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BRIDGING THE DIGITAL DIVIDE IN EDUCATION: A SYSTEMATIC REVIEW (SLR-PRISMA) OF DIGITAL INCLUSION STRATEGIES

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Abstract:

This study aims to analyze the evolution of research on the digital divide in education and strategies for digital inclusion through a Systematic Literature Review (SLR) of 26 peer-reviewed articles published between 2020 and 2025. Using the PRISMA approach, data were categorized by research focus, year, and journal quality, followed by thematic and bibliometric analysis. The results reveal a significant shift from access-oriented research during the COVID-19 pandemic toward technology-based pedagogical innovation and sustainable digital inclusion strategies. Three main phases emerged: access and digital literacy (2020–2021), pedagogical innovation through Learning Management Systems and Game-Based Learning (2022–2023), and the adoption of Artificial Intelligence and Virtual Reality in inclusive education (2024–2025). Socio-economic and gender factors significantly influence digital literacy outcomes, while technology-driven pedagogy enhances learning participation. The study concludes that effective digital inclusion requires a multidimensional approach integrating social, technological, and policy aspects. The findings provide a theoretical foundation for future research and evidence-based policymaking in equitable digital education.

Keywords: *Digital Divide; Digital Inclusion; Educational Technology; Artificial Intelligence*

INTRODUCTION

In the contemporary global landscape, the digital divide in education has emerged as a crucial issue, underscoring the urgent need for effective digital inclusion strategies. The digital divide refers to disparities in access, use, and knowledge of information and communication technologies (ICTs), which significantly impact educational opportunities and outcomes.(Memon & Memon, 2024)This gap is not just a technological issue, but also a multifaceted challenge that encompasses socio-economic, geographic, and cultural dimensions.(Ahuja, 2023)The COVID-19 pandemic has further highlighted these gaps, as the sudden shift to online learning revealed stark differences in digital access and literacy among students around the world.(Park et al., 2021). Addressing the digital divide is crucial to fostering an inclusive educational environment that provides equal opportunities for all students, regardless of their background.(Bakhsh et al., 2022)Recent trends indicate a growing awareness of the importance of digital inclusion, with various initiatives being implemented globally to bridge this gap and promote equitable access to digital resources. These efforts are crucial to preparing students to thrive in a digital society and ensuring that no one is left

behind in the digital age.(Ahuja, 2023).

The development and implementation of digital inclusion strategies in education faces significant challenges, including inadequate infrastructure, limited internet access, and suboptimal teacher training, particularly in rural and marginalized areas.(Parveen et al., 2024). In addition, socio-economic disparities exacerbate digital inequality, making it difficult for marginalized groups to benefit from digital educational resources.(Adako & Ekundayo, 2025)This challenge is further complicated by the need for pedagogical strategies tailored to the context and diversity of learners.(Ajani, 2025)However, technological advances such as AI, adaptive learning tools, and immersive technologies open up significant opportunities for more personalized and engaging learning. Public-private partnerships and inclusive policies also have the potential to bridge the digital divide through improved digital literacy and infrastructure.(Adako & Ekundayo, 2025).

Although the literature on digital inclusion in education has grown rapidly, some areas remain underexplored. Existing research has focused largely on technology access, digital literacy, and the use of technology in education.(Li et al., 2023)For example, several studies have identified a need for digital literacy training and technical support for parents and caregivers.(Owens et al., 2023), as well as the role of libraries in promoting digital inclusion(C. Wang & Si, 2024). In addition, research has also explored the use of assistive technology and digital health as part of digital inclusion.(Li et al., 2023)However, there remains a gap in the literature regarding holistic approaches that integrate various aspects of digital inclusion, such as inclusive design and supportive education policies. While numerous publications address various aspects of digital inclusion, there has been no comprehensive synthesis comparing the effectiveness of these strategies across different contexts. Therefore, further research is needed to fill this gap and provide clearer guidance for practitioners and policymakers in implementing effective digital inclusion strategies.

