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# ARTIFICIAL INTELLIGENCE AND GLOBALIZATION: NEW PARADIGMS IN ECONOMIC HIGHER EDUCATION

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**Abstract:** *This paper examines the relationships between artificial intelligence and globalization within higher education through a bibliometric analysis of academic literature. Using data retrieved from the Web of Science database, the study analyzes 59 articles and review papers published between 2020 and February 2026. It investigates publication trends, identifies the main contributing authors and countries, and explores patterns of international collaboration. The findings reveal growing scholarly interest, alongside a geographically diverse but uneven distribution of contributions and limited cross-national cooperation. Keyword co-occurrence analysis conducted with VOSviewer identifies four major thematic clusters: pedagogical and application-oriented research on artificial intelligence and machine learning; system-level perspectives linking technology, science, and globalization; student-centered themes focused on performance, design, sustainability, and implementation challenges; and globalization-driven concerns related to internationalization, employability, and quality. This study contributes by offering a structured and up-to-date bibliometric mapping of recent research at the intersection of artificial intelligence and globalization in higher education, explicitly highlighting higher education as the integrative nexus through which technological innovation, institutional transformation, and global dynamics are jointly articulated.*

**Keywords:** *artificial intelligence, globalization, higher education, economic education, digital transformation.*

**JEL Classification:** *I23; O32; C80.*

## 1. INTRODUCTION

The rapid advancement of artificial intelligence, together with the intensification of globalization processes, is increasingly reshaping higher education systems worldwide. Universities are facing growing pressure to adapt teaching practices, governance structures, and educational outcomes to the requirements of a globalized and technology-driven economy. Within this context, artificial intelligence is frequently

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examined as a key driver of transformation, supporting data-driven decision-making, learning optimization, and the alignment of higher education with labor market demands (Li et al., 2022; Chatterjee et al., 2020).

At the same time, globalization has amplified the international dimension of higher education, fostering cross-border academic interactions, institutional competition, and the internationalization of curricula. Research addressing higher education highlights how these global dynamics influence institutional strategies and educational models, particularly in relation to employability and skills development. Studies focusing on higher education practices emphasize the growing role of universities in preparing graduates for increasingly competitive and globally integrated labor markets (Mgaiwa, 2021).

Beyond technological efficiency, the integration of artificial intelligence in higher education raises broader socio-economic, ethical, and governance-related considerations. Existing contributions point to the need for understanding artificial intelligence not only as a technical innovation, but also as a phenomenon embedded in institutional, economic, and societal contexts. This perspective is reflected in studies examining artificial intelligence applications across different sectors, including education, decision-making, and knowledge representation, which are increasingly interconnected in a globalized academic environment (Chu et al., 2020; Li et al., 2022).

Despite the growing number of studies addressing artificial intelligence and higher education, recent bibliometric evidence suggests that research in this area remains fragmented, both thematically and geographically. Analyses of existing literature indicate a dispersion of research efforts across disciplines, limited collaboration among authors, and an uneven distribution of contributions across countries (López-Chila et al., 2024). These characteristics make it difficult to identify dominant research streams and emerging trends at the intersection of artificial intelligence and globalization in higher education.

In response to this gap, the present study adopts a bibliometric approach to provide a structured overview of the academic literature addressing artificial intelligence and globalization within higher education. Using publications indexed in the Web of Science database for the period 2020–February 2026 and applying bibliometric techniques supported by VOSviewer, the study aims to:

(1) examine the annual evolution of publications;

(2) identify the main contributing authors and their countries of affiliation;

(3) highlight patterns of international collaboration;

(4) cluster the most frequently used keywords and

(5) provide an overview of the dominant research themes. By mapping the intellectual structure of the field, this study seeks to clarify how artificial intelligence and globalization are jointly addressed in higher education research and to establish a foundation for future empirical and comparative investigations.

## 2. METHODOLOGY

The purpose of this study is to systematically examine the academic literature addressing the relationships between artificial intelligence, higher education, and globalization by means of a bibliometric analysis. Bibliometric methods are increasingly employed to map research domains, identify structural patterns, and synthesize large bodies of scientific knowledge through the quantitative analysis of scientific publications. In this context, bibliometric analysis is used to ensure a transparent, replicable, and structured exploration of an emerging and multidisciplinary research field.

The data for this study were retrieved from the Web of Science database. The search was conducted using a structured Boolean query applied to titles, abstracts, and keywords, designed to capture publications explicitly addressing artificial intelligence within higher education and global or international contexts. The query used in the search process was formulated as follows:

*TS* = ((*"artificial intelligence"* OR *"AI tools"* OR *"machine learning"*) AND (*"higher education"* OR *university** OR *"tertiary education"*) AND (*globalization* OR *internationalization* OR *"global education"* OR *"cross-border education"* OR *"transnational education"* OR *"international higher education"*)).

The analysis included only articles and review articles published in English. The temporal scope of the study covers the period 2020–February 2026, corresponding to the date of data retrieval from the Web of Science database. This timeframe reflects recent developments in artificial intelligence and their implications for higher education systems. The application of these inclusion criteria resulted in a final dataset consisting of 59 publications.

The study selection process followed the PRISMA 2020 guidelines in order to ensure transparency and methodological rigor. The initial set of records identified through the database search was screened based on document type, language, and thematic relevance by applying database-level filters and query constraints. As these criteria were operationalized directly within the search strategy, all retrieved records met the predefined inclusion criteria and formed the final dataset used for bibliometric analysis.

