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Limitaciones de la inteligencia artificial en educación a distancia

Limitations of artificial intelligence in distance education

Limitações da inteligência artificial no ensino a distância

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Resumen

El uso de inteligencia artificial (IA) en educación ha generado un debate creciente sobre sus alcances reales en el logro académico. Esta investigación tuvo como objetivo analizar la eficacia de un modelo de IA (ChatGPT) como herramienta de apoyo en la acreditación de un curso autogestivo en línea. El estudio se realizó bajo un enfoque cualitativo, con diseño de estudio de caso, y contó con la participación de una docente mexicana de nivel medio superior, que documentó sistemáticamente su experiencia durante el proceso de acreditación. Se recurrió a técnicas de recolección de datos que incluyeron capturas de pantalla, transcripciones, diario reflexivo y bitácoras, analizadas mediante codificación temática. Los resultados mostraron que, a pesar del acompañamiento intensivo de la IA, la participante no logró acreditar el curso "Fundamentos de Inteligencia Artificial", revelando que la herramienta no compensó las brechas conceptuales existentes. Se concluye que el uso de IA sin mediación pedagógica intencionada puede promover aprendizajes operativos, pero no garantiza la comprensión profunda. El valor de este estudio radica en documentar empíricamente los límites de la IA en contextos de evaluación a distancia, un tema de creciente interés global y educativo.

Palabras clave: autoformación, cursos en línea, educación a distancia, evaluación educativa, inteligencia artificial.

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Abstract

The use of artificial intelligence (AI) in education has sparked growing debate about its actual effectiveness in supporting academic achievement. This study aimed to analyze the effectiveness of an AI model (ChatGPT) as a support tool for successfully completing a self-paced online course. The research followed a qualitative approach using a case study design, with the participation of a Mexican upper-secondary school teacher, who systematically documented her experience throughout the accreditation process. Data collection techniques included screenshots, chat transcripts, reflective journaling, and activity logs, all analyzed through thematic coding. Results showed that despite intensive support from the AI, the participant did not pass the "Fundamentals of Artificial Intelligence" course, highlighting that the tool did not bridge existing conceptual gaps. The study concludes that the use of AI without intentional pedagogical mediation may foster operational learning, but does not ensure deep understanding. The value of this research lies in empirically documenting the limitations of AI in distance assessment contexts, a topic of growing global and educational relevance.

Keywords: self-directed learning, online courses, distance education, educational assessment, artificial intelligence.

Resumo

O uso da inteligência artificial (IA) na educação tem gerado um crescente debate sobre seu impacto real no desempenho acadêmico. Esta pesquisa teve como objetivo analisar a eficácia de um modelo de IA (ChatGPT) como ferramenta de apoio à acreditação de um curso online autodirigido. O estudo foi conduzido utilizando uma abordagem qualitativa, com delineamento de estudo de caso, e incluiu a participação de uma professora do ensino médio mexicana que documentou sistematicamente sua experiência durante o processo de acreditação. As técnicas de coleta de dados incluíram capturas de tela, transcrições, diários reflexivos e registros, que foram analisados por meio de codificação temática. Os resultados mostraram que, apesar do intenso apoio da IA, a participante não foi aprovada no curso "Fundamentos da Inteligência Artificial", revelando que a ferramenta não compensou as lacunas conceituais existentes. O estudo conclui que o uso da IA sem mediação pedagógica intencional pode promover a aprendizagem operacional, mas não garante uma compreensão

profunda. O valor deste estudo reside na documentação empírica das limitações da IA em contextos de avaliação remota, um tema de crescente interesse global e educacional.

Palavras-chave: aprendizagem autodirigida, cursos online, educação a distância, avaliação educacional, inteligência artificial.

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Introduction

In recent years, the use of artificial intelligence (AI) tools in educational settings has increased significantly. Platforms such as ChatGPT (OpenAI, 2024) allow students to access automated responses, immediate explanations, and assisted task resolution, posing new challenges to traditional models of assessment, teaching, and learning (Luckin et al., 2016; Holmes et al., 2019).

Given this scenario, it is crucial to analyze not only the pedagogical potential of AI, but also its limitations when used as an academic support tool in virtual environments. Several studies indicate that AI can personalize learning (Cope & Kalantzis, 2016); however, it has also been noted that its indiscriminate use can foster the automation of knowledge without ensuring deep understanding or the development of critical thinking (Worthington, 2022).

