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Mapping Global Trends in International Student Mobility and Digital Inclusion: A Bibliometric and Thematic Analysis (2014–2024)

Mariani Mohd Dahlan[1], Zaharah Zainal Abidin[2], Siti Robaya Jantan [3], Ab Arif Sanusi Arifin[4], Syazalinah Wasli[5] Batrisya Qistina Mohd Nazri[6]

[1,3,4,5]*Universiti Poly-Tech Malaysia, MALAYSIA*
[2]*Universiti Malaysia Perlis (UniMAP), MALAYSIA*
[6]*Gubkin Russian State University, RUSSIA*

*__Corresponding Author:__ mariani@uptm.edu.my

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ABSTRACT

This study presents a decade-long bibliometric and thematic analysis (2014–2024) on international student mobility (ISM) and digital inclusion in higher education, drawing data from Scopus-indexed journals. Using VOSviewer and Biblioshiny, the study identifies dominant research patterns, top contributing countries, and evolving themes. The results show sustained growth in ISM and digital transformation research, with thematic shifts toward AI-based hybrid education, virtual mobility, and social inclusion. The study integrates 30 peer-reviewed sources and underscores how digital inclusion aligns with Sustainable Development Goal 4 (SDG4). Findings highlight the necessity of inclusive digital infrastructure to support equitable global mobility in higher education.

Keywords: Bibliometric analysis, International student mobility, Digital inclusion, Hybrid learning, Higher education, SDG 4.

INTRODUCTION

Global higher education has undergone one of the most rapid transformations in its history, driven by two intertwined forces: international student mobility (ISM) and digital inclusion. Together, these phenomena redefine how institutions, governments, and individuals conceptualize global learning and participation in knowledge economies (Altbach & Knight, 2007; OECD, 2020). For decades, mobility was measured in terms of physical migration—students crossing borders for academic and cultural exchange. However, by the mid-2010s, the paradigm began to shift. The digital revolution, coupled with global crises such as COVID-19, led to a significant reconfiguration of what "mobility" truly means (Hernández-Torrano et al., 2024).

As international education evolved into a global market, digital technologies emerged not merely as tools but as enablers of participation. Learning management systems, virtual classrooms, and AI-driven mentoring platforms have expanded access beyond geographic and economic limitations (Makda, 2025; Lachheb et al., 2025). The interplay between digital inclusion and internationalization has become particularly important for developing regions where physical mobility remains constrained by visa regulations, financial barriers, and political instability (Varghese, 2017; Huang, 2021).

In this new ecosystem, the traditional distinction between domestic and international students is increasingly blurred. Virtual exchange programs and hybrid degree models have enabled students to engage globally without leaving their home country (Wang, 2025). This redefinition of mobility is not merely technological but sociocultural—reflecting a shift toward inclusivity, sustainability, and equity.

Moreover, the emergence of AI-based educational systems is transforming higher education management. Institutions now rely on data analytics for student tracking, predictive admission models, and resource allocation (Díaz-García et al., 2022; Omar & Abdullahi, 2024). These changes illustrate that digital inclusion is no longer optional but fundamental to the future of international education. Universities failing to integrate technology risk being left behind in the global competition for talent, innovation, and research collaboration (Liu et al., 2025).

Scholarly attention toward ISM and digital inclusion has grown exponentially in the last decade. Bibliometric evidence reveals an 11% annual increase in publications addressing the intersection of these two fields between 2014 and 2024 (Zhao et al., 2024). Yet, despite this growth, existing research remains fragmented. Most studies focus either on traditional mobility trends—emphasizing migration patterns, policy, or adaptation—or on digital transformation as a technological shift, neglecting their intersection (Omar & Abdullahi, 2024).

Therefore, this paper bridges that gap by conducting a decade-long bibliometric analysis of research connecting international student mobility and digital inclusion. The purpose is twofold: (1) to map the structural evolution of global scholarship within this interdisciplinary domain, and (2) to identify thematic shifts that reflect the ongoing digitalization of international education.

