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Incorporation of artificial intelligence into Cuban education: advantages and limitations

Incorporación de la inteligencia artificial a la educación cubana. Ventajas y limitaciones

Ernesto Sardiñas Padilla[1], Keylan Valdés García[2]

ABSTRACT

La Artificial intelligence (AI) represents a set of tools and models that have recently experienced exponential development. Due to its diverse features, it has received a significant boost and has begun to be introduced in a growing number of areas with a wide range of uses. In developed countries, implementing new technologies related to AI in the educational sector has an obvious advantage regarding the path taken. This research analyzed the possibilities of implementing AI in the teaching-learning process from an early age in Cuba. Based on a bibliographic review of the most relevant background information and the triangulation of statistical data provided by state entities, the information was collected and processed, making it possible to provide examples and guidelines for inserting AI in the studied context. Finally, the conclusion was reached that, under the relevant ethical standards, the use of new technologies in teaching would constitute a very useful tool and allow for raising the level of performance of both students and teachers.

Keywords: artificial intelligence, computer science, educational technology, information technology.

JEL Classification: I0, I21, I28

RESUMEN

La inteligencia artificial (IA) representa un conjunto de herramientas y modelos que en los últimos tiempos han experimentado un desarrollo exponencial. Debido a sus diversas prestaciones, ha recibido un importante impulso y se ha comenzado a introducir en un número creciente de áreas con una amplia gama de usos. En países desarrollados, la implementación de las nuevas tecnologías referentes a las IA en el sector educativo lleva una ventaja evidente en cuanto al camino recorrido. El objetivo de la presente investigación fue analizar las posibilidades de implementación de la IA en el proceso de enseñanza-aprendizaje desde edades tempranas en Cuba. A partir de una revisión bibliográfica de los antecedentes más relevantes y la triangulación de datos estadísticos proveídos por entidades estatales, se recopiló y procesó la información, lo que permitió aportar ejemplos y lineamientos para la inserción de la IA en el contexto estudiado. Por último, se arribó a la conclusión de que, bajo las normas éticas pertinentes, el empleo de las nuevas tecnologías en la enseñanza constituye una herramienta de gran utilidad, además de elevar el nivel de desempeño, tanto de los alumnos como de los docentes.

Palabras clave: informática, inteligencia artificial, tecnología de la información, tecnología educacional.

Clasificación JEL: I0, I21, I28

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[1]Universidad de La Habana. La Habana, Cuba.

[2]Universidad de Ciencias Informática. La Habana, Cuba.

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INTRODUCTION

The concept of artificial intelligence (AI) is not new (Bertram et al., 2021; Kaul et al., 2020; Li et al., 2021; Rensfeldt & Rahm, 2023). Alan Turing had already begun working on this concept in 1936 under the assumption that a machine capable of holding a dialogue with a human being, without the latter being able to determine whether the person it was conversing with was a human or a "robot" would be considered intelligent (Grundner & Neuhofer, 2021; Grzybowski et al., 2024; Hoffmann, 2022). The incompleteness of this concept would later be enriched by the contributions of Searle, who

would question the ideas postulated by Turing and create the "Chinese room" thought experiment based on the idea that AI would permeate society but never be free from suspicious glances (Leach, 2022; Ribeiro, 2021).

As with the concept of AI itself, its implementation in education is not new, although it has experienced considerable growth (Chen et al., 2020; Guan et al., 2020). In Begoña Gross's 1992 article, "AI and its Application in Teaching," she explores the influence of AI on educational software (Gross, 1992), based on computer-assisted teaching and intelligent tutors. This provides an analysis of the negative aspects of implementing these methods.

Although the field has evolved significantly, several studies highlight its potential applications in education. They highlight that it allows instruction to adapt more precisely to the student based on prior interactions; that it helps modulate the characteristics of explanations to suit the needs of each student (Bhutoria, 2022; Embarak, 2022; Tavakoli et al., 2022); that it allows for efficient organization of available materials on a specific topic (Benvenuti et al., 2023); that it helps recognize reasoning errors (Celik, 2023; Yang et al., 2021); among others.

Research addressing the effects of AI use in elementary education is relatively scarce, although it legitimizes the need for its introduction (Ali et al., 2021; Su & Yang, 2022; Yang, 2022). In contrast, research addressing its use in higher education is more numerous (Crompton et al., 2020; Chen et al., 2020; Chiu et al., 2023). While these two levels of education differ significantly, especially regarding the mission and vision of both social institutions, lessons can be learned from their experiences if a holistic approach is applied.