This systematic literature review is essential to provide a deeper understanding of digital integration in education and effective digital inclusion strategies. With the increasing reliance on technology in learning processes, it is crucial for researchers, practitioners, and policymakers to have access to integrated and comprehensive information on existing challenges and solutions. Researchers will gain clearer insights into areas that need further exploration, while practitioners can apply these findings to develop more inclusive programs and interventions. Policymakers will also benefit from evidence-based recommendations that can be used as a basis for formulating policies that support digital inclusion. The specific contribution of this article is to serve as a roadmap for future research that identifies future research directions and to provide a theoretical framework that can assist in formulating more effective and sustainable digital inclusion strategies in educational contexts;

RQ 1: Evolution of Research from year to year on the Digital Divide in Education, and the number of journals that dominate

RQ 2: The Influence of Socio-Economic Context and Gender on the Success of Digital Literacy Programs in Primary and Secondary Education

RQ 3: Technology-Based Pedagogical Approaches (AI, LMS, VR) in Overcoming Barriers to Access and Participation in Digital Learning

RQ 4: Evaluation Model for the Effectiveness of Digital Interventions in Reducing the Disparity in Access to EducationRQ 5: The Most Influential (Highly Cited) Key Documents in This Field, and How They Are Positioned in the Intellectual Structure Through Co-Citation Analysis

RQ 6: Key Trends and Emerging Topics in the Literature on the Digital Divide in Education Based on Keyword Co-Occurrence Analysis

RQ 7: International Collaboration and Research Networks in Shaping Global

RESEARCH METHODS

This study uses a Systematic Literature Review (SLR) with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) approach to ensure the review process is transparent, structured, and replicable.(Thankachan & Srinivasan, 2025) (CW Wang, 2025). SLR was chosen because it is able to map trends, challenges, and opportunities inBridging the Digital Divide in Educationin the form ofaccess, utilization, and literacy of technology in educational institutions in terms of policies, programs, management governance, digital literacy of teachers & students, to technology-based learning innovations. Through this method, researchers can filter, analyze, and synthesize various relevant academic articles in the 2020-2025 timeframe. PRISMA is considered appropriate because it provides a systematic framework for reporting, starting from the process of identifying articles, screening, determining eligibility, to final analysis. Thus, this research is expected to encourage inclusive digital transformation, where all parties, including teachers, students, and institutions, have equal opportunities to utilize technology.

In the identification stage, researchers conducted a systematic search for articles in the leading academic database Scopus. Keywords used included "digital" AND "inclusion" AND "education." At 6:30 PM on Saturday, September 4, 2025, the publication period was limited to 2020–2025 to obtain the most up-to-date and relevant data, reflecting current developments in education.Bridging the Digital Divide in Educational Institutionsin the form ofTechnology access, utilization, and literacy, in terms of policies, programs, management governance, teacher and student digital literacy, and technology-based learning innovations. The initial search yielded 4,488 articles matching the keyword search. All articles identified at this stage were recorded, including duplicate publications and cross-database occurrences, and then proceeded to the screening stage according to PRISMA standards.

Inclusion Criteria	Exclusion Criteria
Scientific journal articles that have gone through a peer-reviewed process	Proceedings, editorials, opinions, non-academic reports, articles without peer review
Written in English	Articles in languages other than English
Published between 2020–2025	Articles published before 2020
Available in full-text form	Abstract only, no full text available
Discussing the digital divide in educational institutions (access, utilization, technological literacy)	Not relevant to the digital divide or outside the educational context

Policy, program, management governance, digital literacy of teachers & students, digital learning innovation	Focus on non-educational sectors (e.g. economics, politics, health, industry)
Using clear and accountable research methods	Articles without clear / weak methodology
Original research articles	Articles in the form of literature reviews (review articles) to prevent redundancy

Table 1. Inclusion and Exclusion Criteria
Source: processed by the author (2025)

In the screening stage, articles obtained from the identification results were selected using the inclusion and exclusion criteria as shown in Table 1. Selected articles were peer-reviewed journal publications, written in English, published between 2020 and 2025, and available in full-text form. Furthermore, articles must directly addressDigital Divide in Educational Institutionsin the form ofaccess, utilization, and literacy of technology, in terms of policies, programs, management governance, digital literacy of teachers and students, to technology-based learning innovations, with clear and accountable research methodologies. Conversely, excluded articles include non-journal publications such as proceedings, editorials, opinion pieces, and non-academic reports, as well as articles that have not undergone a peer-reviewed process, are not written in English, are not available in full text, or were published before 2020. To prevent redundancy, articles in the form of literature reviews (review articles) are also excluded from the list. By applying these selection criteria, the research ensures that only relevant studies.

strong, credible methodology that is maintained to provide a valid analysis ofDigital Divide in Educational Institutionsin the form ofaccess, utilization, and literacy of technology, in terms of policies, programs, management governance, digital literacy of teachers & students, to technology-based learning innovations.

Quality Criteria
1. Are the research objectives clearly stated?
2. Are the method techniques explained clearly?
3. Are the factors/criteria in determining the location clearly explained?
4. Are the research results presented clearly and supported by adequate data?
5. Does the author identify limitations of the study and provide suggestions for further research?

