revista
tempos e espacos
em educacão

Artificial intelligence tools in literature review: a study based on the theme of logical fallacies

Ferramentas de inteligência artificial na revisão de literatura: um estudo com base no tema das falácias lógicas

Herramientas de inteligencia artificial en la revisión de la literatura: un estudio basado en el tema de las falacias lógicas

Ivan Martins Santana[1], Francislê Neri de Souza[1], Helena Brandão Viana[3]

[1] Adventist University Center of Sao Paulo, Engenheiro Coelho, São Paulo, Brazil.

Corresponding author:
Helena Brandão Viana
E-mail: hbviana2@gmail.com

How to cite: Santana, I. M., Souza, F. N., & Viana, H. B. (2024). Artificial intelligence tools in literature review: a study based on the theme of logical fallacies. *Revista Tempos e Espaços em Educação, 17(*36), e22252. http://dx.doi.org/10.20952/revtee.v17i36.22252

ABSTRACT
This article presents an innovative study on the use of Artificial Intelligence (AI) tools in academic literature review, specifically focusing on the identification and understanding of logical fallacies, a relevant theme in the digital age characterized by the prevalence of misinformation. The study details how three AI tools (Elicit, ChatPDF, and ChatGPT) can be employed to enrich the educational approach to logical fallacies. The main objective is to demonstrate how AI can improve the efficiency and depth of academic literature reviews. The adopted methodology includes the use of Elicit for searching and selecting articles, ChatPDF for reading and interpreting PDF documents, and ChatGPT for data analysis and synthesis. The results show that AI allows for a quick and comprehensive screening of the literature, facilitating the initial identification and selection of relevant publications. However, human intervention is crucial for critical analysis and the final selection of articles, ensuring the relevance and quality of the data. This balance between AI and human evaluation results in a robust and comprehensive literature review. The contributions of the study include demonstrating the effectiveness of AI tools in the literature review and proposing a hybrid model that combines technology and human discernment. This model has the potential to be applied in other fields of knowledge, promoting significant methodological advancements in academic research.
Keywords: Literature Review. Artificial Intelligence. Elicit. ChatPDF. ChatGPT.

RESUMO
Este artigo apresenta um estudo inovador sobre a utilização de ferramentas de Inteligência Artificial (IA) na revisão de literatura acadêmica, focando especificamente na identificação e compreensão de falácias lógicas, um tema relevante na era digital caracterizada pela prevalência de desinformação. O estudo detalha como três ferramentas de IA (Elicit, ChatPDF e ChatGPT) podem ser empregadas para enriquecer a abordagem educacional sobre falácias lógicas. O objetivo principal é demonstrar como a IA pode melhorar a eficiência e a profundidade da revisão de literatura acadêmica. A metodologia adotada inclui a aplicação do Elicit para busca e seleção de artigos, o ChatPDF para leitura e interpretação de documentos em PDF, e o ChatGPT para análise e síntese de dados. Os resultados mostram que a IA permite uma triagem rápida e abrangente da literatura, facilitando a identificação inicial e a seleção de publicações pertinentes. No entanto, a intervenção humana é crucial para a análise crítica e a seleção final dos artigos, garantindo a relevância e a qualidade dos dados. Este equilíbrio entre IA e avaliação humana resulta em uma revisão de literatura robusta e abrangente. Os contributos do estudo incluem a demonstração da eficácia das ferramentas de IA na revisão de literatura e a proposta de um modelo híbrido que combina tecnologia e discernimento humano. Este modelo tem o potencial de ser aplicado em outras áreas de conhecimento, promovendo avanços metodológicos significativos em pesquisas acadêmicas.
Palavras-chaves: Revisão de Literatura. Inteligência Artificial. Elicit. ChatPDF. ChatGPT.

RESUMEN
Este artículo presenta un estudio innovador sobre el uso de herramientas de Inteligencia Artificial (IA) en la revisión de la literatura académica, centrándose específicamente en identificar y comprender falacias lógicas, un tema relevante en la era digital caracterizada por la prevalencia de la desinformación. El estudio detalla cómo se pueden emplear tres herramientas de inteligencia artificial (Elicit, ChatPDF y ChatGPT) para enriquecer el enfoque educativo de las falacias lógicas. El objetivo principal es demostrar cómo la IA puede mejorar la eficiencia y profundidad de la revisión de la literatura académica. La metodología adoptada incluye la aplicación de Elicit para búsqueda y selección de artículos, ChatPDF para lectura e interpretación de documentos PDF y ChatGPT para análisis y síntesis de datos. Los resultados muestran que la IA permite una selección rápida y completa de la literatura, facilitando la identificación inicial y la selección de publicaciones pertinentes. Sin embargo, la intervención humana es crucial para el análisis crítico y la selección final de los artículos, asegurando la relevancia y calidad de los datos. Este equilibrio entre la IA y la evaluación humana da como resultado una revisión de la literatura sólida y completa. Las contribuciones del estudio incluyen demostrar la eficacia de las herramientas de inteligencia artificial en la revisión de la literatura y proponer un modelo híbrido que combine tecnología y juicio humano. Este modelo tiene el potencial de ser aplicado a otras áreas del conocimiento, promoviendo importantes avances metodológicos en la investigación académica.
Palabras clave: Revisión de la literatura. Inteligencia artificial. Obtener. ChatPDF. ChatGPT.

INTRODUCTION

The literature review process was significantly facilitated by artificial intelligence tools, which acted as initial facilitators. This article focuses on the use of Artificial Intelligence (AI) tools in the development of a theoretical foundation for a work aimed at identifying and understanding logical fallacies, an issue of the digital age characterized by the prevalence of misinformation. With the goal of improving teaching strategies for students, the theoretical work details how AI tools, specifically Elicit, ChatPDF, and ChatGPT, can be employed to enrich the educational approach to logical fallacies. These tools enabled a rapid and comprehensive scan of the vast amount of available

literature, facilitating the initial identification, understanding, and selection of potentially relevant publications to the research topic. It is noted that the application of AI in literature review has gained prominence in recent years, facilitating the screening and analysis of large volumes of academic data (Wagner, Lukyanenko & Paré, 2021).

