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ORIGINAL

Artificial intelligence tools in the daily study of medical students

Herramientas de inteligencia artificial en el estudio diario de estudiantes de Medicina

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ABSTRACT

The use of artificial intelligence (AI) tools in medical education has gained relevance in recent years, offering new opportunities to optimize learning and academic management. This study examines the impact of AI on the study habits of medical students at San Gregorio de Portoviejo University, assessing both its benefits and the challenges associated with its implementation. Through a quantitative methodology, a sample of students was surveyed to determine their perceptions of the use of AI in their academic training. The results indicate a majority acceptance of these tools, highlighting their usefulness in improving autonomous learning and the organization of the study. However, the need for specific training to optimize its use was also identified. It is concluded that, although AI represents a valuable resource in medical education, its impact depends largely on access to the technology and adequate training in its use.

Keywords: Artificial Intelligence; Medical Education; Autonomous Learning; Digital Tools; Academic Training.

RESUMEN

El uso de herramientas de inteligencia artificial (IA) en la educación médica, ofrece nuevas oportunidades para optimizar el aprendizaje y la gestión académica. Este estudio analiza el impacto de la IA en los hábitos de estudio de los estudiantes de Medicina de la Universidad San Gregorio de Portoviejo, evaluando sus beneficios y desafíos asociados a su implementación. A través de una metodología cuantitativa, para conocer su percepción sobre el uso de la inteligencia artificial en su formación académica. Se evidenció una aceptación mayoritaria de estas herramientas, destacando su utilidad para mejorar el aprendizaje autónomo y la organización del estudio. Sin embargo, también se identificó la necesidad de capacitaciones específicas para su aprovechamiento óptimo. Aunque la Inteligencia Artificial represente un recurso valioso en la educación médica, su impacto depende en gran medida del acceso a la tecnología y de la formación adecuada en su uso.

Palabras clave: Inteligencia Artificial; Educación Médica; Aprendizaje Autónomo; Herramientas Digitales; Formación Académica.

INTRODUCTION

The incorporation of artificial intelligence (AI) into academic life, especially in the training of medical students, has grown significantly in recent years. This technology is presented as a tool with great potential

to optimize learning, but it can also become a challenge when misused, making it a double-edged sword. One of its primary benefits lies in the ability to tailor educational content to the individual needs of students, promoting autonomous learning and enhancing administrative efficiency in academic institutions. To better understand its impact, a comprehensive review of the existing literature was conducted, analyzing scientific articles, technical reports, and case studies on the implementation of AI in education. This analysis enabled us to identify key themes, assess their benefits, and recognize the challenges that must be addressed to ensure the practical and ethical application of artificial intelligence in medical education.[1]

Globally, the use of AI remains limited in many countries, and Ecuador is no exception. According to Barragán[2], the country is in an early stage of technological adoption, with few public policies aimed at promoting the use of AI as a tool for social, economic, and environmental development. This situation highlights the need to investigate how students, particularly in demanding fields such as medicine, integrate these tools into their academic training.

Recent studies have highlighted the impact of AI-based tools, such as ChatGPT, Gemini, and Blackbox, on autonomous learning. However, Mendiola[3] points out that these technologies represent a challenge for educators, who have implemented strategies such as collaborative annotation, submission of drafts, and audio or video recording to ensure the originality of student work. In the Ecuadorian context, research such as that by Jiménez et al.[4] has emphasized that, although AI is neither inherently good nor bad, its potential for misuse requires a more attentive and responsible approach.

The concept of artificial intelligence is not a new one. For decades, research has been conducted on the concept of creating machines that can interact with humans and perform tasks autonomously. Over time, various approaches have refined this concept, enabling the development of new applications and performance enhancements. In the field of education, AI has been explored as a tool to personalize learning, improve the organization of academic content, and optimize teaching processes. However, challenges related to its implementation have also arisen, especially in developing countries, where access to technology and infrastructure can represent significant obstacles.[5]

Despite the advantages offered by AI, there are still few studies analyzing how and to what extent medical students incorporate these tools into their academic routines. This is particularly relevant in developing countries, where economic limitations, unequal access to technology, and gaps in educational infrastructure can exacerbate the challenges associated with its use.

