysis

Data analysis was performed using SPSS version 26.0, applying both descriptive and inferential statistics. Descriptive analysis involved measures of central tendency and dispersion. For inferential analysis, the following tests were used:

1. Mann-Whitney U: To compare pretest and posttest differences between groups.
2. Friedman Test: To assess intra-group differences across skill dimensions.
3. Bonferroni Post Hoc: To identify significant pairwise differences after Friedman.
4. Ordinal Regression: To examine the influence of sociodemographic variables.
5. Communalities Analysis: To evaluate factor variance in each dimension.

A significance level of $p < .05$ was established for all tests.

3.7. Research Skills to Develop

The intervention was structured with a view to enhancing the following six core research skills, which are essential for academic development in higher education:

1. Problem Formulation: Ability to identify relevant topics, formulate clear research questions, and define specific objectives.
2. Information Search and Analysis: Competence in locating, evaluating, and selecting reliable sources using academic databases and specialized search engines.
3. Methodological Design: Capacity to choose appropriate quantitative or qualitative approaches, define data collection techniques, and develop a coherent research plan.

4. Data Analysis and Interpretation: Proficiency in applying statistical and analytical tools to process data and extract valid conclusions.
5. Academic Writing: Skill in structuring research reports, applying citation norms, and constructing clear, evidence-based arguments.
6. Ethical Information Management: Commitment to academic integrity through proper citation, avoidance of plagiarism, and adherence to ethical research standards.

This competency-based structure was specifically designed to foster critical thinking and research autonomy among undergraduate students, contributing to their academic and professional growth.

3.8. Ethical Considerations

The study followed the ethical principles of the Declaration of Helsinki. All participants provided informed consent, with assurances of data confidentiality and the right to withdraw at any time without academic repercussions. Students were informed of the study's objectives and instructed to use ChatGPT ethically and responsibly throughout the intervention.

3.9. Study Variables

The independent variable was the ChatGPT-based intervention, which was implemented through a structured 15-session program. The dependent variable was the development of research skills; these were assessed across the following five dimensions: problem formulation; information analysis; data collection; results interpretation; and academic writing. This framework enabled a precise evaluation of ChatGPT's effectiveness as an educational tool in higher education.

4. Results

The results are presented according to the six dimensions of research skills, organized by group (experimental and control) and evaluation phase (pretest and posttest). In order to identify differences in skill levels (from Very Low to Very High), descriptive and inferential analyses were applied, using Mann-Whitney U tests, Friedman test, Bonferroni post hoc test, ordinal regression, and communalities analysis. The sample consisted of 100 undergraduate students (68% female; M = 23.5, SD = 1.1), evenly distributed across the two groups, allowing for a valid comparison of progress following the intervention.

4.1. Results Related to Research Question 1: Overall Impact of ChatGPT on Research Skills

Table 2 presents the assessment scale used to classify students' skill levels. Table 3 and Figure 1 display the distribution of students across these levels before and after the intervention. The experimental group showed a notable shift toward higher performance categories, with significant gains in the High and Very High levels. In contrast, the control group showed minimal change. The Mann-Whitney U test ($U = 95.4$, $p < .05$) confirmed the statistically significant impact of ChatGPT on overall research skill development.

Table 2. Scales and levels of the variable research skills of undergraduate students, as well as each of its dimensions, according to scores

Variable	Scale	Level
Research Skills	[40–71]	Very Low
	[72-103]	Low
	[104-135]	Medium
	[136-167]	High
	[168-200]	Very High
Dimensions	Scale	Level
Problem Formulation	[7–12]	Very Low
	[13-18]	Low
	[19-24]	Medium
	[25-30]	High
	[31-35]	Very High
Information Analysis	[7–12]	Very Low
	[13-18]	Low
	[19-24]	Medium
	[25-30]	High
	[31-35]	Very High
Methodological Design	[7–12]	Very Low
	[13-18]	Low
	[19-24]	Medium
	[25-30]	High
	[31-35]	Very High
Data Analysis & Interpretation	[7–12]	Very Low
	[13-18]	Low
	[19-24]	Medium
	[25-30]	High
	[31-35]	Very High
Academic Writing	[6–10]	Very Low
	[11-15]	Low
	[16-20]	Medium
	[21-25]	High
	[26-30]	Very High
Ethical Information Management	[6–10]	Very Low
	[11-15]	Low
	[16-20]	Medium
	[21-25]	High
	[26-30]	Very High

Note. The scores represent the total results from the research skills questionnaire (40 items across six dimensions). Qualitative levels (Very Low to Very High) were defined using quintiles based on the total scale (40–200 points), with each dimension contributing proportionally to the overall score.