Elicit is an advanced AI tool developed to assist in the search and selection of academic literature. It allows researchers to formulate specific questions related to their study topics, and by using AI algorithms, the tool identifies and recommends a variety of relevant scientific articles. Elicit stands out for its ability to provide quick summaries and insights on articles, facilitating an efficient and targeted initial screening.

The ChatGPT tool, specialized in natural language processing, allows for interactions in a dialogue format. This tool proves extremely useful in the phases of analysis and synthesis of data derived from carefully selected articles. Its role is fundamental in formulating inquiries and responses regarding the content of the articles, facilitating the assimilation and structuring of key ideas. Furthermore, ChatGPT is useful for generating suggestions for questions and topics to be explored based on the selected articles, contributing to a deeper and more focused analysis.

ChatPDF, on the other hand, is an AI tool that specializes in analyzing PDF documents. This tool was used to read and interpret the selected scientific articles. With ChatPDF, it is possible to extract essential information from documents, such as methodologies, results, and conclusions, quickly and efficiently. The tool also allows for specific questions to be asked about the content of the documents, helping to clarify doubts and deepen the understanding of the texts.

However, it is crucial to emphasize that AI is used only as a starting point. The final selection of articles and in-depth analysis depend entirely on human evaluation. After the initial identification by AI, each article must be carefully read, reviewed, and assessed by the researcher to ensure relevance, quality, and alignment with the research objectives. This process involved critical reading of abstracts, evaluation of methodology, and analysis of the results and conclusions presented in each study. The importance of self-verification of AI tools in the context of identifying logical fallacies is highlighted by Hong, Zhang, Pang, and Zhang (2023), who investigate the ability of large language models (LLMs) to identify their own errors in logical reasoning. The study introduces a dataset (fallacies), containing 232 types of reasoning fallacies, providing a comprehensive analysis of these models' self-verification ability. The results suggest that while AI tools may show promise in identifying fallacies, they still face significant challenges in ensuring the validity of self-verification methods (Hong *et al*., 2023).

Thus, AI tools have proven useful for the initial screening and organization of articles. However, human discernment is indispensable in the critical analysis and final selection of materials. This balance between the efficiency provided by AI and the detailed analysis performed has ensured a comprehensive and robust literature review.

The use of AI tools in academic research has gained significant attention in recent years, being the subject of several studies and publications. Tutoring systems, such as the Thesis Writing Tutor (TURET), documented in " TURET2.0: Thesis Writing Tutor Aimed on Lexical Richness in Students' Texts" (González-López, López-López, García-Gorrostieta, & Espinoza, 2016), aim to help students improve the lexical richness of their texts. AI algorithms can be used to identify and group relevant sources or help identify and correct grammatical and stylistic errors (Farias, 2023).

Additionally, Sourati, Venkatesh, Deshpande, Rawlani, Ilievski, Sandlin, and Mermoud (2022) explore robustness and explainability in identifying logical fallacies in natural language arguments. The study formalizes theoretical methods of identifying fallacies within a three-stage evaluation framework: detection, coarse classification, and fine classification. Using language models combined with background knowledge and explainable mechanisms, the results indicate that identifying fallacies is a challenging task that may require specialized forms of reasoning to capture various classes of fallacies (Sourati *et al*., 2022).

This study aims to explore the effectiveness of AI tools in academic literature review, particularly in identifying and analyzing logical fallacies. By integrating advanced technologies such as Elicit, ChatPDF, and ChatGPT, we seek not only to improve the efficiency of the review process but also to provide a richer and more critical analysis of the researched materials. Through this investigation, we hope to contribute to the advancement of academic research methodologies, demonstrating the importance of synergy between AI and human evaluation in promoting a grounded education.

METHODOLOGY

The methodology employed in this work was carefully structured into three distinct phases, each incorporating the use of a specific AI tool to optimize different aspects of the research process.

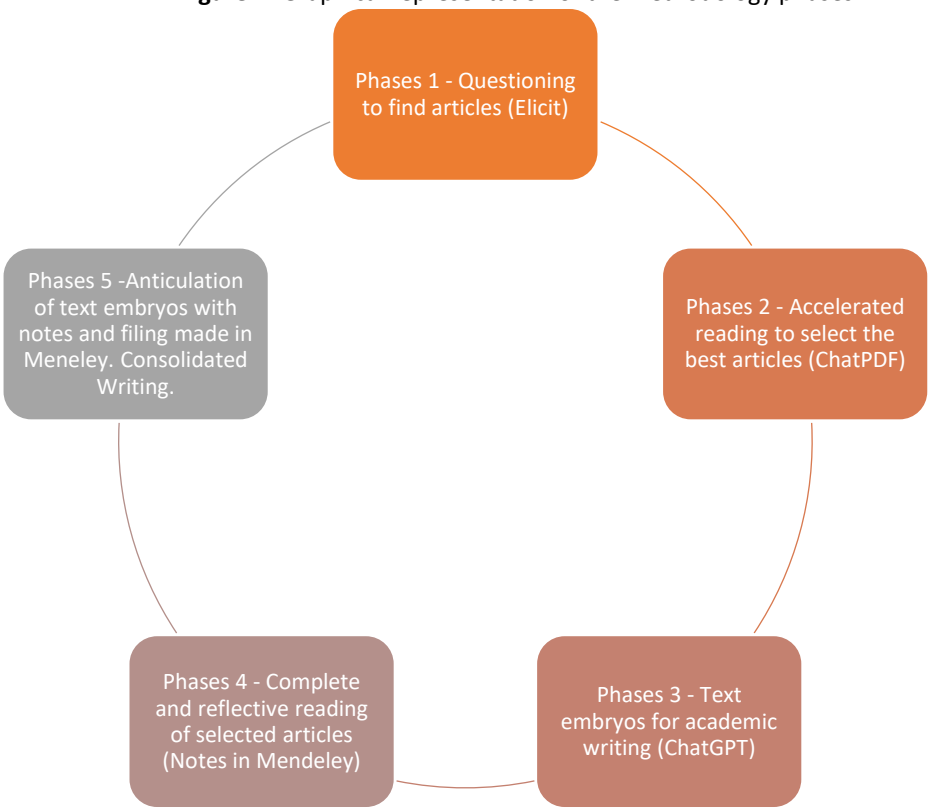
Phase One involved the use of the Elicit tool for the initial search and selection of relevant bibliographic references. This tool allowed for efficient and targeted filtering of the literature, facilitating the identification of scientific articles aligned with the research objectives. Elicit has been recognized for its efficiency in selecting relevant literature, which streamlines the systematic review process (Mahligawati, Allanas, Butarbutar, & Nordin, 2023).