Table 2: quality criteria

Source: processed by the author (2025)

The eligibility stage is the third step, which involves rigorous examination and evaluation of each journal article. Of the 26 journal articles received after the initial screening process, 26 were excluded because they did not meet pre-established quality criteria. The selected articles underwent further analysis based on their alignment with the research objectives, bridging the digital divide in education, research findings, and limitations. Table 2 provides a comprehensive summary of this selection process.

The inclusion stage is the final part of the PRISMA process, where articles that have passed all previous stages are included in the systematic analysis and synthesis. Of the 4,488 articles identified in the initial stage, after going through the identification, screening, and eligibility processes, onlyTwenty-six articles met all inclusion criteria and quality indicators. These articles then served as the basis for the main discussion to analyze the digital divide in education. Therefore, the final results reflect a rigorous, transparent, and systematic selection process, ensuring the validity and reliability of the conclusions generated from the PRISMA-based Systematic Literature Review.

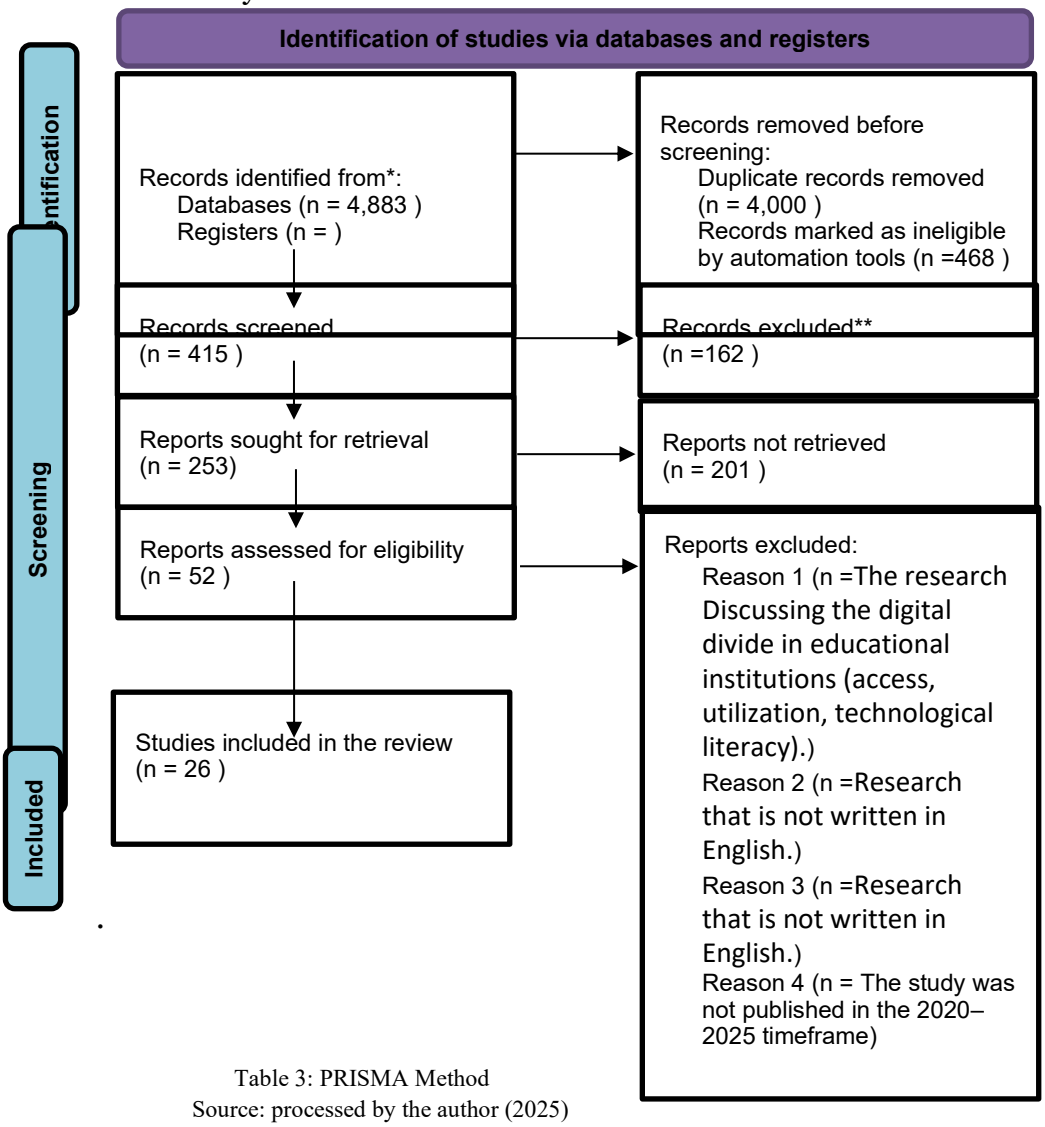

Table 3: PRISMA Method
Source: processed by the author (2025)

