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OFFLINE DIGITAL EDUCATION: A BIBLIOMETRIC EXPLORATION OF RESEARCH TRENDS AND EMERGING THEMES

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Abstract:

Offline digital education has emerged as a critical area of research, particularly in addressing educational access and equity in regions with limited internet connectivity. However, the existing body of literature on this topic remains fragmented, making it challenging to identify key trends, influential contributors, and emerging themes. This study conducts a comprehensive bibliometric analysis to map the research landscape of offline digital education using data retrieved from the Scopus database. A total of 930 documents were collected through advanced Scopus searching. The dataset was then cleaned and harmonized using OpenRefine to ensure consistency and accuracy. Statistical and graphical analyses were conducted with the Scopus analyzer, while VOSviewer software was employed to generate visualizations of keyword co-occurrence, citation networks, and collaboration patterns. The results reveal a significant increase in publications over the past decade, with China, the United States, and India emerging as the leading contributors, collectively accounting for over 40% of the total output. Key research themes identified include offline learning technologies, mobile-based education solutions, and strategies for bridging the digital divide. Furthermore, collaboration networks highlight a growing trend toward international research partnerships. This study provides valuable insights into the evolution of offline digital education research, offering a clear picture of its current state, key influencers, and potential future directions. The findings serve as a reference point for researchers, educators, and policymakers seeking to enhance the effectiveness and inclusivity of offline digital education initiatives worldwide.

Keyword:

ASEAN, Education Trends, Emerging Themes Education, Offline Digital Learning, Offline Digital Education

Introduction

The exploration of offline digital education in some countries reveals a multifaceted landscape characterized by both advancements and challenges. The bibliometric analysis of research trends indicates that higher education institutions, particularly in Malaysia and Indonesia, have made significant strides in online learning and collaborative learning, with Malaysia ranking 4th globally in online learning productivity (Chung & Cam, 2024). However, contributions in areas such as virtual reality, educational technology, and artificial intelligence remain limited, suggesting opportunities for growth and the need for enhanced research capacity and regional collaboration (Chung & Cam, 2024). This highlights the importance of targeted efforts to strengthen the global impact of institutions and address regional educational challenges effectively.

The digital divide remains a critical issue in the Asia region, with significant investments in ICT infrastructure aimed at increasing accessibility and adoption rates (Prajaknate, 2017). Despite these efforts, disparities persist, particularly in countries like Cambodia, Lao PDR, Myanmar, and Vietnam, which have only recently begun investing in ICT infrastructures (Prajaknate, 2017). In contrast, countries like Thailand, the Philippines, Malaysia, Indonesia, and Singapore have made more substantial progress in integrating ICT into their education systems (Prajaknate, 2017). However, barriers such as insufficient technical mastery among teachers and limited access to ICT resources continue to hinder the effective use of digital technologies in education (Prajaknate, 2017). Addressing these challenges requires comprehensive policies and continuous teacher training to enhance ICT skills and integration into the curriculum.

The COVID-19 pandemic has further accelerated the digital transformation in education, necessitating rapid adaptation to online learning environments (Cataldo et al., 2021)(Madli, Janin, Wahab, et al., 2025). This shift has led to the development of new teaching methods, digital tools, and online assessment techniques, as well as increased focus on student and educator interaction in virtual settings (Cataldo et al., 2021)(Madli et al., 2024). The pandemic has also highlighted the importance of digital competencies and the need for professional development among educators to navigate the digital landscape effectively (Bondarenko et al., 2023). Research indicates that while there has been significant progress in digital education, challenges such as infrastructure gaps, digital access, and the need for equitable resource allocation remain prevalent, particularly in rural and remote areas (Sholeh et al., 2025).

Emerging themes in digital education research include the integration of transdisciplinary approaches, the use of emerging technologies, and the focus on social inclusiveness and user experience (Intaratat et al., 2024; Joshi et al., 2024). Studies emphasize the importance of aligning digital education initiatives with sustainable development goals (SDGs) and promoting inclusive education practices that cater to diverse learner needs (Intaratat et al., 2024). Additionally, the exploration of offline digital education tools, particularly in resource-limited settings, underscores the potential of portable electronic devices to enhance educational outcomes and bridge the digital divide (McHenry et al., 2019)(Madli, Janin, Gulabdin, et al., 2025). These findings suggest that future research should continue to explore innovative solutions and best practices to ensure that digital education is accessible, equitable, and effective across the region. In summary, Malaysia stands as a promising example of a nation that recognizes the vital importance of technology education in shaping its future. This article will delve into the current research trends in this field, shedding light on how Malaysia is positioning itself to harness the full potential of technology to drive economic growth, innovation, and social well-being.

