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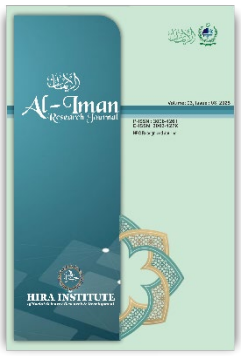

Landscape of Digital Learning Trends at Tertiary Education from 2001 to 2024: A Bibliometric Analysis

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Abstract

The current research entitled "Landscape of Digital Learning Trends at Tertiary Education from 2001 to 2024: A Bibliometric Analysis" is timely as higher education increasingly emphasizes digital learning. Research from 2001 to 2024 has established clear targets and collected massive amounts of data to improve the analysis. The current study has four comprehensive and concise research objectives. This study provides a comprehensive bibliometric mapping of postsecondary digital learning trends utilizing Dimensions.com's 2,740 articles, 1,227 of which were analyzed. This study analyses well-known authors and their most cited works, publishing and citation patterns, prominent sources, and contributors to digital learning research. The analysis identifies productive countries, authors, and organizations, analyses co-authorship, and measures publication connections with similar terms. Excel was used to analyze yearly publishing trends, and VOS viewer for bibliometrics. The most quoted work of American author Ruiz was found in 2006 through a study. The data shows a rising trend in publishing frequency and citation patterns, especially after 2015, when 33 publications were published and 253 in 2022. This tendency may be due to worldwide technology improvement and the COVID-19 pandemic, which has increased online learning. The study also lists productive authors, nations, and journals advancing digital learning. This bibliometric mapping provides a foundational knowledge base of the tertiary level landscape of digital learning research, which will inform future research and educate researchers, educators, and policymakers about the key actors and changing patterns of this field. The findings emphasize the need for digital learning research and collaboration to improve higher education teaching and learning.

Keywords:

Digital Learning, Trends, Tertiary Education, Bibliometric Analysis.

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Introduction

Digital learning has changed the face of higher education and is changing the way people learn all across the world. Digital technologies, like online courses, learning management systems, and virtual classrooms, have been increasingly used in higher education since the early 2000s due to technological improvements (Selwyn, 2010). The academic landscape of digital learning trends has not been thoroughly mapped out, especially in terms of identifying important figures, seminal works, and developing topics, despite this increase (Garrison & Anderson, 2011). An all-encompassing picture of the evolution of digital learning and its effects on higher education is impeded by this lack of study. There is a need for a longitudinal bibliometric approach to identify trends in publishing, key figures, and changes in themes since previous studies tend to concentrate on certain technologies or brief periods (Bond et al., 2020). To fill this gap, this research examines the academic literature on digital learning from 2001 to 2024 in a methodical fashion.

This study aims to analyze research articles published between 2001 and 2024 to have a better understanding of digital learning trends in tertiary education. The objectives of this study are as follows: (1) To find out the publishing frequency of research articles in the field of digital learning in higher education during 2001 to 2024 (2) To explore influential authors' top cited articles and countries (year-wise) in digital learning (3) to find out bibliographic coupling: country, document, citations, total link strength and (4) To explore the co-citation: source, citations and total link strength. This study uses bibliometric approaches to create a map of the field's intellectual structure, which in turn sheds light on its development and important figures (Siemens, 2013).

Educators, policy makers, and academics can benefit greatly from this study's thorough review of digital learning trends, which highlights seminal publications and new fields of study. According to Zawakki-Richter and Naidu (2016), the results will show where further research is needed and how to incorporate digital learning into higher education best. This study identifies key authors, institutions, and thematic trends to understand digital learning's global impact. Instructional innovation is also promoted (Veletsianos & Shepherdson, 2020). The research is important because it may provide a data-driven, systematic analysis of current trends in digital learning, which would be a significant addition to the existing literature. Based on the most important publications and writers in the industry, the results will provide teachers with insights into successful digital learning practices (Garrison & Anderson, 2011). To help with allocating resources and developing policies, the study will show politicians what works and what needs more research (Selwyn, 2010). By revealing knowledge gaps and new research interests, bibliometric analysis lays the groundwork for future investigations (Veletsianos & Shepherdson, 2020). The research adds to our knowledge of the evolution and effects of digital learning by drawing a picture of its worldwide geography.

