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Why are artificial and natural intelligence?

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Abstract: Artificial Intelligence (AI) and Natural Intelligence (NI) are often positioned as opposing entities, even interchangeable. Unfortunately, studies on the possibility of integrating the two are still relatively limited. However, in the context of instructional, AI is not viewed as a threat to NI, but rather as a facilitator capable of enhancing human potential. This research aims to map and analyze literature trends related to the integration of AI and NI in the field of instructional. A systematic literature review (SLR) with bibliometrics serves as the backbone of the analysis, enabling the identification of publication patterns, authors, research themes, and existing research gaps. This research includes an analysis of annual scientific production, the most relevant sources, a thematic map, and a factorial analysis. The concept of integrating AI and NI reinforces each other in sustainable educational practices. Thus, this research not only broadens academic perspectives but also promotes a new paradigm that AI and NI are part of the cybergogy era.

Keywords: Artificial Intelligence, Bibliometrix, Natural Intelligence.

Introduction

The issue arises within the modern educational landscape, where Artificial Intelligence (AI) is increasingly instructional. Classrooms, universities, and digital learning platforms increasingly rely on AI-based tools (Rizvi et al., 2025; Tariq, 2026). However, this integration raises critical pedagogic questions about the relationship between AI and Natural Intelligence (NI)—whether technology is a substitute for human reasoning or a complement to it (Siaw and Ali, 2025). As instructional contexts evolve, the Guru and lecturer face the challenge of maintaining the essential human dimensions of empathy, creativity, and ethical reasoning alongside machine-driven efficiency (Kizito and Umeogu, 2025; Scholapurapu, 2025). In this environment, the tension between AI and NI becomes evident. While AI offers precision, speed, and access to vast data (Yadav et al., 2025), NI represents intuition, values, and social understanding that machines cannot replicate (Cecchini et al., 2025). The issue is not simply about technology adoption but about reimagining how learning can be enhanced when AI serves as a facilitator (Lin et al., 2025). The ethical study and application of theory (Kamila and Jasrotia, 2025), research, and practices to advance knowledge (Gelashvili-Luik et al., 2025), improve performance, and empower learners (Ellikkal and Rajamohan, 2025) to sustain meaningful learning experiences in both traditional and digital classrooms (Yadav, 2025).

The problem can be most clearly observed in instructional research and practice that seek to harmonize AI and NI within the framework of cybergogy remains limited (Waryanto et al., 2025). Consequently, there is a growing need to explore models that illustrate how these intelligences can coexist to strengthen sustainable instruction (Jangde and Ahmad, 2025). The effort to integrate AI and NI is not merely technical but philosophical and pedagogical (Waghid, 2025), aiming to preserve human values while embracing innovation in the era of intelligent learning systems (Alqahtani and Wafula, 2025). This research is important because the rapid advancement of Artificial Intelligence (AI) in education has created both opportunities and challenges for human learning and teaching (Pedro

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et al., 2019). While AI can efficiently process data and personalize instruction, the human dimension represented by Natural Intelligence (NI) remains irreplaceable (Madhini et al., 2025). However, current studies often frame AI and NI as separate or even competing entities (Carvalho and Lampinen, 2025; Stella et al., 2025). This research seeks to bridge that divide by exploring how AI can enhance, rather than diminish, human intellectual and emotional capabilities in instructional contexts. Understanding this integration is crucial to ensure that technology strengthens rather than overshadows the essence of human learning (Magliocca et al., 2025).

The beneficiaries of this research are educators, curriculum designers, policymakers, and researchers who seek to develop learning environments that are both intelligent and human-centered (University of Maryland, College Park and Shneiderman, 2020). Teachers can utilize insights from this study to design instructional strategies that leverage AI as a supportive tool for fostering critical and creative thinking (Albakry et al., 2025). Policymakers can use the findings to guide ethical and balanced education policies in the digital era, while researchers gain a clearer map of existing knowledge and research gaps concerning AI–NI integration. This research is also essential because existing methods and models of AI implementation in education often focus on technological performance. The lack of frameworks that explicitly integrate AI and NI highlights the need for a systematic review to identify potential pathways for improvement (Lee et al., 2025). By using a systematic literature review (SLR) and bibliometric analysis, this study contributes to refining theoretical and practical approaches that align AI-driven instruction with human intelligence. Such improvement is vital to advance sustainable education practices in the cybergogy era, where learning depends not only on data and algorithms but also on the continuous growth of human wisdom and ethical consciousness.