For example, the review conducted on the teaching of medical sciences through the use of AI in our country found as conclusions the existence of problems generated by the divergence between AI and the natural, such as communication difficulties due to the poverty of the language of the "machines" and the limitation of access to data compared to the "real" doctor or radiologist (Iglesias López, 2023). Both of these conflicts have been largely resolved due to the recent progress these models have made, but in developing countries, they continue to pose a significant barrier (Aly, 2022). However, some progress has been seen in Cuba, as evidenced by a 2019 publication in the journal Educación Médica Superior, in which the authors declare AI's ability to interact with its environment and interpret external data, among other characteristics (Vidal Ledo et al., 2019).

Another area where relevant research on the use of AI has emerged is foreign language instruction, where the use of AI is proposed. The use of modern methods that allow students to learn Spanish (Hernández, 2021). Also notable is a study in the field of journalism, which establishes the existence of two fundamental views regarding the use of AI in this field: one that describes the social consequences of its use and another that seeks ways to complement human action using these techniques (Gómez-Diago, 2022).

The Educational Informatics Program of the Ministry of Education (MINED) in Cuba establishes, among its fundamental guidelines, providing educational agents with access to scientific and technical information, as well as methodological advice for its implementation. The use of AI is embedded in this guideline, which constitutes the central theme of this research. Therefore, the hypothesis is posed: the active use of AI in Cuban education can favor the improvement of teaching-learning processes. The central objective is to assess the impact of new technologies assisted by AI on teaching.

This research provided precise data on the use of AI in other countries, as well as the real possibilities of its use in Cuba. Updating Cuban computational thinking should be one of the State's primary goals, considering that interaction with ICTs is becoming increasingly frequent and necessary in modern times. Therefore, a population connected to new technologies from childhood will be better prepared for life.

METHODOLOGY

Protocol

A comprehensive bibliographic review was conducted (Lockwood et al., 2019; Ruiz-Perez & Petrova, 2019) to define the current state of the art and the development of AI, as well as its background, both nationally and internationally. Elsevier's ScienceDirect database and Google Scholar were used to identify relevant, high-impact sources (table 1). The search strategy targeted keywords based on the authors' needs, the possibility of triangulation, and adherence to guidelines proposed in previous research (Eberle et al., 2021; Leidl et al., 2020; Litvak et al., 2022; Su & Yang, 2022).

Table 1.
Search protocol

Database and search engine	Keywords
Elsevier, ScienceDirect	artificial intelligence evolution education, artificial intelligence history; artificial intelligence + alan turing; searle + chinese room thought experiment; didactic applications artificial intelligence in education; AI and basic education; AI and higher education
Google Scholar: Emerald, Dialnet, SCIelo, Redalyc; Taylor and Francis.	artificial intelligence evolution education, artificial intelligence history; didactic applications artificial intelligence in education; inteligencia artificial Scielo Cuba; artificial intelligence primary education; artificial intelligence + experiences

Source: own elaboration

Case analysis

National government entities, such as the Ministry of Education, and foreign entities, such as UNESCO and UNICEF, provided the core materials. Developed countries' experiences in AI applied to education were considered to draw parallels that can be applied to our country. This strategy made it possible to identify the limitations of AI implementation in Cuban pedagogy, as well as to analyze problems encountered in these countries and their solutions in order to follow their example and avoid repeating them (Ouyang & Jiao, 2021).

Data and Table Analysis

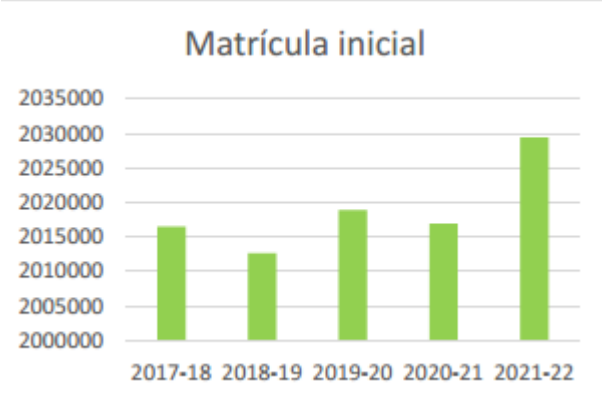
Tables on education prepared by the Cuban National Office of Statistics and Information, as well as other sources, were analyzed to arrive at conclusions such as teacher availability, student enrollment, and results based on identified indicators. With the latter information, the plan was to estimate how the use of AI in Cuban classrooms might or might not improve the teaching process.

Methods

Different methods were implemented that contributed to the veracity and rigor of this report. These included processes of analysis and synthesis of the collected information, which facilitated data collection on the implementation of technologies in foreign countries and extrapolating them to local conditions. Based on the compiled data, deductions were made possible to infer how the education system might evolve if the proposed techniques were implemented. The use of statistical methods allowed for the identification of patterns in educational quality.