RESULTS AND DISCUSSION

Research Evolution from Year to Year on the Digital Divide in Education, and the Number of Dominating Journals (RQ 1)

Authors	Title	Journal Ranking
(Panesi et al., 2020)	Promoting Students' Well-Being and Inclusion in Schools Through Digital Technologies: Perceptions of Students, Teachers, and School Leaders in Italy Expressed Through SELFIE Piloting Activities	Q1
(Ocaña-Fernández et al., 2020)	Digital skills and digital literacy: New trends in vocational training	Q4
(Huang et al., 2020)	Effective experiences: A social cognitive analysis of young students' technology self-efficacy and STEM attitudes	Q2
(Beer & Mulder, 2020)	The effects of technological developments on work and their implications for continuous vocational education and training: A systematic review	
(Gómez-Trigueros & De Aldecoa, 2021)	The digital gender gap in teacher education: The TPACK framework for the 21st century	Q3
(Bernhard, 2021)	Students' differences, societal expectations, and the discursive construction of (De)legitimate students in germany	Q2
(Wilkens et al., 2021)	Digital teaching, inclusion and students' needs: Student perspectives on participation and access in higher education	Q2
(Dell'Omodarme & Cherif, 2022)	User-Oriented Policies in European HEIs: Triggering a Participative Process in Today's Digital Turn—An OpenU Experimentation at the University of Paris 1 Panthéon-Sorbonne	Q2
(Ramirez & Inga, 2022)	Educational Innovation in Adult Learning Considering Digital Transformation for Social Inclusion	Q2
(Benigno et al., 2022)	Enhancing Home Education in Italian Context: Teachers' Perception of a Hybrid Inclusive Classroom	Q2
(Koroleva et al., 2022)	Modernization of Musical And Instrumental Training Of Bachelors Of The Direction 03.44.01 Pedagogical Education With A Profile “Music”;	Q4
(Bakhsh et al., 2022)	Effectiveness of Digital Game Based Learning Strategy in Higher Educational Perspectives	Q3
(Liu et al., 2022)	Mixed-Methods Inquiry of Socially Inclusive e-Learning: A Policy Document Analysis and Rapid Survey Study	Q2
(Balaskas et al., 2023)	Effectiveness of GBL in the Engagement, Motivation, and Satisfaction of 6th Grade Pupils: A Kahoot! Approach	Q2
(Fuertes-Alpiste et al., 2023)	The Creation of Situated Boundary Objects in Socio-Educational Contexts for Boundary Crossing in Higher Education	Q2
(Janeš et al., 2023)	Preliminary Results from Norway, Slovenia, Portugal, Turkey, Ukraine, and Jordan:	Q2

	Investigating Pre-Service Teachers' Expected Use of Digital Technology When Becoming Teachers	
(Martínez-Serrano et al., 2023)	Inspection Digital Literacy for School Improvement	Q3
(Möhlen & Prummer, 2023)	Vulnerable Students, Inclusion, and Digital Education in the Covid-19 Pandemic: A Qualitative Case Study From Austria	Q2
(Tomczyk & Edisherashvili, 2024)	Learning Objectives in Older Adult Digital Education-Redefining Digital Inclusion	Q3
(Patrizi et al., 2025)	The Contribution Of Artificial Intelligence To The Qualification Of Education Processes; Il contribution dell'intelligenza artificiale per la qualificazione dei processi di istruzione	Q4
(Christodoulidou & Sidiropoulou, 2024)	Teachers' Experiences of Online/Distance Teaching and Learning during the COVID-19 Pandemic in Mainstream Classrooms with Vulnerable Students in Cyprus	Q2
(Cassaretto et al., 2024)	Effects of resilience, social support, and academic self-efficacy, on mental health among Peruvian university students during the pandemic: the mediating role of digital inclusion	Q1
(Stalmach et al., 2024)	Digital Methods to Promote Inclusive and Effective Learning in Schools: A Mixed Methods Research Study	Q3
(Carvalhais et al., 2025)	Reading and Writing Development in Inclusive Settings: Teachers' Perception of the Use of Digital Technology	Q2
(James & France, 2025)	Digital inclusion status of external supervisors of preservice mathematics teachers in an open distance e-learning environment	Q3
(Archer, 2025)	Multimodality and the Affordances of Co-Presence for Inclusion in Higher Education	Q1