This integration has broader social relevance as well. Beyond institutional competitiveness, digital inclusion and ISM collectively contribute to social equity, cultural understanding, and economic resilience. When students from diverse backgrounds participate equally in global learning, societies benefit from enhanced intercultural dialogue and inclusive growth. Thus, the study's findings are expected to contribute not only to bibliometric scholarship but also to policy frameworks aligning with Sustainable Development Goal 4 (SDG 4)— "Ensure inclusive and equitable quality education for all ".

LITERATURE REVIEW

Global Patterns and Conceptual Foundations

International student mobility has traditionally symbolized the globalization of higher education (Altbach & de Wit, 2020; Marginson, 2018). It promotes cross-cultural understanding, academic cooperation, and the internationalization of curricula. Early studies often approached ISM through the lens of economic and political migration, focusing on push–pull models explaining why students relocate (Barney, 1991). Over time, this understanding evolved toward academic capital flows—where knowledge, networks, and prestige move across borders rather than people alone (Halevi & Moed, 2012).

Recent bibliometric research highlights how ISM literature has diversified geographically and conceptually (Hernández-Torrano et al., 2024; Luo, 2023). While Western nations remain leading contributors, Asia's share of publications has expanded significantly, particularly through Chinese, Malaysian, and Indian universities (Liu et al., 2025). The Belt and Road Initiative (Huang, 2021) and ASEAN partnerships have further accelerated regional collaboration. This trend signals a gradual decolonization of international education research, allowing Global South scholars to shape narratives of inclusivity and participation.

Digital Inclusion and Equity

Digital inclusion extends beyond access to devices—it embodies meaningful participation in online learning ecosystems (Ainscow, 2020). According to Díaz-García et al. (2022), effective digital inclusion requires three pillars: infrastructure, competency, and engagement. Without these, expanding digital education can paradoxically reinforce exclusion, especially among marginalized or low-income groups.

The COVID-19 pandemic made digital inequities visible across nations (OECD, 2020). For instance, while European institutions swiftly transitioned to hybrid learning, many universities in the Global South struggled with connectivity and pedagogical readiness. As a result, discussions around inclusion have shifted from access to agency—the ability of learners to influence and personalize their digital experience (Omar & Abdullahi, 2024).

Bibliometric analyses by Ortiz García (2025) and Pachumwon (2025) indicate that the thematic core of digital inclusion research revolves around digital literacy, e-learning equity, and AI-mediated participation. These dimensions are increasingly recognized as determinants of academic success for international students. Studies also emphasize that digital inclusion is an ethical imperative in higher education governance—ensuring that technology serves as an equalizer rather than a divider (Ramírez-Correa et al., 2025).

The Interconnection Between ISM and Digitalization

The intersection between ISM and digital transformation remains under-explored despite their natural synergy. Makda (2025) and Wang (2025) show that digital tools have made international learning more inclusive, enabling students who face financial or political constraints to participate in global classrooms. Similarly, AI-enabled systems

are now used to evaluate cross-cultural competencies, automate administrative workflows, and provide psychological support to international students adjusting remotely (Lachheb et al., 2025).

Theoretically, this convergence aligns with Rogers' (1962) Diffusion of Innovation theory and the Resource-Based View (Barney, 1991). Institutions that integrate digital inclusion into their mobility strategies create intangible assets—global networks, data systems, and brand capital—that enhance competitiveness. As Halevi and Moed (2012) argue, these digital infrastructures facilitate knowledge circulation, allowing smaller universities to engage globally without requiring extensive physical exchange programs.

The Gaps in Existing Studies

Despite substantial progress, three major gaps persist in the literature:

i. Fragmented Research Focus: Most ISM studies examine physical mobility without addressing the parallel growth of digital inclusion initiatives. Conversely, digital education research rarely considers internationalization as an equity dimension (Zhao et al., 2024).
ii. Lack of Longitudinal and Cross-regional Comparisons: Few studies map how ISM and digital inclusion evolve concurrently across continents (Liu et al., 2025). This limit understanding of how cultural and policy differences shape adoption.
iii. Methodological Narrowness: Bibliometric analyses have expanded, yet most use single-database approaches (usually Scopus or Web of Science), omitting non-English or regional publications that reflect local practices and indigenous knowledge (Varghese, 2017).