RESULTS AND DISCUSSION

Figure 1.
Number of schools and teachers

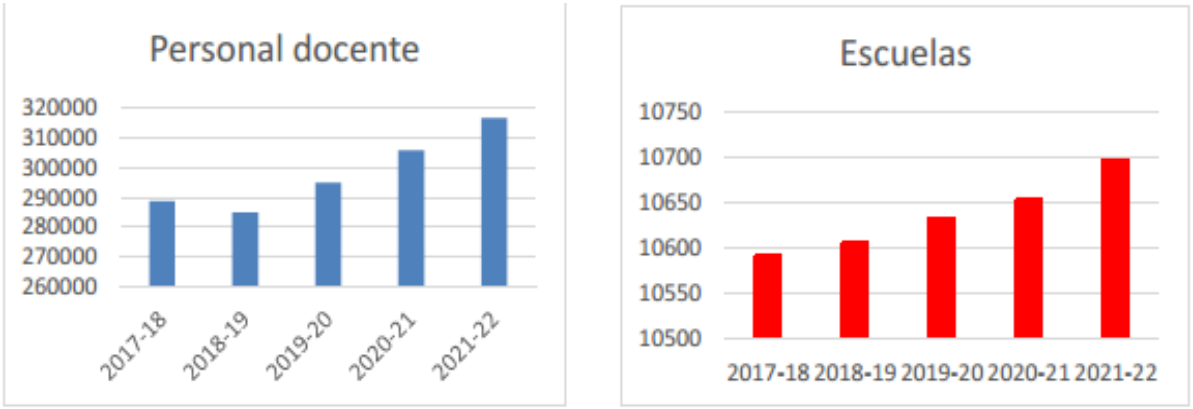


Source: ONEI
Note: the figure appears in its original language

Based on the analysis of the data provided by the Statistical Yearbook of Cuba 2022 Edition 2023 (National Office of Statistics and Information, 2023), during the period 2017-2022, the total number of schools has remained around 10 600, while attendance at them has been increasing, from 2 016 574 in 2017 to 2 029 468 students at the end of the 2021-2022 academic year, which is 0.64% above the total number enrolled in the 2017 academic year.

Similarly, the number of teachers has increased from 289 003 in 2017 to 316 947 in 2022. This represents an increase of 9.67%.

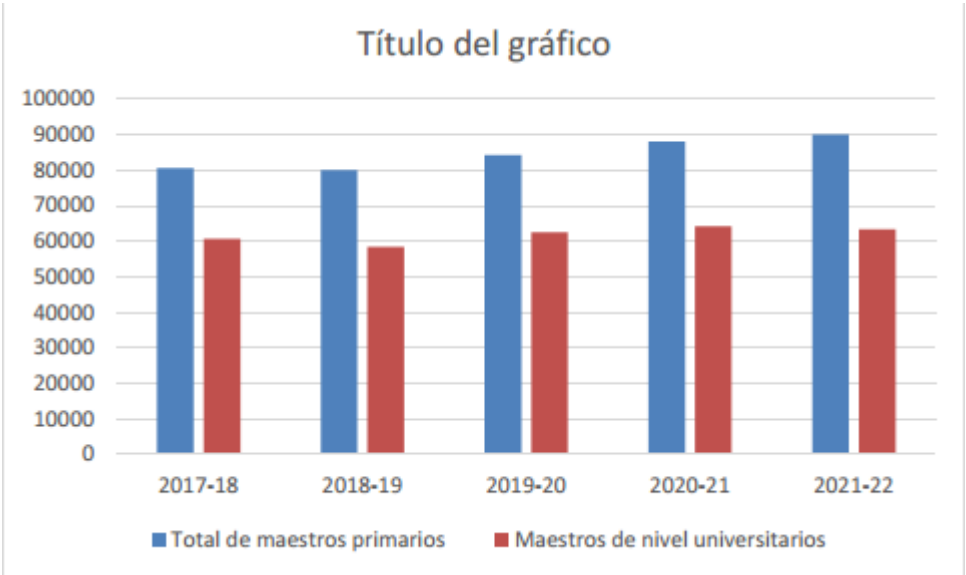
Figure 2.
Number of schools and teachers



