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Development of research competencies through artificial intelligence. An innovative approach

Desarrollo de competencias investigativas a través de la inteligencia artificial. Un enfoque innovador

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Abstract

The article presents the topic on the Development of research competencies through artificial intelligence. An innovative approach. It responds to the constructivist paradigm that focuses on active learning based on the context of experiences and cognetivism, proposes knowledge networks with technology management for the construction of learning. Ideas are described to help solve the current problem, since teachers and students do not have sufficient knowledge of Artificial Intelligence (AI) and its relationship with research competencies. The objective is to propose the optimization of the educational process with the incorporation of AI and the development of research skills in students. It is based on updated contents on the two main topics, with emphasis on their ethical dimension. The analytical-synthetic method was used; documentary analysis and bibliographic review with specialized scientific information that supports the work and projects its results to other possible studies. It is concluded that there is a need to incorporate AI progressively in educational institutions, in which the necessary virtual support should be installed so that research competences are applied in the learning process and can be efficiently managed by teachers and gradually by students. It is an indispensable requirement to achieve a qualitative improvement in the educational processes in order to leave aside verbalism and give way to the formation of cooperative groups in which students raise their concerns, seek alternative solutions and find their own answers.

Keywords

Learning, research skills, innovative approach, ethics, artificial intelligence.

Resumen

El artículo presenta el tema sobre el Desarrollo de competencias investigativas a través de la inteligencia artificial. Un enfoque innovador. Responde al paradigma constructivista que enfoca el aprendizaje activo fundamentado en el contexto de experiencias y el cognitivismo, plantea redes de conocimiento con manejo de tecnología para la construcción del aprendizaje. Se describen ideas que ayuden a resolver el problema actual, pues, los docentes y estudiantes no tienen el suficiente conocimiento de la Inteligencia Artificial (IA) y su relación con las competencias investigativas. El objetivo es proponer la optimización del proceso educativo con la incorporación de la IA y el desarrollo de competencias investigativas en los estudiantes. Se sustenta en contenidos actualizados sobre los dos temas principales, con énfasis en su dimensión ética. Se empleó el método analítico-sintético; el análisis documental y la revisión bibliográfica con información científica especializada que respalda el trabajo y proyecta sus resultados a otros posibles estudios. Se concluye que existe la necesidad de incorporar la IA de manera progresiva en las instituciones educativas, en las cuales se deberá instalar el soporte virtual necesario para que se apliquen las competencias investigativas en el proceso de aprendizaje y lo puedan manejar eficientemente los docentes y paulatinamente los estudiantes. Es un requisito indispensable para lograr un mejoramiento cualitativo en los procesos educativos con la finalidad de dejar a un lado el verbalismo y dar paso a la conformación de grupos cooperativos en los cuales los alumnos planteen sus inquietudes, busquen alternativas de solución y encuentren sus propias respuestas.

Palabras clave

Aprendizaje, competencias investigativas, enfoque innovador, ética, inteligencia artificial.

1. Introduction

This article discusses the issue of developing research competencies through Artificial Intelligence (AI). An innovative approach. In recent years, AI has made inroads in various fields, the problem is that education cannot remain on the sidelines of this benefit, both students and teachers must take on this innovative challenge to achieve new styles of learning and teaching.

The present study aims to propose the optimization of the educational process with the incorporation of AI and the development of research skills in students. Students will construct their own learning through the use of collaborative work, a strategy that gradually develops in them self-management skills and competencies. AI is the justification for carrying out this program. González states that AI itself is capable of providing feedback and acquiring new capabilities such as predicting behaviors and interests. This is achieved through "a computer program, based on artificial neural networks that seek to mimic the capabilities of human beings" (González, 2020, p. 6).

The process facilitates the application of didactic strategies so that teachers can plan in a more dynamic way, and become guides for students who must incorporate research skills through the management of new and interesting alternatives to problem situations. This way of acting prepares them so that in their future life they will be ready to find alternative solutions based not only on knowledge, but also on practical experiences developed in interrelated work. It can be affirmed that the article responds to the relevance of the study from some points of view: it facilitates the change of attitudes of teachers and students, it allows the incorporation of strategies, it opens spaces to incorporate computational tools, it looks at the development of a university career with new perspectives, the future graduates have at their disposal tools that will allow them to initiate and permanently improve their professional actions.