A prominent challenge lies precisely in this unequal access to AI technologies. While artificial intelligence has the potential to revolutionize education by providing personalized learning experiences and overcoming traditional barriers, such as geographical limitations, its benefits are not evenly distributed. Developing countries and marginalized communities often lack the necessary infrastructure, resources, and expertise to adopt AI in education fully. This digital divergence deepens existing educational disparities, hampering progress toward Sustainable Development Goal 4. Thus, the challenges to harnessing the potential of artificial intelligence in education are numerous and multifaceted, representing a key challenge for equity in access to knowledge.[6]

It is critical to understand not only the benefits that artificial intelligence (AI) can offer but also the associated risks. These include the potential replacement of reflective processes with automated responses and the misuse of these technologies, which could lead to ethical and academic challenges. Recent studies have identified two emerging AI-related phenomena that have captured the attention of psychologists, educators, and technologists: "AI dependence syndrome" and "AI phobia." These opposing trends highlight the risks associated with the increasing role of AI in our daily lives and educational settings.[7]

In this sense, this study aimed to analyze the level of artificial intelligence use among medical students according to their stage of study. It also seeks to evaluate whether these tools effectively contribute to their daily learning or whether specific training would be necessary to leverage them. According to Rueda et al.[8], AI has transformed medical education by improving skills and reducing risks through the use of simulators and virtual tutors. Therefore, it is essential to understand medical students' perceptions of the use of AI in their academic training.

METHOD

This study was conducted at San Gregorio de Portoviejo University, employing a quantitative and explanatory approach, aiming to assess the impact of artificial intelligence tools on the study habits and academic performance of medical students. A representative sample was selected using non-stratified random sampling to reflect the different levels of knowledge and experience.

The inclusion criteria were: being an active undergraduate medical student, having access to appropriate electronic devices, and being willing to use AI tools in their studies. Postgraduate medical students and those without access to suitable electronic devices or who were unwilling to use AI tools in their studies were excluded.

For data collection, structural online surveys were used, approved and adopted from a work carried out by Cornejo[9], which measured both the frequency of AI use and students' perception of its impact on their study habits.

The data obtained were analyzed using descriptive statistical techniques, applying methods to evaluate the relationship between variables and their behavior. Regarding ethical principles, the confidentiality of the information collected was strictly guaranteed, ensuring the absolute anonymity of the responses. Likewise, all participants provided their informed consent prior to participating in the study.

RESULTS AND DISCUSSION

The majority of students surveyed have a positive perception of the impact of artificial intelligence on their learning. 44,3 % of participants "strongly agree" that AI can improve the quality of their learning, while 24,6 % "agree"; 21,3 % remained "indifferent", while 4,9 % "disagree", and 4,9 % "strongly disagree" (figure 1).

The survey assessed students' perceptions of artificial intelligence (AI) in learning, yielding 61 responses distributed across five categories: "strongly agree" (44,3 %), "agree" (24,6 %), "indifferent" (21,3 %), "disagree" (4,9 %), and "strongly disagree" (4,9 %). The majority of participants held a favorable opinion, possibly due to the personalization and accessibility that AI offers. However, the neutrality of 21,3 % could reflect a lack of experience with this technology, while concerns about reliability and technological dependence may influence the 9,8 % who hold a negative opinion. Compared with previous studies, the results align with the growing acceptance of AI, while also highlighting the need to balance its use with traditional strategies to maximize its impact on education.

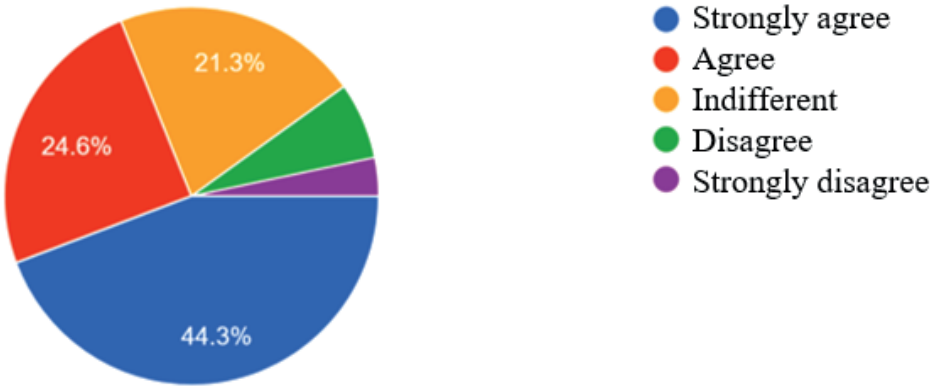

Figure 1 . Do you think artificial intelligence can improve the quality of your learning?

Regarding the need for training in artificial intelligence (figure 2), the results indicate that 39,3 % of respondents "Strongly Agree" with the importance of receiving specific training for the proper use of these tools, while 29,5 % "agree"; 21,3 % were "indifferent", 6,5 % "disagree", and 3,3 % "strongly disagree".