As background and problem statement, the case of a Mexican high school teacher with a professional background in Administration (bachelor's and master's degrees) is presented. She enrolled in the online course "Fundamentals of Artificial Intelligence," offered by the Carlos Slim Foundation, with the purpose of exploring this phenomenon from a situated perspective. Her decision to take the course stemmed from her intention to experience, from a reflective and documented standpoint, the learning practices that her own students could adopt through the intensive use of AI.

The course covered the fundamentals of artificial intelligence from a computational perspective, focusing on programming, algorithms, and heuristic models. This approach presented a challenge for the participant, whose academic background did not include prior training in technological disciplines or applied mathematics. Consequently, the lack of conceptual foundations in this area became a significant factor when interacting with AI, as it influenced the types of questions asked, the interpretations made, and the ability to critically reflect on the responses provided by the model.

Based on this experience, which integrated the role of active participant and researcher, the real conditions in which a user with academic preparation resorts to AI to solve online exams were analyzed, as well as the scope of such assistance in the accreditation of a course.

Given the circumstances described, the following research question was posed as the central problem: Does artificial intelligence, used as an assistant in solving virtual exams, guarantee academic achievement in self-training contexts?

Documented experience suggests that this is not necessarily the case, and that the use of AI can even reveal conceptual gaps or unresolved cognitive difficulties. In this sense, the study aimed to explore the limitations of AI support in real-world remote assessment scenarios. The choice of the "Fundamentals of Artificial Intelligence" course was deliberate, as it is a training program directly related to the subject of study, in which the intensive use of a tool like ChatGPT would be particularly relevant.

Although the course had a technical and computational focus, it was considered that the intensive support of AI could enable accreditation, even without a specialized programming profile.

It was hypothesized that artificial intelligence, used as a support tool during an online accreditation process, would significantly facilitate academic achievement.

However, the results obtained allowed us to qualify this initial assumption, showing that AI, although useful as a reference resource, does not by itself guarantee conceptual understanding or success in self-training contexts.

Method

This study adopts a qualitative approach, employing a case study design, as it allows for an in-depth analysis of contemporary phenomena in real-world contexts (Yin, 2018). The research focused on an individual experience aimed at understanding the possibilities and limitations of using artificial intelligence (AI) in academic accreditation processes in a virtual setting.

The participant in this study was a Mexican high school teacher with a master's degree, who enrolled in the online course "Fundamentals of Artificial Intelligence" of the Carlos Slim Foundation (2025), under a self-directed modality.

The purpose was to experience, as an active user, the intensive support of an AI assistant (ChatGPT, model GPT-4o) in solving accreditation exams.

Since this was an exploratory study, standardized instruments were not used. Instead, a data collection strategy based on three components was designed:

(1) an observation guide to record relevant interactions with AI;

(2) a logbook format to systematize the experience during the resolution of the exams; and

(3) a guided reflection scheme that guided the participant in recording her assessments of the usefulness of AI.

These inputs were designed by the researcher based on the study objectives, ensuring their internal consistency and relevance for the collection of relevant information.

In addition, direct records of the experience were used: screenshots of exams completed with AI support, transcripts of chats with the assistant, and a reflective journal written by the participant. This journal included observations on successes, errors, difficulties, strategies used, perception of the support provided, and decisions made during the process, as well as a personal assessment of the actual usefulness of AI in solving the exams.

The consistency between the designed instruments, the information collected and the subsequent analysis was ensured through a systematic cross-review that allowed the methodological coherence of the study to be maintained.

Regarding the data analysis, a qualitative content analysis was used, aimed at identifying emerging patterns and categories around three axes:

(1) the type of support requested from AI;

(2) the academic performance achieved; and

(3) the limitations observed in the process.

Subsequently, this information was triangulated with the results obtained in the evaluations (final grades), in order to interpret the real scope of AI as a support tool in virtual educational environments.

Qualitative analysis procedure

The analysis of the information was carried out through a systematic process of inductive thematic coding, aimed at understanding the limitations in learning artificial intelligence content in a distance training course without direct pedagogical mediation.

In the first stage, a detailed and repeated reading of the empirical material was carried out, consisting of the course monitoring log, the evidence generated during its development,

the interactions with the artificial intelligence tool, and the results obtained in the evaluations. This reading allowed for the identification of relevant fragments related to academic performance, the type of support provided by AI, and the difficulties encountered throughout the accreditation process.