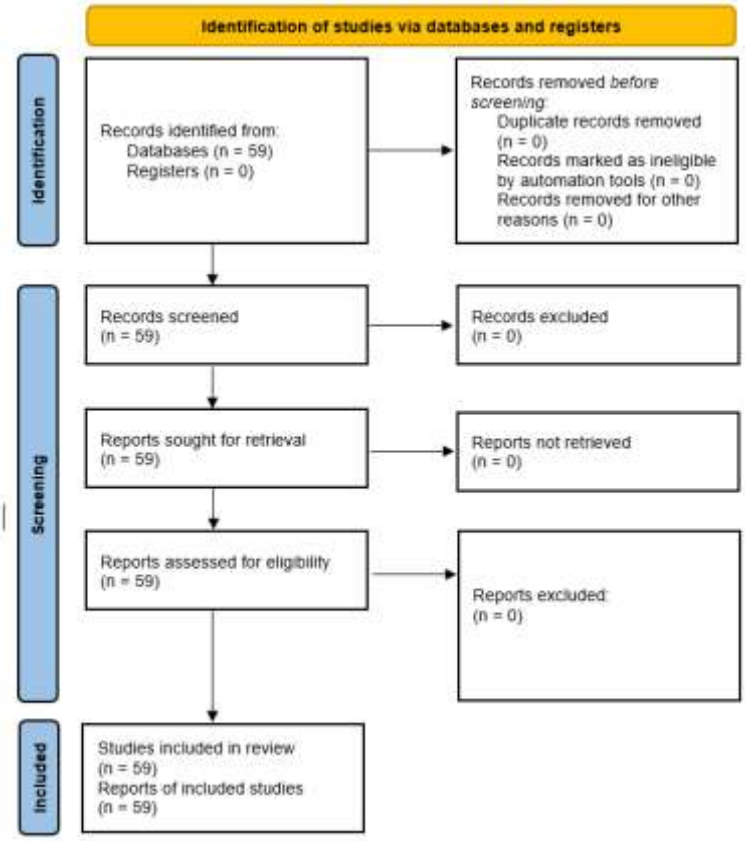



*Figure 1. PRISMA 2020 flow diagram illustrating the study selection process*

(*Source*: Adapted from Page, M. J., McKenzie, J. E., Bossuyt, P. M., *et al.* (2021). *The PRISMA 2020 statement: An updated guideline for reporting systematic reviews*. BMJ, 372, n71. https://doi.org/10.1136/bmj.n71)

The PRISMA flow diagram reflects a streamlined selection process, as all eligibility criteria were applied directly at the database query stage. Consequently, no additional records were excluded during screening or eligibility assessment.

After the selection process, the bibliographic data were exported from the Web of Science database in formats compatible with bibliometric analysis software. The dataset was subsequently analyzed using VOSviewer**,** which enables the construction and visualization of bibliometric networks. Several types of analyses were performed, including the examination of publication trends over time, co-authorship analysis at the author and country levels, and keyword co-occurrence analysis.

Keyword co-occurrence analysis was based on terms extracted from titles, abstracts, and author keywords. Thresholds were applied to select the most frequently occurring terms for visualization, allowing the identification of thematic structures within the literature. Full counting was employed to account for all occurrences of terms and contributions within the analyzed corpus. Both standard network visualizations and overlay visualizations were generated in order to support the exploration of conceptual relationships and temporal patterns. Country names and institutional affiliations were retained exactly as indexed in the Web of Science database. No manual standardization of naming conventions was performed, as minor labeling variations reflect database indexing conventions and do not alter the structural properties of the bibliometric networks analyzed.

Although the final dataset comprises 59 publications, only a subset of the most relevant and representative studies is cited explicitly in the manuscript. These references are used to support the interpretation of bibliometric patterns and thematic clusters, while the complete dataset underpins the quantitative analyses performed.

From the perspective of economic education, this methodological approach is particularly relevant, as artificial intelligence and globalization increasingly influence curricula, teaching practices, and employability-oriented learning outcomes in economics and business-related fields. By mapping the broader higher education literature, the analysis provides contextual insights into how AI-driven educational innovation, digital transformation, and global competitiveness shape the environment in which economic education operates. This positioning allows the findings to inform future research and curricular development in economic education, especially with regard to skills formation, labor market alignment, and internationalization dynamics.

Overall, this methodological approach establishes a clear and reproducible framework for mapping the academic literature on artificial intelligence and globalization in higher education. The results of the bibliometric analysis are presented and discussed in the following section.

## 3. RESULTS AND DISCUSSIONS

Digital transformation and globalization have progressively shaped the academic debate on higher education, with artificial intelligence gaining increasing attention as a key element of this transformation. As illustrated in Figure 2, the period 2020–February 2026 reflects a gradual but clearly ascending research interest in the intersection between artificial intelligence, globalization, and higher education.

A total of 59 publications were identified during the analyzed timeframe. The early years of the period, particularly 2020 and 2021, are characterized by a limited number of contributions, suggesting an initial exploratory phase of the research topic. A more visible increase in publication activity can be observed starting in 2022, followed by a substantial growth in 2023 and 2024. The year 2025 represents the most productive period in terms of academic output, indicating a consolidation of scholarly interest in this area. Although 2026 records a lower number of publications, this value reflects partial coverage up to February 2026 and does not necessarily indicate a decline in research activity.

Overall, the publication trajectory suggests that the intersection of artificial intelligence, globalization, and higher education is evolving into an increasingly recognized research domain, with sustained academic attention over recent years.

