



RESEARCH ARTICLE

Impact of Artificial Intelligence Strategies on the Research Skills of Teacher Training Students

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ABSTRACT

The present study explores the impact of artificial intelligence (AI) strategies on the development of research skills of teacher training students in a context marked by rapid scientific and technological evolution, connectivity, and virtual class experiences during the pandemic. With the aim of promoting the appropriate use of AI and strengthening the research capabilities of future teachers, non-experimental applied research with a correlational design was developed. The population was made up of 101 students from the Pedagogical Institute of Ica, of which 80 made up the sample selected through stratified random sampling. Data collection was carried out through surveys using a questionnaire as an instrument. The results obtained, analysed using Spearman's Rho hypothesis test, reveal a significant correlation (Spearman Rho = 0.849) between the use of AI strategies and the students' investigative skills, which shows that AI can be a valuable tool to enhance the development of these skills.

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INTRODUCTION

Today, the development of research skills in teacher education students is essential to ensure their professional and personal success. These skills not only enable them to identify and address social problems in innovative ways, but are also fundamental to contributing to the advancement of knowledge and educational innovation. In an increasingly interconnected and technologically advanced world, artificial intelligence (AI) presents itself as a powerful tool to enhance these skills. The implementation of AI-based strategies can significantly transform the educational process, personalising learning and facilitating access to advanced resources. This article explores the impact of such strategies on the research skills of students in a Pedagogical Institute in Ica, Peru, in the year 2024.

Globally, it is crucial that students develop research skills. These skills are fundamental for their professional and personal development, as they enable them to identify societal problems and

propose innovative solutions (Fernández-Monge et al., 2022). At the international level, the European Commission argues that higher education institutions that generate knowledge contribute effectively to national development and innovation processes. Research centres and universities must therefore be attentive to the needs of society (Aquino and Pecart, 2023).

In Spain, Silva and Martel (2018) found that research skills were projected to be at a low level, even among master's students. The main weaknesses identified were related to knowledge of the research paradigm, the selection of methodological resources to validate instruments, criteria for selecting representative samples and techniques for analysing statistical data. In Mexico, Valenzuela et al. (2021) pointed out that many higher education students focus on meeting accreditation and graduation requirements, neglecting the research skills necessary for their professional development.

At the national level, it has been observed that many students present research products with incoherent theoretical arguments, methodological weaknesses and an inadequate handling of argumentative discourse (Perdomo et al., 2020). In Piura, Chávez-Ayala et al. (2023) pointed out that the level of research skills of university students is unknown due to the lack of valid instruments, which prevents authorities from proposing beneficial actions to improve the research profile. To address this situation, an instrument was developed to measure these skills with a certain level of validity and reliability, and from its application it is possible to determine the real development of the research skills of higher education students.

At the local level, students at a Pedagogical Institute in Ica have shown various difficulties in the development of research skills, affecting abilities such as questioning and theoretically interpreting reality, managing research methodology and communicating the results. In this context, artificial intelligence (AI) is presented as a possible solution to current educational problems. AI can automate tasks, learn from human mistakes and personalise learning. In countries such as China, policies are already being implemented to apply AI in schools, which could give rise to a new term: artificial education. In the institution it has been observed that students have difficulties in identifying educational problems in their professional practice, i.e., problematisation as a research skill has certain deficiencies; likewise, the ability to theoretically ground reality is difficult since they do not select adequate theoretical content for the research work they carry out and when they make references they do so outside the relevant regulations; it has been observed that the research methodology is inadequate and even more so when they must present the results as data processing students express serious shortcomings.

The purpose of this study was to examine the impact of AI on the development of investigative skills in student teachers. AI has the potential to enhance hands-on learning, saving time and space, and reducing the risks associated with interacting in potentially hazardous environments, such as chemistry laboratories (Tuomi, 2018). These advances have been made possible by the technological convergence of advanced and accessible hardware and appropriate software.

The general research problem is formulated as follows: How does the use of artificial intelligence strategies impact the development of research skills in teacher training students in a Pedagogical Institute of Ica, in the year 2024? The specific problems include: How does the use of virtual tutors based on artificial intelligence affect the development of research skills in teacher training students? How do adaptive learning platforms with artificial intelligence contribute to the strengthening of research skills in teacher training students; to what extent does the recommendation of educational content with artificial intelligence algorithms favour the development of research skills in teacher training students; how does the creation of educational content with artificial intelligence impact the development of research skills in teacher training students; and how does the creation of educational content with artificial intelligence impact the development of research skills in teacher training students?