Research Question

RQ1: What are the research trends in offline digital education studies according to the year of publication?
RQ2: What are popular subjects area related to the study and how much percentages for each subjects?
RQ3: What are the most cited articles?

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RQ4: Where is the top 10 countries based on number of publication?
RQ5: What are the popular keywords related to the study?
RQ6: What are co-authorship by countries collaboration?

Methodology

Bibliometrics entails the collection, organization, and analysis of bibliographic data derived from scientific publications (Alves et al., 2021; Assyakur & Rosa, 2022; Verbeek et al., 2002). In addition to basic statistics, such as identifying core journals, publication years, and prominent authors (Wu & Wu, 2017), bibliometric methods also encompass advanced techniques like document co-citation analysis. Conducting a thorough literature review requires a systematic and iterative approach, involving the careful selection of keywords, comprehensive literature searches, and detailed analyses. This process enables the development of a well-rounded bibliography and ensures reliable outcomes (Fahimnia et al., 2015). In this context, the study prioritized high-impact publications, as they offer valuable insights into the theoretical frameworks shaping the research field. To guarantee accuracy, SCOPUS was used as the primary source for data extraction (Al-Khoury et al., 2022; di Stefano et al., 2010; Khiste & Paithankar, 2017). Furthermore, to uphold quality standards, only peer-reviewed journal articles were included, while books and lecture notes were intentionally excluded (Gu et al., 2019) Leveraging Elsevier's Scopus, renowned for its extensive coverage, publications from from 1987 to September 2025 were were gathered for detailed analysis.

To enhance data cleaning and standardization, OpenRefine was employed as a supplementary tool. This step ensured the removal of inconsistencies, duplication, and formatting errors in bibliographic records, thereby improving the reliability of subsequent analyses. Leveraging Elsevier's Scopus, renowned for its extensive coverage, publications from 1987 to September 2025 were collected, cleaned, and refined for a more accurate and meaningful bibliometric assessment.

Data Search Strategy

For this bibliometric analysis, the data were retrieved from the Scopus database, which is widely recognized for its extensive coverage of peer-reviewed literature across disciplines. The search strategy applied the research string: *TITLE-ABS-KEY (Offline Educati AND Digital) AND (LIMIT-TO (LANGUAGE, "English")) AND (LIMIT-TO (PUBSTAGE, "final"))**, ensuring that only documents containing relevant keywords in the title, abstract, or keywords were included. This approach filtered the dataset to publications focused specifically on offline education within the context of digital integration. The use of the "LIMIT-TO (LANGUAGE, 'English')" criterion ensured that all records analyzed were in English, facilitating consistent interpretation of the data. Additionally, the "LIMIT-TO (PUBSTAGE, 'final')" condition excluded articles in early access or pre-print stages, ensuring that only peer-reviewed and finalized documents were included in the analysis. This systematic search was performed in September 2025, providing the most up-to-date dataset available at the time of the study. The infomation may furthe refer table 1 and 2.

The search yielded a final dataset of 930 documents, representing a comprehensive collection of studies published across journals, conference proceedings, and other academic sources indexed in Scopus. These documents reflect the growing academic interest in the intersection of offline education and digital technology, particularly in areas such as blended learning, digital content delivery, and technology-driven pedagogy. The dataset serves as a robust foundation for bibliometric analysis, enabling the exploration of research trends, influential authors, leading journals, and collaborative networks in the field. By relying on Scopus as the primary database, the study ensured broad coverage and high-quality data, allowing for a reliable and systematic mapping of the scholarly landscape.

TABLE 1

Table 1: The Search String.

Scopus	**TITLE-ABS-KEY (Offline Educati* AND Digital) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (PUBSTAGE , "final"))** **Access date: September 2025**

Table 2: The Selection Criterion Is Searching

Criterion	Inclusion	Exclusion
Language	English	Non-English
Publication Stage	Final	In Press

Data Analysis

VOSviewer is an intuitive bibliometric software created by Nees Jan van Eck and Ludo Waltman at Leiden University, Netherlands (van Eck & Waltman, 2010, 2017). Extensively used for analyzing and visualizing scientific literature, the tool excels in producing clear network visualizations, clustering related entities, and generating density maps. Its flexibility enables detailed examinations of co-authorship, co-citation, and keyword co-occurrence networks, offering researchers a broad perspective on research landscapes. The interactive design, combined with regular updates, ensures smooth and effective navigation of extensive datasets. With its ability to calculate metrics, adjust visualizations, and integrate with multiple bibliometric data formats, VOSviewer serves as an essential resource for scholars exploring complex academic domains.