Source: ONEI
Note: the figure appears in its original language

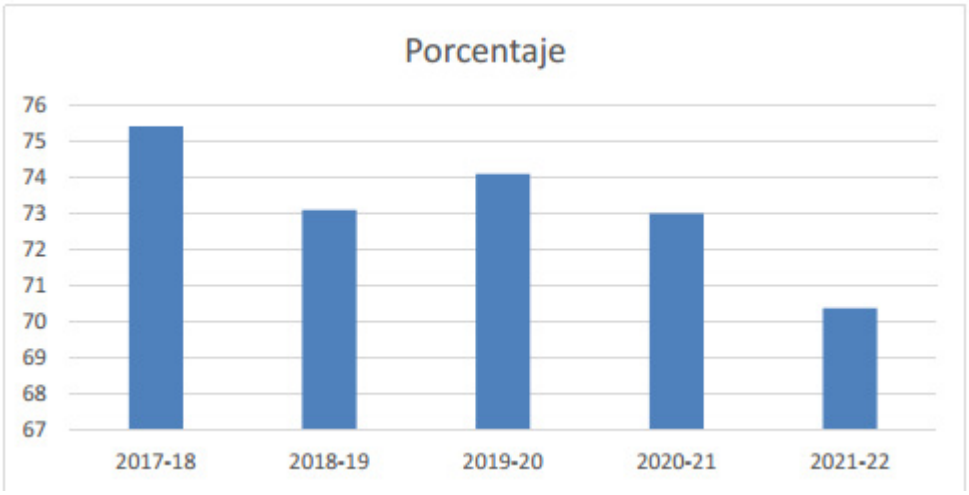
However, despite this apparent improvement in the student-teacher ratio, it is worth noting that the educational level of teachers has dropped from 75.4% in 2017 with a university degree to 70.4% in 2022 at the primary level. Other educational levels are also not exempt from this decline (see figure 3). In secondary education the total number of teachers with a university degree has dropped from 85.1% in 2017 to 81.5%. Within this level of education, upper secondary education has remained the most stable (see figure 4).

Figure 3.
Number of primary teachers versus number of primary teachers with higher education



Source: ONEI
Note: the figure appears in its original language

Figure 4.
Percentage relative to the number of teachers with higher education level



Source: ONEI
Note: the figure appears in its original language

Of the total number of students enrolled in primary education, 823 161, a total of 18 244 are in classes with more than 35 students, which is unfavorable to the teaching-learning process, as the teacher's attention to the students will be diminished. Of these more than 18 thousand children, 1 360 are located in groups with more than 45 students in enrollment, with 28 groups in the country. The total number of primary schools increased from 6 887 to 6 940. However, the schools built were entirely rural. In fact, the number of urban primary schools decreased from 2 081 to 2 076.

After analyzing these data, it is concluded that, despite the increasing number of teachers, the number of urban primary schools—where the largest number of students and the level of teachers is concentrated—has been declining. In this environment, teaching based on new technologies, primarily AI, could have a place. AI would increase teachers' ability to respond effectively to students' needs in diverse contexts and teaching regimes (Crompton et al., 2022; Wang et al., 2023; Wang & Cheng, 2021; Williamson & Eynon, 2020).

However, while advantageous, implementing AI in education, especially primary education, would require new processes to enable its successful use. An example of this is that teachers will need to acquire knowledge about the use of different AI models while understanding how to introduce it appropriately so that it does not affect the teaching-learning process (Cope et al., 2021; Fitzpatrick, 2020). Furthermore, studies also indicate that students must develop skills, including computational thinking (Bull et al., 2020; Kim et al., 2020; Kite & Park, 2023).

Despite the aforementioned, the Cuban government has attempted, as far as possible, to educate students on the use of technology. However, a critical analysis of the country's current context indicates that the technological ecosystem in Cuban schools is markedly outdated.

Analysis of a case

Next, we will analyze the case of New South Wales, which launched the "Educating in a Changing World" project in 2016, with the aim of identifying elements that can be applied in our context. This project aimed to develop the implications of technological advances while promoting reforms in educational programs, seeking to give teaching a more innovative approach.

According to the analysis, New South Wales's student population is similar to that of Cuba, with more than one million students enrolled in 3 000 schools. According to the New South Wales Ministry of Education, AI has strong potential in education, provided the methods are right. AI can help relieve teachers of some of the tasks that are currently their responsibility.

This latter aspect can be an advantage, especially in classrooms with high enrollment, allowing teachers to more accurately identify the educational needs of each student. The draft emphasizes that principals will be responsible for determining the most appropriate times for implementing AI. It also argues that new pillars of education, such

as reading, writing, and arithmetic, should be complemented by new ones that are not cognitive but rather abstract and qualitative.