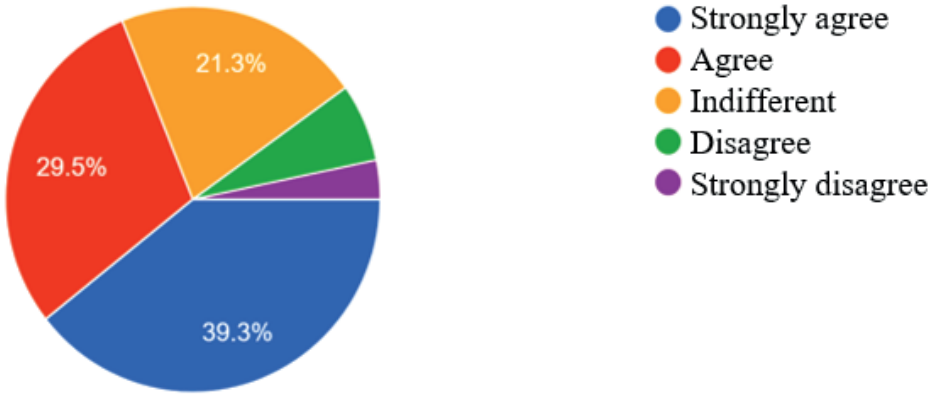

Figure 2. Do you think additional training is necessary to maximize the benefits of artificial intelligence tools?

The survey assessed students' perceptions of artificial intelligence (AI) in learning, yielding 61 responses distributed across five categories: "strongly agree" (44,3 %), "agree" (24,6 %), "indifferent" (21,3 %), "disagree" (4,9 %), and "strongly disagree" (4,9 %). The majority of participants held a favorable opinion, possibly due to the personalization and accessibility that AI offers. However, the neutrality of 21,3 % could reflect a lack of

experience with this technology, while concerns about reliability and technological dependence may influence the 9,8 % who hold a negative opinion. Compared with previous studies, the results align with the growing acceptance of AI, while also highlighting the need to balance its use with traditional strategies to maximize its impact on education. Regarding the need for additional AI training, 39,3 % of respondents indicated they "strongly agree" with receiving specific training, while 29,5 % "agree". A further 21,3 % were "indifferent", which could reflect a lack of awareness about the benefits of such training. On the other hand, 6,5 % expressed "disagree" and 3,3 % "strongly disagree", suggesting that some students consider their current skills sufficient. This finding is consistent with studies that highlight the importance of ongoing training for the effective use of AI in education.

The results show a favorable attitude among students regarding the idea that universities should increase their investment in technology. Forty-one percent of respondents "strongly agree" with this statement, while 23 % "agree". A further 26,2 % were "indifferent", while 4,9 % "disagree", and 4,9 % "strongly disagree" (figure 3).

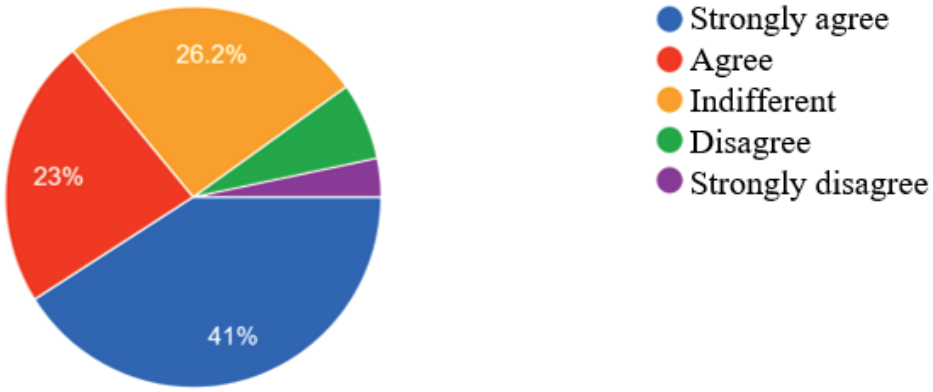

Figure 3. Do you think the university should increase its investment in technology implementation?

The survey reveals strong student support for increased investment in technology (64 % strongly agree/agree), suggesting a perceived need to improve technological infrastructure and tools. A further 26,2 % are indifferent, possibly due to a lack of problems with current technology or because they do not consider it a priority. Only a minority (9,8 %) oppose increased investment. To identify specific areas for improvement, it is recommended to compare these results with other questions on internet quality, digital resources, and technical support, along with external data from other universities.

