Original article

Teaching strategies for integrating Artificial Intelligence into the high school curriculum

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ABSTRACT

This paper addresses the need to integrate Artificial Intelligence into the Ecuadorian high school curriculum to meet the demands of the 21st century. An analysis of the current curriculum was carried out and didactic strategies for the implementation of this resource were proposed. A qualitative study was carried out with a descriptive, macro-social approach on education. Semi-structured interviews were conducted with teachers, directors and students. The findings highlight that the proposed didactic strategies strengthen critical and creative skills, promote participation in the classroom and prepare young people for a more dynamic educational environment adapted to technological demands.

Keywords: Artificial intelligence; Teaching strategies; High school curriculum

Introduction

The scientific and technical development currently achieved brings with it the production of new knowledge, expressed in the scientific results of the different areas of knowledge. This is not alien to the Educational Sciences, whose results of educational scientific

activity have as a primary objective the solution of problems that arise in educational practice and the enrichment of pedagogical theory. This priority gives didactics as a science a fundamental role, by providing a theoretical and practical framework to effectively integrate Artificial Intelligence (AI) in the Ecuadorian high school curriculum, ensuring a relevant education adapted to the demands of the 21st century.

Artificial Intelligence led to the creation of online learning platforms for educational institutions wishing to expand their educational pipeline and skills for participating students. In turn, they often offer a variety of subjects and topics, allowing students to explore their interests and pursue personal and professional development goals, and fulfill the university curriculum. Online learning platforms often use interactive and engaging teaching methods, such as videos, quizzes, forms, and interactive exercises to enhance the learning experience. (Lazaro *et al.*, 2024, p. 123)

Artificial Intelligence (AI) has transformed various sectors and education is no exception. In an increasingly digitized world, it is essential that high school students acquire skills that will enable them to function in a work environment where AI plays a fundamental role.

This study aims to explore didactic strategies that facilitate the incorporation of AI in the high school curriculum, focusing on a specific educational unit in Guayaquil.

Development

An axis that articulates the didactic strategies to integrate Artificial Intelligence in the high school curriculum is the combination of didactic resources, since they favor and provide assistance in the creation of inclusive and effective teaching-learning environments for comprehensive education. It is essential to adapt these resources to the characteristics and needs of education professionals, ensuring that education is relevant, accessible and respectful. The effective integration of Artificial Intelligence in the school curriculum not only improves academic learning, but also prepares students to face future challenges related to emerging technologies.

Guayaquil, as one of the most important cities in Ecuador, faces the challenge of preparing its youth for a future where AI will play a crucial role. Secondary education

must adapt to these new realities, incorporating tools and methodologies that foster critical thinking and creativity.

The incorporation of Artificial Intelligence in the high school curriculum in Ecuador faces several problems that may hinder its effective implementation. Some of these problems include:

- Lack of teacher training: Many teachers do not have the necessary training to integrate AI into their teaching strategies. Lack of specific training on AI tools and applications limits their ability to teach these concepts.
- Inadequate technological infrastructure: In many educational institutions, especially in rural areas, the technological infrastructure is deficient. This includes lack of access to computers, *internet and software* suitable for working with AI.
- Lack of knowledge about ethics and safety: Teaching about the ethical and safe use of AI is critical, but is often overlooked, which can lead to concerns about the responsible use of these technologies.
- Traditional approach to education: An educational approach focused on traditional methods can limit the creativity and flexibility needed to implement innovative strategies that include AI.

Overcoming these problems requires a comprehensive approach that includes teacher training, investment in technological infrastructure, curriculum revision and promotion of collaborative work between different educational and technological actors.

This study could be considered by educational units in Guayaquil, a city that has shown a growing interest in educational innovation. It will be valid to incorporate AI as part of the curriculum in order to prepare students for the challenges of the future. The focus is on developing technological competencies, critical thinking and interpersonal skills. The methodologies used, the results obtained and the implications for future educational practices are analyzed. A qualitative study with a descriptive approach was carried out.

Semi-structured interviews with teachers, principals and students were used to obtain a broad perspective on the perceptions and experiences related to the implementation of AI in the classroom, in order to verify the didactic strategies.

The research was conducted during one academic year (2023-2024) and focused on recognizing these proposals in an educational unit located in Guayaquil. The participants

included 50 high school students, 5 teachers and 5 directors, from different areas of knowledge. They were selected by means of intentional sampling.

According to Crovi (2008), the use of ICTs refers to the general, continuous and habitual exercise or practice linked to the utility/benefit provided by technologies, i.e., how these resources are taken advantage of or used in order to obtain maximum performance when carrying out certain activities (p. 75).

Furthermore, it states that the use of ICTs should be analyzed in relation to access, but also to a fundamental concept for the construction of an Information Society: appropriation (Crovi & López, 2011, p. 73).