The article is structured as follows: section 1. Introduction, synthesizes the aspects contained in the article; section 2. Literature review, explains the theoretical and methodological elements of AI and the competency-based approach in education; section 3. Methods and Materials, focuses on the methodological processes and instruments used; section 4. Results, describes the authors' proposals; section 5.

2. Literature review

2.1 Artificial Intelligence

AI represents a breakthrough in the technological revolution, linking human dexterity with the power of machines to solve complex problems. It applies innovative solutions that transform the way technology and the surrounding world interact. Rouhiainen (2018) defines AI as "the ability of machines to use algorithms, learn from data, and use what they learn in decision making as a human would" (p. 17). Additionally, Morandín-Ahuerma (2023) explains that "artificial intelligence is based on the use of algorithms and machine learning technologies to give machines the ability to apply certain cognitive skills and perform tasks on their own autonomously or semi-autonomously" (p. 96). AI devices, unlike humans, do not need to rest and can analyze extensive information at once. In its constant evolution, it opens new frontiers in the understanding and application of intelligence, overcomes traditional limitations and rethinks the landscape of what is possible.

In the last decades worldwide, the application of AI in the development of learning processes in educational systems has been growing. This reality is also observed in Ecuador,

where the aspiration to generalize its practice in school classrooms is still scarce as explained by research conducted by (Ashford-Rowe, et al., 2019; Frontier Economics, 2018; Ganascia, 2018; Luckin et al., 2016; OECD, 2018). The use of AI in education becomes a challenge for teachers and students who must acquire competencies at two levels: technical with specific tools in digital development, and methodological with innovative strategies for the didactic process. The application of AI at all levels of the education system will have the potential to revolutionize pedagogical practices. "In this context, renewed hopes are placed on what new AI technologies can bring to reduce access barriers, automate management, and optimize teaching and learning processes" (Jara and Ochoa, 2020, p. 3). In this sense, the implementation of AI requires specialized planning, monitoring, and ongoing evaluation to ensure that the objectives of each level of study are met. To ensure educational policies, programs and practices, it is essential that AI be applied and have a positive impact on the learning and development of students with investigative competencies, oriented to build scientific and technological thinking.

2.2 Artificial intelligence in education

The incorporation of AI in education is intended to promote the improvement of the quality of educational institutions with the improvement of learning outcomes through technologies and techniques planned by specialists in the organization of the curriculum of the educational system. As expressed by Arana (2021) in education, "artificial intelligence seeks that computers, machines and other artifacts emulate human intelligence, thus developing learning and adaptability skills that allow them to make autonomous decisions" (p. 1). This purpose is beginning to be felt as a need to be incorporated progressively by teachers, who are being demanded because some students are beginning to apply it for their school work only as a copy and paste.

The application of AI in classrooms requires teachers and students to develop, in advance, a set of basic skills on machine learning algorithms, evaluation and questioning of query results, identification of biases and limitations, programming to customize research results, selecting and classifying data according to topics, management of platforms related to learning content, always in a responsible and ethical manner (Espinoza et al., 2023; Holmes et al., 2021).

The assessment of learning outcomes among teachers and students will increase its application in other educational institutions that wish to keep up with the latest trends and technological advances with AI management (Cruz et al., 2023; Pastora and Fuentes, 2021; Vivar and Peñalo, 2023). Its possibilities will increase with practice. As Sandoval (2018) puts it, "it is intuited that the complex relationship between learning, the digital revolution and artificial intelligence will demand educators to be able to respond to the needs, interests and emerging skills presented by the student body" (p. 157). It is also mentioned that the university as responsible for linking the learning acquired at school with the requirements of the working world should integrate the subject of AI in its curricula (Moreno-Gutiérrez et al., 2022). It is the task of teachers to learn about AI so that it becomes a tool to support the improvement of the quality of education.