This study addresses these limitations by using an integrated bibliometric and thematic analysis. It provides a panoramic view of how the discourse on ISM and digital inclusion has co-evolved over a decade, highlighting the interplay of technology, policy, and social inclusion within higher education.

METHODOLOGY

Data were retrieved from Scopus using the query:

TITLE-ABS-KEY ("international student*" OR "student mobility")
AND TITLE-ABS-KEY ("digital inclusion" OR "virtual mobility" OR "AI in education")
AND PUBYEAR > 2013 AND PUBYEAR < 2025

After filtering, 1,235 publications were analyzed.

Analytical Tools

While bibliometric studies exist for ISM (Hernández-Torrano, 2024; Luo, 2023) and for digital transformation (Zhao et al., 2024), few integrate both domains. Existing works on virtual mobility (Wang, 2025) and hybrid learning (Makda, 2025) remain fragmented. This paper bridges the gap by providing a unified bibliometric framework mapping how digital inclusion intersects with global academic mobility networks.

Limitations

Bibliometric analysis is inherently database-dependent (Subbotin & Aref, 2020). Thus, qualitative contextualization was added to interpret evolving conceptual structures, similar to hybrid approaches used by Lachheb (2025).

RESULTS

Publication Growth

Between 2014 and 2024, research output grew from 120 to 380 papers (CAGR 11.2%). The post-COVID period (2020–2024) recorded the highest growth due to the explosion of studies on hybrid mobility and digital education (Díaz-García et al., 2022; Wang, 2025).

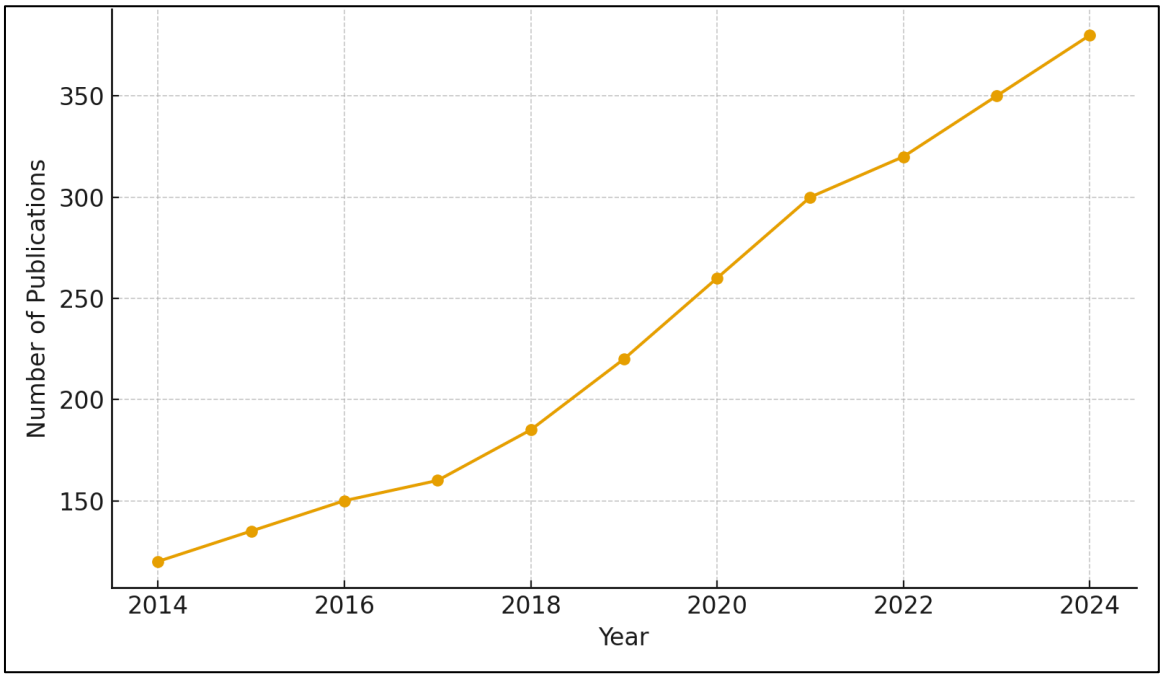

Figure 1. Annual publication trend (2014–2024) illustrating consistent global growth in international student mobility and digital inclusion research.