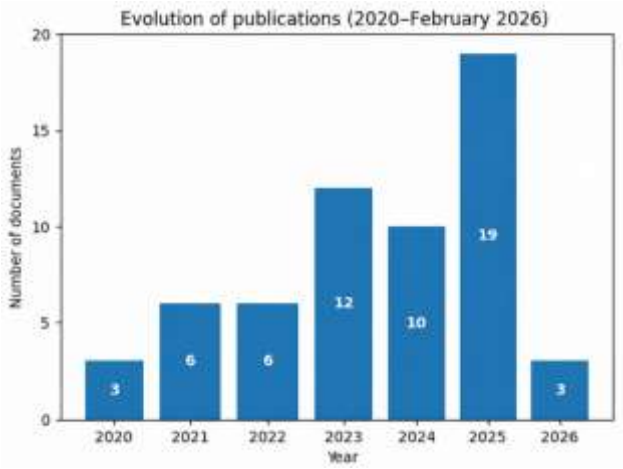



*Figure 2. Evolution of the number of publications*

(*Source*: Own processing)

Table 1 presents the Top 5 most cited papers on the topic of artificial intelligence and globalization in higher education, as indexed in the Web of Science database for the period 2020–February 2026. Citation counts are used as an indicator of academic visibility and influence within the analyzed corpus. Out of the 59 publications included in the dataset, these five papers stand out due to their significantly higher citation impact. The distribution of citations reveals that the most influential contributions often address artificial intelligence from broader technological, decision-making, or employability-related perspectives, which intersect with higher education and global contexts. This pattern reflects the interdisciplinary nature of the research field and highlights the role of cross-domain studies in shaping the scholarly debate.

At the same time, the presence of higher education–focused studies among the most cited publications indicates that issues such as employability, institutional practices, and educational strategies remain central to the discussion. Overall, the citation structure suggests a research area that is still developing, with a limited number of highly influential works contributing to the emerging intellectual foundation of the field.

*Table 1. Top 5 most cited papers on artificial intelligence and globalization in higher education (2020–February 2026), as indexed in the Web of Science database*

| **Title of the paper** | **No. of citations in WoS** |
|---|---|
| Li, C., Chen, Y., & Shang, Y. (2022). *A review of industrial big data for decision making*. Engineering Science and Technology, an International Journal, 29, 101–112. | 172 |
| Chatterjee, A., Gerdes, M. W., & Martinez, S. G. (2020). *Identification of risk factors associated with digital transformation and artificial intelligence systems*. Sensors, 20(9), 2734. | 121 |
| Cantu-Ortiz, F. J., Galeano Sanchez, N., Garrido, L., & Ruiz, A. (2020). *An artificial intelligence educational strategy for employability in higher education.* International Journal of Interactive Design and Manufacturing, 14(4), 1195–1209. | 84 |
| Chu, X., Sun, B., Huang, Q., & Pan, J. (2020). *Quantitative knowledge presentation models of artificial intelligence*. Artificial Intelligence in Medicine, 103, 101810. | 51 |
| López-Chila, R., Llerena-Izquierdo, J., Sumba-Nacipucha, N. A., & Cueva Estrada, J. M. (2024). *Artificial intelligence in higher education: An analysis of existing bibliometrics*. Education Sciences, 14(1), 47. | 29 |

(*Source*: Own processing based on Web of Science database (2020–February 2026))

To explore patterns of international collaboration within the literature on artificial intelligence and globalization in higher education, a co-authorship analysis was conducted at the country level. This analysis focuses on identifying both the geographical distribution of contributing countries and the structure of cross-national research connections. The network visualization was generated using VOSviewer, based on the co-authorship relationships between the countries represented in the dataset. A minimum threshold of one document per country was applied in order to preserve the broad geographical coverage of the dataset. However, the network map displays only countries connected through visible co-authorship links. Countries without co-authorship links are included in the overall dataset and reported in Table 2, but they do not appear as connected nodes in the network visualization. Therefore, Figure 3 should be interpreted together with Table 2, which provides the complete distribution of countries, documents, and citations.

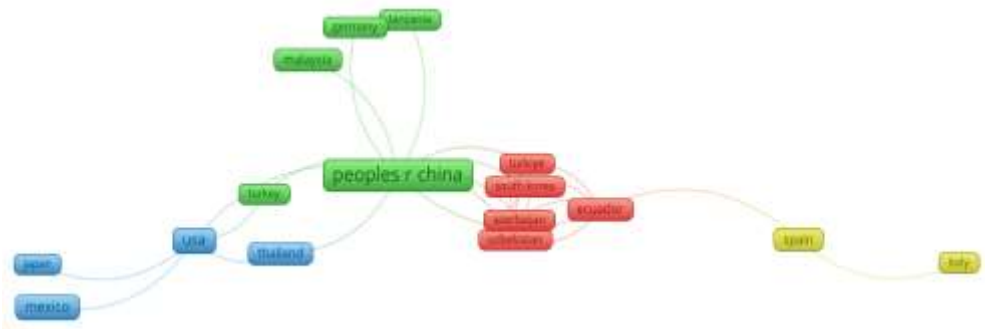



*Figure 3. International co-authorship network by country*

(*Source*: VOSviewer output)

Figure 3 presents the international co-authorship network at the country level. The map reveals a geographically diverse but weakly connected structure, suggesting that research on artificial intelligence, globalization, and higher education has an international scope, but that collaboration between countries remains limited and unevenly distributed. The absence of a dense and highly integrated collaboration core indicates that this research field is still developing in terms of cross-national cooperation. Most countries are connected through small collaboration groups rather than through a consolidated global research network.

The network is organized into four small collaboration clusters. Before interpreting these clusters, it should be noted that the dataset contains minor country-labeling variations, particularly the presence of both "Turkey" and "Turkyie". These labels were retained as indexed in the Web of Science database and were therefore treated by VOSviewer as separate nodes in the co-authorship network. Consequently, they appear in different clusters, although this distinction reflects a database-level labeling inconsistency rather than two analytically distinct countries. The first cluster includes Japan, Mexico, Thailand, and the USA. The second cluster includes Germany, Malaysia, People's R China, Tanzania, and Turkey. The third cluster includes Azerbaijan, Ecuador, South Korea, Turkyie, and Uzbekistan, while the fourth cluster consists of Italy and Spain. These clusters show that international collaboration exists within the analyzed literature, but it is mainly limited to bilateral or small-scale cross-national links. Therefore, the network does not indicate a broad and cohesive international collaboration structure, but rather a fragmented pattern of cooperation.