Phase Two utilized the ChatPDF tool for the detailed analysis of the selected documents. With this tool, it was possible to conduct a quick and interactive reading of the texts, enabling a deeper understanding and identification of key points in the articles.

Finally, in Phase Three, ChatGPT was used to assist in synthesizing and organizing the information obtained. This tool helped to coherently structure the content and develop solid arguments based on the references analyzed.

TRADUZIR PARA O INGLÊS AS INFORMAÇÕES DO FIGURA

Figure 1: Graphical representation of the methodology phases



Source: Prepared by the authors.

However, it is essential to emphasize that AI is used only as a starting point. The final selection of articles and the in-depth analysis depend entirely on human evaluation. After the initial

identification made by AI, each article must be carefully read, reviewed, and evaluated by the researcher to ensure relevance, quality, and alignment with the research objectives. The effectiveness of the AI tools used in this study, such as Elicit, ChatPDF, and ChatGPT, in literature review processes and academic text analysis, is widely documented in the literature. Whitfield and Hofmann (2023) examined Elicit, highlighting its ability to increase efficiency and assist in searching and selecting relevant literature through the use of language models (Whitfield; Hofmann, 2023). Kung (2023) also emphasizes Elicit's utility in synthesizing evidence and extracting text, facilitating a systematic literature review.

Moreover, the robustness of tools like ChatPDF in document analysis is supported by studies that highlight its effectiveness in the automatic screening of medical literature, offering a precise and quick evaluation of the analyzed documents (Feng et al. 2022). ChatGPT, in turn, has been noted for its ability to process and synthesize large volumes of text, providing detailed and in-depth analysis, as discussed in studies on AI-assisted peer review (Checco et al., 2021).

RESULTS

By integrating these three AI tools into distinct stages of the process, it is possible to combine efficiency, analytical depth, and academic rigor in the development of the work, as detailed below.

First phase

The process begins with the selection of scientific articles supported by the Elicit AI[1]. For this, it is necessary to formulate relevant questions that align with the study's objectives and research questions. For each question, several articles are presented, some of which offer the option to directly access the file in PDF format; this option was chosen for the preparation of this dissertation. The following questions were formulated: What strategies are being used to teach critical thinking in the classroom? What are the most common logical fallacies used in educational contexts?

For the first question, "What strategies are being used to teach critical thinking in the classroom?", references aligned with teaching critical thinking in the classroom were sought, and upon submitting the question, the tool provided a generic summary aimed at validating the understanding of the submitted question.

> The suggested articles indicate that critical thinking can be taught in the classroom using a variety of strategies. Naiditch (2020) suggests that inquiry-based and project-based learning, as well as Freire's problem-posing approach, can be used to develop critical thinking skills. Bazhouni (2018) recommends questioning, appropriate classroom organization, written assignments, and debates and discussions in class to promote critical thinking among university students. Mihail (2022) argues that critical thinking should be integrated into all programs and educational cycles, and that teaching and learning strategies should be reformed to encourage critical thinking. Vincent-Lancrin (2023) suggests that critical thinking should be incorporated across all subjects in school curricula, and that teacher-friendly rubrics can support lesson planning and formative assessments. Overall, the articles suggest that critical thinking is an essential skill that can be taught through a variety of pedagogical tools and strategies, with the translation done by Google Translate (Elicit org, 2023, our translation).

For the second question, "What are the most common logical fallacies used in educational contexts?", we sought references on teaching the identification of logical fallacies in educational settings. Upon submitting the question, the tool responded with a generic summary to validate the understanding of the question:

[1] The "Elicit" tool is an artificial intelligence-based research assistant designed to help users find relevant information and insights in scientific articles and other academic documents. Available athttps://elicit.com/.

> The articles suggest that logical fallacies are prevalent in educational contexts. Jordan (1904) argues that ignoring errors and a lack of trust in intelligently conducted experiments are the most influential fallacies in education. Jason (1986) questions the claim that fallacies are commonly committed errors in reasoning, while Floridi (2008) argues that some logical fallacies, such as denying the antecedent and affirming the consequent, can serve as informative shortcuts that provide a quick and rough way to extract useful information from the environment. Aswani (2023) examines logical fallacies in story problem-solving among elementary students and identifies three types of logical fallacies: red herring, motion fallacy, and correlation/causality fallacy. Overall, the articles suggest that logical fallacies are common in educational contexts and can negatively impact learning and critical thinking, with the translation done by Google Translate (Elicit org, 2023, our translation).

The tool offers an insights feature that allows for the easy creation of various versions of the initial question. In each result, all relevant articles on the topic, with available PDF files, were selected. A set of rigorous parameters was adopted for selecting articles with the aid of the Elicit tool, justifying the choice of articles to be worked on in the next phase. The criteria included verifying thematic relevance, prioritizing articles that directly addressed the key questions of this research, as well as considering the timeliness and recency of studies to ensure an updated discussion. Classic or foundational works were also included, particularly those that contributed to contextualizing or understanding the evolution of key concepts over time.

Second phase

After selecting the articles that met the aforementioned criteria, the ChatPDF[2] artificial intelligence was used to analyze the documents selected by the researcher, with the support of the Elicit tool in the previous phase. Again, it was necessary to formulate questions that would allow the AI to respond appropriately to ensure a consistent analysis. A standard set of questions was applied to all analyzed documents, including: Does the author provide practical examples of how to identify and avoid logical fallacies in everyday situations? What are the key concepts presented, and what focus of the document can be highlighted as a reference in a theoretical foundation? What approach does the text present to identify and avoid logical fallacies?