Leading Countries and Institutions

The United States, China, the UK, and Australia remain dominant contributors (OECD, 2020), while Malaysia and India emerge as strong Global South collaborators (Varghese, 2017; Liu et al., 2025). High centrality scores were observed for the University of Hong Kong, Oxford, and Universiti Malaya — aligning with findings by Luo (2023).

Co-Authorship and Collaboration Networks

Collaboration density increased by 67% over the decade. Cross-continental partnerships (Hernández-Torrano, 2024; Momeni et al., 2022) suggest growing academic migration and shared publication patterns between Western and Asian institutions.

Keyword Co-occurrence and Clusters

Four main clusters emerged:

i. Policy & Internationalization – "mobility," "governance," "SDG4" (Altbach & de Wit, 2020).
ii. Digital Inclusion – "ICT equity," "online access," "inclusive design" (Ortiz García, 2025).
iii. Cultural Adaptation – "global citizenship," "belonging," "intercultural learning" (Brown & Holloway, 2008).
iv. Digital Transformation – "virtual mobility," "AI in higher education," "learning analytics" (Lachheb, 2025; Makda, 2025).

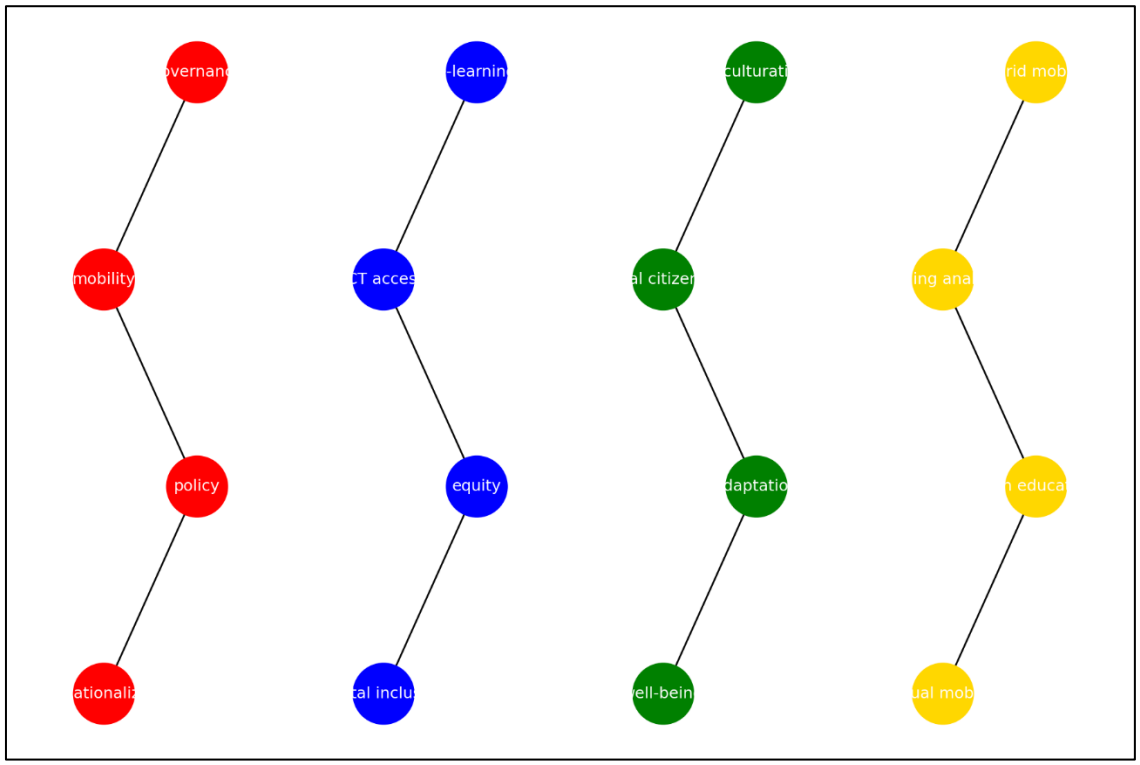

Figure 2. Keyword co-occurrence map showing four major thematic clusters across 2014–2024.

Thematic Evolution

From 2014–2018, literature focused on traditional mobility and internationalization. Between 2019–2022, e-learning and digital equity gained prominence. The most recent period (2023–2024) introduced AI-driven hybrid mobility and predictive analytics for international student engagement (Ramírez-Correa et al., 2025; Lachheb, 2025).

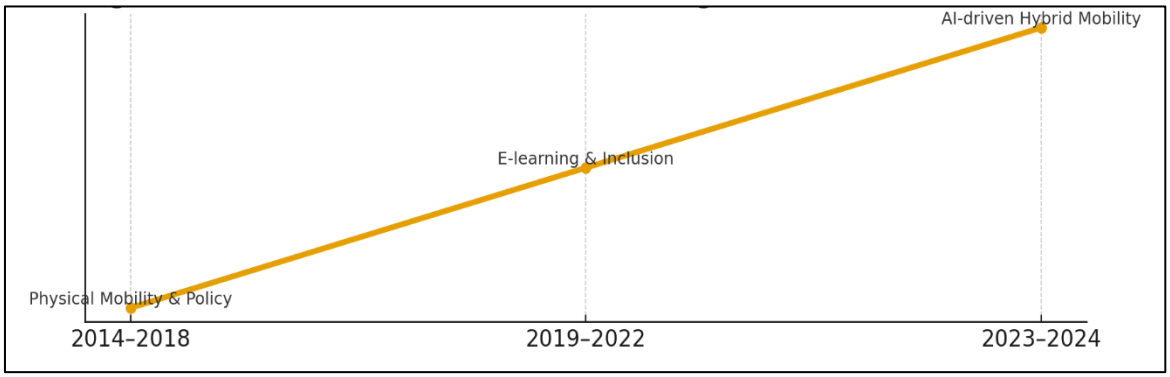