Among the countries visible in the co-authorship network, People's R China occupies the most central position. This centrality reflects both its high number of publications and its role as an intermediary between several otherwise weakly

connected collaboration groups. People's R China therefore appears not only as the most active contributor in terms of publication volume, but also as a key country shaping the collaborative structure of the field. In contrast, other countries appear either as peripheral nodes or as members of small collaboration clusters, with more limited connections to the wider network.

The European dimension of the network also requires attention. European countries are present in the dataset, including Ukraine, Spain, England, Slovakia, Norway, Italy, France, Germany, Denmark, Bulgaria, Poland, and Scotland. However, only some of them appear as connected nodes in the co-authorship map. For example, Italy and Spain form a small bilateral cluster, while Germany appears in the cluster centered around People's R China. Other European countries are represented in the country-level distribution of publications and citations, but they do not appear as part of a cohesive European co-authorship structure. This indicates that Europe is represented in the analyzed literature, but its contribution is fragmented across individual or small-scale collaborative links rather than consolidated into a strong regional collaboration structure. This distinction is important because the absence of a strong European cluster in the network does not imply the absence of European countries from the dataset. Rather, it suggests that European participation is more visible at the level of publication distribution than at the level of structured international co-authorship. In other words, European countries contribute to the literature, but their contributions are not strongly connected through a unified collaboration pattern. This finding also suggests that future research on artificial intelligence and globalization in higher education could benefit from stronger intra-European and cross-regional collaboration, especially given the relevance of digital transformation, internationalization, employability, and quality assurance for European higher education systems.

The presence of both "Turkey" and "Turkyie" does not alter the overall interpretation of the collaboration structure, but it highlights the need for caution when interpreting country-level bibliometric networks based on database-indexed affiliation labels.

Overall, the country-level co-authorship analysis indicates that research on artificial intelligence and globalization in higher education is geographically diverse, but weakly integrated in terms of international collaboration. The network is organized into four small collaboration clusters rather than into a dense and cohesive global research structure. Most cooperative ties are therefore limited to bilateral or small-scale cross-national connections, while broader connectivity across the network is largely mediated by a limited number of central nodes, especially People's R China. At the

same time, European countries are present in the dataset, but their participation remains fragmented and does not form a strong European collaboration cluster.

According to Table 2, the geographical distribution of publications is relatively diverse, with 39 countries represented in the dataset. The highest number of documents is recorded by People's R China (19 documents), followed by the USA (6 documents) and Ukraine (5 documents), indicating a strong concentration of output in a small number of countries. Several countries contribute a moderate number of publications, including Mexico (4 documents) and Spain (3 documents), while most countries are represented by one or two documents.

In terms of citation impact, the distribution is uneven. People's R China also registers the highest citation count (376 citations), followed by Norway (121 citations) and Mexico (103 citations), despite Norway being represented by a single document. This suggests that citation influence does not necessarily mirror publication volume, since countries with fewer publications may still achieve substantial visibility. At the same time, multiple countries record zero citations, reflecting either the recency of publications or lower visibility within the analyzed corpus.

*Table 2. Authors' country of origin, number of documents and citations*

| No. | Country | Documents | Citations |
|---|---|---|---|
| 1 | People's R China | 19 | 376 |
| 2 | USA | 6 | 10 |
| 3 | Ukraine | 5 | 5 |
| 4 | Mexico | 4 | 103 |
| 5 | Spain | 3 | 52 |
| 6 | Ecuador | 2 | 28 |
| 7 | Vietnam | 2 | 23 |
| 8 | England | 2 | 17 |
| 9 | Slovakia | 2 | 7 |
| 10 | Malaysia | 2 | 6 |
| 11 | Thailand | 2 | 1 |
| 12 | Colombia | 2 | 0 |
| 13 | Russia | 2 | 0 |
| 14 | Norway | 1 | 121 |
| 15 | Tanzania | 1 | 40 |
| 16 | Italy | 1 | 21 |
| 17 | Argentina | 1 | 12 |
| 18 | France | 1 | 12 |
| 19 | India | 1 | 11 |
| 20 | Turkey | 1 | 9 |
| 21 | Germany | 1 | 6 |
| 22 | Philippines | 1 | 6 |
| 23 | Iran | 1 | 5 |

| No. | Country | Documents | Citations |
|---|---|---|---|
| 24 | Denmark | 1 | 5 |
| 25 | Azerbaijan | 1 | 3 |
| 26 | South Korea | 1 | 3 |
| 27 | Turkyie | 1 | 3 |
| 28 | Uzbekistan | 1 | 3 |
| 29 | Bulgaria | 1 | 2 |
| 30 | Japan | 1 | 1 |
| 31 | Kazakhstan | 1 | 1 |
| 32 | Peru | 1 | 1 |
| 33 | Cuba | 1 | 0 |
| 34 | Australia | 1 | 0 |
| 35 | Poland | 1 | 0 |
| 36 | Saudi Arabia | 1 | 0 |
| 37 | Scotland | 1 | 0 |
| 38 | Singapore | 1 | 0 |
| 39 | U Arab Emirates | 1 | 0 |

(*Source*: Own processing)

The analysis of term frequency offers a descriptive overview of the vocabulary used in research addressing artificial intelligence and globalization in higher education. By examining recurring terms extracted from titles and abstracts, it is possible to identify the dominant concepts that frame current academic debates in this area. Previous studies included in the dataset highlight the growing relevance of artificial intelligence for educational systems, employability, and institutional transformation in higher education (Cantu-Ortiz et al., 2020; Chatterjee et al., 2020; Li et al., 2022).

At the same time, bibliometric and review-based contributions emphasize the expansion of AI-related research within higher education contexts, particularly in relation to internationalization and global academic environments (López-Chila et al., 2024). The results of this descriptive analysis are summarized in Table 3.