The responses are presented quickly, analyzing the entire document regardless of language. The responses helped select the best articles for reading and referencing. At the end of the response analysis of all articles, ten were selected as the foundation for this dissertation.

In selecting the articles for this foundation, a set of criteria was adopted that complemented the initial criteria from phase 1, focusing on the direct relevance to the theme of the work, which is the application and understanding of logical fallacies. These criteria include: a) Application of Standard Questions: Initially, a standard set of questions was applied to all the documents selected in the first phase. These questions, mentioned above, were designed to assess the depth and relevance of the articles in relation to the research objectives; b) Evaluation of Responses: The answers to these questions were analyzed for each article. We looked for documents that not only responded affirmatively to these questions but also demonstrated a level of detail and practical applicability that aligned with the needs of our research; c) Selection Based on Relevance and Depth: The articles that provided the most relevant answers to the questions were selected for further reading and detailed analysis; d) Validation of Selected Articles: After selection, an additional validation of the chosen articles was performed. This validation involved a critical reading to ensure that the documents were aligned with the central theme of the dissertation, made significant contributions to the field of study, and were either current or classic works essential to the evolution

[2] ChatPDF is an AI tool that allows users to interact with PDF documents in a conversational format. Users can ask questions about the document content and receive answers.

of the concepts or theories discussed.

Third phase

ChatGPT was used to generate a brief summary of the responses from each selected article, incorporating analysis and writing aligned with the theme and objectives of the dissertation. Suggestions were requested for questions to be answered by each article selected in the previous phases. The following articles were analyzed: Carnielli, Epstein &Murcho (2011); Portillo & Fernández (2018); Battersby, Bailin & Laar (2011); Canal (2020); Hasibuan, Yusriati & Manurung (2020), Garcia (2017); Arp, Barbone & Bruce (2019); Gozálvez-Pérez, Valero-Moya & González-Martín (2022); Phelps (2017).

To compose the theoretical foundation, the following questions were formulated based on suggestions from ChatGPT[3] using the ChatPDF tool, along with the respective responses provided by the tool.

For the work "Bad arguments 100 of the most important fallacies in Western philosophy" (Arp, Barbone & Bruce, 2019):

• How does the text define critical thinking? The text defines critical thinking as a process of careful and systematic evaluation of information, ideas, and arguments, aiming to formulate well-grounded and reliable conclusions.

• What importance is attributed to critical thinking in education within the work? The work places great importance on critical thinking in education, highlighting that it is essential for developing problem-solving skills, decision-making, and effective communication. The text also emphasizes that critical thinking is fundamental for forming responsible and engaged citizens who are capable of critically evaluating the information they receive and making informed decisions.

Are there practical examples or cases mentioned that illustrate the relevance of critical thinking in education? Yes, the text provides several practical examples and cases that illustrate the relevance of critical thinking in education. For instance, it mentions the importance of teaching students to critically evaluate information sources and to identify common logical fallacies. The text also highlights the importance of teaching students to think independently and to question their own beliefs and assumptions.

• What are the most prevalent and relevant logical fallacies mentioned? The most prevalent and relevant logical fallacies mentioned include suppression of evidence, acceptance of unjustified premises, appeal to emotion fallacy, false dichotomy fallacy, straw man fallacy, appeal to authority fallacy, and appeal to tradition fallacy.

• How does the work classify and define each of these logical fallacies? The work classifies and defines each of these logical fallacies as follows: a) Suppression of evidence: When evidence that contradicts a particular position or argument is omitted or ignored [T1, p. 23, 153, 399-402]; b) Acceptance of unjustified premises: When a premise is accepted without adequate evidence or justification [T1, p. 408-409]; c) Appeal to emotion fallacy: When emotions are used to persuade the audience instead of presenting rational arguments [T2, p. 25-26]; d) False dichotomy fallacy: When a false choice between two options is presented, ignoring other possibilities [T2, p. 26-27].

• Are there practical examples of each logical fallacy mentioned in the work? Yes, the work provides practical examples of each fallacy mentioned to help readers identify and avoid them. For example, the text presents examples of suppression of evidence in debates on climate change and examples of appeal to authority fallacies in discussions on health and nutrition.

[3] "ChatGPT is a language model developed by OpenAI, based on the GPT (Generative Pretrained Transformer) architecture. Inspired by the advances presented in the seminal paper "Attention Is All You Need" by Vaswani *et al*. (2017), this artificial intelligence architecture is designed to generate text and perform a wide range of natural language processing tasks. These tasks include answering questions, translating languages, summarizing texts, and generating creative content such as stories, poems, or scripts."

• What is the importance of recognizing and understanding these logical fallacies in the educational context? Recognizing and understanding these fallacies is fundamental in the educational context as it helps students critically evaluate the information they receive and make informed decisions. Furthermore, knowledge of these fallacies can help students avoid reasoning errors and develop more effective argumentation skills. Ultimately, understanding these fallacies can contribute to students becoming more responsible and engaged citizens, capable of critically evaluating information and making well-founded decisions.

For the work "Pensamento crítico - o poder da lógica e da argumentação" (Carnielli, Epstein & Murcho, 2011):

• How does the document conceptualize critical thinking? The document conceptualizes critical thinking as a process of careful and systematic evaluation of information, ideas, and arguments with the goal of arriving at well-founded and justified conclusions. Critical thinking involves skills such as analysis, interpretation, evaluation, inference, explanation, and self-regulation.

• What are the main elements or characteristics of critical thinking highlighted in the text? The main elements or characteristics of critical thinking highlighted in the text include careful analysis of information and arguments, critical evaluation of evidence and sources, identification of premises and conclusions, recognition of fallacies and biases, formulation of well-founded and justified arguments, and self-regulation of thought.