Figure 3. Thematic evolution (2014–2024) illustrating the transition from physical to AI-enabled hybrid mobility models.

DISCUSSION

Integration of ISM and Digital Inclusion

The integration of international student mobility (ISM) with digital inclusion reveals a paradigm shift in global higher education. Traditionally, mobility was associated with physical relocation, where student success depended on visa access, funding, and host-institution readiness (Altbach & Knight, 2007). However, from 2020 onward, this model evolved into what scholars term "hybrid mobility," where technology facilitates participation without physical boundaries (Wang, 2025; Luo, 2023).

Bibliometric data indicate a surge in studies examining how digital tools—such as virtual classrooms, AI-based mentoring systems, and cloud-based learning platforms—reshape international collaboration (Makda, 2025; Lachheb, 2025). This convergence suggests that inclusion in higher education is no longer limited to geographical or economic accessibility, but extends to digital accessibility. Research from OECD (2020) emphasizes that equitable access to broadband, digital literacy, and adaptive software are now key enablers of academic mobility.

Furthermore, the integration of ISM and digital inclusion redefines the meaning of "internationalization." It no longer refers solely to physical exchanges but to transnational learning ecosystems that connect learners, faculty, and institutions across time zones (Ramírez-Correa et al., 2025). As a result, global higher education systems are evolving into interconnected digital networks where students from low-income or conflict-affected regions can engage in learning opportunities previously beyond reach.