Review of Related Literature

Digital learning includes all pedagogical practices that utilize computers and networks, including content delivery, instructional methods, and course management. When individuals use the term "digital learning," they could be referring to anything from improving upon the conventional classroom setting to entirely doing away with face-to-face meetings in favor of online alternatives and more utilization of digital media. "Digital learning" refers to the process of delivering education, whether formal or informal, through the use of various electronic media for the goals of instruction, training, or learning. According to Hussain (2020), "digital learning" is a way of describing a classroom in which both students and instructors interact via some digital medium.

Both in and out of the classroom, digital learning resources have been increasingly popular in recent years. The success and distinctiveness of this literary institution may be attributed mostly to the extraordinary teaching methods that are implemented there. Higher

education institutions ought to make use of current statistics. The main focus of our research is the global participation and contribution of individuals and organizations in the integration of e-learning systems. It is of the utmost importance to discover a means of making research and instructional materials accessible to all, as this function highlights. Both instructors and pupils learn new material. Equipping individuals with the means to pursue further study is a fundamental objective of educational training. Because it gets in the way of learning and information sharing, this method is good. Its territory is enormous and comprehensive. Digital learning has the support of the great majority of people.

The ubiquitous nature of technology in today's society has led to the rise of online education as a significant component of modern education. Examining the literature on digital learning as a skill for the modern world, this review shows how children can learn important skills like digital literacy, problem-solving, and adaptability through this medium. The study also explores how well students are prepared to deal with the problems of a digital world that is always evolving and changing through the use of online education.

This concept of "digital learning" includes online courses, e-learning platforms, and digital technology utilized with traditional instruction. The ability to navigate, evaluate, and produce information efficiently using digital technology is a must-have talent in today's environment. There is more to digital learning than just using technology. The World Economic Forum (2016) states that in order to cultivate other crucial abilities, such as critical thinking, collaboration, and communication, one must first acquire digital literacy. One needs digital literacy—the capacity to engage with digital content, understand its context, and assess its credibility—to reap the benefits of digital learning completely. One of the most important aspects of being tech-savvy is being aware of the moral and societal consequences of using technology (Bawden, 2008). Nowadays, being able to study well in a digital environment is crucial for both personal and professional success. One of the most important requirements for digital literacy is the ability to engage in society actively.

A thorough examination of trends and intellectual contributions has been prompted by the fast transformation of higher education in the last twenty years, brought about by digital learning. From 2001 to 2024, this literature analysis uses bibliometrics to map the intellectual landscape of digital learning trends. In this part, we will examine the citation patterns, major topics, and key works that help to explain digital learning in higher education. The discussion is chronological and thematic, including topics such as research paths, educational shifts, and technological developments. Research on learning management systems (LMSs) and online course delivery for digital learning began in the early 2000s (Allen & Seaman, 2010). The ease of use and accessibility of online learning platforms at the university level were the primary foci of this study (Means et al., 2010). Web 2.0 tools like wikis, forums, and blogs made it possible for students to work together on projects (McLoughlin & Lee, 2010). Faculty resistance and the digital divide caused adoption rates to differ by region (Selwyn, 2011). According to bibliometric studies conducted during this time, emerging countries were less prolific publishers than North America and Europe (Zawacki-Richter et al., 2015).

Midway through the 2010s, developments in AI and LA led to an uptick in adaptive and personalized learning (Ferguson, 2012; Siemens, 2013). Picciano (2012) states that researchers are investigating the effects of Big Data on student engagement and performance. Massive Open Online Courses (MOOCs) democratized education worldwide but raised concerns regarding completion rates and pedagogical efficiency (Daniel, 2012; Liyanagunawardena et al., 2013). Bibliometric analyses show a rise in education, computer science, and cognitive psychology cooperation (Chen et al., 2018). Studies on scalable digital learning solutions were cited more due to open-access publishing (Veletsianos, 2015). COVID-19 made digital learning mandatory from 2020 onward (Hodges et al., 2020). According to Radanti et al. (2020), hybrid and mixed-learning models utilized VR and AR to create

immersive experiences. Emergency remote teaching, digital equity, and mental health topics have increased significantly in bibliometric studies (Bozkurt et al., 2020; Rapanta, 2021). Future research is being shaped by micro-credentials, blockchain for academic records, and AI-driven tutoring systems (Selwyn et al., 2021). The section finishes by noting study gaps and suggesting future digital learning bibliometric research.