• Are there significant differences in how critical thinking is conceptualized compared to other sources? It is not possible to answer this question without knowing which other sources are being compared. However, the document presents a comprehensive and detailed approach to critical thinking, including various specific skills and strategies for critically evaluating information and arguments.

• Why is critical thinking vital, as discussed in the work? Critical thinking is essential because it helps individuals make informed and well-founded decisions, critically evaluate information and arguments, identify fallacies and biases, formulate strong arguments, and communicate ideas clearly and persuasively. Additionally, critical thinking is crucial for solving complex problems, making ethical decisions, and participating in responsible civic engagement.

• How does critical thinking contribute to argumentation and decision-making processes? Critical thinking contributes to argumentation and decision-making processes by providing a systematic and rigorous framework for evaluating information, evidence, and arguments. It helps identify premises and conclusions, assess the validity and reliability of sources, recognize fallacies and biases, formulate well-founded arguments, and communicate ideas clearly and persuasively. Critical thinking also helps avoid reasoning errors and make informed, well-reasoned decisions.

• Does the text provide practical suggestions or strategies for cultivating critical thinking? Yes, the text offers several practical suggestions and strategies for cultivating critical thinking, including: practicing careful analysis of information and arguments, critically evaluating sources and evidence, identifying premises and conclusions, recognizing fallacies and biases, formulating well-founded arguments, communicating ideas clearly and persuasively, and self-regulating thought processes. Additionally, the text includes concrete examples and practical exercises to help readers develop their critical thinking skills.

From the work "El pensamiento crítico en las redes sociales. Una propuesta teórica para la educación cívica en entornos digitales" (Gozálvez-Pérez, Valero-Moya & González-Martín, 2021; Neri de Souza, [s. d.]):

• How does the work conceptualize critical thinking within the realm of social networks and digital environments? The work conceptualizes critical thinking within the realm of social networks and digital environments as the skill-disposition to critically evaluate the information received in digital environments, identifying reliable sources and verifying the truthfulness of information. It

also emphasizes the importance of developing a critical ethos, i.e., a reflective and critical attitude towards the information received and shared on social networks.

• Are there specific critical thinking skills or competencies highlighted as essential for navigating digital environments? Yes, the work highlights specific critical thinking skills or competencies essential for navigating digital environments, such as the ability to assess the credibility of information sources, the skill of identifying and analyzing arguments, the capacity to recognize and avoid fallacies, and the ability to critically evaluate the information received and shared on social networks.

• What is the relevance of critical thinking for civic education in digital environments? Critical thinking is fundamental to civic education in digital environments because it enables students to critically evaluate the information they receive and share on social networks, identify reliable sources, and verify the truthfulness of information. Additionally, critical thinking allows students to participate in informed and constructive debates, contributing to the development of responsible and autonomous media citizenship.

• Does the text propose specific pedagogical strategies or educational methods for fostering critical thinking in students in digital contexts? Yes, the work proposes several pedagogical strategies and educational methods for fostering critical thinking in students in digital contexts, such as critical analysis of news and information, identification of fallacies, argument analysis, and critical reflection on personal beliefs and values. Furthermore, the work emphasizes the importance of an interdisciplinary and collaborative approach to civic education in digital environments, involving teachers from different fields and encouraging active student participation.

• How does the work address critical thinking in the digital context, especially regarding the identification of logical fallacies? The work addresses critical thinking in the digital context, particularly concerning the identification of fallacies, as an essential skill for critically evaluating information received on social networks. It emphasizes that fallacies are common in digital environments and that identifying and analyzing these fallacies is crucial to avoiding the spread of false information and misinformation. The text presents various strategies for identifying and analyzing fallacies, such as argument analysis, identifying implicit premises, and critical reflection on one's own beliefs and values.

• What is the importance of identifying logical fallacies in digital environments and social networks for the development of critical thinking, as discussed in the work? The importance of identifying fallacies in digital environments lies in the need to critically evaluate the information we receive on social networks. Fallacies are invalid or misleading arguments that can lead to false or deceptive conclusions and are common in digital environments. Identifying and analyzing these fallacies is crucial to preventing the spread of false information and misinformation and to participating in informed and constructive debates. Moreover, recognizing fallacies can help develop broader critical thinking skills, such as argument analysis and critical reflection on personal beliefs and values.

• Does the work offer pedagogical strategies to teach students how to recognize logical fallacies in digital communications? The work contributes to the discussion on civic education in digital environments by proposing a theory for developing critical thinking in social networks and other digital settings. It emphasizes the importance of an interdisciplinary and collaborative approach in digital civic education, involving teachers from various fields and encouraging active student participation. Additionally, it presents several pedagogical strategies and specific educational methods to foster critical thinking in students within digital contexts, such as the critical analysis of news and information, the identification of fallacies, argument analysis, and critical reflection on one's beliefs and values. In summary, the work contributes to the discussion on civic education in digital environments by proposing a critical and reflective approach to evaluating information received on social networks and other digital platforms.

For the work "A lógica da argumentação e as falácias da sustentabilidade" (Garcia, 2017):

• How does the text define the concept of a fallacy?

The text defines a fallacy as a way to mislead people, either consciously or unconsciously, into forming incorrect understandings of a particular subject. Fallacies are reasoning errors that can be used to persuade or manipulate people but are not based on valid evidence or arguments.

• What types, categories, and classes of logical fallacies are discussed in relation to sustainability? The text addresses various types of fallacies related to sustainability, including the fallacy of ignorance of the subject, false analogy, begging the question, genetic fallacy, ad populum, ad misericordiam, false cause, accident, consensus fallacy, ad hominem, threat fallacy, malicious use of ambiguous words, and slippery slope.

• Are there specific examples or practical cases of logical fallacies associated with sustainability? Yes, the text presents several examples of fallacies linked to sustainability. For example, the fallacy of ignorance might be used to argue that there is not enough evidence to prove climate change exists. The false cause fallacy may be invoked to claim that reducing greenhouse gas emissions is unnecessary since the Earth has naturally undergone warming and cooling periods. Another example is the consensus fallacy, which could be employed to argue that, since most people are not concerned with sustainability, no measures are needed to protect the environment.