The relevance and importance of this research lies in its ability to introduce and validate innovative strategies based on artificial intelligence that have the potential to transform teacher training and thus the quality of education in general. By addressing a current problem with advanced technological tools, this study positions itself at the forefront of educational research, offering practical and theoretical solutions that can have a lasting impact on society.

a) **Theoretical justification:** In the current educational context, marked by rapid scientific and technological evolution, the development of research skills in teacher training students has become a pressing need. These skills, which enable future educators to identify social problems, formulate hypotheses, collect and analyse data, and propose innovative solutions, are fundamental for their professional and personal performance (Fernández-Monge et al., 2022).

However, several studies have revealed that these skills are not always adequately developed in teacher education students. In Spain, Silva and Martel (2018) found that these skills were projected to be at a low level, even in master's students. In Mexico, Valenzuela et al. (2021) identified that teacher education does not always focus on the development of these skills, which limits the potential of future educators. In this context, artificial intelligence (AI) emerges as a promising tool to address the problem of developing research skills in teacher education students. Its ability to automate tasks, learn from human errors and personalise learning can contribute significantly to this goal.

Several theoretical studies have supported the potential of AI for the development of research skills. Prensky (2001) has pointed out that the incorporation of digital technologies in learning can foster students' motivation and engagement, key aspects for the development of research skills. Jonassen (2000) has proposed that AI-based learning environments can provide students with more authentic and meaningful learning experiences, which can contribute to the development of higher-order research skills.

b) **Practical justification:** The present research is of great practical relevance, as its results can contribute to improving initial teacher education and, consequently, the quality of education in general. The findings of this study can provide valuable information for the design of teacher education strategies that effectively integrate AI. These strategies may include the use of virtual tutors, adaptive learning platforms, educational content recommendation systems and tools for creating educational content with AI.

The implementation of these strategies can contribute to: Strengthen the research skills of teacher education students: Students will be able to develop skills such as searching for information, analysing data, formulating hypotheses and communicating research results. Improve the preparation of future teachers to face the challenges of today's world: Teachers will be better prepared to use AI in their pedagogical practices and to foster the development of research skills in their students. Contribute to innovation in teacher education: The integration of AI in teacher education can open up new possibilities for the design of more personalised, effective and relevant learning experiences.

c) **Social justification:** The development of research skills in teacher training students has a significant social impact, as it contributes to the formation of critical, reflective citizens capable of participating actively in society. Future teachers who have developed research skills will be able to: Tackle social problems in a critical and proactive manner: they will be able to identify social problems, analyse their causes and propose innovative solutions. Foster a research culture in society: They will be able to transmit the importance of research to their students and motivate them to develop their research skills. Contribute to the advancement of knowledge: They will be able to carry out research that contributes to the understanding of diverse social phenomena and the search for solutions to problems relevant to society.

d) **Methodological justification:** This research is based on a rigorous and appropriate methodology to address the problem posed. A quantitative, non-experimental, correlational research design will be used. The population will be made up of teacher training students from a Pedagogical Institute in Ica, Peru. The sample will be selected in a stratified random manner. The data will be collected through surveys and the instrument will be a validated questionnaire. The data collected will be analysed using appropriate statistical techniques. The chosen methodology will allow: Obtain valid and reliable data: The surveys and the validated questionnaire will allow the collection of accurate information on the management of artificial intelligence strategies and the students' research skills. Establish relationships between variables: The causal correlational analysis will allow us to determine if there is a significant relationship between the management of artificial intelligence strategies and the students' research skills; and how one of the variables has a positive impact on the other.

The general objective of the study is to analyse the impact of the use of artificial intelligence strategies in the development of research skills in teacher training students in a Pedagogical Institute in Ica in the year 2024. The specific objectives are: To evaluate the impact of virtual tutors based on artificial intelligence on the development of research skills in teacher training students; To determine the influence of adaptive learning platforms with artificial intelligence in strengthening research skills in teacher training students; To analyse the contribution of the recommendation of educational content with artificial intelligence algorithms to the development of research skills in teacher training students; To evaluate the impact of the creation of educational content with artificial intelligence on the development of research skills in teacher training students.