In higher education, digital technologies are integrated using learning theories that have changed with technology. Vygotsky's (1978) constructivism, modernized for digital contexts, emphasizes active learning through social engagement and knowledge building (Dabbagh, 2005). Siemens (2005) added connectivism, which views learning as a networked process aided by digital instruments. Researchers evaluate tertiary digital pedagogies using these theories (Downes, 2010). In MOOC and social learning platform studies, connectivist methodologies are increasingly cited (Kop & Hill, 2008). In adaptive learning systems, behaviorist and cognitivist approaches shape digital learning interventions (Anderson, 2008). According to Skinner's behaviorist principles, early e-learning models included programmed teaching and immediate feedback (Merrill, 2013). In the 2010s, learner-centered approaches emphasized metacognition and self-regulated learning (Zimmerman, 2011). Studies combining several theoretical frameworks have better citation impacts, highlighting the relevance of interdisciplinary digital education research (Wang et al., 2017).

The Garrison et al. (2000) Community of Inquiry (CoI) paradigm is commonly used in online learning community investigations. This concept emphasizes social, cognitive, and teaching presence for meaningful digital learning (Shea & Bidjerano, 2010). Recently published bibliometric studies suggest an increasing interest in adapting the CoI framework to AI chatbots and virtual collaborative spaces (Fiock, 2020). Literature studies on digital learning efficacy often mention the framework's adaptability (Stenbom, 2018). Although theoretical approaches are diverse, their application to non-Western educational environments is unclear (Hwang & Tsai, 2011). The theory is dominated by North American and European research, according to bibliometric assessments (Bond et al., 2019). To bridge this gap, culturally relevant digital pedagogies should be studied (Gunawardena et al., 2016).

Research Methodology

This research uses bibliometric analysis to look at how digital learning is changing at tertiary education. Bibliometric analysis is a statistical method for gleaning important information from academic literature, such as notable authors and recurrent themes. In order to look ahead to the future of education, this study uses this methodology to analyze previous researches on digital learning and spot trends. This study examines digital learning at higher education from 2001 to 2024 using bibliometrics. Research begins with collecting scientific publications from the Dimensions database, which has a huge collection. First, download 2,740 articles on ‘digital learning,’ ‘tertiary education,’ and ‘higher education.’ A rigorous refinement procedure selected 1,227 digital learning-focused papers for further study. The bibliometric mapping is easy using VOSviewer. The software builds and displays bibliometric networks for co-authorship, citation trends, and keyword distributions. The investigation seeks famous authors, their most cited publications, and the geographic distribution of digital learning research.

Inclusion and exclusion criteria ensured relevant articles were collected. A total of 1,240 peer-reviewed articles on higher education digital learning were included. Methodically gathering publication year, authors, citation counts, journal, and keywords was part of the data extraction. This data was organized to make analysis easier. The data analysis phase includes trend analysis and bibliometric mapping. Bibliometric mapping and citation analysis were done using VOSviewer (Van Eck & Waltman, 2010). The most cited works and their links were shown in citation networks to show major publications and prominent authors. The researchers used co-authorship analysis to find major research groups and networks, as well as

well-known colleagues in the area. Keyword co-occurrence analysis found groups of related topics and suggested research opportunities.

The bibliometric mapping was done with VOSviewer, a specialist software program for viewing bibliometric networks. Visual representations of co-authorship relationships, keyword occurrences, and citation networks were made during this analysis. The purpose of mapping these relationships was to find important resources, authors, and works in the field of digital learning that were related to each other and to cast a wide net of relevant material. The bibliometric mapping was performed with VOSviewer, a potent tool for visualizing bibliometric networks. The goal of this investigation was to find the connections between authors, publications and keywords in our 1,240-article dataset. In the first step it was to create citation networks to find important writers and publications in the topic. To this end, the analysis shows the most cited work, which generally is used as the foundational work within the digital learning discourse, using citation counts.