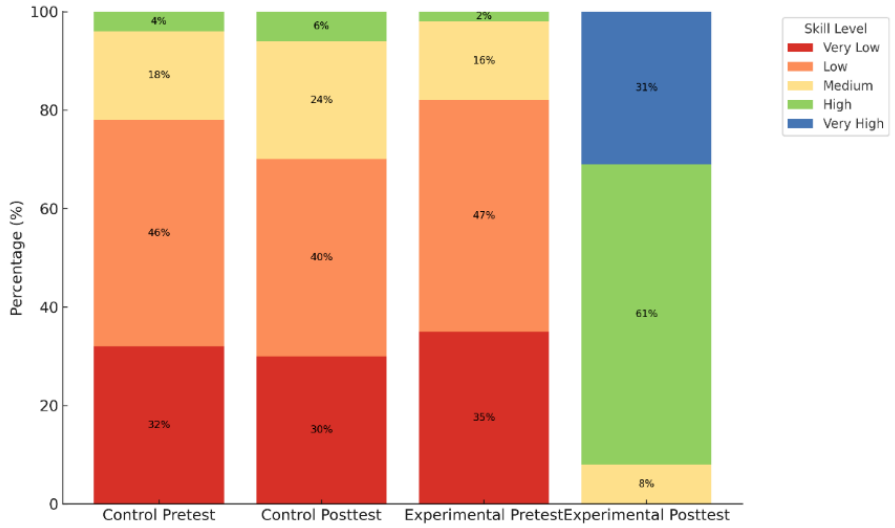

Figure 1. Stacked distribution of research skill levels by group and phase. The experimental group showed a clear shift toward higher skill levels following the intervention, in contrast to the control group, which remained largely unchanged.

As shown in Figure 1, a clear improvement was seen in the experimental group's overall research skills following the intervention, with 92% of students reaching High or Very High levels, compared to the minimal gains achieved in the control group. Prior to the intervention, both groups demonstrated low performance, but the ChatGPT-supported program notably enhanced higher-order research competencies.

Table 3. Application of ChatGPT to Develop Research Skills in Undergraduate Students: Mann-Whitney U Test in the Evaluation Phase

Test	Group	Range Average	U value	p-value	Significance
Pretest	Control	29.4			
	Experimental	26.3	388.5	p = 0.349	Not significant
Posttest	Control	30.4			
	Experimental	46.8	95.4	p < .001	Significant

Note. Information taken from the application of the instrument (a questionnaire designed to measure the level of research skills in undergraduate students).

As the results shown in Table 3 reveal, no significant differences were identified between the control and experimental groups in the pretest phase (U = 388.5, p = .349 > .05), indicating similar initial levels of research skills across both groups. However, the experimental group showed significantly higher scores in the posttest (U = 95.4, p = .000 < .05), suggesting that the ChatGPT-supported intervention had a statistically significant positive effect on the overall development of research skills.

4.2. Results Related to Research Question 2: Impact by Dimension of Research Skills

In order to analyze the impact of ChatGPT across research skill dimensions, descriptive and inferential data were examined.

Table 4 shows the percentage distribution of students by performance level in each dimension, comparing the experimental and control groups both before and after the intervention. A clear shift toward higher levels can be observed in the experimental group, while the control group remained mostly unchanged.

Table 4. Distribution of Students by Performance Levels in Each Research Skill Dimension, According to Group and Test Phase

Dimension	Group	Test	Very Low	Low	Medium	High	Very High
Problem Formulation	Experimental	Pretest	36%	46%	16%	2%	0%
	Control	Pretest	33%	46%	19%	2%	0%
	Experimental	Posttest	0%	0%	8%	59%	33%
	Control	Posttest	31%	42%	25%	2%	0%
Information Analysis	Experimental	Pretest	35%	47%	16%	2%	0%
	Control	Pretest	32%	46%	20%	2%	0%
	Experimental	Posttest	0%	0%	10%	59%	31%
	Control	Posttest	30%	40%	28%	2%	0%
Methodological Design	Experimental	Pretest	36%	45%	17%	2%	0%
	Control	Pretest	32%	44%	22%	2%	0%
	Experimental	Posttest	0%	0%	11%	58%	31%
	Control	Posttest	36%	45%	17%	2%	0%
Data Analysis & Interpretation	Experimental	Pretest	34%	47%	17%	2%	0%
	Control	Pretest	32%	46%	20%	2%	0%
	Experimental	Posttest	0%	0%	8%	61%	31%
	Control	Posttest	30%	43%	25%	2%	0%
Academic Writing	Experimental	Pretest	35%	45%	18%	2%	0%
	Control	Pretest	34%	44%	20%	2%	0%
	Experimental	Posttest	0%	0%	12%	61%	27%
	Control	Posttest	30%	42%	26%	2%	0%
Ethical Info Management	Experimental	Pretest	34%	46%	18%	2%	0%
	Control	Pretest	30%	44%	24%	2%	0%
	Experimental	Posttest	0%	0%	8%	61%	31%
	Control	Posttest	31%	41%	26%	2%	0%