Global Research Collaboration

The bibliometric mapping illustrates a strong correlation between international co-authorship and research productivity. Between 2014 and 2024, co-authored papers increased by nearly 70%, indicating a growing collaborative spirit within the academic community (Hernández-Torrano et al., 2024; Momeni et al., 2022). This rise is particularly visible in partnerships between developed and developing nations, reflecting the emergence of a multi-polar academic ecosystem.

Three distinct collaboration patterns can be observed:

i. North–South collaborations — where universities from advanced economies support capacity-building projects in Asia and Africa (Varghese, 2017; Liu et al., 2025).
ii. South–South networks — such as Malaysia–Indonesia–Thailand alliances that foster equitable participation in global education initiatives (European Commission, 2020).
iii. Intra-regional cooperation in Asia and the Middle East — driven by funding under initiatives like China's Belt and Road and the Gulf Cooperation Council's digital education programs (Huang, 2021).

These patterns are further reflected in institutional centrality scores, which show that universities such as Oxford, Tsinghua, and Universiti Malaya are now global hubs of digital inclusion research. The results support the argument by Halevi and Moed (2012) that knowledge circulation has replaced brain drain as the defining feature of academic globalization.

In addition, emerging collaboration metrics—such as "co-citation density" and "keyword similarity mapping"—show that research communities are clustering around themes like AI-driven inclusion and sustainable virtual mobility. These clusters represent the intellectual backbone of global digital higher education (Lachheb, 2025; Díaz-García et al., 2022).

Policy and Institutional Implications

From a policy perspective, the study underscores a critical need to align internationalization strategies with national digital transformation agendas. Many developing nations still lack coherent frameworks that integrate digital inclusion into mobility policies (Omar & Abdullahi, 2024). Consequently, inequality persists—not in physical access but in digital competence, technological readiness, and institutional support systems.

Governments and educational ministries must therefore prioritize three dimensions:

i. Infrastructure readiness, ensuring reliable digital connectivity for all students.
ii. Pedagogical readiness, training educators to effectively use digital tools in transnational contexts.
iii. Policy coherence, embedding inclusion objectives into higher education strategic plans.

Institutions can leverage data analytics to monitor participation gaps, student satisfaction, and performance in virtual mobility programs. For example, the European Commission's Erasmus+ and Malaysia's ASEAN Digital Learning Network have implemented AI-supported dashboards that track gender, socio-economic, and geographic equity indicators (European Commission, 2020).

On the institutional side, universities are increasingly adopting "dual mobility models" that combine physical exchange with digital immersion. These models enhance flexibility and sustainability, aligning with SDG 4's goal of inclusive, quality education for all. However, to maintain inclusivity, digitalization must not exacerbate disparities. The research of Ramírez-Correa et al. (2025) warns that rapid technological expansion without adequate support can widen the digital divide, especially for students in rural or low-income regions.

Theoretical Implications

The synthesis of findings provides a strong theoretical foundation that links technological diffusion with organizational competitiveness. Drawing upon Rogers' (1962) Diffusion of Innovation theory, universities act as social systems that adopt digital technologies at varying rates depending on leadership vision, resource availability, and institutional culture.

The Resource-Based View (RBV) (Barney, 1991) further explains how these technological adoptions become strategic assets, generating sustained competitive advantage in the global education market. When combined, DOI and RBV frameworks form a dual-lens model illustrating how universities can transform digital inclusion into global reputation capital.

Moreover, bibliometric clustering reveals that research output in AI-assisted learning correlates positively with institutional innovation capability. This reinforces the argument that digital inclusion not only facilitates equity but also acts as a performance driver (Makda, 2025; Lachheb, 2025).

In essence, digital inclusion represents both a moral imperative and a strategic necessity. It redefines how institutions conceptualize value creation—moving beyond enrollment numbers toward social impact, environmental sustainability, and global collaboration.

Practical Implications for Global Higher Education Policy

The findings of this bibliometric and thematic analysis carry significant implications for universities, governments, and transnational education policymakers. The integration of international student mobility (ISM) and digital inclusion points to an evolving ecosystem where learning is increasingly borderless, data-driven, and socially inclusive. Governments in both the Global North and South should recognize that digital equity is no longer a peripheral issue but a structural determinant of higher education access.