It also performed co-authorship analysis to gauge if there are researcher collaboration trends over time. This analysis highlights well known research groups and networks that extend our knowledge of digital learning, and does so by showcasing the depth of collaborative efforts within the field. Keyword co-occurrence analysis was also done in order to find new themes and subjects in the literature. With capturing the links between terms, the study mapped the links, and also identified different clusters of similar concepts thereby pointing to areas of interest and research. Finally, given everything, the bibliometric mapping depicted graphically the research environment which distinguished notable authors and thematic flows that influence the study of digital learning in higher education.

Data Analysis and Interpretation

Table No. 1

Frequency of publication (year-wise)

Publication year	No. of publications
2001	3
2002	3
2003	3
2004	5
2005	3
2006	7
2007	13
2008	7
2009	9
2010	14
2011	10
2012	17
2013	19

2014	26
2015	33
2016	25
2017	28
2018	48
2019	44
2020	100
2021	149
2022	253
2023	215
2024	77

Table 1 reveals that since 2001, the table shows the annual frequency of publications on digital learning trends in tertiary education. Research production has grown and changed throughout the years. Three phases of data exist: slow-growth (2001–2010), moderate-growth (2011–2019), and rapid-growth (2020–2024). In the first decade, publication numbers averaged 6.8 per year. Three papers were published in 2001–2003, indicating low interest or early research on digital learning in tertiary education. There was a minor increase in 2004 (5 publications) and 2006 (7 publications), with the first jump in 2007 (13 publications) and 2010 (14 publications). This phase likely introduces digital learning research's core concepts and technologies.

Publications increased to 24.4 each year in the second decade. From 10 publications in 2011 to 48 in 2018, academic interest grew. From 2014 to 2017, digital learning research produced around 25 articles annually, reflecting its maturity. From 2017 (28) to 2018 (48), publications doubled, suggesting a turning point, maybe due to e-learning platform improvements or digital education policy changes. The last five years saw the biggest growth, averaging 158.8 publications. From 44 to 100 publications in 2020, a tipping point was reached. The global COVID-19 pandemic accelerated online learning, causing this increase. Publications increased to 149 in 2021 and 253 in 2022. 2023 witnessed a modest dip (215), but the numbers remained high, demonstrating significance. The fragmentary 2024 data (77 articles) imply strong research.

The table shows how digital learning research has grown from humble beginnings to a thriving academic subject. The COVID-19 epidemic sparked it, but the high output post-2020 suggests educational paradigm shifts. This trend indicates higher education's expanding technology integration and future growth. The aforementioned data is also depicted in the following figure;