Table 5 summarizes the Mann–Whitney U test results. No significant differences were found between groups at the pretest stage ($p > .05$), but posttest comparisons revealed statistically significant differences in all dimensions ($p < .001$), confirming the positive impact of the intervention.

Table 5. Mann-Whitney U test results for each research skill dimension (pretest and posttest)

Dimension	Test	Group	Mean	U value	p-value	Significance
Problem Formulation	Pretest	Control	30.6			
		Experimental	26.7	398.7	p=0.398	Not significant
	Posttest	Control	30.8			
		Experimental	47.2	112.4	p < .001	Significant
Information Analysis	Pretest	Control	29.2			
		Experimental	26.8	397.5	p=0.411	Not significant
	Posttest	Control	29.6			
		Experimental	45.9	105.8	p < .001	Significant
Methodological Design	Pretest	Control	30.6			
		Experimental	27.9	396.3	p = 0.387	Not significant
	Posttest	Control	30.8			
		Experimental	46.3	117.4	p < .001	Significant
Data Analysis & Interpretation	Pretest	Control	29.7			
		Experimental	27.3	378.7	p = 0.379	Not significant
	Posttest	Control	30.1			
		Experimental	46.8	100.2	p < .001	Significant
Academic Writing	Pretest	Control	30.3			
		Experimental	27.6	383.9	p = 0.376	Not significant
	Posttest	Control	30.8			
		Experimental	46.4	98.6	p < .001	Significant
Ethical Information Management	Pretest	Control	30.2			
		Experimental	27.5	389.7	p = 0.349	Not significant
	Posttest	Control	30.2			
		Experimental	46.7	89.6	p < .001	Significant

Note. Mann-Whitney U test results comparing control and experimental groups by research skill dimension at pretest and posttest. Values of $p < .05$ indicate significant differences.

4.3. Inferential Analysis: Statistical Significance of Differences Between Dimensions

4.3.1. Friedman Test

The Friedman test was applied to assess differences in the development of research skills across the six dimensions within the experimental group. As shown in Table 5, the test yielded statistically significant differences ($\chi^2 = 49.818$, $gl = 7$, $p = .000$), indicating that not all dimensions improved at the same rate.

Table 5. Friedman Test for Comparing Research Skill Dimensions in Undergraduate Students

Estadísticos de prueba[a]	
N	50
Chi-cuadrado	49.818
gl	7
Sig. asintótica	0

a. Prueba de Friedman

The results suggest that the intervention had a heterogeneous effect, with some dimensions showing greater progress than others. Therefore, the null hypothesis of equal rank distributions is rejected, confirming that the intervention produced significant differences across the evaluated dimensions.

4.3.2. Bonferroni Post Hoc Test

A Bonferroni post hoc test was applied to identify specific differences between skill dimensions. As revealed in Table 6, several comparisons were statistically significant ($p < .0018$), particularly between Data Analysis & Interpretation and Ethical Information Management.

Table 6. Post Hoc Bonferroni Test for Differences Between Dimensions of Research Skills Using ChatGPT

Difference in dimensions (CG and EG) in the level of autonomous learning	Difference in ranks	Test statistic	Standard Error	Sig	Adjusted significance
PF – IA	4.12	3.17	1.06	0.002	0.0018
PF – MD	4.25	1.22	1.06	0.001	0.0018
PF – DAI	3.98	3.22	1.06	0.001	0.0018
PF – AW	4.31	2.65	1.06	0.003	0.0018
PF – EIM	4.15	2.25	1.06	0.004	0.0018
IA – MD	3.99	2.29	1.06	0.002	0.0018
IA – DAI	4.17	3.91	1.06	0.000	0.0018
IA – AW	4.23	1.95	1.06	0.001	0.0018
IA – EIM	3.97	0.05	1.06	0.002	0.0018
MD – DAI	4.05	0.52	1.06	0.002	0.0018
MD – AW	4.12	0.92	1.06	0.001	0.0018
MD – EIM	4.09	0.88	1.06	0.002	0.0018
DAI – AW	3.96	0.74	1.06	0.001	0.0018
DAI – EIM	4.18	2.00	1.06	0.004	0.0018
AW – EIM	4.09	1.43	1.06	0.001	0.0018

These results confirm that the ChatGPT-supported intervention did not affect all competencies uniformly, proving more effective in dimensions related to the analysis and interpretation of academic information.