Table 3. Research evolution every year
Source: processed by researchers (2025)

Table 3. Revealing the Evolution of Research on the Digital Divide in Education 2020–2025 shows a shift in focus from technology access to digital inclusion strategies. In 2020–2021, studies highlighted the challenges of online learning, digital literacy, and socioeconomic disparities caused by the pandemic. The 2022–2023 period emphasized pedagogical innovations such as hybrid learning and game-based learning. In 2024–2025, research shifted to AI applications, immersive learning, and sustainable digital policies. Quantitatively, Q2 journals dominated, accounting for approximately 60% of publications, followed by Q3 (25%), Q1 (10%), and Q4 (5%). This trend marks a shift toward more empirical, interdisciplinary, and global policy-driven digital inclusion research.

The Influence of Socio-Economic Context and Gender on the Success of Digital Literacy Programs in Primary and Secondary Education (RQ 2)

Research on the relationship between socioeconomic context and gender and digital literacy success confirms that these factors are key determinants of disparities in access to and participation in technology-based education. Panesi et al. (2020, Q1) and Wilkens et al. (2021, Q2) found that students from low-income families experience significant limitations in digital device ownership and internet access, which directly impacts online learning outcomes. Furthermore, Gómez-Trigueros & De Aldecoa (2021, Q3) revealed that gender disparities, particularly in the context of teacher education, contribute to digital literacy inequality because women often have lower self-confidence in mastering technology. Cassaretto et al. (2024, Q1) added a psychosocial dimension, showing that social support and mental resilience can moderate the impact of socioeconomic inequality on digital literacy success. Therefore, effective digital literacy efforts must consider a multidimensional approach that combines technological interventions, social support, and gender equality policies to sustainably narrow the digital divide.

Technology-Based Pedagogical Approaches (AI, LMS, VR) in Overcoming Barriers to Access and Participation in Digital Learning (RQ 3)

Recent literature suggests that technology-based pedagogical approaches play a strategic role in addressing barriers to access and participation in digital learning, particularly in the post-pandemic era. Ramirez & Inga (2022, Q2) and Benigno et al. (2022, Q2) highlight the use of Learning Management Systems (LMS) and adaptive learning platforms to support inclusive learning for students from diverse social backgrounds. Technologies such as Artificial Intelligence (AI) (Patrizi et al., 2025, Q4) and Virtual Reality (VR) (Bakhsh et al., 2022, Q3) can enhance learning personalization, create more interactive learning experiences, and foster intrinsic student motivation. Balaskas et al. (2023, Q2) found that game-based learning (GBL) significantly contributed to increased student engagement in primary education. However, several studies also highlight implementation challenges, such as educators' digital readiness and limited infrastructure in developing regions. Therefore, technology-based pedagogical approaches must be accompanied by strategies to strengthen teacher capacity and supporting policies to ensure effective and equitable digital inclusion.

Evaluation Model of the Effectiveness of Digital Interventions in Reducing the Gap in Access to Education (RQ 4)

Evaluating the effectiveness of digital interventions is a key aspect in measuring the extent to which policies and technological innovations can reduce disparities in access to education. Beer & Mulder (2020) compiled a systematic review emphasizing the importance of evaluation based on learning outcomes, social engagement, and digital skills development. Liu et al. (2022, Q2) extended this approach with mixed methods to assess the impact of e-learning inclusion policies across various national contexts, demonstrating that the success of interventions is highly dependent on the integration of educational policies, infrastructure readiness, and institutional capacity. Meanwhile, Stalmach et al. (2024, Q3) developed a mixed-methods evaluation model that assesses the influence of technology use on the effectiveness of inclusive learning. Research trends indicate a shift in the evaluation paradigm from simply measuring technology access to a holistic understanding encompassing the psychosocial, participatory, and sustainability aspects of digital learning. This evaluative

approach provides an important foundation for developing evidence-based and long-term digital inclusion policies.