Based on this review, units of meaning were identified that were recurrently associated with:

(a) the use of artificial intelligence as support for answering questions without a solid conceptual understanding;

(b) the presence of persistent conceptual errors, particularly in the interpretation of fundamental notions such as heuristics, search processes and decision-making;

(c) procedural errors in solving items that required applying concepts to specific situations; and

(d) sustained difficulties in understanding theoretical content, evidenced by the inability to explain the evaluated concepts in one's own words, even when some answers were formally correct.

These units were subsequently coded inductively, assigning initial codes that emerged directly from the data. These codes were then progressively grouped into thematic categories, based on criteria of recurrence, analytical relevance, and coherence with the study's purpose.

This process allowed the analysis to be organized around three central axes: the instrumental use of artificial intelligence as operational support, the conceptual and procedural errors associated with the understanding of the contents, and the conceptual barriers that consistently influenced the non-accreditation of the course, despite the constant use of the technological tool.

To ensure the reliability of the analysis, triangulation of information sources was used, systematically comparing qualitative records (logbook, evidence, and interactions with AI) with the results obtained in the evaluations. This comparison allowed for the consistent identification of the discrepancy between apparent performance and actual conceptual understanding.

Given the author's dual role as researcher and participant, a reflective and self-critical stance was maintained during the recording and analysis of information, and the triangulation of sources was used as a strategy to reduce possible interpretation biases.

It should be noted that the researcher gave her informed consent to document the process for scientific purposes and to publish the results in a peer-reviewed journal.

Results

The participant's use of artificial intelligence allowed her to obtain correct answers on some questions of the accreditation exams. However, her academic results did not reach the required level, as she obtained an average score of 70%, while the minimum required was 80%.

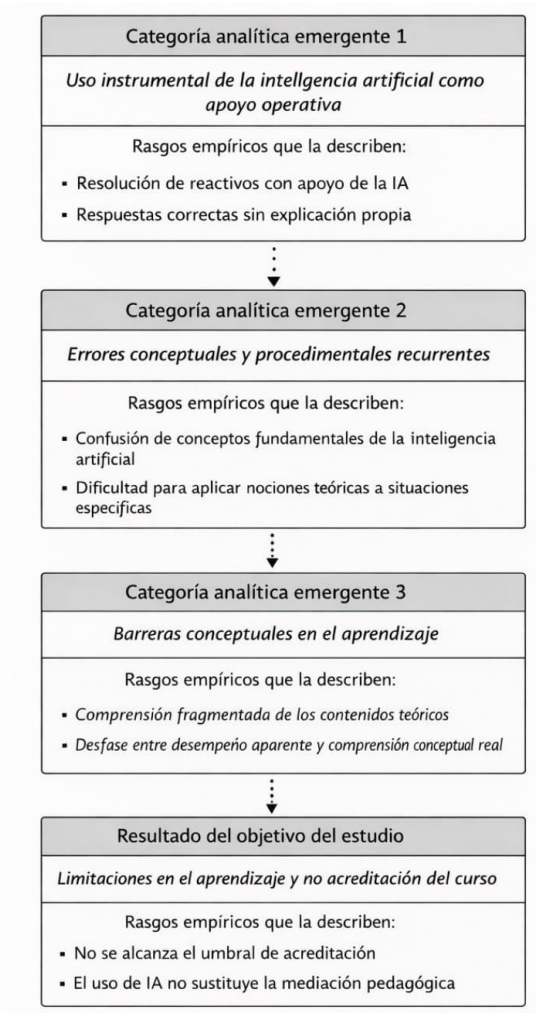
Two main causes associated with insufficient performance were identified.

First, difficulties in deeply understanding the fundamental concepts assessed were evident. The participant's academic background, with a degree in administration, did not include prior experience in programming or computational fundamentals. The course focused on "Fundamentals of Artificial Intelligence" from a technical perspective, with content such as search algorithms, data structures, and heuristic logic, which demanded previously undeveloped cognitive skills. Recent studies indicate that the effective use of AI-based tools depends largely on the user's prior knowledge and their ability to integrate new conceptual frameworks (Liu et al., 2022; Ng et al., 2020).