What remains unclear in current educational research is how Artificial Intelligence (AI) and Natural Intelligence (NI) can be effectively integrated to complement each other in instructional settings. Most existing studies treat AI and NI as separate, even conflicting, domains-AI as a technological tool and NI as a purely human capability. As a result, there is limited understanding of the theoretical and practical mechanisms through which AI can enhance, rather than replace, human intelligence in learning processes. The absence of comprehensive mapping of research trends, dominant themes, and empirical models further obscures how the two intelligences interact within instructional frameworks.

This article will conduct a conceptual analysis using Bibliometrix through the R-Biblioshiny application to map and interpret research trends and themes related to the integration of AI and NI in instructional contexts. This process involves extracting and analyzing data from the Scopus database to identify publication patterns, influential authors, key sources, and thematic developments over time. By applying bibliometric indicators such as co-occurrence networks, thematic mapping, and factorial analysis, the researcher aims to reveal the conceptual structure and intellectual evolution of the topic. These steps will provide a comprehensive overview of how the integration of AI and NI has been studied, highlight underexplored areas, and propose directions for future research and model development in sustainable, human-centered education.

This study is limited to analyzing published research data indexed in the Scopus database and does not include primary data collection or field-based studies. The focus is confined to the conceptual and thematic mapping of literature related to the integration of Artificial Intelligence (AI) and Natural Intelligence (NI) within instructional and educational contexts. It does not explore specific technological applications, institutional case studies, or geographical variations in implementation. Therefore, the scope of this research is global and conceptual rather than regional or empirical, aiming to provide a comprehensive overview of conceptual knowledge structures.

Materials and Methods

Study area

This study employs a Systematic Literature Review (SLR) supported by bibliometric analysis to explore the integration of Artificial Intelligence (AI) and Natural Intelligence (NI) in instructional research. The data are collected from the Scopus database, filtered by relevant keywords, publication years, and subject areas to ensure accuracy and representativeness. The analysis is conducted using the R-Biblioshiny application to identify publication trends, conceptual structures, and thematic developments, without involving any specific physical study site.

Procedures

The procedures involve collecting bibliographic data from the Scopus database using defined keywords related to the integration of AI and NI in instructional contexts. The retrieved data are then processed and analyzed using the R-Biblioshiny tool to generate visualizations of publication trends, thematic maps, and conceptual structures.

Results and Discussion

Data collected from Scopus on the topic "Why Artificial Intelligence and Natural Intelligence" demonstrates consistent and increasingly dynamic research developments from 1961 to 2026. Covering 4,614 documents sourced from more than 1,100 publications—from journals and proceedings to books—the study of the relationship between artificial intelligence and natural intelligence appears to have experienced strong intellectual maturity over the past six decades.

The publication growth rate has reached 4.72% per year, indicating that this topic continues to occupy a prominent position in global scientific discourse. The average document age is approximately 6.99 years, indicating that the literature in this field is relatively new and continually updated. Each document contains an average of 32.56 citations, totaling over 36,000 references, a strong indication that this field is developing through a broad knowledge network.

In terms of article content, there is a rich distribution of keywords: 16,602 Keyword Pluses and 11,328 Author's Keywords, indicating the diversity of perspectives, methodologies, and approaches used by researchers. Meanwhile, authorship indicates the involvement of 14,795 authors, including 946 single authors, with an average collaboration of 3.49 authors per publication. The 22.15% international collaboration rate confirms that the study of artificial intelligence (AI) and natural intelligence (NI) is an increasingly global, cross-border scientific agenda.

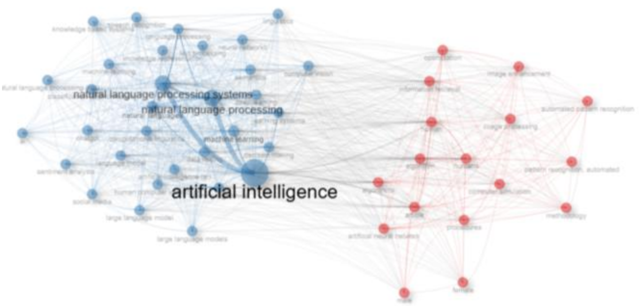
In terms of document type, the majority of publications are journal articles (4,424), accompanied by 190 books, reinforcing the rapid development of research on AI and NI, particularly through peer-reviewed scientific forums. Collectively, this data provides a solid foundation for understanding the research landscape, thematic trends, and future development directions in the study of why and how artificial intelligence interacts with, compares with, or is conceptualized with natural intelligence.