The general hypothesis is: The management of artificial intelligence strategies has a significant impact on the development of research skills in teacher training students in a Pedagogical Institute of Ica in the year 2024; the specific hypotheses state that: Hypothesis 1: The use of virtual tutors based on artificial intelligence has a significant positive impact on the development of research skills in teacher training students. Hypothesis 2: Adaptive learning platforms with artificial intelligence contribute significantly to the strengthening of research skills in teacher education students. Hypothesis 3: The recommendation of educational content with artificial intelligence algorithms greatly favours the development of research skills in teacher training students. Hypothesis 4: The creation of educational content with artificial intelligence has a significant positive impact on the development of research skills in teacher training students.

Regarding the theoretical foundation, according to Lobo (2019), artificial intelligence seeks to create machines that manage to have their own way of thinking and acting, just like people. AI researchers seek to develop systems that can perceive their environment, learn from their experiences and make intelligent decisions. According to Tuomi (2018), AI becomes a scientific discipline responsible for strengthening the knowledge and functions of machines so that they can deal with various problems and meet some needs through their acquired intelligence.

Artificial intelligence (AI) teaching strategies are a set of tools, techniques and methodologies that use AI to enhance the teaching-learning process. These strategies aim to personalise learning, automate repetitive tasks, provide real-time feedback and encourage active student participation (Siemens et al., 2015).

According to Hernández and Pérez (2020), didactic strategies based on artificial intelligence "allow for a personalisation of learning that adapts to the individual needs of each student, facilitating a more inclusive and efficient educational process" (p. 45). Furthermore, García (2019) points out that "artificial intelligence in education not only improves the personalisation of learning, but also provides teachers with tools to analyse and continuously improve their pedagogical practices" (p. 112).

Lopez and Martinez (2021) note that "AI-based adaptive learning platforms automatically adjust educational content and activities according to student progress and needs, promoting autonomous and meaningful learning" (p. 78). "AI didactic strategies are increasingly being used in a variety of educational settings, including schools, universities and businesses. These strategies have the potential to improve student learning, increase educators' efficiency, and reduce educational costs." (Huang, Yin, & Kong, 2021).

According to Aldave (2023) AI didactic strategies have the following dimensions: D1: Use of AI-based Virtual Tutors, D2: AI-enabled adaptive learning platforms, D3: Recommendation of educational content with AI algorithms and D4: AI-enabled educational content creation. D1: Use of AI-based Virtual Tutors, AI-based virtual tutors are systems that use artificial intelligence to provide personalised, real-time support to learners. According to Woolf (2009), these tutors can adapt to the pace and learning style of each student, offering specific explanations, examples and feedback to enhance the learning process. D2: Adaptive Learning Platforms with AI, adaptive learning platforms with AI are online learning environments that use artificial intelligence algorithms to personalise the educational experience according to the individual needs of students. According to Johnson et al. (2016), these platforms can adjust content and activities based on students' performance and preferences, thus optimising their learning process. D3: Educational Content Recommendation with AI Algorithms, educational content recommendation with AI algorithms involves the use of machine learning techniques to suggest relevant educational materials to students. According to Drachsler and Greller (2012), these systems can analyse students' learning patterns and interests to provide personalised recommendations that enhance their educational experience. D4: Educational Content Creation with AI, educational content creation with AI refers to the use of artificial intelligence to generate teaching materials, such as exercises, tests and multimedia resources. According to Luckin et al. (2016), this technology enables the fast and efficient production of educational content tailored to students' needs, contributing to a more dynamic and accessible education.

The second variable called research skills, according to Monge et al. (2022), refers to a set of skills that are applied systematically to guide and effectively carry out research work in the academic environment.

They refer to activities in the instruction of knowledge, customs, values and behaviour of the subject, representing skills acquired in adapting to the environment. This encompasses various methods aimed at developing research strategies for obtaining new knowledge (Angamarca-Angamarca, 2020).

Regarding the importance of research skills, Vera et al. (2021) state that research skills are a contemporary need. In addition to their obvious benefits in the achievement of academic goals, these skills have also been shown to have a positive impact on the careers of recent graduates, allowing their performance to stand out and be effective in resolving issues of social relevance. Conceptual definition: A set of skills that are systematically applied to guide and effectively carry out research work in academia (Monge et al., 2022).