Secondly, confusion was observed in the interpretation of evaluative processes and solution sequences. Several exercises required ordering steps or applying logical criteria that the AI did not always interpret correctly. For example, in an item related to A* search, the logical steps were reversed: the path was prioritized without first analyzing the graph or calculating the heuristic costs. Furthermore, an erroneous inference was made by assuming that blind search uses heuristics, when by definition it does not (Russell & Norvig , 2020).

These findings were derived from thematic analysis applied to the information obtained through the previously described data collection techniques. Three main categories emerged from this analysis: (1) type of support provided by AI, (2) type of frequent errors made while solving the exercises, and (3) conceptual barriers identified in the learning process.

Figure 1. Synthesis of emerging analytical categories and main findings of the study



Note : Prepared by the author based on the qualitative analysis of the case study.

As can be seen in Figure 1, these categories allow the results to be interpreted from a pedagogical perspective, showing that artificial intelligence can offer answers with a high statistical probability of being correct, but not necessarily derived from a structural understanding of the problem.

These results also reveal a tension between apparent performance and actual conceptual understanding, which raises relevant implications for evaluation processes in AI-mediated environments.

In this same vein, it should be noted that, according to OpenAI (2024), the GPT-4o model generates linguistic sequences based on contextual probability, without employing formal validation or structural semantic understanding. This aligns with the observations of Luckin et al. (2016), who clarify that artificial intelligence in education requires human mediation to filter, question, and critically integrate the information provided.

The evidence obtained in this study suggests that, although artificial intelligence served as operational support, it failed to compensate for the conceptual gaps necessary to successfully complete the course. The gap between automation and genuine understanding has also been documented by García-Sanz-Calcedo and González-Gaya (2022), who point out that AI systems can offer syntactically correct answers without necessarily demonstrating deep conceptual understanding if they are not integrated into a reflective learning process.

Therefore, the results obtained in this study allow us to infer that the effectiveness of AI as a sole support tool for the accreditation of complex learning in self-managed courses is limited.

Consequently, the hypothesis put forward is not fully confirmed, since, although AI offered timely assistance, it did not guarantee academic achievement on its own.

Paradoxically, it should be noted that, even though it was a course on artificial intelligence and had intensive support from an AI-based tool, the course was not accredited.

This finding reinforces the need for a deep conceptual understanding as an indispensable condition for the consolidation of learning in contexts mediated by artificial intelligence.

Discussion

The findings of this study allow us to analyze the implications of using artificial intelligence as a support tool in remote academic assessment processes. While various authors, such as Holmes et al. (2019) and Cope and Kalantzis (2016), highlight the potential of AI to personalize learning and offer immediate feedback, this case demonstrates that its effectiveness is conditioned by multiple factors, including the user's academic profile, their level of conceptual understanding, and the nature of the content being assessed.

The AI used (ChatGPT) demonstrated the ability to suggest correct answers and, in some cases, to organize ideas coherently. However, as Floridi and Chiriatti (2020) point out, these responses are based on probabilistic linguistic correlations and not on formal logical reasoning processes.

In this study, this manifested itself in errors in the interpretation of key concepts, such as heuristic search mechanisms, which directly impacted the participant's performance and failure to pass the course.

In this same sense, and according to the reviewed literature, Luckin et al. (2016) point out that AI should be understood as a technology that amplifies human capabilities, but that

requires intentional pedagogical support to be meaningfully integrated into educational processes.

Furthermore, the fact that the participant did not pass the course, despite the intensive use of AI, reinforces this perspective. Without a prior understanding of computational principles and without the mediation of a sound instructional design, AI can hardly compensate for the user's cognitive limitations.

The study also highlights that self-directed courses can create a perception of accessibility and simplicity when technological assistance tools are available, which can lead to an overestimation of actual understanding.

In line with this, García-Peñalvo et al. (2021) argue that autonomy in learning does not imply an absence of structure, and that dependence on intelligent assistants can shift cognitive effort towards a more mechanical than reflective resolution.

Finally, the results reveal a gap between the operational tasks that AI facilitates and the cognitive processes that human learning requires. In this sense, artificial intelligence can support the execution of activities, but it does not replace the reasoning, conceptual articulation, and knowledge validation processes that are part of deep learning.

Furthermore, Selwyn (2023) strengthens this perspective, as he warns that the central challenge lies not in the technology itself, but in the type of pedagogical culture that is built around it, so as to foster a meaningful teaching-learning environment.