• How can understanding these logical fallacies be applied or be relevant to critical thinking in an educational context? Understanding these fallacies can be applied in the educational context to help students develop critical thinking skills. By learning to identify and analyze fallacies, students become better equipped to evaluate arguments and make informed decisions. Moreover, knowledge of fallacies can make students more aware of the persuasive tactics used in media and politics, enabling them to be more critical of the information they receive. In short, understanding fallacies can be a valuable tool for developing critical thinking skills and forming more informed and engaged citizens.

For the work "Examining Argument Elements and Logical Fallacies of English Education" (Hasibuan, Yusriati & Manurung, 2020):

• How are argument elements related to logical fallacies in the text? The text explains that the study investigates the relationship between argument elements and logical fallacies in students' oral discussions in English education. The research aims to identify argument elements and logical fallacies employed by students and understand the causes of these phenomena.

• What logical fallacies are commonly observed in oral discussions of English education students? The study found that the most common logical fallacies observed in students' oral discussions were hasty generalization, appeal to pity, appeal to fear, questionable statistics, slippery slope, appeal to consensus, circular reasoning, pointing to another error, and personal attack.

• How do these logical fallacies impact effective communication and learning? These fallacies can negatively affect effective communication and learning by causing misunderstandings, confusion, and a lack of critical thinking skills. Students may also be less likely to engage in productive discussions and may struggle to develop strong argumentation skills.

• What strategies does the text suggest to avoid or overcome these logical fallacies in the educational process? The text suggests several strategies to avoid or overcome these fallacies in education. These include exposing students to logical argumentation and fallacies, teaching them to structure logical arguments, and encouraging the use of clear and precise language in discussions. Additionally, teachers and lecturers can provide feedback and guidance to help students improve their argumentation skills.

For the work "El uso de falacias en la comunicación absurda" (Portillo & Fernández, 2018):

• What criteria and classifications of logical fallacies does the document present? The document provides a diachronic review of the criteria and classifications of fallacies, including the distinction between formal and substantive fallacies. Formal fallacies occur due to a formal error in

reasoning, while substantive fallacies are based on inadequate connections that involve inferences and depend on overly general assumptions.

• How are these logical fallacies employed in communications aimed at absurdity or humor? Fallacies are used in absurd communications to generate humor and ambiguity. The study analyzes how these logical-discursive mechanisms can function as generators of inferences, elements that semantically enrich discourse, contextual ambiguities, and creators of new mental spaces, predominantly absurd or impossible.

• Are there any lessons or relevant insights that can be applied to education and critical thinking from the analysis of logical fallacies in absurd communications? Yes, the analysis of fallacies in absurd communications can provide relevant insights for education and critical thinking. For example, it can help develop skills in analyzing and evaluating arguments, as well as identifying manipulation and misleading persuasion. Furthermore, the analysis of fallacies in absurd contexts can enhance creativity and the ability to think outside the box.

For the work "Como não identificar falácias" (Canal, 2020):

• What approach does the text present for identifying and avoiding logical fallacies? The text presents Alvin Goldman's epistemological approach for identifying and avoiding fallacies.

• How does this approach differ from other conventional or dominant ones? Alvin Goldman's approach differs from conventional or dominant approaches, such as formal logic of informal fallacies, by being broader and more comprehensive. It considers social, cultural, and psychological factors that may influence how people argue and evaluate arguments. Additionally, this approach is more pragmatic, focusing on improving argumentative practices with the aim of promoting the pursuit of truth.

• What insights does this work offer for effective teaching and learning of logical fallacy identification in the educational context? The work provides relevant contributions to effective teaching and learning of fallacy identification in the educational context. It highlights the importance of teaching students not only to identify formal and structural logical errors but also to understand the nature of fallacies and how they can be used to manipulate and deceive. It also emphasizes the importance of an epistemological and social approach to identifying fallacies, along with the need for a pragmatic approach aimed at improving argumentative practices with a focus on the pursuit of truth. The work suggests that effective teaching of fallacy identification should be integrated into a broader critical thinking curriculum, which includes skills such as argument analysis, evidence evaluation, and informed decision-making.

For the work "Fallacy Identification in a Dialectical Approach to Teaching Critical Thinking" (Battersby, Bailin & Laar, 2011):

• How does the work relate the identification of logical fallacies to the teaching of critical thinking? The work relates fallacy identification to the teaching of critical thinking by arguing that identifying fallacies is an important part of evaluating arguments and is therefore an essential skill for developing critical thinking. The dialectical approach is presented as an effective way to teach fallacy identification, as it allows students to compare different arguments and recognize fallacies in real-world situations.

• What methods or strategies does the work suggest for effectively teaching logical fallacy identification? The work suggests that fallacy identification can be effectively taught through a dialectical approach, which involves analyzing competing arguments and comparing their strengths and weaknesses. Additionally, the work emphasizes the importance of teaching students how to effectively respond to fallacies, rather than simply identifying them. Concrete and practical examples are also presented as an effective way to teach fallacy identification.

• Is there any evidence or case study in the work demonstrating the effectiveness of these methods in developing critical thinking? While the work does not present specific case studies, it draws on extensive research in argumentation and critical thinking, as well as practical teaching

experiences. The authors argue that the dialectical approach and teaching of concrete examples are effective methods for teaching fallacy identification and developing critical thinking.

DISCUSSION

In the study of logical fallacies and critical thinking, this introduction focuses on dissecting and reflecting on the intersection between traditional theory and modern approaches mediated by technology. We seek to understand the dynamics between the application of AI tools and human analysis in academic research. The objective is to evaluate not only the effectiveness of these tools in identifying logical fallacies but also to explore their broader implications in the development of the academic model among high school students.

AI tools, while innovative and efficient, require the complement of human discernment for effective interpretation and application of data. We will discuss the interaction between the speed and comprehensiveness provided by AI tools and the need for detailed human critical analysis, revealing a new facet of the academic research process. The goal is to establish a dialogue between the findings obtained through the employed methodology and contemporary educational practices.