4.3.3. Ordinal Regression Analysis

An ordinal regression analysis confirmed the predictive strength of the intervention, with a statistically significant model ($\chi^2 = 50.953$, df = 50, p = .000) and high pseudo R-squared values: Cox & Snell = 0.912, Nagelkerke = 0.924, and McFadden = 0.931.

Table 7. Model Fit Information Using Ordinal Regression for the Impact of ChatGPT on Research Skills Development

Información de ajuste de los modelos				
Modelo	**Logaritmo de la verosimilitud -2**	**Chi-cuadrado**	**gl**	**Sig.**
Sólo intersección	50.953			
Final	0	50.953	50	0

Función de enlace: Logit.

The high R^2 values indicate that the model explains over 92% of the variance in research skill development, highlighting the key role and effectiveness of the ChatGPT-supported intervention as an innovative educational tool.

Table 8. Pseudo R-Squared Values for the Ordinal Regression Model on the Impact of ChatGPT on Research Skills Development

Pseudo R cuadrado	
Cox and Snell	0.912
Nagelkerke	0.924
McFadden	0.931

Función de enlace: Logit.

Table 8 shows high pseudo R-squared values—Cox and Snell (0.912), Nagelkerke (0.924), and McFadden (0.931)—indicating that the intervention explains over 92% of the variance in research skill development. Therefore, this confirms the strong predictive capacity and educational impact of the ChatGPT-supported program.

4.3.4. Principal Component Analysis (Communalities)

Table 8 presents the results of the Principal Component Analysis, showing high communalities ranging from 0.879 to 0.883 across all six dimensions. These values confirm the strong alignment between items and constructs, thereby supporting the instrument's internal consistency and construct validity.

Table 9. Communalities of Research Skill Dimensions Using Principal Component Analysis

	Initial	Extraction
Problem Formulation/ Information Analysis	1	0.883
Problem Formulation/ Methodological Design	1	0.883
Problem Formulation/ Data Analysis & Interpretation	1	0.882
Problem Formulation/ Academic Writing	1	0.881
Problem Formulation/ Ethical Information Management	1	0.879

Extraction method: principal component analysis.

Table 9 confirms the instrument's structural validity, with communality values between 0.879 and 0.883, well above the 0.70 threshold. These results support the internal consistency of the instrument and the reliability of the findings. Notably, the greatest improvements in Academic Writing and Ethical Information Management suggest that the pedagogical strategies, including the guided use of ChatGPT and ethical reflection, were effective in addressing Research Question 3.

5. Discussion

The primary objective of this study was to evaluate the impact of using ChatGPT on the development of research skills among undergraduate students at a university in Trujillo, Peru, during the 2024 academic year. The findings demonstrated that the implementation of a structured 15-session program, in which ChatGPT was integrated as a pedagogical tool to support specific research tasks, had a positive and statistically significant effect. The Mann-Whitney U test results ($U = 95.4$, $p < .05$) indicated that students in the experimental group improved substantially more than those in the control group, with 61% reaching the Very High level in overall research skills by the end of the intervention. This confirms the tool's effectiveness in supporting students' research learning processes. This aligns with the findings of Guo and Lee (2023), who emphasized AI's capacity to enhance complex cognitive abilities. Furthermore, these outcomes reinforce the theoretical foundation that generative AI, when embedded in structured and guided instructional frameworks, offers a powerful mechanism through which to foster high-level academic competencies.

The specific activities designed for the intervention revealed a consistent impact across all six dimensions of research skills. In the Problem Formulation dimension, the percentage of students at the Very High level rose from 2% to 59% ($U = 112.4$, $p < .05$), reflecting ChatGPT's utility in helping learners explore topics and refine research questions. In line with this, Rasul et al. (2023)

highlighted AI's role in stimulating critical thinking during the early stages of research. Similarly, in the Information Analysis dimension, students engaged with ChatGPT to locate and critically evaluate academic sources, leading to an increase from 0% to 51% in the Very High category ($U = 105.8$, $p < .05$). This corroborates the findings of Almulla and Ali (2024), who argued that AI enhances data management and academic source analysis. Indeed, these findings demonstrate that ChatGPT serves not merely as a search engine or content generator, but as a cognitive aid that can support intellectual exploration and refine academic judgment when used under pedagogical guidance.