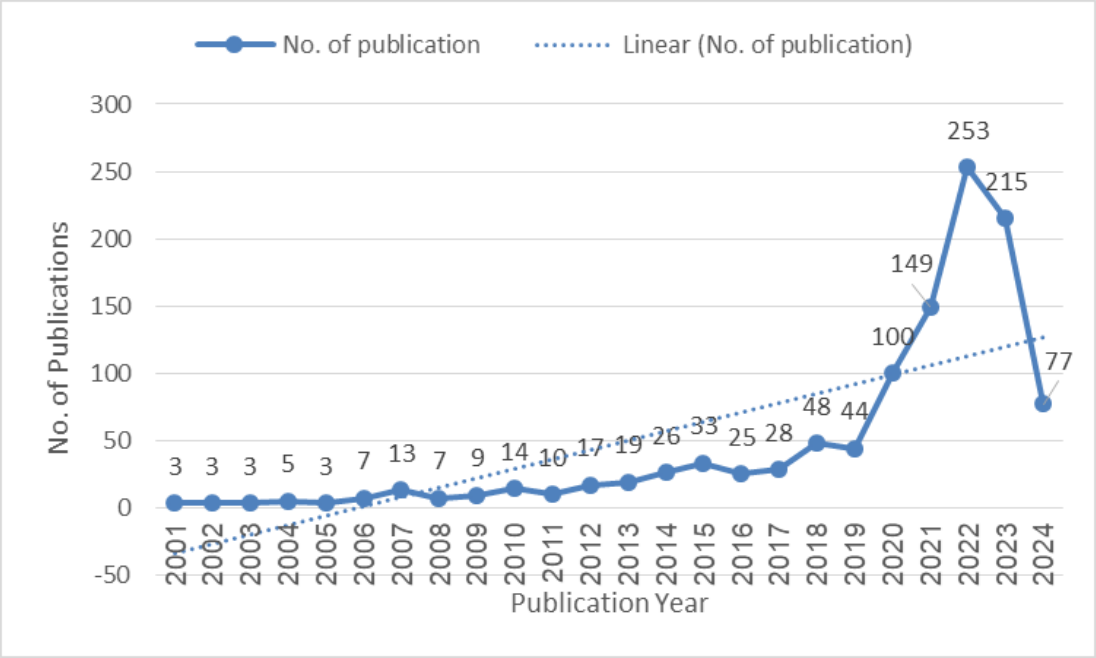

Figure 1 Frequency of publication (year-wise)

Table 2

Top cited paper, author and country (2001 -2024)

S#	Year	Title	Author	Country	GS Citation
1	2006	The Impact of E-Learning in Medical Education	Ruiz, et al.	USA	3259
2	2023	ChatGPT for Language Teaching and Learning	Kohnke, et al.	Hong Kong	1178
3	2006	Adapting your teaching to accommodate the net generation of learners.	Skiba & Barton	USA	524
4	2020	The unreasonable effectiveness of deep learning in artificial intelligence	Sejnowski, T. J.	USA	505
5	2022	Student engagement in online learning in Latin American higher education during the COVID-19: A systematic Review	Salasâ-Pilco, et al.	China	458

6	2007	The paradoxical future of digital learning	Warschauer, M.	USA	389
7	2020	Transformation of the mathematics classroom with the internet	Engelbrecht, et al.	South Africa	372
8	2018	A survey of the advancing use and development of machine learning in smart manufacturing	Sharp, et al.	USA	339
9	2010	The Teacher as Designer: Pedagogy in the New Media Age	Kalantzis, M. & Cope, B.	USA	325
10	2021	Shifting to digital: a policy perspective on Student perceptions of privacy principles for learning analyticsâ	Corrin, Linda	Australia	294

Table 2 shows the top ten tertiary education digital learning trends publications from 2001 to 2024, including influential works, authors, nations, and Google Scholar (GS) citation counts. Six of the ten studies were from the US, demonstrating its leadership in digital learning research. This popularity may be due to the US's sophisticated technological infrastructure and educational technology research. One publication each from Hong Kong (Kohnke et al., 2023), China (Salas-Pilco, 2022), South Africa (Engelbrecht, 2020), and Australia (Corrin, 2021) shows a global but uneven distribution of influential research.

These works have had 294 to 3259 citations, indicating their impact. Ruiz et al. (2006)'s highest-cited publication on e-learning in medical education (3259 citations) may have been influential due to its early examination of practical applications. Kohnke et al. (2023) on ChatGPT in language acquisition (1178 citations) shows a rapid rise in AI-driven education. Among the subjects are e-learning (Ruiz et al., 2006), AI and machine learning (Sejnowski, 2020; Sharp, 2018), student involvement (Salas-Pilco, 2022), and privacy in learning analytics. Early papers (2006–2010) focus on digital learning fundamentals, whereas subsequent papers (2018–2023) emphasise AI and online learning adaptations during crises like COVID-19.
Increased interest in digital learning, owing to technological developments and worldwide transitions to online education, is demonstrated by the peak publications in 2006 (three papers) and 2020–2023. There was a delay in significant contributions between 2011 and 2017, as seen by the low number of highly referenced papers.

The table shows the US's supremacy in digital learning research, with global contributions and a shift towards AI and crisis-driven online learning. This analysis shows how digital learning scholarship is changing and becoming more important in higher education.