2.3 Optimization of learning with artificial intelligence

Based on "today, Artificial Intelligence (AI) is a reality that surpasses fiction in many aspects, because it is present in one way or another in all areas of modern social life" (Arbeláez and Rojas, 2021, p. 504). Its application as a technical tool that optimizes learning requires specialized planning and specific training of each pedagogical process for teachers and students to apply this academic advance successfully. Its implementation will allow policies,

programs, projects and educational practices to influence the learning and development of students with research competencies aimed at building scientific and technological thinking. The institutions that apply it socialize strategies with better learning results because "today it is difficult to imagine an educational environment, from the most initial ones, in which there is not some participation or interaction with a computer device that handles or processes digital information" (Arana, 2021, p. 15).
These include: personalization of learning, personalized virtual assistants, virtual tutoring, data analytics, simulations and virtual labs, online collaboration, knowledge gap detection, adaptive gamification, formative assessment (Del Puerto and Esteban, 2022; Martínez-Comezaña et al., 2023).
The progress of AI, considered as a scientific discipline, is in a diffusion stage. This situation predicts that, in education, its influence will be greater due to the socialization among teachers who have applied it, who, among others, suggest the following platforms as supports that can be useful and optimize their educational practices, according to each level of studies and for an inclusive education.

General Basic Education: DreamBox interactive math lessons, Knewton real-time content and assessments based on student performance, IXL Learning practice activities in math, reading, writing, science and other subjects, Prodigy educational math game, Edmentum, SMART Learning Suite Online, ALEKS, DreamBox Learning, Quizbot, Skills Strand activities in different areas, Fishtree, Mindspark intelligent tutor focused on reading and math (García-Cosio, 2021; Rivas, 2018). These tools are used by teachers according to the progress of curricular content as follow-up actions related to the progress of each student. They can be socialized to parents to work at home as support for their children.

General Unified Baccalaureate: Code.org with programming, AI4K12 for machine learning, Google AI Experiments with hands-on interactive projects, IBM Watson Education, for project-based learning creates simple chatbots or programs that make decisions based on data, digital competencies to search for information, evaluate sources and maintain privacy and online collaboration among students with secure platforms, visits to AI technology companies. These are platforms with valuable educational experience for students (Abeliuk, 2023; Coicaud, 2019; Lavanda-Jaramillo et al., 2019). Thus "Artificial Intelligence promises the improvement of education on a large scale, with the main feature of personalization according to the needs of each student" (Macias-Moles, 2021, p. 15).

Higher Education: Khan Academy adapts mathematics content and other subjects to the individual needs of students, Coursera offers online courses, Edmodo teaches social learning modalities, DreamBox with mathematical processes for primary and helps pre-professional practices, Adaptive Learning Systems has personalized adaptive learning systems, IBM Watson Education personalizes content and assessments, Blackboard Learn suggests content and activities, Google Classroom and Google Workspace for Education, personalize E-A, Symbaloo creates personalized resource dashboards (Salmerón, et al., 2023; Ocaña-Fernández et al., 2019; Quiroz, 2023). These platforms help both students and teachers in their interrelationship processes because "AI is impacting human relationships, through communication and ways of interacting" (Sanabria-Navarro et al., 2023, p. 105).

Inclusive education. At all levels of the education system, IA supports teachers with a set of strategies for educational inclusion, to achieve personalized learning and ensure that students with special educational needs work with the whole group without discrimination and with self-esteem. "In a society that tends towards diversity it is essential to introduce inclusion as an educational model. It is based on understanding to forge an interaction with

difference understanding it as an opportunity for enrichment in a shared space" (Santalla, 2017, p. 13).

In inclusive education, educators use AI as a tool to incorporate the whole group into the work. It helps teachers to customize content and strategies according to the individual learning pace of each student, especially those with special educational needs. AI leads to increased student engagement with improved learning outcomes. The integration of cognitive, affective and social characteristics contributes progressively to improve academic performance (Fernandez, 2023; Jara and Ochoa, 2020; UNESCO, 2019).

In inclusive education, platforms offer interactive activities and exercises that are adapted according to the level of knowledge of each student because "to educate in respect for difference is to seek meeting points where diversity can collectively create" (Ponce and Riveros, 2021, p. 354). The pedagogical strategies that teachers can implement to take advantage of them as learning tools, among others are, personalized tutorials. Simulations and virtual laboratories on science or historical recreations. Individual assessment of each student to identify learning strengths and weaknesses, in real time. Intelligent educational games that reinforce the concepts of the different subjects. Automated grading of essays, quizzes and homework assignments. Virtual classroom assistance that answers student questions. Computer vision management to analyze errors, give automated feedback with video tutorials, exercises and practice tests. Encouragement of discussion and writing to generate creative texts. Exploration of complex concepts to explain abstract topics (Tarrillo-Flores, 2022, p. 24-33).