According to Valenzuela et al. (2021) research skills are not only beneficial for studies linked to final deliveries or theses to obtain an academic degree, but are also useful in everyday activities. These skills are applied in situations that involve observing, recording, searching, organising data and conclusions, among other tasks.

According to Aquino and Pecart (2023), the dimensions of the research ability variable are made up of a series of capacities: Ability to problematise reality; ability to theoretically ground reality; ability to manage the research methodology and the ability to analyse and process and communicate the results.

a) **Ability to problematise reality:** Aldas, Avila and Gonzalez (2020) point out that "The research skills problematise, theorise and verify make it possible to understand the logic of the research process" (p. 45). Chirino et al. (2009) indicate that: "The ability to problematise reality refers to the ability to identify, delimit and formulate research problems in a clear, precise and relevant manner" (p. 12). Machado et al. (2008): "The problematisation of reality is the starting point of scientific research, and consists of identifying a situation or phenomenon that needs to be studied and explained" (p. 165).

b) **Ability to theoretically ground reality:** Aldas, Ávila and González (2020): "The theoretical grounding of the research is based on the review of the existing literature on the topic of study, which allows the research to be contextualised and a solid conceptual framework to be built" (p. 46). Chirino (2002): "The theoretical foundation of the research is a process of review, analysis and synthesis of the existing literature on the topic of study, with the aim of constructing a conceptual framework that serves as a basis for the research" (p. 15). Machado et al. (2008): "Theoretical grounding is an essential element of scientific research, as it allows understanding the research problem from different perspectives and formulating more solid hypotheses" (p. 166).

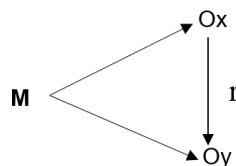
c) **Ability to manage research methodology:** Aldas, Avila and Gonzalez (2020): "The management of research methodology involves the selection, application and adaptation of the most appropriate research methods and techniques for the study of reality" (p. 47). Chirino et al. (2009): "The ability to manage research methodology refers to the mastery of research methods and techniques, as well as the ability to apply them rigorously and systematically" (p. 13). Machado et al. (2008): "Research methodology is the set of procedures and techniques used to collect, analyse and interpret research data" (p. 167).

d) **Ability to analyse and process and communicate results:** Aldas, Avila and Gonzalez (2020): "The analysis and interpretation of research results involves the organisation, systematisation and explanation of the data collected, in the light of the theoretical framework and the research objectives" (p. 48). Chirino (2002): "The ability to analyse and process and communicate research results refers to the ability to interpret data critically and reflectively, and to communicate research findings clearly, accurately and concisely" (p. 16). Machado et al. (2008): "Communication of research results is the process of informing the scientific community about research findings through publications, presentations and other means" (p. 168).

METHOD

For Sánchez (2019), applied research is that which seeks to provide solutions to specific problems that have an impact on a specific social group or an individual. Therefore, any research that aims to find specific and practical solutions to problems in different areas is called applied. The research focuses on addressing and improving the research skills of student teachers, which is a concrete and present need in education. The development of these skills is essential for future teachers, as it will enable them to generate knowledge, conduct pedagogical research and improve their educational practices.

For Hernández and Mendoza (2018), the non-experimental design is based on direct observation of the environment without modifying the variables involved for subsequent study. For Moreno (2018), this is a correlational design that allows one variable to be associated with another and its impact or influence.



Where:

M: Study sample

Ox: Management of artificial intelligence strategies

Oy: Research skills

r: Relationship between the variables and the arrow indicates chance.

The population consisted of 101 students of the IESPP. "JUAN XXII" of Ica 2024. Olivero (2016) defines it as a group of subjects to whom the instruments are applied in order to obtain the corresponding data. Thus, the sample was made up of 80 students from the Ica 2024 Pedagogical Institute. The stratified random sampling technique was used, which is a sampling technique in which the population is divided into homogeneous subgroups, called strata, and then random samples are selected from each of these strata.

The survey technique was used. The following instruments were used: Questionnaire on the management of artificial intelligence strategies: which was made up of 24 items divided among its 4 dimensions, in addition, it had a rating scale of very poor (1), poor (2), fair (3), good (4) and very good (5). Questionnaire on research skills: this was made up of 24 items divided into its 4 dimensions, and also had a rating scale of very poor (1), poor (2), fair (3), good (4) and very good (5).