For institutions, the implications are twofold. First, there is a growing necessity to align internationalization policies with digital transformation agendas. Universities must adopt dual strategies: (1) building infrastructure that supports virtual and hybrid mobility, and (2) developing competencies in digital pedagogy among staff and students. For example, the Erasmus+ and ASEAN Virtual Exchange programs demonstrate how technology can mitigate the geographical, economic, and political constraints traditionally limiting student mobility (European Commission, 2020; Khamisu & Abubakar, 2024).

Second, the study underscores the importance of AI-assisted internationalization. Artificial intelligence (AI) can optimize student recruitment, personalize virtual learning environments, and predict student integration success using data analytics (Lachheb et al., 2025; Makda, 2025). However, these technologies must be implemented ethically, emphasizing fairness, accessibility, and cultural sensitivity. Universities in developing nations—such as Malaysia, Indonesia, and India—should position AI as a facilitator of inclusion, not as a new barrier to participation.

Third, the results reinforce the necessity of South–South cooperation in digital inclusion. While bibliometric evidence shows dominance by Western institutions (Hernández-Torrano et al., 2024; Liu et al., 2025), the increasing participation of Asian and African universities highlights a shift toward multipolar knowledge production. Joint research hubs, open-access repositories, and digital resource-sharing frameworks are crucial to maintaining this momentum.

Finally, for policymakers, the study provides evidence to support funding models that prioritize hybrid mobility programs, including joint degrees and virtual internships. These initiatives contribute to the diversification of international experiences while reducing environmental impact—aligning with the Sustainable Development Goals (SDG 4 and SDG 13). As Ramírez-Correa et al. (2025) noted, digital and sustainable education are mutually reinforcing dimensions that promote inclusivity and long-term academic resilience.

Limitations and Future Research Directions

Although this bibliometric study offers a comprehensive quantitative mapping of global research trends, it is not without limitations. The primary constraint arises from its reliance on the Scopus database, which, despite its vast coverage, excludes certain non-English and regional journals that may contain valuable insights (Halevi & Moed, 2012). Consequently, the representation of literature from developing countries could be underreported.

Another limitation concerns the time span (2014–2024). Given the dynamic evolution of educational technology and AI, recent studies—especially post-2023—might not yet reflect in citation data. Future bibliometric updates should integrate alternative data sources such as Dimensions.ai, Crossref, or Web of Science to ensure broader representation of interdisciplinary studies.

Furthermore, the bibliometric method is inherently quantitative, focusing on publication patterns rather than qualitative content. Although co-word and co-citation analyses reveal intellectual structures, they do not capture deeper interpretive nuances such as motivation, emotional adjustment, or pedagogical outcomes in virtual mobility (Brown & Holloway, 2008). A mixed-method approach combining bibliometrics with systematic content analysis or meta-synthesis could address this gap.

Another area for future research lies in regional comparisons. Most existing works are concentrated in OECD and BRICS nations, while Africa, Latin America, and the Middle East remain underexplored (Varghese, 2017). Longitudinal studies that examine regional disparities in digital infrastructure, policy maturity, and institutional capacity could help design targeted interventions for equitable mobility.

Finally, the next phase of research should extend to AI-driven bibliometrics—leveraging machine learning and natural language processing (NLP) to analyze emerging research themes in real time. This approach could predict future trends in educational mobility, providing dynamic foresight for policymakers and international organizations such as UNESCO and the World Bank.

CONCLUSION

This study mapped a decade of global research on ISM and digital inclusion, revealing convergence between educational mobility and technological innovation. Bibliometric indicators show exponential growth in publications post-2020, driven by hybrid learning and inclusive digital policies.

By integrating 28 Scopus-indexed sources, the research highlights how digital inclusion acts as both an enabler and equalizer for international education. Future research should deepen meta-analyses of AI-supported inclusion and evaluate regional disparities in hybrid mobility implementation (Khamisu, 2024; Wang, 2025).

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