To conclude, AI influences the transformation of education, offering opportunities to improve the quality and accessibility of learning. These systems can personalize educational approaches, adapting them to the individual needs of students. AI achieves more effective and efficient learning because it analyzes the performance and progress of each student with personalized feedback and content tailored to learning skills and preferences.

2.4 Ethics and artificial intelligence in education

The application of AI as a work tool facilitates the interrelation between students and teachers with various platforms, and constitutes a support for the pedagogical processes of different learning subjects; however, it is important to be cautious about its use, as explained by Flores-Vivar and García-Peñalvo (2023).:

> Information and communication technologies, represented through networks and social media, knowledge-based systems, interactive multimedia, big data and artificial intelligence, are an intrinsic part of the social fabric, (...) of the disciplines of knowledge, playing an increasingly important role that will even increase in the future. Its presence is omnipresent in education, so the development, evolution and expansion of these technologies in the educational context, (...) requires in-depth and comprehensive studies that show the advantages and disadvantages of their use (p. 1).

The use of AI in education is inevitable because of its ability to support academic advancement. It is imperative that teachers and students value its application from ethical and moral perspectives. It is essential to prevent students from mechanically copying content without reflection just to accomplish a task. This attitude will result in superficial learning without acquisition of new knowledge and will cause students to pass from one year to another without skill development, which not only contributes to educational

inequality, but also threatens equity in access to education (Piedra et al., 2023; Llovera-López et al., 2023; Naupay-Gusukuma, 2023; Rivas, 2018; Del Campo et al., 2023).

Given this reality, teachers are encouraged to prioritize strategies that foster critical thinking and reflection in students when using AI as an educational tool. According to García et al. also highlights the importance of incorporating ethical values in the educational process, ensuring that "students not only acquire knowledge, but also develop an ethical sense that guides their behavior in a world increasingly driven by technology" (García et al., 2023).

3. Research Competencies

When starting a university career and at all levels of initial, basic general education and high school, the mastery of research skills is required, it cannot be expected that the teacher transmits everything, the student must take on the challenge of initiating the skills, then convert them into competencies in the research field. This step ensures a new vision in their training, turns them into a subject that is always looking for information to find the reasons for different problems and at the same time predisposes them to seek scientific information to support their initial assessments, incorporate knowledge, techniques and improve learning outcomes.

There are several research competencies that students should incorporate for an efficient development of their critical thinking. It can be said that the main competencies are, search and selection of scientific information according to the problems they are developing. Use of technological tools that facilitate the systematization of issues of interest for their research processes. Knowledge of the scientific method to adapt their processes to this methodology. Application of techniques for the collection of information. Elaboration of research results. Formulation of pertinent and relevant conclusions. Teamwork to better ensure research results (Chávez-Vera et al., 2022, p. 253).

3.1 Research competencies related to artificial intelligence

The aforementioned competencies and others that will emerge in the development of student training should be supported with the use of AI, which in short is the use of information produced by man and that is uploaded to the "cloud", which when he needs can enter the stored information and ask questions about issues of interest, with the confidence that the answers will be accurate. Hence, this article insists that the use of AI in education is a challenge for both key actors, teachers and students, who have to acquire competencies related to digital development and innovative strategies for the didactic process. In this context, the learning of research competencies is urgent and necessary because it satisfies the two mentioned requirements.

Cruz (2021) states that research competencies constitute "an integral action that allows identifying, interpreting, arguing, and solving problems of the context with suitability and ethics, integrating knowing how to be, knowing how to do, and knowing how to know" (p. 40). It refers to the fundamentals that a researcher should handle and that he/she should do so in an ethical environment. Research competencies will be developed from different approaches: conceptual, accompanying and delimiting, and socio-formative. In the conceptual approach, it refers to a process that facilitates the solution of problems of reality, for which teachers and students must articulate collaborative work to a life project with

ethical values. In the accompaniment approach, emphasis should be placed on the formation of innovative responses to specific problem situations in the context in which they develop. In the delimitation approach, they are prepared to respond in the future to a job position. "Competencies are integral performances that have the purpose of forming people capable of facing diverse challenges of their context with creativity, good disposition, attitude of continuous improvement and ethics" (Cruz-Herrera, 2021, p.47). Thus, students "have to use different information and communication technologies through networks and social media. They must avoid using ambiguous, vague or misleading language, and develop communication skills based on intellectual honesty" (Naupay-Gusukuma, 2023, p. 17). It can be inferred that the obligation of students is to face real situations, before which they must bring out the competences acquired in the learning process, which in the particular case of research competences are still insufficient.