The Most Influential (Highly Cited) Key Documents in This Field, and How They Are Positioned in the Intellectual Structure Through Co-Citation Analysis(RQ 5)

Authors	Cited by
P., Beer, Patrick; RH, Mulder, Regina H.	111
IM, Gómez-Trigueros, Isabel Maria; CY, de Aldecoa, Cristina Yáñez	42
S., Panesi, Sabrina; S., Bocconi, Stefania; L., Ferlino, Lucia	34
YJ, Ocaña-Fernández, Yolvi Javier; LA, Valenzuela-Fernández, Luis Alex; WEM, Chiparra, William Eduardo Mory; SAG, Gallarday-Morales, Santiago Aquiles Gallarday	18
K., Bakhsh, Khuda; MA, Hafeez, Muhammad Abdullah; S., Shahzad, Shumaila; B., Naureen, Bushra; MF, Farid, Muhammad Faisal	17
L., Wilkens, Leevke; A., Haage, Anne; F., Lüttmann, Finnja; CR, Bühler, Christian R.	15
S., Balaskas, Stefanos; C., Zotos, Christos; M., Koutroumani, Maria; M., Rigou, Maria	14
KT(., Huang, Kuo Ting (Team); CA, Ball, Christopher A.; SR, Cotten, Shelia R.; LTJ, O'Neal, La Toya J.	12
A., Ramirez, Abdon; EM, Inga, Esteban Mauricio	8
M., Cassaretto, Monica; A., Espinosa, Agustin; C., Chau Pérez-Aranibar, Cecilia	8
A., Janeš, Alexander; SS, Madsen, Siri Sollied; HI, Saure, Heidi Iren; MH, Lie, Marit Helene; BE, Gjesdal, Beate Eltarvåg; S., Thorvaldsen, Steinar; R., Brito, Rita; S., Krasin, Serhii; M., Jwaifell, Mustafa; AS, Konca, Ahmet Sami	7
LK, Möhlen, Lisa Katharina; S., Prummer, Susanne	6
V., Benigno, Vincenza; GP, Caruso, Giovanni Paolo; FM, Dagnino, Francesca Maria; E., Dalla Mutta, Edoardo; C., Fante, Chiara	5
A., Stalmach, Aleksandra; P., D'Elia, Paola; S., Di Sano, Sergio; G., Casale, Gino	4
P., Christodoulidou, Panayiota; CG, Sidiropoulou, Charalampia Gr	3
M., Fuertes-Alpiste, Marc; N., Molas-Castells, Nuria; MJ, Rubio-Hurtado, Maria José; F., Martínez-Olmo, Francesc	2
N., Bernhard, Nadine	1
IA, Koroleva, Irina A.; NV, Korchagina, Nataliya V.; IN, Sergienko, Irina N.	1
J., Liu, Ji; F., Qiang, Faying; Y., Zhou, Ying	1

Table 4. Most influential authors

Source: processed by the author (2025)

Table 4. Citation data shows the dynamics of research influence related to the digital divide in education. The most influential article was written by Beer & Mulder (111 citations), indicating the dominance of systematic studies on the impact of technology on vocational education. This was followed by Gómez-Trigueros & De Aldecoa (42) and Panesi et al. (34), which focused on digital inclusion and student well-being. Most other studies had <20 citations, indicating that many works are still recent (2022–2025) and in the academic diffusion stage. This pattern indicates that early pandemic research is being more widely cited, while post-2022 studies are beginning to build influence within the framework of digital innovation and education policy.

Key Trends and Emerging Topics in the Literature on the Digital Divide in Education Based on Keyword Co-Occurrence Analysis (RQ 6)