At first, an application was submitted to the director of the Institute requesting permission for data collection. Once the authorisation was obtained, the survey was applied, consisting of two questionnaires, which were entered into a Microsoft Excel 2020 spreadsheet and then processed in the SPSS 25 programme.

Table 1: Variables, dimensions and indicators of the data collection instruments

Variables	Dimensions	Indicators
Variable (x)	D1: Use of AI-based virtual tutors,	Understanding and role of virtual tutors Advantages and effectiveness Use and relationship with the virtual tutor
	D2: Adaptive learning platforms with AI	Knowledge and characteristics Use and skills Advantages and selection
	D3: Recommendation of educational content with AI algorithms	Knowledge and techniques Data and accuracy Advantages and skills:
	D4: Creation of educational content with AI.	Students who know how to create educational content. Students who can identify the benefits of using AI in the creation of educational content
V(y): Research skills	D1: Ability to problematise reality	Identification of the research problem: Formulation of research questions: Justification of the research problem: Definition of objectives: Establishment of hypotheses or variables:
	D2: Ability to theoretically ground reality	Literature review: Identification of theoretical approaches: Integration of theoretical approaches: Proposition of new theories or models:
	D3: Ability to manage research methodology	Selection of research methods and techniques: Application of research methods and techniques: Data collection and interpretation:
	D4: Ability to analyse and process and communicate results.	Identification of trends and findings: Discussion of findings in the context of the literature: Generation of new research questions: Communication of findings to a specialised audience: Use of findings to guide educational practice:

Method of data analysis. For the analysis of the data, descriptive statistics were used: frequencies were found, double-entry tables were designed to respond to the objectives set in order to identify and understand how the variables are related and, through inferential statistics, the description of the hypothesis test was developed, so that the acceptance or rejection of the solution to the problem was recognised. The results obtained through the study were as is, to the reality found, without modifying anything.

RESULTS

This presents the findings identified, according to the proposed objectives, as well as the hypothesis test using Spearman's Rho for ordinal qualitative variables.

Table 1. Relationship between the use of artificial intelligence strategies and research skills

Management of artificial intelligence strategies	Research skills							
	Deficient		Regular		Good		Total	
	n	%	n	%	n	%	n	%
Deficient	5	6.3%	1	1.3%	0	0%	6	7.5%
Regular	1	1.3%	43	53.8%	5	6.3%	49	61.3%
Efficient	0	0%	2	2.5%	23	28.7%	25	31.3%
Total	6	7.5%	46	57.5%	28	35%	80	100%

Note: Data collected through the application of the instruments

The table shows that of the total number of students who participated in this study, 53.8% have a regular level of management of artificial intelligence strategies and their research skills are regular, while 28.7% of students have an efficient management of artificial intelligence strategies with a good development of their research skills, 6.3% have a deficient management of artificial intelligence strategies and their research skills are also deficient.

Despite the fact that the vast majority of students have research skills at a fair (57.5%) and good (35%) level, however, there is still a group of students who need to improve, for which it is essential to train them in the management of artificial intelligence strategies.

Table 2. Relationship of the dimension virtual tutors in artificial intelligence and research skills

Virtual tutors in artificial intelligence	Research skills							
	Deficient		Regular		Good		Total	
	n	%	n	%	n	%	n	%
Deficient	3	3.8%	1	1.3%	0	0%	4	5%
Regular	3	3.8%	37	46.3%	6	7.5%	46	57.5%
Efficient	0	0%	8	10%	22	27.5%	30	37.5%
Total	6	7.5%	46	57.5%	28	35%	80	100%

Note: Data collected through the application of the instruments.

The table shows that of the total number of students who participated in this study, 46.3% have a regular development in the dimension of virtual tutors in artificial intelligence and also in their research skills, while 27.5% of students have an efficient management in the dimension of virtual tutors in artificial intelligence with a good development of their research skills, 3.8% have a poor management in the dimension of virtual tutors in artificial intelligence and also in their research skills. It is shown that the vast majority of students have research skills at a fair (57.5%) and good (35%) level, however, there is still a group of students who need to improve, for which it is very important to train them in the management of virtual tutors in artificial intelligence.

Table 3. Relationship of the adaptive learning platforms dimension with artificial intelligence and research skills

Adaptive learning platforms	Research skills							
	Deficient		Regular		Good		Total	
	n	%	n	%	n	%	n	%
Deficient	4	5%	1	1.3%	0	0%	5	6.3%
Regular	2	2.5%	39	48.8%	5	6.3%	46	57.5%
Efficient	0	0%	6	7.5%	23	28.7%	29	36.3%
Total	6	7.5%	46	57.5%	28	35%	80	100%

Note: Data collected through the application of the instruments.