With reference to higher education Ceballos-Almerayaya expresses that,

> the future teacher as a researcher in training must develop research competencies that allow him/her to act in new situations, have the ability to identify, pose and solve problems, under a commitment with his/her sociocultural environment, increase skills to work in international contexts, search, process and analyze information (Ceballos-Almerayaya, 2021, p. 183).).

3.2 Evaluation of research competencies in research projects

Consequently, it is necessary to evaluate, among other aspects, the facility to determine empirical problems and their influence on future research projects, their causes and possible consequences, the questions that should serve as the basis for the development of the research, the formulation of general and specific objectives that give rise to the precision of methodological strategies, the design of instruments applicable to a sample of the population, precision in the results and in the discussion.

Pacora et al. (2021) state that in order to evaluate research competencies, it is necessary to,

> resort to the use of rubrics because competencies constitute the set of comprehensive actions that allow for solutions to real-world problems in a holistic manner, which impacts the adoption of multidisciplinary work and peer collaboration (p. 64).

Rubric-based assessment facilitates the establishment of criteria regarding the mastery of research competencies at upper, high, medium, or lower levels. Limits that can be determined more easily if the person shares their work with a group of peers. Moreover, it allows for reflection and the implementation of strategies to advance within the mentioned limits. Casillas et al. (2022) express:

> that digital competencies in the area of communication and collaboration are not dependent on the student's academic level or gender, but rather on the family's economic and cultural level, which facilitate or hinder access to digital devices for acquiring knowledge (p. 16).

In conclusion, the evaluation of competencies related to collaboration and communication requires that there are better opportunities and resources at home to engage with digital

devices, gradually giving them the chance to incorporate these competencies into their personal repertoire. They will always be attentive to listening to other opinions and comparing them with their own, analyzing their content to assimilate them or continue in a deeper search. Acquiring new knowledge based on what others say is an intelligent way to grow intellectually and not just assimilate elaborated knowledge; they do not accept being simple receivers, they like to be more participative and creative. "It is not just about delivering information, but rather ensuring that students, through virtual learning environments, prepare for their professional future and take a leading role in the development of research projects" (Ramírez-Ramírez and Fernández de Castro, 2020, p. 10).

3.3 Research competencies in the educational curriculum

Traditionally, the different processes for developing research have been placed in the educational curriculum as isolated parts for students to mechanize the process, without presenting them with a problem situation, so that they can think of possible alternative solutions. Only in this way will they develop the necessary competencies to discover the causes of the problem, the implications of proposing alternative solutions, seek the state of the art, and develop a theoretical framework that supports their proposals, determine the problem, formulate the research objectives, accompany them with one or more hypotheses, if the case warrants, that allows them to advance, design the instruments and conduct field research, elaborate the results and conclusions, and formulate a proposal. In this regard, Carmona et al. (2021) state that, "a chair should be created that allows linking theory with practice so that students can get involved proactively." At the same time, teachers must become interpreters of the curriculum design and not just transmitters. (p. 820). It reaffirms the need to change the roles of teachers and students.

4. Methods and materials

The investigative approach of this article is qualitative. Paiz-Recinos et al. (2020) state that "in projective instruments, qualitative research focuses on describing the thoughts and feelings of a group or individual being evaluated." (p. 153). In addition to what these authors have expressed, it can be stated that scientific research of a projective type with a bibliographic design is a research approach based on the review and critical analysis of existing scientific literature to project or predict trends, future developments, or possible scenarios in a specific field of study.