A notable strength of VOSviewer lies in its capability to convert complex bibliometric datasets into easy-to-interpret visual maps and charts. Emphasizing network visualization, the software is particularly adept at clustering associated items, analyzing keyword co-occurrence patterns, and generating density-based visuals. Researchers appreciate its user-friendly platform, which allows both beginners and experienced users to investigate research trends efficiently. Continuous enhancements keep VOSviewer at the forefront of bibliometric tools, enabling valuable insights through precise metrics and customizable visuals. Its adaptability to diverse bibliometric datasets, including co-authorship and citation networks, makes it a versatile and indispensable tool for obtaining deeper insights and understanding intricate research patterns.
The datasets containing publication year, titles, authors, journal sources, citations, and keywords in PlainText format were extracted from the Scopus database, covering the period

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from 1987 to September 2025. These datasets were processed and examined using VOSviewer version 1.6.20. Through the implementation of VOS clustering and mapping techniques, the software facilitated the creation and analysis of visual maps. As an alternative to the Multidimensional Scaling (MDS) method, VOSviewer positions items in low-dimensional spaces where the distance between any two elements accurately represents their similarity or relatedness (van Eck & Waltman, 2010). In this way, VOSviewer maintains a conceptual resemblance to the MDS approach (Appio et al., 2014). However, unlike MDS, which largely relies on similarity measures such as cosine and Jaccard indices, VOS employs a more appropriate normalization approach for co-occurrence frequencies, specifically the association strength (ASij), calculated as (Van Eck & Waltman, 2007):

$$AS_{ij} = \frac{C_{ij}}{w_i w_j}$$

which is "proportional to the ratio between on the one hand the observed number of cooccurrences of i and j and on the other hand the expected number of co-occurrences of i and j under the assumption that co-occurrences of i and j are statistically independent" (Van Eck & Waltman, 2007).

Result and Discussion

RQ1: What Are The Research Trends In Offline Digital Education Studies According To The Year Of Publication?

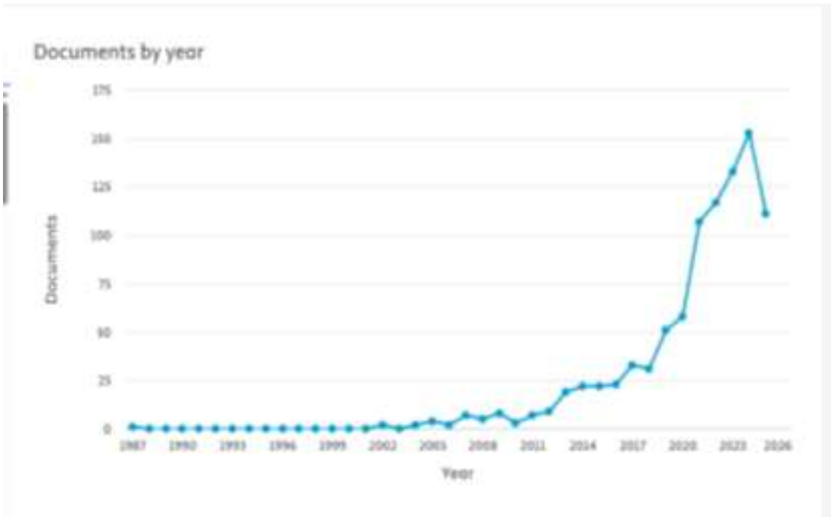

Figure 1: Trend of Research In Offline Digital Education By Years

As shown figure 1, the publication trend on offline digital education demonstrates a significant growth trajectory over the past four decades, reflecting the increasing scholarly attention to this evolving field. From its early mention in 1987 with just a single publication, research activity remained minimal for more than two decades, with fewer than ten publications annually until 2012. This slow growth indicates that offline digital education was an underexplored concept during its formative years, likely due to limited technological infrastructure and the predominance of traditional educational methods. The noticeable increase starting in 2013, with a gradual rise to 31 publications by 2018, signals the initial recognition of digital tools in

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offline learning environments. This period coincides with global efforts to integrate technology in education and the rising affordability of digital devices, laying the groundwork for more robust academic exploration.

A dramatic surge in publications is evident from 2020 onward, with numbers climbing from 58 in 2020 to a peak of 153 in 2024, before slightly tapering to 111 in 2025. This sharp increase is strongly linked to the educational disruptions caused by the COVID-19 pandemic, which accelerated the adoption of digital tools for offline and blended learning solutions worldwide. The continued high output beyond the pandemic era suggests a sustained research interest, focusing on improving offline digital learning strategies, accessibility, and pedagogical models. The peak in 2024 also highlights the maturing of the field, where scholars are increasingly examining advanced themes such as digital inclusion, content localization, and sustainable models for offline digital education. Although there is a slight dip in 2025, the figure remains historically high, indicating that offline digital education has transitioned from a niche topic to a mainstream area of academic and practical relevance.