The table shows that of the total number of students who participated in this study, 48.8% have a regular development in the adaptive learning platforms dimension and also in their research skills, while 28.7% of students have an efficient management in the adaptive learning platforms dimension with a good development of their research skills, 5% have a poor management in the adaptive learning platforms dimension and also in their research skills. It has been found that the vast majority of students have research skills at a fair (57.5%) and good (35%) level, however, there is still a group of students who need to improve, for which it is very important to train them in the management of adaptive learning platforms of artificial intelligence.

Table 4. Relationship between the dimension of recommending educational content with artificial intelligence algorithms and research skills.

Recommendation of educational content with artificial intelligence algorithms	Research skills							
	Deficient		Regular		Good		Total	
	n	%	n	%	n	%	n	%
Deficient	5	6.3%	1	1.3%	0	0%	6	7.5%
Regular	1	1.3%	36	45%	1	1.3%	38	47.5%
Efficient	0	0%	9	11.3%	27	33.8%	36	45%
Total	6	7.5%	46	57.5%	28	35%	80	100%

Note: Data collected through the application of the instruments.

The table shows that of the total number of students who participated in this study, 45% have a regular development in the dimension of recommendation of educational content with artificial intelligence algorithms and also in their research skills, while 33.8% of students have an efficient management in the dimension of recommendation of educational content with artificial intelligence algorithms with a good development of their research skills, 6.3% have a poor management in the dimension of recommendation of educational content with artificial intelligence algorithms and also in their research skills.

It has been proven that the vast majority of students have research skills at a fair (57.5%) and good (35%) level, however, there is still a group of students who need to improve, for which it is very important to train them in the management of the dimension of recommendation of educational content with artificial intelligence algorithms.

Table 5. Relationship between the dimension of content creation with artificial intelligence and research skills

Content creation with artificial intelligence	Research skills							
	Deficient		Regular		Good		Total	
	n	%	n	%	n	%	N	%
Deficient	5	6.3%	1	1.3%	0	0%	6	7.5%
Regular	1	1.3%	41	51.2%	4	5%	46	57.5%
Efficient	0	0%	4	5%	24	30%	28	35%
Total	6	7.5%	46	57.5%	28	35%	80	100%

Note: Data collected through the application of the instruments.

The table shows that of the total number of students who participated in this study, 51.2% have a regular development in the dimension of content creation with artificial intelligence and also in their research skills, while 30% of students have an efficient management in the dimension of content creation with artificial intelligence with a good development of their research skills, 6.3% have a poor management in the dimension of content creation with artificial intelligence and also in their research skills.

It has been found that the vast majority of students have research skills at a fair (57.5%) and good (35%) level, however, there is still a group of students who need to improve, for which it is very important to train them in the management of the dimension of content creation with artificial intelligence.

Normality analysis

In the present study, the Kolmogorov-Smirnov test was applied, where significance levels of less than 0.05 were obtained, indicating that the data do not have a normal distribution. Therefore, the non-parametric Rho Spearman test was applied to determine the relationship between the variables.

Hypothesis testing

To perform the hypothesis test, statistical hypotheses (null hypothesis and alternative hypothesis) were proposed, then the significance level of 0.05 was chosen and the Rho Spearman test was applied.

General Hypothesis:

H₀: The use of artificial intelligence strategies does NOT have an impact on the development of research skills in teacher training students in a Pedagogical Institute in Ica in the year 2024.

H_a: The use of artificial intelligence strategies has a significant impact on the development of research skills in teacher training students in a Pedagogical Institute in Ica in the year 2024.

Table 6. Relationship between the management of AI strategies and research skills

		VY: Research skills	
Spearman's Rho	VX: Management of artificial intelligence strategies	Correlation coefficient	,849
		Coefficient of determination	R ² = 0.72
		Sig. (bilateral)	,000
		N	80

Note: Correlation results via SPSS.