The analytical-synthetic method was employed to process and evaluate various viewpoints on the proposed study. Various bibliographic sources were explored and different theories were evaluated. In this regard, Deroncele et al. (2021) state that "epistemic attitude is related to the critique of bibliographic sources and scientific literature in the analysis of the research object." (p. 174). The study of various bibliographic sources provides scientific support to the ongoing matter and is carried out through the collection and synthesis of information from relevant academic bibliographic sources, allowing the projection of its results to other possible studies. The bibliographic and documentary review of specialized scientific literature allowed for a heuristic balance, thus resorting to an exhaustive review of information found in books, journals, scientific articles, and interviews conducted by various authors. The bibliographic review allows for an initial and general understanding of a little-studied topic, laying the groundwork for more detailed and specific research in the future. Gough et al. (2012) state that their review incorporates three fundamental activities:

> 1_Identification and search for articles with the review of literature and previous research to highlight the key competencies to be developed, and design teaching and learning strategies for all levels of the educational system, based on the use of AI. 2_ Evaluation of the quality of evidence to accept, improve, or reject the authors' submissions, through the selection of the most suitable tools for the development of research competencies with the support of AI. 3_ Synthesis of the articles with the analysis of the results to identify patterns, trends, practice proposals, and conclusions that contribute to scientific knowledge in the field of development of the topic proposed in the article (p. 14).

5. Results

The results of the literature review and conducted research support the proposal of the researchers who advocate for the need to incorporate AI supported by research competencies into the Ecuadorian educational system. It is anticipated that its application will produce, among other things, the following changes in all curricular elements and in their implementation by the human talent of educational institutions.

5.1 In aspects related to the curriculum

The improvement of the quality of education through the application of AI requires the technological training of all actors in the educational system because its practice will impact educational curricula, which will be adapted to the context with the participation of the entire educational community in new teaching and learning models. The following are presented in two matrices the most relevant aspects of the results concerning the curriculum (table 1) and human talent (table 2).

Fluent communication in a foreign language	***Chabot* management**	**Educational problem solving skills**	**Increased cognitive skills**
Use of virtual resources in which the mastery of basic foreign language skills, especially English, is required.	*Chabots* are software based on Artificial Intelligence, capable of maintaining a real-time conversation by text or voice. A great opportunity to see the importance of AI.	In the different subjects of the educational curriculum, the teacher can organize collaborative work groups for the students themselves to solve and find creative answers, with the help of artificial intelligence.	With the help of artificial intelligence and the guidance of a participatory and purposeful work of students, they can find the opportunity to develop cognitive skills that favor the development of essential competencies: critical thinking, cooperation and adaptability.

Cuadro 1. Resultados curriculares

Learning, mastering and fluent communication of a foreign language. In language teaching-learning processes, intelligent tutoring systems offer tools with instant and

permanent feedback. The didactic interaction process will facilitate the execution of communicative actions according to the learning contents with the use of virtual assistants. Thus, in virtual learning training with the use of chatbots, AI provides personalized tutoring and access to learning resources at any time, in addition to providing a more interactive and accessible learning experience. These systems have shown to be effective in improving students' motivation and commitment to accomplish tasks in individual and collaborative group work. In improving educational problem-solving skills, AI tools are available in all subjects in different years of study and allow the analysis of large amounts of educational data to identify patterns and provide solutions to complex problems. Students in working groups through simulation and scenario modeling learn to make educational decisions in the face of study problems and explain with researched data each topic. In the increase of cognitive skills with the development of research competencies, the application of AI will contribute to link knowledge with research skills. These competencies will enable students to receive, process and elaborate information autonomously with the presentation of challenging tasks and the provision of instant feedback. AI facilitates the fulfillment of holistic learning that encompasses not only knowledge acquisition, but also essential competencies such as critical thinking, cooperation and adaptability. Studies show that AI technologies can support autonomous learning and the development of metacognition in students.

5.2 Aspects related to human talent

Its incorporation with the participation of trained teachers would prepare students from the beginning of their education with skills that respond with knowledge, tools and strategies appropriate to the digital transformation linked to the technological revolution that support the scientific development of students. Its incorporation would allow the improvement of some aspects related to:

Research and critical thinking	**Optimization of digital competencies**	**Inclusion of students with SEN**	**Development of interdisciplinary projects**
Development of complex investigations with the analysis of data corresponding to varied experiences and students apply skills of comprehension, interpretation, analysis, synthesis, conclusion and evaluation of their learning.	Gradual acquisition of digital tools and devices that allow students to find information, analyze their results, elaborate new proposals and find their own learning, strengthening their successes and discarding their mistakes.	With the support of artificial intelligence, teachers can incorporate their students with special educational needs to fulfill their learning with special strategies so that they do not feel rejected.	Ejecución de proyectos en los que se pueda evidenciar: colaboración interdisciplinaria, integración tecnológica e innovación, que incluyan manejo de hardware, software y redes de comunicación eficientes.