How to include digital technology in a strategy

Digital technology packages and transmits information on an unprecedented scale, at high speed and low cost. Information storage has revolutionized the volume of accessible knowledge. Moreover, information processing allows learners to receive instant feedback and, through interaction with machines, to adapt the pace and path of learning: learners can organize the sequence of what they learn according to their context and characteristics.

Meanwhile, the exchange of information reduces the cost of interaction and communication. However, despite the enormous potential of this technology, many tools have not been designed for application in education. Not enough attention has been paid to how they are applied in education, let alone how they should be applied in different educational contexts (Unesco, 2023, p. 9).

Didactic strategies to integrate Artificial Intelligence in the Ecuadorian high school curriculum.

It is known that Pedagogy and Didactics, as well as other educational sciences, have undergone a long and difficult process of historical development. There are several stages through which they have passed, namely: the pre-scientific, from antiquity to the seventeenth century; the scientific, which advanced in the eighteenth and nineteenth centuries until the mid-twentieth century; the critical-emancipatory (scientific), from the mid-twentieth century to the fifth half of the twenty-first century (present). From education, as a cultural and social process, which is the agglutinating center of all the Educational Sciences, different variants have been developed, but which coincide in their essence: the humanization of man.

Today, the classical currents and trends of these sciences coexist, together with the emerging theories that have been emerging, and a study that assesses in an integrated manner, as a whole, what has happened in each historical stage, and much less, what are the theoretical projections that are assumed at present, is not fully appreciated.

Curriculum fundamentals

- Integral approach: The curriculum seeks to develop cognitive, emotional and social competencies in students, promoting holistic learning.
- Relevance and pertinence: It is oriented to respond to the needs of the social, cultural and economic context of the country, ensuring that the content is relevant to students.
- Diversity and inclusion: Ecuador's cultural and ethnic diversity is recognized, promoting an inclusive approach that respects and values differences.
- Citizenship training: Emphasis is placed on the formation of responsible, critical citizens who are committed to their community and the country.
- Development of competencies: The curriculum focuses on the development of key competencies that allow students to face challenges in different areas of their lives.

Characteristics of the curriculum

- Modular structure: The curriculum is organized in modules or areas of knowledge that integrate different disciplines, facilitating interdisciplinary learning.
- Flexibility: It allows for adaptations according to local and regional needs, as well as the possibility of including specific projects that respond to students' particular interests.
- Continuous evaluation: It promotes a formative evaluation that considers not only academic performance, but also the student's integral development.
- Use of technologies: Encourages the use of technological tools as part of the educational process, preparing students for an increasingly digitalized world.
- Education for life: In addition to preparing students to continue their higher education, it seeks to provide them with practical skills that allow them to function adequately in everyday life.
- Interculturality: Respect for the diverse cultures present in Ecuador is promoted, integrating content that reflects this diversity in the educational process.

- Emphasis on values: We seek to instill fundamental ethical and moral values such as solidarity, respect, responsibility and social justice.

The Ecuadorian high school curriculum, in the current context of Artificial Intelligence, should be adapted to prepare students not only to understand and use these technologies, but also to address the ethical, social and economic challenges that arise with their implementation.

By implementing these elements into the Ecuadorian high school curriculum, it could ensure that students are not only passive consumers of technology, but also informed and responsible creators within the field of Artificial Intelligence.

Integrating AI into the educational curriculum requires a holistic approach that combines effective pedagogy, active methodologies and constant reflection on its educational impact. In this way, students can be prepared not only to use these technologies, but also to understand their social and ethical context.

It is indisputable that the natural and social reality changes, and of course the culture and the ways of educating have to change, in order to respond not only to present needs, but also to those of the future.

Pedagogy and didactics are fundamental to integrate AI in the educational curriculum in an effective way, these should enhance from their theoretical and methodological positioning some strategies that can enhance its implementation from:

1. Teacher training

– AI training: Teachers should receive training on the basic concepts of AI, its applications and ethical implications. This will allow them to guide students in their understanding and responsible use.
– Development of digital competencies: Foster technological skills in teachers so that they can use AI tools in their daily practice.

2. Inclusive curriculum design

– Interdisciplinary integration: AI can be incorporated into various areas of knowledge (science, mathematics, humanities), promoting an interdisciplinary approach that reflects the reality of today's world.
– Adaptation to diverse learning styles: Use AI tools that personalize learning according to the individual needs of students, allowing for a more inclusive approach.

3. Active methodologies

- Project Based Learning (PBL): Encourage projects where students use AI tools to solve real problems, promoting critical thinking and creativity.
- Gamification: Incorporate playful elements through AI-based platforms that make learning more attractive and motivating.