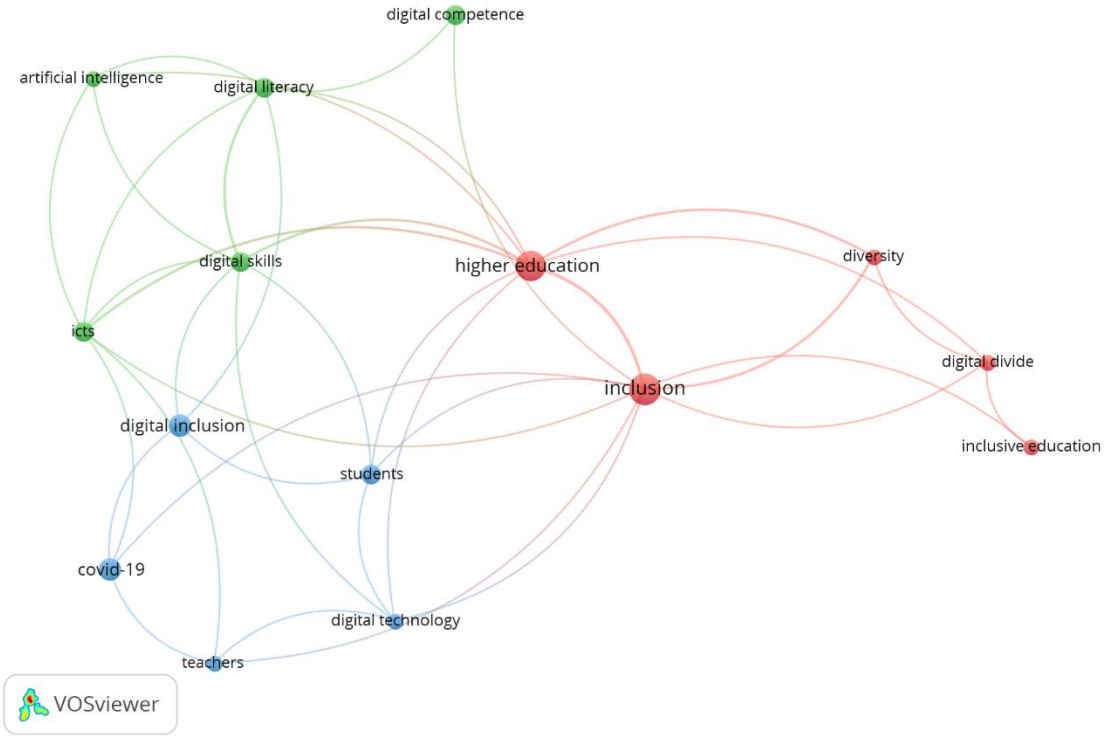

Figure 1. Main Trends and Topics
Source. Processed by the author (2025)

Figure 1. Visualization of keyword co-occurrence shows three main clusters in educational digital divide research. The red cluster highlights the themes of inclusion, higher education, and the digital divide, indicating a strong focus on higher education and social diversity. The green cluster emphasizes digital literacy, ICTs, and artificial intelligence, indicating a technology orientation and digital competency. Meanwhile, the blue cluster focuses on digital inclusion, teachers, and COVID-19, reflecting the practical context of implementation during the pandemic. The interconnectedness between the clusters illustrates

that digital inclusion serves as a conceptual bridge between the pedagogical, technological, and policy dimensions of modern education.

International Collaboration and Research Networks in Shaping Global Research Directions on the Digital Divide in Education (RQ 7)

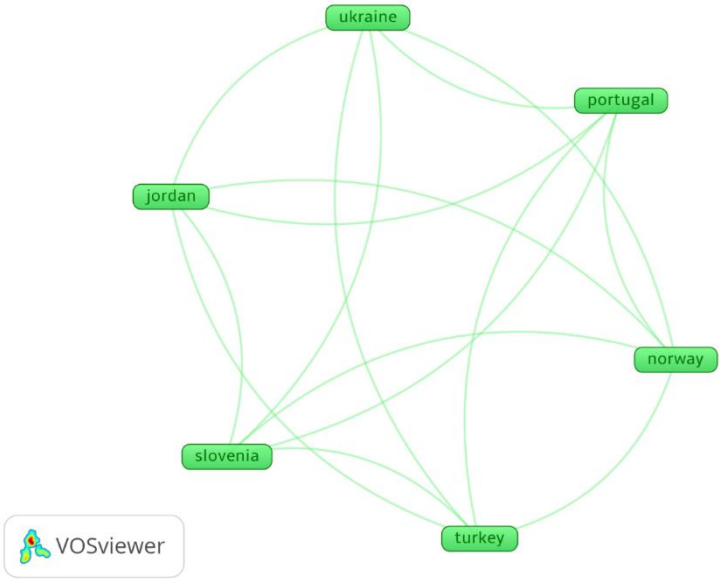

Figure 2. International collaboration
Source. processed by the author (2025)

Figure 2. The international collaboration map shows a strong research network between Norway, Portugal, Turkey, Slovenia, Jordan, and Ukraine in the study of the digital divide and educational inclusion. The dense interconnectedness between these countries reflects collaboration across Europe and the Middle East in developing inclusive digital strategies. Norway and Turkey appear to be at the center of this connectivity, indicating a dominant role in collaborative publications. This pattern indicates growing global attention to equitable digital access across various socio-economic contexts and demonstrates broader efforts to harmonize digital education policies at the regional and international levels.