Table 1. Main_Information_bibliometrix

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	1961:2026
Sources (Journals, Books, etc)	1100
Documents	4614
Annual Growth Rate %	4,72
Document Average Age	6,99
Average citations per doc	32,56
References	36162
DOCUMENT CONTENTS	
Keywords Plus (ID)	16602

Author's Keywords (DE)	11328
AUTHORS	
Authors	14795
Authors of single-authored docs	946
AUTHORS COLLABORATION	
Single-authored docs	1034
Co-Authors per Doc	3,49
International co-authorships %	22,15
DOCUMENT TYPES	
article	4424
book	190

A conceptual map emerging from the interconnectedness of keywords in publications on Artificial Intelligence (AI) and Natural Intelligence (NI) in picture 1,Co_occurrenceNetwork.



picture 1 Co occurrence Network

Bubble size and color are important indicators in understanding the evolving intellectual structure of both fields. The largest bubble in this network is occupied by the term "artificial intelligence," indicating that this concept is the central focus and has the highest frequency of occurrence and connectivity. Other large nodes, such as machine learning, decision-making, and natural language processing systems, demonstrate that AI research relies heavily on the development of learning models, language processing, and algorithm-based decision-making.

Visually, the network is divided into two main clusters, distinguished by color:

1. Blue Cluster

   This cluster is dominated by concepts related to language processing, machine learning, and knowledge representation. Terms such as natural language processing, neural networks, semantics, linguistics, and large language models form a dense and interconnected cluster. The blue color reflects a research focus more oriented toward cognitive interaction, language, and learning systems—areas that bridge the gap between artificial intelligence and natural human intelligence.

2. Red Cluster

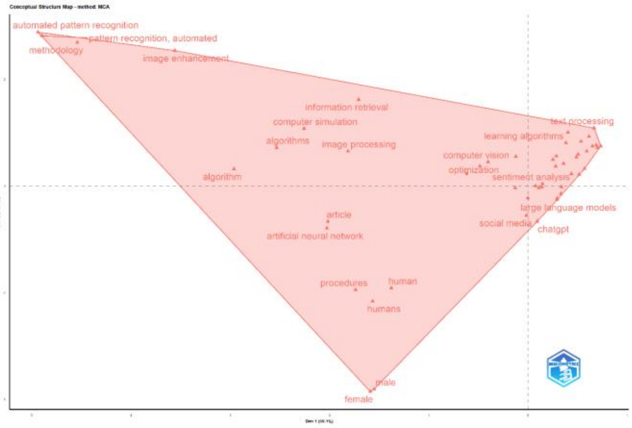
   The red cluster indicates more technical and practical research areas, such as image processing, pattern recognition, optimization, computer simulation, and methodological aspects. Nodes such as "humans," "male," and "female" appearing in this cluster reflect the connection of AI research to population-based studies, experiments, or the medical field. Red indicates a focus on procedural, automatic pattern recognition, and visual processing as central domains.

The inter-cluster network connected by gray lines shows that although the two colors represent different research focuses, there are important points of intersection where AI and NI enrich each other. The varying bubble sizes indicate the intensity of use of certain concepts, while the colors indicate disciplinary tendencies and clustering of research themes. Overall, this map confirms that the relationship between Artificial Intelligence and Natural Intelligence moves along two major axes: the cognitive-linguistic axis (blue) and the technical-computational axis (red), both of which intersect through the central hub, AI, as the umbrella concept connecting all branches of study.

Map Conceptual Structure (MCA) Description

This interrelationships of keywords in research on Artificial Intelligence and Natural Intelligence map visualizes how research themes cluster and how certain concepts occupy strategic positions in a two-dimensional space. In the graphical view, the red area indicates the conceptual space occupied by all keywords, forming a polygon that reflects the range and diversity of topics. The density and position of keywords within this polygon provide insight into the research orientation and the relationships between concepts.

1. Left side of the map (Negative Dimension) – Technical cluster - image processing On the left side, particularly on the negative axis of Dimension 1, themes emerge such as: automated pattern recognition, pattern recognition, automated, image enhancement, methodology, algorithm, computer simulation, image processing. This cluster illustrates the research focus on image processing, technical algorithms, optimization, and computational methods. This represents the technical foundation for the development of artificial intelligence, which is more oriented towards procedures and visual technologies.
2. Right side of the map (Positive dimension) – Language cluster, learning algorithms, and modern AI: text processing, learning algorithms, computer vision, optimization, sentiment analysis, large language models, social media, chatgpt. This cluster depicts newer and more applicable research domains, particularly language processing, generative AI, large language models, digital social interaction, and modern learning algorithms. The clustering of keywords in this area indicates that contemporary AI research is heavily focused on NLP, LLM, and social applications.
3. Bottom side of the map – Demographics and human aspects cluster At the bottom of the map, keywords such as: female, male, humans, human, procedures, indicate that a number of studies link AI to population-based data, medical studies, human experimentation, or demographic analysis. This cluster places greater emphasis on the natural intelligence aspect associated with algorithm testing or human-based modeling.
4. Overall Structure
   The large red polygon connecting all keywords indicates a broad thematic space, from: classical computational techniques (left), modern AI based on digital language and social (right), The relationship between AI and human studies (bottom). The horizontal dimension (Dimension 1, 19.1%) displays a spectrum from technical-visual to language-learning, while the vertical dimension (Dimension 2, 11.7%) indicates a shift between the human and abstract technical aspects of AI and NI research.