The Rho Spearman value = 0.849 (high correlation), the coefficient of determination is equivalent to 72% and the significance obtained is 0.000, which is less than the critical region $\alpha = 0.05$; consequently, the null hypothesis is rejected and the alternative hypothesis is accepted. Therefore, the management of artificial intelligence strategies has a significant impact equivalent to 72% in the development of research skills in teacher training students in a Pedagogical Institute of Ica in the year 2024,

DISCUSSION

According to the results obtained, it is proven that there is a relationship between the management of artificial intelligence strategies and research skills in students of a pedagogical institute in Ica 2024. In this way, a correlation is obtained with a Spearman's rho coefficient of 0.849 and a coefficient of determination of 72%. These results coincide with those of Naupay (2023) in his thesis where it was obtained that research skills are very important at all educational levels, it is also observed that the early development of these skills strengthens research capacity.

In accordance with the results obtained, the null hypothesis is rejected, and the general research hypothesis is accepted, i.e., The use of artificial intelligence strategies has a significant impact on the development of research skills in teacher training students in a Pedagogical Institute of Ica in the year 2024.

As for the inferential results between the management of artificial intelligence strategies in the dimension of virtual tutors based on artificial intelligence and research skills, in students of a pedagogical institute in Ica 2024, a significant correlation was obtained, with 0.715, which means a coefficient of determination that indicates the degree of impact of one variable on the other of 51%; between the management of artificial intelligence strategies in the dimension of adaptive learning platforms with artificial intelligence and research skills in students of a pedagogical institute in Ica 2024, a Spearman rho coefficient of 0.812 was found, with a coefficient of determination of 66%; between the management of strategies in artificial intelligence in its dimension recommendation of educational content with artificial intelligence algorithms and research skills in students of Education of a pedagogical institute in Ica 2024, Spearman's Rho of 0.817 and a coefficient of determination of 67%; between the management of strategies in artificial intelligence in its dimension creation of educational content with artificial intelligence and research skills in education of a pedagogical institute in Ica 2024, with a coefficient of relationship of 0.711 and a coefficient of determination of 51%; these results coincide with those of Cueva, F. and Ortega, O. (2018) in their research on an educational software in the development of research skills and development of an educational software, where it is concluded that students should use educational software for the development of learning in a playful way, in addition students should be oriented in the use of educational software. This research shows that the use of technological resources called software or computer programmes favours the development of research skills such as the search for information and the theoretical basis of the study variables as well as data processing.

Thus, the null hypothesis is dismissed, and the general research hypothesis is accepted, i.e., there is a relationship between the management of strategies in artificial intelligence in its dimension virtual

tutors based on artificial intelligence and research skills in students of a Pedagogical Institute Ica 2024. In view of the above, the null hypothesis is rejected, and the general research hypothesis is accepted, i.e., there is a relationship between the management of artificial intelligence strategies in the dimension of adaptive learning platforms with artificial intelligence and research skills in students of a Pedagogical Institute Ica 2024.

The problem centred on the management of artificial intelligence strategies and research skills in students of a Pedagogical Institute in Ica in the year 2024 poses a series of challenges and relevant questions in the field of education. Some key aspects of the discussion of this problem are: **Need for Technological Integration:** The management of artificial intelligence strategies implies the integration of advanced technologies in the educational process. This challenge may be related to the technological infrastructure available at the Pedagogical Institute, as well as to the training of teachers to use these tools effectively.

Research Skills Development: The positive correlation between the use of artificial intelligence strategies and research skills highlights the importance of fostering learners' ability to conduct research effectively. The key question is how these strategies can be harnessed to enhance and develop these research skills optimally. **Inclusion of Virtual Tutors and Adaptive Learning Platforms:** The significant correlation between the use of artificial intelligence strategies and the use of virtual tutors and adaptive learning platforms highlights the need to explore how these specific tools impact on the development of research skills. It is crucial to understand how these technologies can personalise learning and hone learners' ability to conduct research autonomously. **Recommendation of Educational Content and Content Creation:** The positive connection between the management of artificial intelligence strategies and the recommendation of educational topics, as well as the design of content with artificial intelligence, suggests that these strategies can be instrumental in enriching the educational process. However, the discussion should focus on how these specific strategies can be optimised to cultivate investigative skills and promote more effective learning.

Challenges and Opportunities for Students: Acceptance of the general research hypothesis underlines that there is a positive relationship between the management of artificial intelligence strategies and research skills. However, it is important to address the challenges that students may face when incorporating these technologies into their learning process, as well as to identify opportunities to enhance their research skills. **Implications for curriculum design:** The discussion should extend to possible implications for curriculum design at the Pedagogical Institute: How can academic programmes be adjusted to effectively integrate the use of artificial intelligence strategies and strengthen students' research skills?