*Table 3. The 15 most significant terms associated with AI and globalization in higher education, as identified through VOSviewer analysis*

| No. | Keyword | Occurrences | Total link strength |
|---|---|---|---|
| 1 | higher education | 17 | 33 |
| 2 | artificial intelligence | 17 | 24 |
| 3 | education | 6 | 12 |
| 4 | artificial-intelligence | 5 | 11 |
| 5 | internationalization | 5 | 6 |
| 6 | international students | 4 | 9 |
| 7 | students | 4 | 9 |
| 8 | machine learning | 4 | 8 |
| 9 | science | 4 | 7 |

| No. | Keyword | Occurrences | Total link strength |
|---|---|---|---|
| 10 | challenges | 3 | 9 |
| 11 | employment | 3 | 8 |
| 12 | quality | 3 | 8 |
| 13 | technology | 3 | 8 |
| 14 | artificial intelligence (ai) | 3 | 6 |
| 15 | design | 3 | 6 |

(*Source*: Own processing)

As shown in Table 3, which includes only keywords with a minimum of three occurrences, the most frequent terms in the dataset are *higher education* and *artificial intelligence*, followed by concepts related to education systems, internationalization, students, and technological development. The presence of keywords such as *machine learning*, *technology*, *employment*, *quality*, and *challenges* indicates that the literature simultaneously addresses the integration of AI technologies and their implications for educational outcomes and institutional performance. This thematic orientation is consistent with prior research on AI-supported learning strategies, digital transformation, and employability-focused approaches in higher education (Cantú-Ortiz et al., 2020; Li et al., 2022; Chu et al., 2020). In addition, the recurrence of globalization-related terms, including *internationalization* and *international students*, reflects the growing emphasis on the global dimension of higher education systems and cross-border educational processes (Mgaiwa, 2021; López-Chila et al., 2024). Although Table 3 provides a quantitative snapshot of the most salient keywords selected using the same occurrence threshold, it does not reveal how these concepts are structurally connected within the literature. To address this limitation, a keyword co-occurrence network analysis was conducted to examine the relationships among terms and to identify broader thematic structures. The following section presents the results of this analysis, based on the keyword co-occurrence map shown in Figure 4 and the thematic clusters summarized in Table 4.

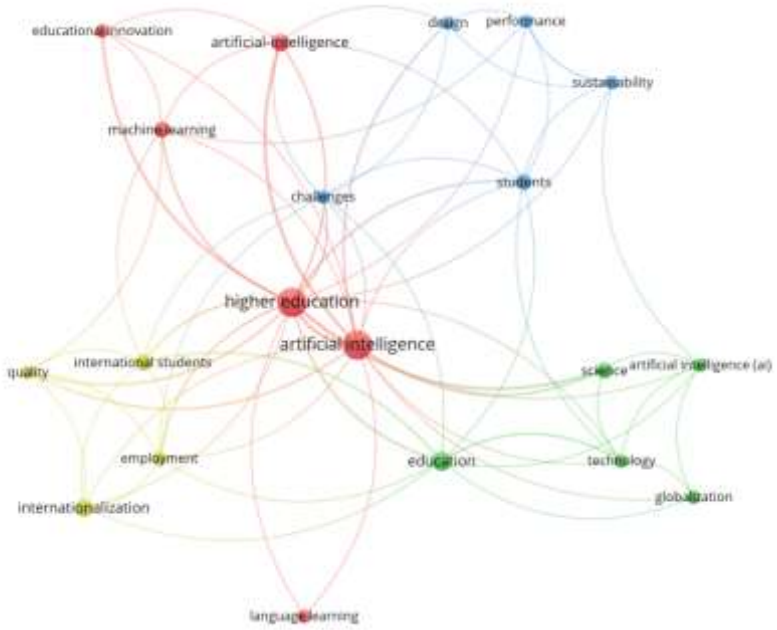



*Figure 4. Keywords Co-occurrence Map*

(*Source*: VOSviewer output)

*Table 4. The most relevant terms of each cluster (minimum keyword occurrence threshold = 3)*

| Cluster | The main keywords based on occurrence thereof |
|---|---|
| **1 (red)** | artificial intelligence; artificial-intelligence; machine learning; educational innovation; higher education; language learning |
| **2 (green)** | artificial intelligence (AI); education; technology; science; globalization |
| **3 (blue)** | students; performance; design; sustainability; challenges |
| **4 (yellow)** | internationalization; international students; employment; quality |

(*Source*: Own processing based on VOSviewer output)

First cluster, represented in red, groups the keywords *artificial intelligence*, *artificial-intelligence*, *machine learning*, *educational innovation*, *higher education*, and *language learning*. This cluster represents the pedagogical and application-oriented core of the keyword co-occurrence network, concentrating research that directly addresses how artificial intelligence is embedded into teaching, learning, and curriculum design in higher education. A central theme within this cluster is the role of *machine learning* in enabling adaptive and data-driven learning environments. Several

studies emphasize that machine learning algorithms support personalization, automated assessment, and learning analytics, allowing institutions to respond more effectively to heterogeneous student needs. Maurya et al. (2021) contribute methodological perspectives on classification and predictive models relevant for educational data analysis, while Estrada-Real and Cantú-Ortiz (2022) explore how analytics-driven decision-making enhances both instructional effectiveness and institutional competitiveness. These contributions frame machine learning as a foundational component of educational innovation rather than a peripheral technology. Educational innovation emerges as a second defining axis of this cluster. Research in the dataset consistently frames artificial intelligence as a catalyst for pedagogical redesign and institutional change. Zhao (2023) examines AI-based training modes in higher education, showing how algorithmic support reshapes instructional strategies and learning trajectories. In a complementary direction, El-Soussi and Yousef (2026) focus on AI-supported writing and assessment design, arguing that the pedagogical impact of AI depends on how learning tasks and evaluation criteria are reconfigured. These studies collectively emphasize that innovation is not driven by technology alone, but by its integration into coherent pedagogical frameworks. The prominence of *language learning* highlights one of the most empirically developed application areas of artificial intelligence in higher education. Research in this domain focuses on intelligent tutoring systems, automated feedback mechanisms, and conversational agents that support language acquisition. Hurajová and Chmelíková (2025) analyze the transformation of ESP and LSP courses in the context of AI adoption, identifying both pedagogical opportunities and instructional challenges. Similarly, Zhou et al. (2025) demonstrate how AI-supported speaking practice improves learner engagement and oral proficiency, particularly in multilingual and international academic environments. The strong linkage between language learning and artificial intelligence reflects the importance of communication skills in globally oriented higher education systems. Beyond specific applications, several studies frame AI-driven educational innovation as a strategic response to broader institutional pressures. Wang and Yu (2022) discuss AI-supported learning strategies as part of smart education systems, illustrating how instructional innovation aligns with digital infrastructure development. López-Chila et al. (2024) further consolidate this view through bibliometric evidence, showing that artificial intelligence has become a central theme in contemporary higher education research agendas. Taken together, these contributions portray Cluster 1 as a relatively mature and cohesive research stream focused on transforming core teaching and learning processes through AI-enabled innovation.