These include the ability to determine self-efficacy, to understand concepts adequately, and to possess good resilience and mental flexibility skills. Particular emphasis is placed on developing critical thinking skills in students that will enable them to better discern. The document emphasizes that all these skills can, at least in principle, be acquired through extracurricular activities that foster cooperation, decision-making, and goal-setting (Bhatt & Muduli, 2023; Markauskaite et al., 2022; Y. Wang, 2021).

Sports, the arts, debates, and volunteering could become effective methods for developing these skills. Fortunately, these activities are already being carried out in Cuba. It remains to be seen how to appropriately approach working with students to develop interpersonal skills, which is essential in today's world (Goldberg et al., 2021; Kopelman-Rubin et al., 2021; Theelen et al., 2022).

Evaluation of the results, synthesis of the fundamental lines and confirmation of the study hypothesis

The implementation of new technologies related to artificial intelligence in Cuban education could greatly benefit classrooms, their students, and their teachers. The use of AI would allow:

- Introducing students to the world of computing in a teacher-controlled manner can foster the development of computer responsibility in students from an early age.
- Regulating the difficulty level of answers to complex questions since the use of keywords in the AI interface allows for changes in its language.
- Reviewing the quality of student essays while receiving real-time feedback. This would allow errors to be corrected as the student progresses through the content.
- Connecting different content by asking interconnected questions with answers that evolve from the most basic levels to delve deeper into the topics.
- Learning and correcting languages, realistically interacting with the computer.
- Increasing creativity through the use of image-generating AI.

The use of artificial intelligence would offer teachers advantages in class, such as:

- Being able to provide more differentiated attention to students by analyzing their questions.
- Creating more creative classes, allowing students greater freedom to choose how to approach the content.
- Developing classes with new forms of communication and teaching media.

Despite the benefits of using AI in the classroom, this would represent a shift in the teaching methods currently implemented in our country. Consequently, students will need to be introduced to new ways of introducing novel knowledge in the field; much of what is currently lacking is insufficient or simply outdated. Likewise, teachers will need to increase their computer skills so they can make informed decisions in the classroom, answer student questions, and develop appropriate teaching activities. Therefore, the use of new technologies has certain limitations in Cuba, such as:

- The need to guarantee students the means to access digital resources.
- Creating locations capable of supporting both the machines on which the activities are carried out and the students, and which are also suitable for teaching activities.
- Ensuring that the interfaces used are free of charge in order to maintain one of the pillars of the Cuban state.
- Develop artificial intelligence models in our own context that better adapt to our reality.

Based on these elements, we conclude that the use of AI in Cuban classrooms could significantly benefit students and teachers. It could even contribute to increasing the number of graduates and their training. This leads us to confirm the hypothesis proposed at the beginning of the research.

Example of class optimization using AI

Using a model class, ideas will be proposed to expand the proposed methods with the help of artificial intelligence. Subject: Spanish.

Topic: Text Writing.

Subject: Descriptive Texts.

Objective: To explain the characteristics of descriptive texts by using examples generated using AI, in which students find patterns that can later be used in writing activities.

Method: Heuristic. Ask questions that, after interacting with the AI-generated texts, allow students to delve into the details of the text in order to generalize.

Introduction: To introduce the topic of the class, we will conduct an activity with the students in which we will read an excerpt from José Martí's work "The Paris Exposition," found in The Golden Age. This article describes the characteristics of the event that took place in 1889 in the French capital. Students will be asked to close their eyes so they can imagine the place described.

Next, the concept of description will be addressed, and then we will move on to the specific topic.

Proposed activities

- Define concepts necessary for the class, such as description, text, adjective, etc.
- Ask students to create a short text describing an imaginary place.
- Ask the AI to generate an image so students can observe the relationship between the textual description and the results.
- Feed the AI the student's text to obtain suggestions for possible changes. This would include punctuation, spelling, grammar, etc. This activity will measure students' critical thinking.
- Generate and read other descriptive texts so students can extract generalities and characteristics.

Independent study: Write a text using a series of adjectives. This will allow linking this class with others that will follow, linked to grammar.

Conclusions: Ask questions that summarize the content covered to ensure students have grasped the main concepts and characteristics of the descriptive texts.

CONCLUSIONS

After conducting a critical analysis of the available information, it is concluded that the hypothesis proposed by the authors is true. The active use of new technologies in Cuban classrooms would improve the quality of lessons and enhance the skills of students and teachers regarding the latest technological advances. Likewise, this transformation would foster values and the development of critical thinking in young people.

It is evident that in the future, teaching trends will focus on using AI in the classroom due to its significant advantages. Therefore, implementing it in our country now will allow us to remain at the forefront of teaching worldwide. However, this will require extensive training for those involved, developing proprietary programs that allow for technological independence, and organizing the location of facilities.