Thus, this empirical experience raises a relevant discussion for distance education environments: the use of AI must be articulated with critical training strategies, not only as a means to solve tasks, but as a resource that requires an active, reflective user with the capacity for cognitive self-regulation.

In summary, this analysis made it possible to identify more clearly the conditions under which artificial intelligence can—and cannot—be effective in the accreditation of technical content, providing a useful frame of reference for future research and pedagogical practices in virtual environments.

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Conclusions

The results of this case study show that while artificial intelligence offers operational advantages in online self-directed learning, it does not, in itself, guarantee academic achievement or deep conceptual understanding. The hypothesis that AI would significantly facilitate course accreditation was partially rejected, as the participant did not pass. This result highlights the limitations of this technology in contexts requiring structured reasoning, solid prior knowledge, and conceptual interpretation skills.

However, the intensive use of ChatGPT did contribute as an operational support tool. It allowed for the immediate resolution of doubts and achieved an average success rate of 70%; however, the accreditation criteria required 80%, which proved decisive in the academic outcome.

This case study offers a contextualized analysis of the impact of AI in a specific educational setting. It also highlights the risks of automating learning processes without considering the cognitive dimension involved. In this regard, it underscores the importance of designing learning environments that integrate the use of technology with active and structured pedagogical strategies.

The study also highlights the value of the teacher's role as a cognitive mediator, even in self-directed learning environments, to prevent learning from becoming a merely instrumental process. Similarly, it documents an increasingly common phenomenon: the use of AI assistants by students to complete online assessments. This situation raises the need for a critical review of the learning outcomes promoted, the accreditation criteria, and current instructional models.

Regarding limitations, it is acknowledged that the researcher's dual role as participant may have influenced the interpretation of the results, although an effort was made to maintain a reflective and self-critical stance throughout the process. Furthermore, the case study design does not allow for the generalization of the findings; however, it does enable a deeper understanding of the phenomenon within a specific context and provides an analytical basis for future research.

In summary, the central conclusion of this study is that artificial intelligence should not be equated with human intelligence. Rather, it should be understood as a technological tool that, to contribute effectively to learning, needs to be integrated into an intentional pedagogical framework that fosters critical reflection, conceptual articulation, and deep understanding.

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Future lines of research

The study opens up various possibilities for further exploring the role of artificial intelligence in virtual educational contexts, especially in self-directed learning modalities.

One initial line of research involves comparing the academic performance of users who employ AI tools with explicit pedagogical guidance versus those who use them autonomously. This comparison would allow for a more precise identification of the differential contribution of human support in environments mediated by emerging technologies.

Furthermore, this study proposes to analyze how variables such as educational level, prior training in digital skills, and prior familiarity with virtual environments influence the perceived and actual effectiveness of AI models as support tools in assessment processes. These factors can significantly impact conceptual understanding, the quality of questions posed to the model, and, consequently, the learning outcomes achieved.

Another potential line of inquiry focuses on analyzing the ethical and epistemological implications of using generative AI in assessments, particularly when these tools are employed without a training framework that fosters critical thinking. In this regard, it is relevant to study how the notions of “learning,” “passing,” and “understanding” are constructed in contexts where immediate access to answers can displace certain complex cognitive processes.

The findings also allow for the projection of comparative and replicable studies based on the analytical design employed. Firstly, future research could replicate this experience in other distance learning courses with similar technical content, maintaining the use of an artificial intelligence tool as the primary support and the qualitative analysis criteria defined here (inductive thematic coding, identification of units of meaning, and construction of emergent categories). This would allow for comparison of whether similar patterns of instrumental use of AI and difficulties in conceptual understanding are reproduced.

Secondly, comparative studies are proposed between two modalities of the same training course: one that uses artificial intelligence as support without direct pedagogical mediation, and another that incorporates explicit teacher support strategies, such as prior conceptual guidance, critical review of the AI-generated responses, and systematic feedback. This comparison would allow for a direct analysis of the effect of pedagogical mediation on content comprehension, academic performance, and course accreditation.

Finally, future research could broaden the analysis by considering different levels of prior knowledge about artificial intelligence content among the participants, while maintaining the same assessment and qualitative analysis framework. The aim would be to explore how prior knowledge influences the use of AI and the detection of conceptual errors during the learning process.

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