The discussion of AI tools used in this research—Elicit, ChatPDF, and ChatGPT—will focus on analyzing their specific functionalities and efficiencies. The analysis is aimed at better understanding how each tool contributed to the research process, identifying possible areas for improvement, and questioning their applicability in varied academic research contexts. The findings of this study align with the conclusions of Chen, Chen, and Lin (2020), who also identified the effectiveness of AI in the rapid screening of academic literature.

Functionality and Efficiency of Elicit in Literature Selection: The Elicit tool demonstrated high accuracy in identifying relevant articles, contributing to a robust initial selection of literature. Its algorithm covered a wide range of pertinent materials, ensuring the inclusion of diverse sources. However, a possible area for improvement would be the inclusion of features that allow for the recognition of emerging trends and less conventional research areas. Adapting Elicit to identify interdisciplinary or emerging literature that challenges traditional standards would also be a valuable addition.

Detailed Analysis with ChatPDF**:** ChatPDF proved effective in interpreting and analyzing academic texts, providing detailed and contextualized insights. Despite its efficiency, the tool has limitations when dealing with documents in unconventional formats. A suggested improvement would be to enhance ChatPDF to interpret documents in various formats, including graphs and tables, increasing its versatility in analyzing complex content.

Synthesis and Organization with ChatGPT**:** The effectiveness of ChatGPT in synthesizing information was essential in producing cohesive summaries and generating relevant questions and topics, standing out for its ability to condense information without losing critical details or essential context. However, a possible improvement would be to increase ChatGPT's adaptability to different research styles, allowing greater flexibility in applying its functionalities in various contexts.

Interrelationship Between AI Tools and Human Assessment**:** The interdependence between AI tools and human evaluation resulted in a comprehensive and precise review process. However, it is important to reflect on how this synergy can be enhanced for more dynamic or multidisciplinary research contexts. Additionally, there is a need to explore strategies that more effectively integrate AI into interdisciplinary research methodologies, optimizing outcomes and expanding their impact.

Implications for Future Academic Research: Considering the implications of the findings related to the functionality and efficiency of these AI tools, it is clear that they have significant potential to enhance academic research. These tools have proven particularly valuable in the fields of social sciences and humanities, indicating a promising path for future investigations. However, there remain uncertainties regarding the applicability of AI tools in areas beyond these disciplines, suggesting the need for further studies on their usefulness in other fields of knowledge.

CONCLUSION

This study presents an alternative model for using Artificial Intelligence (AI) tools in the review of academic literature, focusing on the analysis of logical fallacies and the development of critical thinking. The integration of tools such as Elicit, ChatPDF, and ChatGPT proved to be an efficient approach, opening new perspectives for academic research. The use of AI allowed for rapid and effective filtering of the literature, distinguished by a balanced combination of technological efficiency and analytical depth. This methodology provided a more focused approach to the critical analysis of the selected materials, highlighting the synergy between technology and human discernment.

Each AI tool employed in the study demonstrated unique characteristics and valuable contributions. Elicit was fundamental in the initial identification and selection of relevant articles, while ChatPDF facilitated the interpretation and analysis of complex texts. ChatGPT, in turn, proved important in synthesizing and organizing the collected ideas. However, this study also identified areas for future improvement, such as the need to adapt the tools to different document formats and broader interdisciplinary contexts.

The success of AI integration in this study suggests its potential in other areas of knowledge, encouraging the development of AI tools that are more adaptable to different research styles and needs. Furthermore, it is essential to investigate the long-term efficiency of these tools in various academic and practical contexts.

The study demonstrated that the combination of AI tools with human evaluation can enrich the academic research process. This balance between technology and human analysis offers a model for future investigations and academic practices, emphasizing the role of AI as a tool in the pursuit of knowledge and the promotion of more effective and inclusive education. The importance of human intervention in critical analysis is highlighted by Vaio, Palladino, Hassan, and Escobar (2020), who argue that AI should complement, not replace, human evaluation.

Despite the significant contributions of this study to the use of Artificial Intelligence (AI) tools in literature review, some limitations were identified that corroborate the challenges discussed by Radanliev, Roure, Kleek, Santos, and Ani (2021), which highlight the biases introduced by reliance on AI algorithms. These limitations should be considered when using AI tools such as Elicit, ChatPDF, and ChatGPT, which, while extremely useful in the initial screening and analysis of academic literature, may introduce certain technological biases. The selection of articles, for example, may be influenced by the algorithms of these tools, which may not fully capture the contextual relevance or intrinsic quality of the texts. To mitigate these biases, future studies should consider combining these tools with other selection methods.

Regarding the Interpretation of Complex Texts, although ChatPDF has demonstrated efficiency in interpreting academic texts, analyzing documents with unconventional or very complex formats still presents challenges. Graphs, tables, and multimedia content, for example, may not be adequately processed by these tools, requiring human intervention to ensure complete and accurate understanding. Thus, the Necessary Human Intervention proves indispensable for critical analysis and detailed evaluation of the selected articles, ensuring the accuracy and quality of the review.

Furthermore, there is a limitation related to the generalization of results, as the conclusions of this study are based on the specific application of AI tools to a set of literature on logical fallacies. Extrapolating these results to other areas of knowledge or types of documents should be done with caution. Future research should explore the applicability of these tools in different disciplines and contexts to validate their effectiveness and adaptability in diverse scenarios.

Additionally, the importance of continuous updates to AI tools is reinforced. The versions used in this study may quickly become obsolete as new updates and improvements are developed. Thus, the effectiveness of these tools should be constantly reassessed in light of technological

advancements, ensuring that the applied methodologies remain robust, precise, and relevant to academic studies in different contexts.

Authors' Contributions: Santana, I. M.: conception and design, acquisition of data, analysis and interpretation of data, drafting the article, critical review of important intellectual content; Souza, F. N.: conception and design, acquisition of data, analysis and interpretation of data, drafting the article, critical review of important intellectual content; Viana, H. B.: conception and design, acquisition of data, analysis and interpretation of data, drafting the article, critical review of important intellectual content. All authors have read and approved the final version of the manuscript.