Picture 2 Map Conceptual Structure (MCA)

Discussion

Research on Artificial Intelligence and Natural Intelligence has advanced rapidly and demonstrates two main branches of knowledge: (1) Research based on technical algorithms and computer vision, such as pattern recognition, image processing, and optimization. (2) Research based on language translation and large-scale language models, such as text processing, learning algorithms, and large-scale language models. Current knowledge indicates that AI is no longer simply an automated system, but has moved toward cognitive capabilities that mimic and interact with human intelligence (NI), particularly in language and social interaction.

Based on the context structure map, there are three main characteristics of the key concepts: Technical-Computational, Cognitive-Linguistic, and Human-Centered. Automatic pattern recognition, image enhancement, algorithms, and computer simulations are mathematical, deterministic, and focused on efficiency and accuracy. Cognitive Linguistics examines text processing, learning algorithms, large-scale language models, chatbots, and sentiment analysis. It is adaptive, probabilistic, and approximates human thought patterns. Human-centered describes humans, men, women, and procedures. It relates to how AI is tested, implemented, or impacts human users.

The conceptualization patterns emerging in the map indicate that Artificial Intelligence (AI) research tends to divide into two broad orientations due to differing historical drivers and technological developments. The visual-algorithmic domain grew out of the classical computer science tradition, which emphasizes mathematical representation, leading concepts such as pattern recognition, image processing, and algorithms to cluster at one end. The technical and deterministic nature of this area led to the emergence of associated buzzwords, suggesting that early AI research was indeed built on a foundation of rigorous computational engineering.

In contrast, the concentration of concepts such as text processing, learning algorithms, large language models, and ChatGPT at the other end of the map reflects a paradigm shift toward AI that mimics human cognitive abilities. The dominance of large language models is not random; it arises from advances in probabilistic computing and the availability of large-scale data that enable machines to learn language patterns in a way that more closely resembles Natural Intelligence (NI) processes. This explains why linguistic and social concepts are increasingly clustered: contemporary research positions language as the primary channel for human-machine interaction.

The emergence of the human cluster (human, male, female) at the bottom of the map is not simply a catchphrase, but demonstrates a methodological drive to connect AI with users and strengthen its social foundations. The presence of these concepts demonstrates that AI does not develop in a vacuum; it is tested, implemented, and evaluated within human populations. In other words, this cluster emerged due to ethical and empirical pressures for AI to be relevant, safe, and bias-free-factors that are increasingly dominant in global discussions about intelligent technologies.

Overall, this structural context is shaped by the interplay of technical evolution, cognitive needs, and social demands. The subtle but interconnected patterns among these clusters suggest that AI is evolving in a hybrid manner: combining high-precision computational mechanisms to replicate the way humans understand the world. Therefore, future research should further examine how these two main traditions—algorithmic and cognitive—will be consolidated within a multimodal model, and how such integration can help explain the limitations and opportunities at the intersection of Artificial Intelligence and Natural Intelligence. Natural Intelligence remains the driving force behind AI development.

Conclusions

Why do we need AI and NI? These terms demonstrate a dual orientation shaped by the historical trajectory and capacity of technological development. On the one hand, the visual-algorithmic tradition persists as a legacy of classical computer science, where AI is based on mathematically driven, deterministic systems such as pattern recognition and image processing. On the other hand, a newer cognitive-linguistic orientation has emerged, driven by advances in probabilistic modeling and abundant data, leading to the superiority of text processing, large language models, and conversational models. This shift reflects a broader movement toward systems designed to approximate human-like understanding and communication.

The emergence of human-centered concepts—including terms related to gender and population—signals a growing attention to the ethical, empirical, and social dimensions of AI. Their emergence is not accidental, but stems from the need to ensure that AI systems operate responsibly and remain anchored in real-world human contexts. This demonstrates that AI development cannot be separated from the populations it serves, is evaluated, and ultimately, natural intelligence becomes the driving force behind its use

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