The ministries involved, as well as independent authors, are encouraged to continue reviewing this important topic with the aim of optimizing the results obtained in this research. In the future, mixed and qualitative empirical research is recommended to allow for a deeper understanding of the perspectives of educational stakeholders involved in the integration of AI in the Cuban educational context.

REFERENCES

Ali, S., DiPaola, D., Lee, I., ... y Breazeal, C. (2021). Children as creators, thinkers and citizens in an AI-driven future. Computers and Education: Artificial Intelligence, 2, 100040. https://doi.org/10.1016/j.caeai.2021.100040

Aly, H. (2022). Digital transformation, development and productivity in developing countries: Is artificial intelligence a curse or a blessing? Review of Economics and Political Science, 7(4), 238–256. https://doi.org/10.1108/REPS-11-2019-0145

Benvenuti, M., Cangelosi, A., Weinberger, A., ... y Orsoni, M. (2023). Artificial intelligence and human behavioral development: A perspective on new skills and competences acquisition for the educational context. Computers in Human Behavior, 148, 107903. https://doi.org/10.1016/j.chb.2023.107903

Bertram, C., Weiss, Z., Zachrich, L., y Ziai, R. (2021). Artificial intelligence in history education. Linguistic content and complexity analyses of student writings in the CAHisT project (Computational assessment of

historical thinking). Computers and Education: Artificial Intelligence, 100038. https://doi.org/10.1016/j.caeai.2021.100038

Bhatt, P., y Muduli, A. (2023). Artificial intelligence in learning and development: A systematic literature review. European Journal of Training and Development, 47(7/8), 677–694. https://doi.org/10.1108/EJTD-09-2021-0143

Bhutoria, A. (2022). Personalized education and Artificial Intelligence in the United States, China, and India: A systematic review using a Human-In-The-Loop model. Computers and Education: Artificial Intelligence, 3, 100068. https://doi.org/10.1016/j.caeai.2022.100068

Bull, G., Garofalo, J., y Hguyen, N. (2020). Thinking about computational thinking: Origins of computational thinking in educational computing. Journal of Digital Learning in Teacher Education, 36(1), 6–18. https://doi.org/10.1080/21532974.2019.1694381

Celik, I. (2023). Exploring the Determinants of Artificial Intelligence (AI) Literacy: Digital Divide, Computational Thinking, Cognitive Absorption. Telematics and Informatics, 83, 102026. https://doi.org/10.1016/j.tele.2023.102026

Chen, X., Xie, H., y Hwang, G. (2020). A multi-perspective study on Artificial Intelligence in Education: Grants, conferences, journals, software tools, institutions, and researchers. Computers and Education: Artificial Intelligence, 1, 100005. https://doi.org/10.1016/j.caeai.2020.100005

Chen, X., Xie, H., Zou, D., y Hwang, G. (2020). Application and theory gaps during the rise of Artificial Intelligence in Education. Computers and Education: Artificial Intelligence, 1, 100002. https://doi.org/10.1016/j.caeai.2020.100002

Chiu, T., Xia, Q., Zhou, X., y Cheng, M. (2023). Systematic literature review on opportunities, challenges, and future research recommendations of artificial intelligence in education. Computers and Education: Artificial Intelligence, 4, 100118. https://doi.org/10.1016/j.caeai.2022.100118

Cope, B., Kalantzis, M., y Searsmith, D. (2021). Artificial intelligence for education: Knowledge and its assessment in AI-enabled learning ecologies. Educational Philosophy and Theory, 53(12), 1229–1245. https://doi.org/10.1080/00131857.2020.1728732

Crompton, H., Bernacki, M., y Greene, J. (2020). Psychological foundations of emerging technologies for teaching and learning in higher education. Current Opinion in Psychology, 36, 101–105. https://doi.org/10.1016/j.copsyc.2020.04.011

Crompton, H., Jones, M., y Burke, D. (2022). Affordances and challenges of artificial intelligence in K-12 education: A systematic review. Journal of Research on Technology in Education, 1–21. https://doi.org/10.1080/15391523.2022.2121344

Eberle, C., Löhnert, M., y Stichling, S. (2021). Effectiveness of Disease-Specific mHealth Apps in Patients With Diabetes Mellitus: Scoping Review. JMIR mHealth and uHealth, 9(2), e23477. https://doi.org/10.2196/23477

Embarak, O. (2022). Internet of Behaviour (IoB)-based AI models for personalized smart education systems. Procedia Computer Science, 203, 103–110. https://doi.org/10.1016/j.procs.2022.07.015

Fitzpatrick, N. (2020). Questions concerning attention and Stiegler's therapeutics. Educational Philosophy and Theory, 52(4), 348–360. https://doi.org/10.1080/00131857.2019.1625330