Cluster 2, represented in green, groups the keywords *artificial intelligence (AI)*, *education*, *technology*, *science*, and *globalization*. This cluster reflects a macro-level and system-oriented perspective on artificial intelligence in higher education, focusing on how AI interacts with technological infrastructures, scientific development, and global institutional dynamics. A key theme within this cluster is the positioning of artificial intelligence within broader technological and scientific ecosystems. Research included in the dataset conceptualizes AI as part of large-scale digital infrastructures that shape institutional organization, governance, and strategic planning. Li et al. (2022) examine industrial big data and AI-supported decision-making models, offering insights into how data-intensive approaches influence organizational processes relevant to higher education systems. Similarly, Bertoletti et al. (2022) apply machine learning techniques to analyze the relationship between higher education systems and regional economic development, reinforcing the view that AI-driven analytics extend beyond classroom-level applications. The strong co-occurrence of *technology* and *science* highlights the infrastructural dimension of AI adoption. Studies emphasize that higher education institutions increasingly operate within global knowledge and innovation systems where scientific production, technological capacity, and educational performance are closely intertwined. Rikap (2024) situates universities within global innovation networks, arguing that artificial intelligence reshapes the role of higher education as both a producer and consumer of advanced technologies. This perspective underscores how AI contributes to redefining institutional missions in a globalized academic environment. *Globalization* provides the contextual framework that connects technological change to institutional strategy and policy alignment. Several contributions address how higher education institutions respond to globalization pressures by adopting AI-enabled systems to enhance efficiency, visibility, and competitiveness. Tsymbal and Kalenyuk (2023) analyze the digital transformation of global education systems, emphasizing how platform-based solutions and data infrastructures influence governance and cross-border educational delivery. From a policy-oriented perspective, Kaya-Kasikci et al. (2025) examine the positioning of higher education institutions within national and international AI policy frameworks, highlighting how regulatory environments shape institutional behavior in a global context. Ethical and governance-related considerations further enrich this cluster. Guo (2024) discusses the ethical implications of artificial intelligence in education, framing AI as a global technological force that requires coordinated institutional responses and long-term oversight. These ethical concerns intersect with questions of governance, accountability, and strategic leadership, reinforcing the idea that AI-driven globalization in higher education involves systemic adaptation rather than isolated

technological adoption. Overall, Cluster 2 captures a coherent body of literature that frames artificial intelligence as a driver of technological, scientific, and organizational transformation in higher education systems operating under globalization pressures. The close association between *technology*, *science*, and *globalization* underscores a research focus on macro-level change, institutional resilience, and policy alignment in an increasingly interconnected global academic landscape.

Cluster 3, represented in blue, groups the keywords *students*, *performance*, *design*, *sustainability*, and *challenges*. This cluster captures a results-oriented strand of research that evaluates how AI-enabled approaches influence learning outcomes, how educational interventions are designed and implemented, and what constraints appear when such initiatives are scaled and sustained within higher education systems. A first visible emphasis is the student-facing dimension of AI adoption, where studies examine how learners interact with emerging tools and how these tools influence performance-related outcomes. For instance, Aydin et al. (2026) investigate the role of ChatGPT in supporting the social and academic integration of international students across university settings, highlighting how AI-mediated interaction can shape the student experience and adaptation process. In a related teaching-and-learning direction, Hurajová and Chmelíková (2025) analyze ESP/LSP courses in the era of AI, showing how AI-related change generates both performance opportunities and practical challenges for higher education instruction. Similar applied concerns appear in the context of English-language learning and AI-supported practice in higher education, where Zhou et al. (2025) focus on structured speaking practice support, a topic that directly maps onto the cluster's student and performance orientation. The keyword *design* indicates that research within this cluster treats educational outcomes as dependent on how AI is embedded in course structures and assessment formats. El-Soussi and Yousef (2026) propose a framework explicitly oriented toward writing assignment design in higher education, emphasizing that the pedagogical value of AI depends on the design of tasks, evaluation criteria, and instructional scaffolding. From the perspective of AI integration into training models, Zhao (2023) addresses an AI-based training mode in international art and design education, where the design of learning environments and human–computer interaction mechanisms is linked to skill formation and performance development. At the level of institutional analytics and performance-related decision support, Estrada-Real and Cantú-Ortiz (2022) propose a data analytics approach oriented toward university competitiveness, aligning with the idea that educational performance is increasingly monitored and supported through AI-driven analytical tools. The presence of *challenges* signals that this literature does not frame AI adoption as frictionless, but instead emphasizes implementation barriers,