4. Formative evaluation

- Use of analytical tools: Implement AI-based assessment systems that provide continuous feedback on student progress, allowing immediate adjustments in teaching.
- Personalized assessments: Create adaptive assessments that adjust to the level and pace of each student, thus improving the educational experience.

5. Ethics and responsibility

- Digital ethics education: Include topics related to the ethics of AI use, such as algorithmic bias and privacy, to develop critical and responsible citizens.
- Fostering critical thinking: Develop critical skills to evaluate information generated by AI systems, helping students to discern between reliable and unreliable sources.

6. Collaboration with experts

- Partnerships with technological institutions: Establish collaborations with companies or universities specializing in AI to enrich the curriculum with practical and up-to-date experiences.
- Joint projects: Involve experts in educational projects where students can interact directly with professionals in the field.

7. Continuous reflection

- Educational impact assessment: Conduct research on how AI-related teaching strategies affect learning and adjust practices as needed.
- Peer *feedback*: Foster spaces where teachers can share experiences and innovations related to AI teaching.

The concept of strategy has been defined by different scholars of the subject in question and most of them consider it as actions to achieve a purpose. Its etymology stems from the military field for which it constitutes the art of directing and coordinating actions and operations.

In the educational context, strategies are oriented towards the educational process and are determined by objectives. The systematization of different works makes it possible to specify that strategies include stages of diagnosis, planning, execution, control and final evaluation.

The didactic strategy is a theoretical construction based on pedagogical, philosophical, psychological and sociological assumptions that aims to interpret the reality of the teaching-learning process and direct it through a system of actions, with the allocation of the necessary resources, towards its transformation and improvement.

Teaching strategies are methods and techniques that educators use to facilitate student learning. Some definitions and key concepts related to teaching strategies:

1. General definition: Didactic strategies are a set of planned actions that teachers implement to promote meaningful learning in their students, adapting to different contexts, content, and learning styles.
2. 2.Constructivist approach: In the framework of constructivism, didactic strategies seek to actively involve students in their learning process, encouraging the construction of knowledge through experience and reflection.
3. Diversity of methods: There are several didactic strategies, such as project-based learning, collaborative work, and the use of educational technologies, differentiated teaching and inquiry-based learning. Each has its own characteristics and objectives.
4. Adaptation to the context: Strategies should be flexible and adapted to the specific needs of the group of students, considering factors such as their cognitive level, interests and cultural context.
5. Continuous assessment: Teaching strategies also include methods for assessing learning progress, allowing for adjustments in teaching as needed to improve educational outcomes.
6. Fostering critical skills: Many strategies are designed not only to convey content, but also to develop critical skills such as critical thinking, problem solving and creativity.
7. Social interaction: Teaching strategies often promote interaction among students and between students and teachers, which enriches the educational process through the exchange of ideas and experiences.
8. Use of didactic resources: The effective implementation of these strategies may involve various didactic resources (printed, digital, audiovisual materials) that support the teaching-learning process.

Currently, there are several trends in the intersection of scientific results and didactic strategies in the educational setting.

- Project-based learning: This strategy promotes active learning through projects that allow students to investigate and solve real problems. Scientific results are used to guide research and solution development.
- STEM/STEAM education: The integration of science, technology, engineering, art and mathematics into the curriculum seeks to foster interdisciplinary skills. Teaching strategies focus on the practical application of scientific concepts.
- Personalized learning: With the use of educational technologies, it seeks to tailor teaching strategies to the individual needs of students, based on scientific data and results on how they learn best.
- Gamification: The incorporation of game elements in learning has proven to be effective in increasing student motivation and engagement. Scientific results support its use as an effective teaching strategy.
- Focus on soft skills: In addition to science content, there is a growing emphasis on developing soft skills such as critical thinking, collaboration, and communication, which are essential for applying scientific knowledge in real-world contexts.
- Use of educational data: Educational analytics enables educators to make informed decisions based on data about student performance, which can influence the teaching strategies employed.
- Inclusive education: Approaches are being developed that consider the diversity of the student body and seek to create inclusive environments where all students can access scientific knowledge.
- Action research: Teachers are increasingly involved in action research processes to evaluate and improve their pedagogical practices based on scientific evidence.

Qualitative assessment of the interview: Teaching strategies for integrating Artificial Intelligence into the high school curriculum

1. Perception of AI:

– Teachers recognize the transformative potential of AI in learning, highlighting its ability to personalize education and facilitate access to educational resources.

- However, there is some resistance due to lack of specific training and fear of the unknown.

2. Didactic strategies proposed:

- Project-based learning: It is suggested to implement projects where students use AI tools to solve real problems, thus encouraging active learning.
- Gamification: Incorporate playful elements using AI to motivate students and make lessons more attractive.
- Interdisciplinary collaboration: Encourage joint work between different subjects that integrate AI concepts, promoting a holistic approach.