DISCUSSION

The results of the Systematic Literature Review (SLR) show that the evolution of research on the digital divide in education experienced a significant shift in focus between 2020 and 2025. Initially, studies highlighted barriers to digital access and literacy due to the COVID-19 pandemic. The 2022–2023 period marked the emergence of innovative pedagogical approaches based on Learning Management Systems (LMS), Game-Based Learning (GBL), and hybrid education. In 2024–2025, the research direction shifted to intelligent technologies such as Artificial Intelligence (AI) and immersive learning to support sustainable digital inclusion. Of the 25 publications, Q2 journals dominated (60%), indicating a focus on policy-based empirical research. These findings confirm that the digital divide issue is no longer seen as a technical issue, but as a global social, pedagogical, and policy challenge.

These results reflect an epistemological shift from a technological-

instrumental approach to a digital inclusion paradigm that places social justice and gender equality at the heart of digital learning. This aligns with Digital Capital theory.(Purwati & Widaningsih, 2025), which emphasizes that ownership of digital resources is not only technological, but also social and cultural. Studies such as(Handayani et al., 2025)This study demonstrates that digital literacy and social support have a synergistic relationship in reducing inequality. Therefore, digital inclusion cannot be achieved solely through infrastructure, but also through empowering students and educators.

Data interpretation indicates that increased international collaboration (Norway, Portugal, Turkey, Jordan, Ukraine, and Slovenia) reflects the formation of a cross-regional research ecosystem that strengthens knowledge co-production in digital education. This finding supports the theory of Connectivism (George Siemens, 2004), which views learning as a result of networks between individuals and technology. In the context of the digital divide, this theory explains why global research collaboration is key to developing inclusive solutions. With cross-national connectivity, digital policy models can be adapted to suit socio-economic and cultural contexts.

This study corroborates the findings of Zhao et al.,(2023)which emphasizes that the digital divide includes not only access to technology, but also skills, motivation, and social support. Most of the articles reviewed(Panesi et al., 2020)And(Wilkens et al., 2021)demonstrates the importance of contextual factors, such as economic status and gender, in shaping students' digital readiness. Thus, the results of this SLR strengthen the argument that digital inclusion is a multidimensional phenomenon that requires an interdisciplinary approach.

This finding is also in line with Zhang & Zhang (2024)which highlights the increasing integration of AI in education to expand digital inclusion. As in(Patrizi et al., 2025)AI is being used for personalized learning and early detection of access barriers. This shared focus suggests that global research is now moving toward a data-driven inclusion model, which combines big data analytics with adaptive education policies.

These results broaden the understanding of the Digital Inclusion Framework.(Pérez-Escolar & Canet, 2023)by adding a new dimension: the interaction between intelligent technologies (AI, LMS) and social justice. The findings suggest that the success of digital inclusion depends not only on infrastructure but also on the ability of education systems to adapt technology to local contexts. For education practitioners, these results provide a basis for designing technology-based learning strategies that are more adaptive and sensitive to the needs of learners from diverse backgrounds. Teachers and educational institutions can use the SLR results to evaluate the effectiveness of digital interventions and strengthen educators' digital capacity. For policymakers, this study emphasizes the importance of evidence-based digital policy in narrowing the education gap. Countries with integrated digital policies, such as Norway and Portugal, have been shown to be faster in building inclusive learning systems. Therefore, the results of this study can serve as a reference for governments in developing countries to design national digital inclusion policies based on empirical evidence and cross-border collaboration.

CONCLUSION

Based on the results of a Systematic Literature Review (SLR) using the PRISMA approach on 26 selected articles for the period 2020–2025, this study

concludes that the evolution of research on the digital divide in education shows a significant shift from the issue of technology access to a focus on sustainable digital inclusion strategies. There are three main phases of development: (1) the initial phase (2020–2021) which highlights barriers to digital access and literacy due to the pandemic; (2) the transition phase (2022–2023) with the emergence of LMS-based pedagogical approaches and game-based learning; and (3) the transformation phase (2024–2025) which integrates Artificial Intelligence (AI), Virtual Reality (VR), and inclusive digital policies. The findings also confirm that socio-economic and gender factors strongly influence the success of digital literacy programs, while technology-based pedagogical approaches are effective in strengthening digital learning participation. A mixed methods-based evaluation model has been proven to be able to assess the effectiveness of digital interventions holistically, encompassing social, psychological, and policy aspects. This study confirms the important position of Digital Capital and Connectivism theories in explaining the relationship between digital resource ownership, social networks, and educational equality. This study adds to the literature by demonstrating that digital inclusion depends not only on infrastructure but also on individual empowerment and cross-border collaboration. Future research should further explore the relationship between digital policies, teacher readiness, and the impact of smart technologies on inclusive learning across various socioeconomic contexts. The findings are expected to serve as a foundation for developing evidence-based digital policies and a global research map on digital inclusion in education.

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