The problem of the management of artificial intelligence strategies and research skills in students of a Pedagogical Institute in Ica in the year 2024; in the light of the findings found in the fieldwork implies considering technological, pedagogical and curricular design aspects in order to make the most of the potential of these tools in the educational process. The results obtained in the research "Management of artificial intelligence strategies and research skills in students of a Pedagogical Institute Ica 2024" mean that there is a direct relationship between the knowledge and application of artificial intelligence strategies and the development of students' research skills. Those who mastered artificial intelligence strategies had more advanced research skills.

This connection between research skills and the mastery of artificial intelligence strategies can be explained by the need to develop fundamental skills such as critical thinking, problem solving and creativity, which are essential for research activity. The thesis posits that artificial intelligence strategy training can help students improve their research skills, as students who received this training showed significant progress compared to those who did not receive this training.

The results of this research suggest that the integration of artificial intelligence in education can significantly improve students' research skills. These implications are significant for the future of education:

The finding that artificial intelligence can help students develop their research skills is significant, as it suggests that this technology can be an effective tool for education. Artificial intelligence strategies require skills such as critical thinking, problem solving and creativity, all of which are essential for researchers.

The research found that training in artificial intelligence strategies can help students develop their research skills. Students who received this training showed greater progress than students who did not.

CONCLUSION

The inferential analysis shows that there is a relationship between the management of artificial intelligence strategies and research skills in students of a pedagogical institute in Ica 2024. The Rho Spearman correlation coefficient obtained is 0.849. The results obtained indicate that there is a relationship between the management of artificial intelligence strategies in the dimension of virtual tutors based on artificial intelligence and research skills in students of a pedagogical institute in Ica 2024. The Rho Spearman correlation coefficient found is 0.715. There is a relationship between the management of artificial intelligence strategies in the dimension of adaptive learning platforms with artificial intelligence and research skills in students of a pedagogical institute in Ica 2024. The Rho Spearman correlation obtained is 0.812. The results obtained demonstrate the existence of a relationship between the management of strategies in artificial intelligence in its dimension recommendation of educational content with artificial intelligence algorithms and research skills in students of education of a pedagogical institute in Ica 2024. This is proven by the Rho Spearman correlation coefficient of 0.817. There is a relationship between the management of strategies in artificial intelligence in its dimension creation of educational content with artificial intelligence and research skills in education of a pedagogical institute in Ica 2024. The correlation coefficient obtained is 0.711. In all cases the calculation of the coefficient of determination is greater than 50%, which indicates the significant and positive influence of artificial intelligence strategies in the development of research skills.

Recommendations

It is suggested that the authorities in charge of education at the Social Development Department of the Regional Government of Ica implement training programmes in artificial intelligence (AI) for teachers at the region's educational institutes. In addition, it is advisable to provide guidelines on the incorporation of AI-related topics in the teacher training curriculum and to advocate for the allocation of financial resources to acquire AI-related equipment and technology in educational institutions. As far as the Regional Education Directorate of Ica is concerned, specialists should encourage the formation of an inter-institutional collaboration group with the aim of promoting AI research in education. Likewise, it is suggested that seminars, workshops and conferences on IA be organised for both teachers and students, as well as the creation of a scholarship or incentive programme for students interested in researching and developing projects related to IA. The Local Education Management Unit of Ica is urged to implement pilot projects in schools in the region to integrate AI into the teaching-learning process. It is recommended to seek collaboration with local companies and organisations to facilitate access to AI-related resources and technology, as well as to promote the formation of AI-focused research groups in local educational institutions. To the directors of the Public Higher Education Institutes of the Ica Region, the integration of courses and subjects related to AI in the curricula of the pedagogical careers is promoted. It also encourages collaboration between the institutes to share good practices and resources on the use of AI in education, and to establish a continuous training programme for teaching staff in the use of AI tools

and strategies. It is suggested that teachers and trainers of the Public Higher Education Institutes in the Ica Region be encouraged to constantly update their knowledge on AI-related topics and educational research. The integration of AI tools in the pedagogical practices and research of teachers is also encouraged, as well as the promotion of collaboration between teachers and students for the development of AI research projects in the educational context.

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