Table 3

Bibliographic coupling: country, document, citations, total link strength

Country	Documents	Citations	Total Link Strength
United States	148	4553	1283

China	28	868	537
United Kingdom	39	754	844
Australia	31	463	622
Canada	21	374	402
Spain	12	351	317
France	9	287	426
India	19	257	394
Brazil	7	241	223
South Africa	4	195	280

This table provides a bibliometric study of digital learning research contributions from various countries, based on three important metrics: total link strength, number of documents, and citations. In addition to research output, these measures show field influence, reach, and collaboration. With 148 papers, 4,553 citations, and 1,283 overall link strength, the United States wins in every category by a wide margin. This preeminence is a result of the country's innovative digital policies, robust support for educational technology, and excellent academic infrastructure. A significant number of citations points to the widespread use of research conducted in the United States, while a high number of strong links implies major international cooperation.

Despite China's superior total link strength (844), suggesting substantial research networks, the United Kingdom ranks second in influence with 39 documents and 754 citations. Even though China only has 28 papers, its 537 link strengths demonstrate a high level of participation, demonstrating its increasing importance in the field of digital learning research. With 31 documents and 622 link strength, Australia is right behind, further demonstrating its engagement in global scholarly conversation. The contributions are moderate yet significant from France, Spain, and Canada. France has a high link strength (426), indicating strong collaborative links, despite only having 9 documents.

In terms of the number of documents, India (19) and Brazil (7) stand out as two developing centres for research. An increasing level of integration with global research networks is indicated by India's 394 link strength. Despite having only 4 papers, South Africa has an impressively high link strength of 280, suggesting that they are engaged in strategic collaborations.

France and South Africa are notable for their strong link strength compared to their output, highlighting their roles as important collaborators rather than main producers, while the United States and the United Kingdom lead in citations. This shows that the contribution of some countries to the flow of knowledge is greater than their volume. While the United States continues to dominate digital learning research, other major players include the United Kingdom, China, and Australia. France and South Africa, two very small nations, show how partnerships can increase the impact of research beyond the number of publications. According to the numbers, digital education is going to be shaped by both developed and developing economies in the future. The bibliographic coupling of country, document, citations, total link strength as follows;

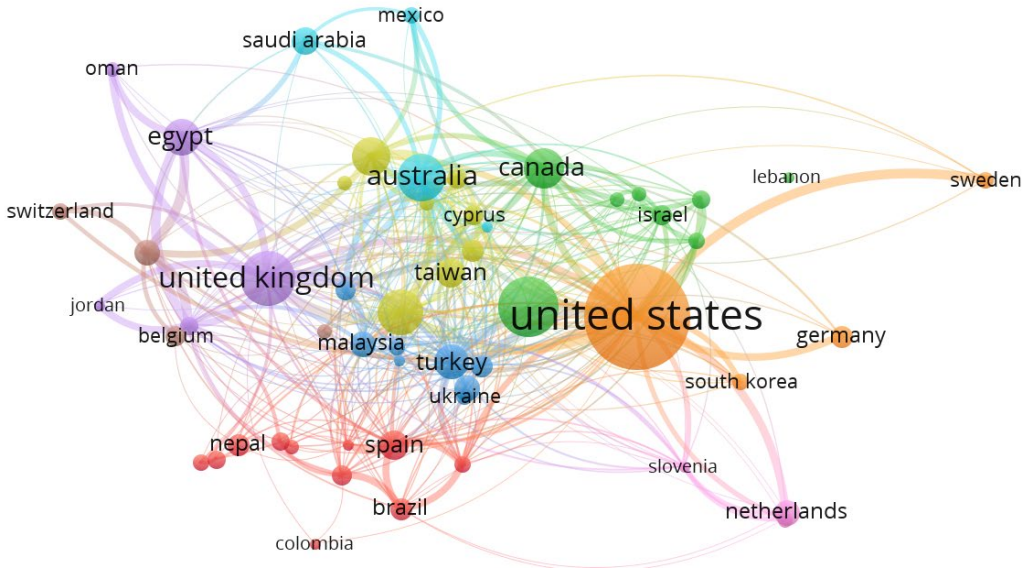

Figure 2 *Bibliographic coupling: country, document, citations, total link strength*