Table 2. Human talent

The following is a more detailed explanation of the aspects listed in the matrix, with the clarification that they are all supported by AI:

Personalization of learning. The teacher can modify traditional teaching schemes with content planning, teaching-learning methods, evaluation processes with AI tools. Learning

would be personalized by adapting it to the individual needs of urban and rural students with results that would improve their performance and personal satisfaction. Teachers would provide guidance so that different students learn to identify and address their strengths and weaknesses in a more inclusive and effective way. It is worth noting its valuable support for teachers who simultaneously serve several grades, single- and multi-grade schools. **Fostering research and critical thinking**. AI tools can facilitate complex research with the analysis of large volumes of data that respond to a variety of experiences. The development of critical thinking and research skills could be objectified when teachers observe that their students learn to access databases and advanced analytical tools, apply skills of comprehension, interpretation, analysis, synthesis, conclusion and evaluation of their learning**. Improvement of digital competencies**. The integration of AI in education will prepare students for the application of devices, handling of computers, tablets, internet browsing, searching for information on the web, interpretation and analysis of data, graphics and statistics, management of tools to collect, clean and visualize data. These tools prepare you for a future career with the management of advanced technologies to meet the challenges of the 21st century.

In addition, the inclusion and accessibility of students with special educational needs with the support of AI, teachers will be able to design understandable and personalized learning tools for students with special needs that will allow them to automate learning. This inclusion process would facilitate their incorporation into regular classrooms through group work with collaborative learning strategies and would also prevent them from feeling left out of the group and, sometimes, from being bullied. **In the development of interdisciplinary projects with AI tools with the management of AI**, interdisciplinary collaboration, technological integration and innovation projects would be carried out to develop comprehensive and effective solutions that include the management of hardware, software and efficient communication networks. These projects would not only allow students to interact with advanced technologies, but would also help them develop critical skills that would impact educational curricula with community decision making.

With reference to the development of interdisciplinary projects, the Organization of Ibero-American States for Education, Science and Culture (OEI), in collaboration with the ProFuturo Foundation, presents the following graph on the present and future relevance of AI in terms of educational level (ProFuturo and OEI, 2023). Figure 1. shows the present and future relevance of AI at the initial, primary, secondary and university levels. It can be seen that, depending on the level, the students' skills management advances.