Goldberg, S., Tanana, M., Imel, Z., y Anderson, T. (2021). Can a computer detect interpersonal skills? Using machine learning to scale up the Facilitative Interpersonal Skills task. Psychotherapy Research, 31(3), 281–288. https://doi.org/10.1080/10503307.2020.1741047

Gómez-Diago, G. (2022). Perspectivas para abordar la inteligencia artificial en la enseñanza de periodismo. Una revisión de experiencias investigadoras y docentes. Revista Latina de Comunicación Social, 80, 29–46. https://doi.org/10.4185/RLCS-2022-1542

Gross, B. (1992). La inteligencia artificial y su aplicación en la enseñanza. Comunicación, Lenguaje y Educación, 4(13), 73–80. https://doi.org/10.1080/02147033.1992.10821001

Grundner, L., y Neuhofer, B. (2021). The bright and dark sides of artificial intelligence: A futures perspective on tourist destination experiences. Journal of Destination Marketing & Management, 19, 100511. https://doi.org/10.1016/j.jdmm.2020.100511

Grzybowski, A., Pawlikowska–Łagód, K., y Lambert, W. (2024). A History of Artificial Intelligence. Clinics in Dermatology, S0738081X23002687. https://doi.org/10.1016/j.clindermatol.2023.12.016

Guan, C., Mou, J., y Jiang, Z. (2020). Artificial intelligence innovation in education: A twenty-year data-driven historical analysis. International Journal of Innovation Studies, 4(4), 134–147. https://doi.org/10.1016/j.ijis.2020.09.001

Hernández, J. (2021). La Inteligencia Artificial y la Enseñanza de Lenguas: Una aproximación al tema. Decires, 21(25), 29–44. https://doi.org/10.22201/cepe.14059134e.2021.21.25.3

Hoffmann, C. (2022). Is AI intelligent? An assessment of artificial intelligence, 70 years after Turing. Technology in Society, 68, 101893. https://doi.org/10.1016/j.techsoc.2022.101893

Iglesias López, D. (2023). Impacto de la Inteligencia Artificial en la Radiología. Revista Cubana de Informática Médica, 15(1). http://scielo.sld.cu/scielo.php?pid=S1684-18592023000100013&script=sci_arttext

Kaul, V., Enslin, S., y Gross, S. (2020). History of artificial intelligence in medicine. Gastrointestinal Endoscopy, 92(4), 807–812. https://doi.org/10.1016/j.gie.2020.06.040

Kim, J., Merrill, K., Xu, K., y Sellnow, D. (2020). My Teacher Is a Machine: Understanding Students' Perceptions of AI Teaching Assistants in Online Education. International Journal of Human–Computer Interaction, 36(20), 1902–1911. https://doi.org/10.1080/10447318.2020.1801227

Kite, V., y Park, S. (2023). What's Computational Thinking?: Secondary Science Teachers' Conceptualizations of Computational Thinking (CT) and Perceived Barriers to CT Integration. Journal of Science Teacher Education, 34(4), 391–414. https://doi.org/10.1080/1046560X.2022.2110068

Kopelman-Rubin, D., Mufson, L., Siegel, A., ... y Brunstein-Klomek, A. (2021). I can succeed, a new social emotional learning program for children based on interpersonal psychotherapy for adolescents. European Journal of Developmental Psychology, 18(1), 112–130. https://doi.org/10.1080/17405629.2020.1768068

Leach, N. (2022). AI and the limits of human creativity in urban planning and design. En Artificial Intelligence in Urban Planning and Design (pp. 21–37). https://doi.org/10.1016/B978-0-12-823941-4.00013-5

Leidl, D., Ritchie, L., y Moslemi, N. (2020). Blended learning in undergraduate nursing education – A scoping review. Nurse Education Today, 86, 104318. https://doi.org/10.1016/j.nedt.2019.104318

Li, H., Yu, H., Cao, N., Tian, H., y Cheng, S. (2021). Applications of Artificial Intelligence in Oil and Gas Development. Archives of Computational Methods in Engineering, 28(3), 937–949. https://doi.org/10.1007/s11831-020-09402-8

Litvak, M., Miller, K., Boyle, T., ... y Goralnick, E. (2022). Telemedicine Use in Disasters: A Scoping Review. Disaster Medicine and Public Health Preparedness, 16(2), 791–800. https://doi.org/10.1017/dmp.2020.473

Lockwood, C., dos Santos, K., y Pap, R. (2019). Practical Guidance for Knowledge Synthesis: Scoping Review Methods. Asian Nursing Research, 13(5), 287–294. https://doi.org/10.1016/j.anr.2019.11.002