Table 4

Co-citation: source, citations and total link strength

Source	Citations	Total link strength
Computers & education	436	6401
Computers in human behavior	203	3295
Education and information technologies	203	3756
Educational technology research and development	146	1644
British journal of educational technology	142	2024
Lecture notes in computer science	85	689
Journal of computer assisted learning	81	1337
The internet and higher education	74	1298
Sustainability	70	1252
Interactive learning environments	69	1520

Based on the number of citations and overall link strength, the co-citation analysis identifies the top scholarly sources in the field of digital learning research from 2001 to 2024. Out of all the sources, Computers & Education stands out as the leading journal with 4,36 citations and 6,401 total linkages. Its lengthy history and thorough coverage of education

technology concerns make it an obvious front-runner in scholarly debates regarding online education. Information Technologies has a greater link strength (3,756 vs. 3,295), indicating more interdisciplinary connections, followed closely by Computers in Human Behaviour and Education, all of which have 203 citations. As a reflection of the multifaceted character of the discipline, these journals centered on the behavioral, infrastructure, and psychological components of digital learning.

The British Journal of Educational Technology (142 citations, 2,024 link strength) and Educational Technology Research and Development (146 citations, 1,644 link strength) are mid-tier journals that consistently have an impact, especially in the fields of pedagogical innovation and technical advancement. Despite receiving fewer citations than some of its competitors, BJET's better link strength suggests stronger collaboration networks. Lecture Notes in Computer Science are more technically focused (85 citations, 689 link strength) and possibly more concerned with computational elements than with larger educational trends.
Journal of Computer Assisted Learning (81 citations, 1,337 link strength), The Internet and Higher Education (74 citations, 1,298 link strength), and Sustainability (70 citations, 1,252 link strength) are a few of the lower-ranked but still significant sources that shed light on emerging themes such as sustainable EdTech and online pedagogy. With only 69 citations, Interactive Learning Environments still manages a link strength of 1,520. This is quite an impressive feat. That it helps bring together various academic communities is strong evidence of its importance in this regard.

While illuminating the complexity of the field through specialized and multidisciplinary journals, the co-citation analysis highlights Computers & Education as the foundation of digital learning research. Sustainability and interactive learning are two topics that are gaining popularity, and the strong link strengths of many sources suggest that academic networks are resilient. This landscape is a reflection of the development of established study areas as well as the ever-changing landscape of related subfields. The bibliometric mapping of the co-citation of the sources in the data is as under;