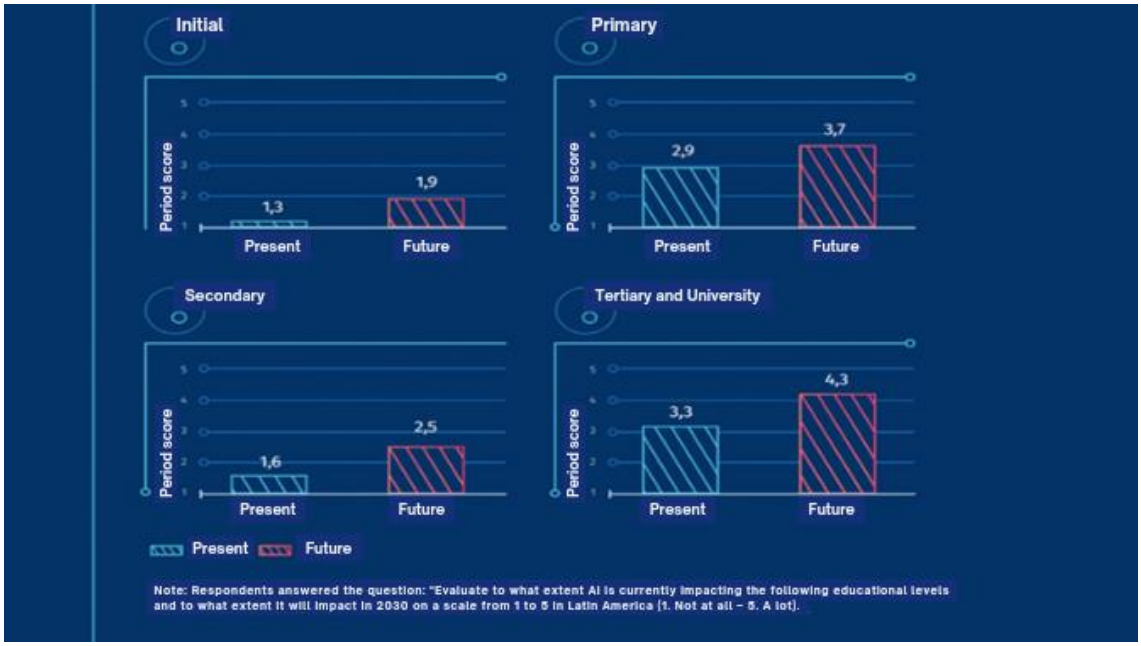

Figure 1. Present and future relevance of AI. Source: (ProFuturo and OEI 2023)

It is anticipated that the integration of AI into the curriculum and training of human talent can raise the quality of education by personalizing learning and providing adaptive resources that fit the needs of each student by increasing knowledge retention and academic performance.

6. Discussion and conclusions

The bibliographic and research study proves the possibility of including AI in the educational system at all levels and modalities, an opinion with which the researchers of the article agree, since this strategy could redefine the role of the teacher and prepare him/her to carry out an inclusive and equitable education with capacities to:

> predict student performance; create personalized lesson plans and assessments tailored to their strengths and weaknesses; motivate lifelong learning around the clock, through chatbot or virtual tutors, machine learning, and other personal assistance tools; develop research skills and prepare for the future professional to enter the workforce (Abreu et al., 2021; Auqui, 2021; Iglesias-Gorrón, 2018; Rochín and Anguiano, 2021; Zhang et al., 2019).

As a complement to the incorporation of AI in the educational system, it is necessary to develop research skills as the best resource to build new knowledge by students, with a new role of the teacher and themselves, so that through collaborative work they can locate the problem situation, seek the background and causes for its occurrence, venture into other research that face the problem, raise clear and precise ideas to find alternative solutions and if possible formulate an innovative proposal. The possible application of the article of research competences through artificial intelligence as an innovative approach, as in the analyzed research.,

> it is necessary to consider in the educational system of all countries that the ethical and social challenges associated with its implementation address the digital divide, inequality of access to technology the need for an appropriate balance between automation and human interaction, because education is integral, it simultaneously develops simultaneously the formation of cognitive, procedural, social and emotional skills of students in their learning process (Aparicio-Gómez and Aparicio-Gómez, 2023; Hernández-Zuluaga, 2022; Rodríguez, 2022; Terrones-Rodríguez, 2018).

In conclusion, the promotion of research competencies not only makes possible, but also favors the effective integration of artificial intelligence in the educational environment.

> It is a true educational revolution that will transform teaching and learning processes with intelligent educational resources that drive not only quality improvement but also accessibility to knowledge on a permanent basis. AI is a potential innovator with a variety of tools that empower students, stimulate their creativity and cultivate critical thinking. Fundamental elements for a transformative and progressive education (Bernal-Segura, 2020; Carmona, Camacho et al., 2021; Rochín and Anguiano, 2021; Rochín and Anguiano, 2021).

The research recognizes the need for teachers and students to continuously prepare themselves not only to use this technology but also to develop optimal alternatives to ensure educational quality and the preservation of human heritage through AI tools that consider the challenges and ethical considerations to minimize risks in their educational practice. It is the responsibility of the members of the educational community to create an ethical, inclusive and effective educational context for all students "research recognizes the need for teachers and students with the preservation of human heritage" (Jara and Ochoa, 2020; Martínez-Comezaña et al., 2023; Terrones-Rodríguez, 2018; UNESCO, 2021).

In sum, it can be affirmed that what was established in the general objective of the research work was fulfilled.

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Statement of Authorship-CRediT

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CELIA AMORES-PACHECO: Conceptualization, application of instruments, drafting of conclusions and recommendations.

MARIELA NÚÑEZ-SANTIANA: Application of instruments, tabulation of results, drafting of conclusions and recommendations.