Substantial improvements were also observed in dimensions involving methodological reasoning and analytical skills. In Methodological Design, the use of ChatGPT enabled students to investigate research paradigms and construct coherent proposals, resulting in a 56-percentage-point increase in the Very High level ($U = 117.4$, $p < .05$). These outcomes support Johnston et al.'s (2024) assertions regarding the role of AI as a cognitive scaffold in research design. Similarly, the Data Analysis and Interpretation dimension exhibited one of the most significant gains—rising from 2% to 68% ($U = 100.2$, $p < .05$)—as students used ChatGPT to simulate the interpretation of both quantitative and qualitative data, enhancing their reasoning and analytical depth. This finding is consistent with that of Guo and Lee (2023), who found that AI supports the development of analytical thinking when it is embedded in iterative, guided tasks. These differentiated improvements indicate that ChatGPT may be more effective in facilitating higher-order thinking and structured cognitive operations, while other skills may still require more nuanced pedagogical intervention.

Furthermore, progress was also documented in the dimensions of Academic Writing and Ethical Information Management. In Academic Writing, students used ChatGPT to structure essays, improve argumentation, and apply citation norms, with 64% reaching the Very High level ($U = 98.6$, $p < .05$). These findings align with the work of Essien et al. (2024), who observed enhancements in students' precision and clarity in academic texts when assisted by AI. In the Ethical Information Management dimension, students were guided to use ChatGPT responsibly, applying academic integrity principles and plagiarism-prevention strategies. This yielded an increase from 0% to 67% in the Very High level ($U = 89.6$, $p < .05$), directly addressing the concerns raised by Wang et al. (2024) regarding the ethical challenges associated with AI in educational contexts. Therefore, these results demonstrate that AI can also serve as a platform for ethical development when its use is embedded within structured and reflective learning environments. Moreover, the contrast with the control group, which showed stagnation or minimal improvement in most dimensions, reinforces the pedagogical value of AI-mediated strategies in fostering both academic excellence and ethical competence.

Finally, the findings must be interpreted in light of the educational and cultural context of Peru, where digital literacy and access to such advanced technologies as ChatGPT remain uneven across institutions. In this setting, the strong results obtained—supported by high pseudo R-squared values (Nagelkerke = 0.924) and robust communalities (0.879–0.883)—suggest that the structured and

pedagogically guided use of AI may have amplified effects, particularly among students with limited prior exposure to digital research tools. The regression analysis confirmed that more than 92% of the variance in research skill development could be attributed to the intervention, indicating not only statistical significance but also strong practical relevance. Furthermore, the findings have important implications for teacher training and curriculum development, pointing to the need for integrating AI literacy and ethical usage frameworks into academic programs. Although the potential risks of overreliance and misinformation remain, this study demonstrates that when implemented with appropriate guidance, ChatGPT can serve as a transformative resource for developing comprehensive research skills in higher education.

6. Conclusion, Implications, and Recommendations

This study evaluated the impact of using ChatGPT on the development of research skills in undergraduate students at a university in Trujillo, Peru, during the academic year 2024. The results demonstrated statistically significant improvements across all evaluated dimensions, particularly in the areas of data analysis and interpretation, academic writing, and problem formulation. Therefore, these findings confirm that the structured integration of artificial intelligence tools, under intentional pedagogical guidance, can enhance autonomous learning, critical thinking, and academic performance. Not only did the proposed intervention show a positive effect on student outcomes but it also promoted responsible practices in ethical information management. Moreover, the high degree of variance explained by the statistical model and the internal consistency of the instrument used support the validity of the methodological approach and consolidate its theoretical and empirical contribution to the field of educational innovation.

From a practical standpoint, the findings highlight the need to gradually integrate artificial intelligence tools into research methodology courses and subjects that foster analytical, argumentative, and communication skills. Additionally, higher education institutions should invest in teacher training on the ethical, strategic, and pedagogical use of AI, as well as in the development of regulatory frameworks to ensure its responsible application. Furthermore, the results help identify the specific dimensions of the research process that may benefit most from the use of ChatGPT, opening opportunities for the design of adaptive resources aimed at strengthening particular competencies. Future studies are encouraged to explore the long-term sustainability of the observed effects, their applicability in various sociocultural and academic contexts, and the impact of such interventions on students' cognitive autonomy over time. Overall, this study contributes to uncovering the transformative potential of artificial intelligence in higher education and outlines new pathways for its effective pedagogical integration.

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