Ethics Approval: Not applicable.

Acknowledgments: Not applicable.

REFERENCES

Arp, R., Barbone, S., & Bruce, M. (2019). *Bad arguments.* Nova Jersey: Wiley-Blackwell.

Battersby, M., Bailin, S., & Van Laar, J. A. (2011). Fallacy identification in a dialectical approach to teaching critical thinking. *OSSA Conference Archive, 43,* 1-13.

Bazhouni, M. (2018). Integrating Critical Thinking Skills in Higher *Education. Education and Linguistics Research, 4*(1), 65-80. https://doi.org/10.5296/elr.v4i1.12964

Canal, R. (2020). Como não identificar falácias: contribuições da abordagem epistemológica de Alvin Goldman contra a abordagem padrão [Apresentação de Trabalho]. Anais do I Congresso Brasileiro Interdisciplinar em Ciência e Tecnologia.

Carnielli, W. A., Epstein, R. L., & Murcho, D. (2011). Pensamento crítico: o poder da lógica e da argumentação. São Paulo: Rideel.

ChatPDF. (2024). Ferramenta de análise de documentos em PDF. https://www.chatpdf.com/

Checco, A., Bracciale, L., Loreti, P., Pinfield, S., & Bianchi, G. (2021). AI-assisted peer review. *Humanities and Social Sciences Communications, 8,* 1-11. https://doi.org/10.1057/s41599-020-00703-8

Chen, L., Chen, P., & Lin, Z. (2020). Artificial intelligence in education: A review. *IEEE Access, 8*, 75264-75278.
Elicit. Ferramenta de revisão de literatura. https://elicit.org/

Farias, S. A. (2023). Pânico na academia! Inteligência artificial na construção de textos científicos com o uso do ChatGPT. *Revista Interdisciplinar de Marketing, 13*(1), 79-83.

Feng, Y., Liang, S., Zhang, Y., Chen, S., Wang, Q., Huang, T., Sun, F., Liu, X., Zhu, H., & Pan, H. (2022). Automated medical literature screening using artificial intelligence: A systematic review and meta-analysis. *Journal of the American Medical Informatics Association, 29*(8), 1425-1432. https://doi.org/10.1093/jamia/ocac066

Floridi, L. (2008). Information: A very short introduction. Oxford: Oxford University Press.

Garcia, D. S. S. (2017). A lógica da argumentação e as falácias da sustentabilidade. *Cadernos do Programa de Pós-Graduação em Direito – PPGDir./UFRGS, 11*(3), 1-15.

González-López, S., López-López, A., García-Gorrostieta, J. M., & Espinoza, I. R. (2016). TURET2.0: Thesis Writing Tutor Aimed on Lexical Richness in Students' Texts. *Research in Computing Science, 129*(1), 9-17.

Gozálvez-Pérez, V., Valero-Moya, Á., & González-Martín, M.-R. (2022). El pensamiento crítico en las redes sociales. Una propuesta teórica para la educación cívica en entornos digitales. *Estudios sobre Educación*, *42*, 35-54. https://doi.org/10.15581/004.42.002

Hasibuan, S. H., Yusriati, Y., & Manurung, I. D. (2020). Examining argument elements and logical fallacies of English education students in oral discussion. *Tell: Teaching of English Language and Literature Journal, 8*(2), 57.

Hong, R., Zhang, H., Pang, X., Yu, D., & Zhang, C. (2023). A closer look at the self-verification abilities of large language models in logical reasoning. *ArXiv, 23*(11), 1-16. https://doi.org/10.48550/arXiv.2311.07954

Jason, H. (1986). The fallacy files. *Critical Thinking Quarterly, 4*(1), 23-34.
Jordan, P. (1904). *The art of logical thinking*. Chicago: M.A. Donohue & Company.

Kung, J. (2023). Elicit. *The Journal of the Canadian Health Libraries Association*, *44*, 15-18. https://doi.org/10.29173/jchla29657

Mahligawati, F., Allanas, E., Butarbutar, M., & Nordin, N. A. N. (2023). Artificial intelligence in physics education: A comprehensive literature review. *Journal of Physics: Conference Series, 2596*, 012080.

Naiditch, I. (2020). Teaching critical thinking in the classroom. *Educational Strategies Journal, 5*(2), 112-119.

OpenAI. (2024). ChatGPT. https://openai.com/chatgpt

Phelps, R. P. (2017). Teaching to the test family of fallacies. *Revista Iberoamericana de Evaluación Educativa, 10*(1), 33-49.

Portillo Fernández, J. (2018). El uso de falacias en la comunicación absurda. *Logos: Revista de Lingüística, Filosofía y Literatura, 28*(2), 443-458.

Radanliev, P., Roure, D., Kleek, M. V., Santos, O., & Ani, U. (2021). Artificial intelligence in cyber physical systems. *AI & Society*, *36*, 783-796. https://link.springer.com/article/10.1007/s00146-020-01049-0

Sourati, Z., Venkatesh, V. P. P., Deshpande, D., Rawlani, H., Ilievski, F., Sandlin, H., & Mermoud, A. (2022). Robust and explainable identification of logical fallacies in natural language arguments. *ArXiv, 22,* 1-27. https://doi.org/10.48550/arXiv.2212.07425

Vaio, A. D., Palladino, R., Hassan, E., & Escobar, O. (2020). Artificial intelligence and business models in the sustainable development goals perspective: A systematic literature review. *Journal of Business Research, 121,* 283-314.

Wagner, G., Lukyanenko, R., & Paré, G. (2021). Artificial intelligence and the conduct of literature reviews. *Journal of Information Technology, 37,* 209-226.

Whitfield, S., & Hofmann, M. A. (2023). Elicit: AI literature review research assistant. *Public Services Quarterly, 19*, 201-207. https://doi.org/10.1080/15228959.2023.2224125

Received: August 3, 2024 | **Accepted:** October 2, 2024 | **Published:** December 31, 2024