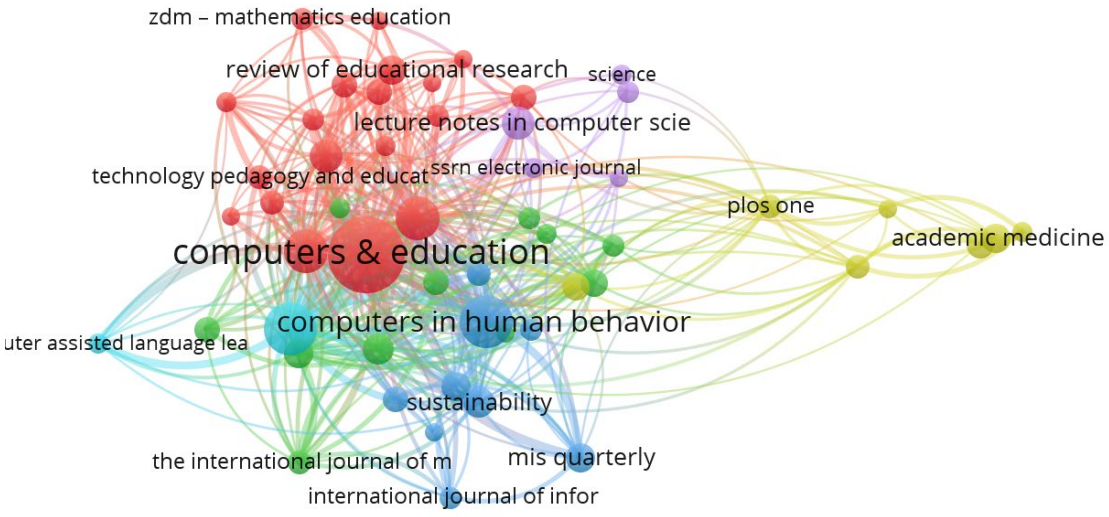

Figure 3 Co-citation of the source in the data

Findings and Conclusions

There has been a tremendous shift in the quality of research published in the field during the last 20 years, according to bibliometric studies of digital learning trends in universities. The research divides the expansion into three separate periods: sluggish expansion (2001–2010), moderate expansion (2011–2019), and fast expansion (2020–2024). The early years of digital learning research (2001–2010) were characterised by an average yearly publication count of just 6.8. Early investigations of digital pedagogy and e-learning platforms probably caused the first notable increases to occur in 2007 and 2010, with thirteen and fourteen publications, respectively. There was a consistent increase over the second phase (2011–2019), with an annual average of 24.4 publications reaching a peak of 48 in 2018. This expansion is in line with developments in blended learning approaches, massive open online courses (MOOCs), and learning management systems (LMS).

Publications reached a high of 253 in 2022 and averaged 158.8 afterward during the fast-growth phase (2020–2024). This skyrocketing ascent is intimately linked to the COVID-19 pandemic, which forced a global shift to online schooling. Even though there was a small drop in 2023 (215 publications), the total is still much more than it was before the epidemic. Digital learning is entrenched in higher education, not just a fad, according to the partial statistics for 2024 (77 articles).

Six of the 10 most important works were published in the United States, according to the study of most-cited publications. Recent publications (e.g., Kohnke et al., 2023, on AI in language learning) reflect current trends towards adaptive learning technologies and artificial intelligence (AI), while the most cited study (Ruiz et al., 2006, with 3,259 citations) highlights the early emphasis on e-learning in medical education. A worldwide but unequal research environment is indicated by the geographical distribution, which also includes contributions from South Africa, Australia, Hong Kong, and China.

With 148 papers, 4,553 citations, and 1,283 total link strength, bibliographic coupling by country further validates the U.S. supremacy. Following China with 28 papers and 868 citations, the UK follows with 39 documents and 754 citations; China demonstrates robust collaboration networks with 537 link strengths. India and Brazil are showing signs of growing influence, while France, Canada, and Australia all make moderate but noticeable contributions. Despite having a low document count (4), South Africa showcases a high link strength (280), highlighting its involvement in international research collaborations.

When looking at international research collaboration, the total link strength measure shows important insights. The United States may be at the top in terms of productivity, but the United Kingdom and China also have robust international academic networks. Despite having only nine papers, France has an abnormally high link strength of 426, suggesting the presence of strategic alliances. Similarly, South Africa is actively engaged in the global discourse surrounding digital learning, as seen by its high link strength relative to its publication volume. These results show that the impact of research depends on both the amount and the reach of collaborations.

Computers & Education is the most influential journal in digital learning research, according to the co-citation analysis (4,36 citations, 6,401 link strength). British Journal of Educational Technology (142 citations, 2,024 link strength) and Computers in Human Behaviour (203 citations, 3,756 link strength) are two other notable sources. Articles in publications such as Sustainability (70 citations, 1,252 link strength) and Interactive Learning Environments (69 citations, 1,520 link strength) represent current developments in sustainable education technology and immersive learning strategies. Digital education is being propelled by an innovative academic ecosystem, as seen by the strong linkages between these sources.
Three major conclusions emerge from the research's examination of the bibliometric environment of online education between 2001 and 2024:

- Digital learning research, which was formerly a specialised topic, saw exponential growth due in large part to the COVID-19 outbreak.
- While the United States continues to lead the pack in digital learning research, other major players include Australia, China, and the United Kingdom; India and Brazil all have promising futures.
- Global relationships are critical for promoting digital education, as collaborative research networks (such in France and South Africa) play a crucial role in amplifying impact.

Recommendations

- Based on the findings, the study proposes the following strategic recommendations:
- The study suggests that in order to bridge the gap between established and developing research economies, partnerships across disciplines and countries should be encouraged.
- AI-driven and sustainable EdTech research may also be prioritized to address educational difficulties.
- Publication firms may have an urgent obligation to improve open-access policies to guarantee the fair distribution of digital learning breakthroughs on a worldwide scale.

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