3. Challenges identified:

- Lack of adequate technological infrastructure is a significant obstacle.
- The need for continuous training for teachers is crucial to ensure proper implementation.
- Resistance to change on the part of educational personnel can limit the effective adoption of new methodologies.

4. Recommendations:

- Develop specific training programs on AI aimed at teachers and students.
- Invest in technological infrastructure that allows effective use of AI-based tools.
- Foster an institutional culture open to educational change and innovation.

The integration of didactic strategies that incorporate Artificial Intelligence into the baccalaureate curriculum presents significant opportunities to improve the educational process. However, it is critical to address existing challenges through adequate training and technological improvements. Collaboration among all educational stakeholders will be key to successful and sustainable implementation.

The results showed a significant increase in interest in technology-related topics among the participating students. Eighty-five percent of them expressed feeling more motivated towards their learning after participating in AI-related activities. In addition, there was a noticeable improvement in critical skills such as problem solving (70%) and collaborative work (75%). Teachers also reported feeling more qualified to teach these contents thanks to the training received during the process.

Some of the actions that will favor didactic strategies to integrate Artificial Intelligence into the high school curriculum are:

1. Project Based Learning (PBL).

PBL was used as a central strategy to involve students in AI-related projects. Students worked in groups to develop simple applications using tools such as Python and platforms such as Scratch. This methodology fostered collaborative skills and allowed students to apply theoretical concepts to practical situations.

2. Use of digital resources

Interactive digital resources were incorporated to explain basic AI concepts through videos, simulations and online tutorials. Platforms such as Khan Academy and Coursera were used to complement traditional learning with up-to-date AI content.

3. Hands-on workshops

Hands-on workshops were organized where local experts shared their knowledge on AI applied in different fields (health, business, and environment). These workshops not only motivated students, but also provided them with a realistic view of the impact of AI in various industries.

4. Interdisciplinary curriculum integration

Curriculum integration was key; activities were designed that combined mathematics, social sciences and computer science with AI-related topics. For example, how algorithms can influence social or economic decisions was explored.

5. Continuous assessment

A continuous assessment system was implemented that included self- and peer-assessments, allowing students to reflect on their own learning and receive constructive feedback.

The effective integration of Artificial Intelligence into the baccalaureate curriculum is possible through meaningful and innovative teaching strategies that foster active learning. The results indicate that the strategies implemented had a positive impact on both learning and student motivation:

- Active learning: PBL fostered more active and participatory learning; students showed greater interest when working with technological tools.
- Increased motivation: Gamification was particularly effective; students reported enjoying their classes more and feeling more motivated when learning about AI.

- Enhanced collaborative work: Interdisciplinary collaboration allowed students to see practical applications of AI, which enriched their conceptual understanding.
- Effective integration of these strategies can lead to a significant increase in student engagement. Students tend to be more motivated when they feel their learning is relevant and personalized.
- Personalizing learning helps cater to different cognitive styles, which is crucial to maintaining high levels of interest.
- AI-based tools can provide instant feedback, which is critical for effective learning; this allows for immediate adjustments to instructional strategies.
- In addition, by using innovative technologies such as AR/VR, it fosters a modern educational culture that appeals to today's digital natives.

Integrating Artificial Intelligence in the classroom not only improves pedagogical methodologies but also creates a more dynamic and inclusive environment where all students can thrive.

Conclusions

The integration of Artificial Intelligence in the high school curriculum represents a significant opportunity to enrich the educational process and prepare students for an increasingly digitized future. Through the study conducted for an educational unit in Guayaquil, various didactic strategies have been identified that not only facilitate the understanding of complex concepts related to AI, but also foster critical and creative skills in students.

It is crucial to incorporate accessible technological tools that facilitate learning about AI. Interactive educational platforms and digital resources can make concepts more understandable and engaging. Teacher training is another key aspect; educators must be trained not only in the use of these tools, but also in how to integrate them effectively into their classes.

On the other hand, the importance of fostering critical thinking regarding the ethical use of AI is highlighted. Students should be aware of the social and ethical implications of

this technology. Debates and reflections on real cases can help develop critical awareness among young people.

It is essential to continuously evaluate the strategies implemented to adapt them to the changing needs of the students and the technological environment. Constant feedback will allow adjusting methodologies and ensuring that the proposed educational objectives are met.

Artificial Intelligence in the high school curriculum through appropriate didactic strategies not only prepares students to face future challenges, but also provides them with valuable tools to become informed and responsible citizens in a world increasingly influenced by technology. The experience gained in this educational unit can serve as a model for other educational institutions seeking to innovate their pedagogical approach to the demands of the 21st century.