Markauskaite, L., Marrone, R., Poquet, O., ... y Siemens, G. (2022). Rethinking the entwinement between artificial intelligence and human learning: What capabilities do learners need for a world with AI? Computers and Education: Artificial Intelligence, 3, 100056. https://doi.org/10.1016/j.caeai.2022.100056

Oficina Nacional de Estadística e Información. (2023). Anuario estadístico de Cuba 2022 Educación Edición 2023. Obtenido de Oficina Nacional de Estadística e https://www.onei.gob.cu/educacion-0

Ouyang, F., y Jiao, P. (2021). Artificial intelligence in education: The three paradigms. Computers and Education: Artificial Intelligence, 2, 100020. https://doi.org/10.1016/j.caeai.2021.100020

Rensfeldt, A., y Rahm, L. (2023). Automating Teacher Work? A History of the Politics of Automation and Artificial Intelligence in Education. Postdigital Science and Education, 5(1), 25–43. https://doi.org/10.1007/s42438-022-00344-x

Ribeiro, A. (2021). Revisiting the Chinese Room: Looking for Agency in a World Packed with Archaeological Things. Cambridge Archaeological Journal, 31(3), 533–541. https://doi.org/10.1017/S0959774321000238

Ruiz-Perez, I., y Petrova, D. (2019). Scoping reviews. Another way of literature review. Medicina Clínica (English Edition), 153(4), 165–168. https://doi.org/10.1016/j.medcle.2019.02.026

Su, J., y Yang, W. (2022). Artificial intelligence in early childhood education: A scoping review. Computers and Education: Artificial Intelligence, 3, 100049. https://doi.org/10.1016/j.caeai.2022.100049

Tavakoli, M., Faraji, A., Vrolijk, J., ... y Kismihók, G. (2022). An AI-based open recommender system for personalized labor market driven education. Advanced Engineering Informatics, 52, 101508. https://doi.org/10.1016/j.aei.2021.101508

Theelen, H., Van den Beemt, A., y Brok, P. (2022). Enhancing authentic learning experiences in teacher education through 360-degree videos and theoretical lectures: Reducing preservice teachers' anxiety. European Journal of Teacher Education, 45(2), 230–249. https://doi.org/10.1080/02619768.2020.1827392

Vidal Ledo, M., Madruga González, A., y Valdés Santiago, D. (2019). Inteligencia artificial en la docencia médica. Educación Médica Superior, 33(3). http://scielo.sld.cu/scielo.php?pid=S0864-21412019000300014&script=sci_arttext

Wang, S., Christensen, C., Cui, W., y Feng, M. (2023). When adaptive learning is effective learning: Comparison of an adaptive learning system to teacher-led instruction. Interactive Learning Environments, 31(2), 793–803. https://doi.org/10.1080/10494820.2020.1808794

Wang, T., y Cheng, E. (2021). An investigation of barriers to Hong Kong K-12 schools incorporating Artificial Intelligence in education. Computers and Education: Artificial Intelligence, 2, 100031. https://doi.org/10.1016/j.caeai.2021.100031

Wang, Y. (2021). Artificial intelligence in educational leadership: A symbiotic role of human-artificial intelligence decision-making. Journal of Educational Administration, 59(3), 256–270. https://doi.org/10.1108/JEA-10-2020-0216

Williamson, B., y Eynon, R. (2020). Historical threads, missing links, and future directions in AI in education. Learning, Media and Technology, 45(3), 223–235. https://doi.org/10.1080/17439884.2020.1798995

Yang, S., Ogata, H., Matsui, T., y Chen, N.-S. (2021). Human-centered artificial intelligence in education: Seeing the invisible through the visible. Computers and Education: Artificial Intelligence, 2, 100008. https://doi.org/10.1016/j.caeai.2021.100008

Yang, W. (2022). Artificial Intelligence education for young children: Why, what, and how in curriculum design and implementation. Computers and Education: Artificial Intelligence, 3, 100061. https://doi.org/10.1016/j.caeai.2022.100061

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AUTHORSHIP CONTRIBUTION

Conceptualization: Ernesto Sardiñas and Keylan Valdés.
Data curation: Keylan Valdés.
Formal analysis: Ernesto Sardiñas.
Research: Ernesto Sardiñas.
Methodology: Ernesto Sardiñas and Keylan Valdés.
Project administration: Keylan Valdés.
Supervision: Ernesto Sardiñas.
Validation: Keylan Valdés.
Visualization: Ernesto Sardiñas.
Original draft: Ernesto Sardiñas.
Writing, proofreading and editing: Keylan Valdés.