The survey results reflect a promising trend in medical students' perceptions of the impact of artificial intelligence (AI) on their learning process. A majority (85 %) strongly agree or agree that AI can improve the quality of their education, far outnumbering those with neutral or disagree opinions. This finding not only demonstrates recognition of AI's potential in medical education but also refutes widespread skepticism about its applicability in this field. Medical education has undergone a significant transformation with the emergence of AI, driving substantial change and innovation. Its high potential not only optimizes the learning process but also facilitates a more effective approach to diagnosis and treatment, in addition to improving communication among physicians, patients, and healthcare professionals.[10]

The positive receptivity toward AI among students is consistent with growing evidence in the scientific literature about its benefits in health sciences education. Previous research has demonstrated that AI can facilitate the acquisition of complex knowledge, personalize teaching to meet individual needs, and optimize learning time by automating repetitive tasks and providing immediate feedback. Furthermore, its application in the clinical setting is also promising, particularly in information-based patient empowerment. AI can provide patients with personalized health data, self-care advice, and medication reminders, thereby better equipping them to participate in their care actively. Likewise, artificial intelligence is capable of detecting self-care deficits by analyzing medical data, enabling healthcare personnel to implement proactive interventions. Furthermore, it facilitates the personalization of care plans by considering the unique characteristics of each patient, helping professionals tailor self-care strategies more effectively. Thus, AI not only transforms health sciences education but also optimizes patient care and well-being.[11]

Despite the widespread enthusiasm, the results also underscore a critical need: the need for additional training in the use of AI. The fact that 85 % of respondents considered specific training necessary reveals a gap between the positive perception of AI and students' actual ability to use it effectively. This need is not surprising, given that AI is a constantly evolving field, with new tools and applications emerging regularly. In this sense, recognizing that human interaction with AI is evolving and transforming highlights the importance of

maintaining a critical and forward-looking perspective. It is essential to continually update the conditions that guide the use of this technology, ensuring that its implementation in education responds ethically to emerging changes and challenges.[12]

Lack of AI training is identified as a key barrier to its successful implementation in medical education. Without adequate training, students may feel insecure using AI tools, which could lead to underutilization or even resistance to change. Furthermore, the incorporation of these technologies into academic and professional settings presents challenges that necessitate ongoing adaptation. Continuing education and the development of digital skills are essential to ensure that AI is effectively integrated into medical education, enabling future healthcare professionals to leverage its full potential in clinical practice and decision-making.[13]

Therefore, universities and educational institutions must address this training need. This could be achieved by incorporating AI modules into the medical curriculum, organizing dedicated workshops and seminars, and creating independently accessible online resources for students.

Artificial intelligence training must be accompanied by strategic investments by universities, ensuring that students have access to up-to-date tools and platforms. This could include the acquisition of specialized software, subscriptions to AI databases, and the creation of labs where students can experiment with various applications. However, in addition to providing access to the technology, it is essential to educate students on the responsible use of AI, emphasizing the consequences of its misuse.

In the case of image generation, for example, AI can be a powerful tool for developing artistic and professional skills in areas such as digital illustration and design. However, it also poses significant risks if not used ethically, as it could be used to impersonate individuals, generate inappropriate or fake content, and manipulate images with malicious intent. Therefore, AI training should not only focus on its technical application but also on fostering critical awareness of its social and ethical implications.[14]

The effective adoption of AI in Ecuadorian education presents various challenges, including teacher training in new technologies, ensuring equal access to digital education, protecting student data privacy, and accurately assessing the real impact of AI on educational outcomes. These aspects are critical to ensuring that the implementation of AI in education is not only efficient but also ethical and equitable, ensuring that all students can benefit equally from its advantages.[15]. Although AI offers significant advantages, its inappropriate use could lead to overdependence and reduce students' critical thinking. Therefore, it is essential to balance the use of these tools with traditional educational strategies. Universities face the challenge of integrating AI responsibly, ensuring that future medical professionals leverage its potential without compromising their ethical and analytical development.

CONCLUSIONS

This study reflects a largely positive perception among medical students regarding the impact of AI on their learning process. A high percentage of respondents believe that AI improves the quality of learning, which is consistent with previous studies highlighting its ability to optimize study through interactive and personalized tools. However, its optimal use depends on three key factors: student training, institutional investment in technology, and the promotion of ethical and balanced use of these tools. Despite the widespread acceptance of AI, the results highlight the need for additional training, as a large portion of students acknowledge that they do not yet have the necessary skills to use it effectively. Furthermore, technological infrastructure plays a crucial role. Many respondents believe that universities should increase their investment in technology to ensure access to up-to-date tools and improve their implementation in academic settings. Without this support, AI adoption could be limited, which would affect its impact on medical education.

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CONFLICTS OF INTEREST

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Methodology: Mario A. García.

Software: Lailimar V. Turibbi, Daniela Z. Quiroz.

Supervision: Mario A. García.

Validation: Mario A. García.
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Writing, review and editing: Luis E. Salas, Shino R. Caamaño, Rodolfo A. Benalcazar, Lailimar V. Turibbi, Daniela Z. Quiroz, Mario A. García.