evaluation difficulties, and the need for institutional readiness. Ada (2025) examines the transition to online learning and the difficulties experienced in technology-driven educational change, reflecting the operational challenges that emerge when institutions redesign teaching processes. Complementary concerns about student perceptions, acceptance, and the evaluation of AI-supported learning experiences appear in empirical work such as Sadegh-Zadeh et al. (2023), which explores undergraduates' perceptions and experiences in AI-related educational settings. Finally, *sustainability* reflects growing attention to whether AI-supported educational models can be maintained over time in ways that remain pedagogically effective and institutionally feasible. Camacho-Zuñiga et al. (2025) discuss continuous learning models shaped by digital transformation, connecting the sustainability of educational systems with the capacity to adapt to persistent technological change. Related discussions of broader system-level sustainability also appear in research on machine learning and classification approaches used in educational contexts, where Maurya et al. (2021) contribute to the broader methodological toolkit that supports performance monitoring and scalable analytics in education-related applications. Overall, Cluster 3 reflects a coherent body of work that focuses on measurable outcomes and practical implementation. The internal grouping of *students*, *performance*, and *design* points to a consistent interest in evaluating AI-enabled education through learner outcomes and instructional design, while the co-occurrence of *challenges* and *sustainability* indicates a parallel concern with feasibility, adoption barriers, and long-term viability.

The fourth cluster, represented in yellow, brings together the keywords *internationalization*, *international students*, *employment*, and *quality*. This cluster captures research that positions higher education in a global competitive environment, where institutions are evaluated through cross-border mobility, graduate outcomes, and quality assurance processes, with AI increasingly appearing as an enabling technology and an analytical lens in this context. A central strand within this cluster addresses employability as a strategic outcome of higher education under globalization pressures. Mgaiwa (2021) frames graduate employability as a core institutional challenge, particularly in contexts where universities must align academic formation with labor market demands. Building on employability as a measurable institutional output, Aviso et al. (2021) examine which university attributes predict graduate employability, reinforcing the cluster's linkage between employment outcomes and institutional quality. This orientation directly connects employability to quality signals, since employment-related performance is increasingly treated as an indicator of institutional success within international higher education systems. The inclusion of *international students* and *internationalization* highlights the operational and cultural dynamics of

cross-border education. Aydin et al. (2026) examine how AI tools such as ChatGPT may support international students' academic and social integration across different university contexts, directly linking AI to student mobility and international student experience. From a more institutional representation perspective, Yanagiura et al. (2025) analyze university websites using AI-based image analysis to examine campus internationalization and representation, illustrating how AI methods can be used to assess internationalization signals and institutional positioning in global education markets. Internationalization is also approached through technological and communication infrastructures. For example, Liang and Jia (2023) explore algorithmic approaches linked to international communication and cooperation, explicitly connecting AI-driven analytical methods to the promotion of higher education internationalization. The keyword *quality* appears in this cluster as a unifying concern connecting mobility and employability. Studies included in the dataset highlight that internationalization introduces quality assurance pressures linked to diverse student populations, program comparability, and institutional reputational competition. Saez-Zevallos and Montalvo-Apolin (2025) contribute through systematic mapping focused on learning strategies in higher education, providing an evidence-oriented base that supports quality-focused decision-making in internationally oriented institutions. Broader concerns about how institutions define and operationalize the "university of the future" in globally competitive environments are reflected in Mairal (2023), where quality and institutional transformation are discussed as part of long-term strategic repositioning. A related set of contributions reinforces that internationalization and quality are increasingly evaluated through data-intensive and AI-supported approaches. Bertoletti et al. (2022) connect higher education systems with regional economic development, combining econometric and machine learning approaches and reinforcing the view that quality and performance debates are increasingly intertwined with AI-based analytical tools. Policy-oriented perspectives also complement this cluster, as Kaya-Kasikci et al. (2025) examine university positioning in AI policies across major global actors, highlighting how international policy environments shape institutional behavior and, indirectly, competitiveness and quality perceptions in international higher education. Finally, quality is also linked to responsible practice in global academic ecosystems. Crawford (2025) discusses methodological limitations in single-institution studies in the era of large language models, indirectly reinforcing quality standards for research and evidence-building in AI-related higher education scholarship. In the same direction, Tuyen (2026) addresses responsible use of AI-generated content in scholarly publishing based on journal policies and editorial practices, connecting AI governance to quality assurance in global academic

communication. Practical innovation in educational delivery, relevant for quality in globally oriented programs, is also reflected in Pashchenko et al. (2025), who discuss strategies for incorporating digital technologies into higher education settings. Overall, Cluster 4 consolidates a research stream in which internationalization processes and international student experience intersect with employment outcomes and quality assurance. The thematic structure indicates that globalization pressures shape both institutional priorities and evaluation criteria, while AI appears as a strategic tool for supporting international student integration, assessing institutional internationalization signals, and strengthening evidence-based quality management.

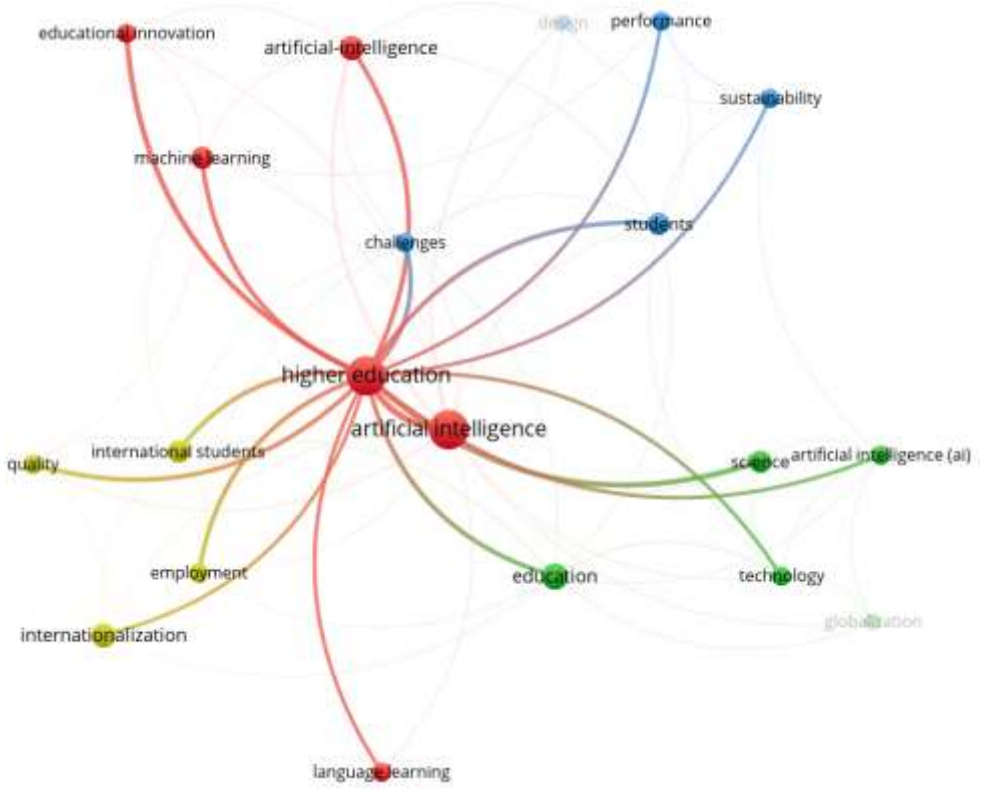



*Figure 5. Relationships between higher education and the main thematic areas associated with artificial intelligence and globalization*

(*Source*: VOSviewer output)

Overall, the four clusters identified through the keyword co-occurrence analysis capture the main research directions linking artificial intelligence, globalization, and higher education. Across all clusters, the term *higher education* emerges as the central

connecting node, indicating that technological, pedagogical, and global dimensions are consistently framed within the institutional context of universities and tertiary education systems. The network structure shows that artificial intelligence and machine learning are closely associated with educational innovation and language learning, reflecting the integration of advanced technologies into core teaching and learning processes. At the same time, system-level concepts such as technology, science, and globalization highlight the broader structural and policy-related transformations affecting higher education in an interconnected global environment.

In parallel, student-centered and outcome-oriented themes, including performance, sustainability, and educational challenges, intersect with institutional design and implementation concerns, emphasizing the practical implications of AI adoption for learning outcomes and long-term feasibility. Finally, globalization-related concepts such as internationalization, international students, employment, and quality converge around higher education as a shared reference point, underlining the growing importance of cross-border mobility, graduate employability, and quality assurance in globally competitive academic systems.

Taken together, the four clusters illustrate that higher education functions as the common conceptual framework through which artificial intelligence, technological development, and globalization are jointly articulated, reinforcing the role of universities as key actors in managing digital transformation and global integration.

## 4. CONCLUSIONS

This study set out to examine how artificial intelligence and globalization intersect within the context of higher education by means of a bibliometric analysis of 59 publications indexed in the Web of Science database for the period 2020–February 2026. By applying VOSviewer techniques to keyword co-occurrence data, the research aimed to reveal the main thematic structures and relational patterns shaping this emerging field.

The results confirm that research at the intersection of artificial intelligence and globalization in higher education is both conceptually diverse and structurally interconnected, reflecting the multidimensional nature of contemporary educational transformation. The keyword co-occurrence analysis identified four major thematic clusters, each capturing a distinct yet interrelated research direction. At the center of the network lies the concept of higher education, which acts as a unifying hub connecting technological, pedagogical, institutional, and global dimensions.

The first cluster highlights the pedagogical and application-oriented core

of the literature, focusing on artificial intelligence, machine learning, educational innovation, and language learning. This body of research emphasizes the integration of AI into teaching and learning processes, illustrating how data-driven and adaptive technologies are reshaping instructional design and learning environments in higher education.

The second cluster reflects a macro-level perspective, linking artificial intelligence with education, technology, science, and globalization. Research in this area conceptualizes AI as part of broader technological and scientific ecosystems that influence institutional structures, governance, and strategic positioning within global higher education systems. Rather than concentrating on specific classroom applications, this stream addresses systemic transformation, policy alignment, and the role of universities within global innovation and knowledge networks.

The third cluster centers on students, performance, design, sustainability, and challenges, capturing a results-oriented and evaluative strand of the literature. Studies grouped within this cluster examine how AI-enabled educational interventions affect learning outcomes, student experience, and institutional performance, while also acknowledging implementation barriers and long-term sustainability concerns. This cluster highlights that the effectiveness of AI in higher education depends not only on technological capability, but also on thoughtful pedagogical design and institutional readiness.

The fourth cluster brings together internationalization, international students, employment, and quality, emphasizing the global competitiveness of higher education institutions. Research in this stream positions employability and graduate outcomes as key indicators of institutional quality in an international context, while also addressing cross-border student mobility and quality assurance. Artificial intelligence appears here as both an enabling technology and an analytical tool, supporting international student integration, institutional evaluation, and evidence-based decision-making under globalization pressures.

Despite these insights, the study is subject to several limitations. The analysis is restricted to publications indexed in the Web of Science database, which, although highly authoritative, may exclude relevant contributions from other sources. In addition, the bibliometric approach captures structural and relational patterns but does not provide in-depth qualitative insights into individual studies. As such, the findings should be interpreted as a mapping of dominant research directions rather than an exhaustive assessment of the field.

Future research could address these limitations by expanding the dataset across multiple databases, extending the temporal scope, and combining bibliometric analysis with qualitative content analysis. Such approaches would allow for a deeper

understanding of how artificial intelligence is reshaping higher education in a globalized context, particularly with regard to emerging ethical, social, and policy-related challenges.

Overall, this study contributes to the growing body of literature by offering a structured overview of the relationships linking artificial intelligence, globalization, and higher education. The findings underscore that technological innovation cannot be understood in isolation from institutional, pedagogical, and global dynamics. Instead, the transformation of higher education emerges as a complex process in which artificial intelligence acts both as a driver of innovation and as a catalyst for rethinking quality, inclusivity, and long-term sustainability in a global academic landscape.

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