RQ2: What Are Popular Subjects Area Related to The Study and How Much Percentages for Each Subject?

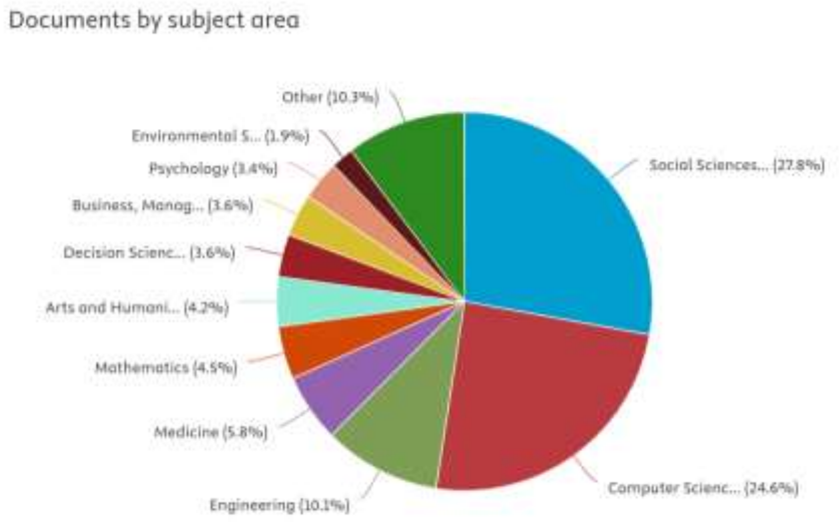

Figure 2: Trend of Publications Based on Research Subjects Area

By referring figure 2, the subject area distribution highlights that Social Sciences (27.8%) and Computer Science (24.6%) dominate research on offline digital education, collectively accounting for over half of the total publications. This reflects the dual focus of the field: the pedagogical and societal implications explored by social science scholars, and the technological infrastructure and system development addressed by computer science research. The prominence of these two areas indicates that offline digital education is not just about technological implementation but also about understanding learner behavior, accessibility, and social impact. Engineering (10.1%) also holds a significant share, suggesting strong contributions in the development of hardware, network optimization, and system design to support offline learning platforms, particularly in regions with limited internet connectivity.

Other disciplines, though smaller in proportion, add meaningful dimensions to the research landscape. Medicine (5.8%) and Mathematics (4.5%) suggest the growing application of offline digital education tools in professional and specialized training contexts, such as medical simulations and math learning platforms. Arts and Humanities (4.2%) emphasize cultural and contextual adaptations of digital content, while Decision Sciences (3.6%) and Business, Management, and Accounting (3.6%) point toward research on strategic planning, adoption models, and the economic feasibility of offline digital solutions. The presence of Psychology (3.4%) reflects an interest in cognitive and behavioral aspects of learning in offline digital settings. Meanwhile, the 'Others' category (10.3%) underscores the interdisciplinary nature of this field, incorporating insights from education policy, communication studies, and emerging applied sciences. Overall, this distribution illustrates that offline digital education is a multidisciplinary research domain, bridging technology, pedagogy, and practical implementation to address global educational needs.

RQ3: What Are The Most Cited Articles?

Table 3: Most Cited Authors

Authors	Title	Year	Source title	Cited by
A.J., van Deursen, Alexander J.A.M.; J.A.G.M., van Dijk, Jan Amg G.M. (van Deursen & van Dijk, 2014)	The digital divide shifts to differences in usage	2014	New Media and Society	1011
S.R., Cotten, Shelia R.; S.S., Gupta, Sipi S. (Cotten & Gupta, 2004)	Characteristics of online and offline health information seekers and factors that discriminate between them	2004	Social Science and Medicine	664
B.M., Kyaw, et al. (Kyaw, Saxena, et al., 2019)	Virtual reality for health professions education: Systematic review and meta-analysis by the digital health education collaboration	2019	Journal of Medical Internet Research	480
A., Vallée, Alexandre; J., Blacher, Jacques; A., Cariou, Alain; E., Sorbets, Emmanuel (Vallée et al., 2020)	Blended learning compared to traditional learning in medical education: Systematic review and meta-analysis	2020	Journal of Medical Internet Research	387
S.M., Livingstone, Sonia M.; P.K., Smith, Peter K. (Livingstone & Smith, 2014)	Annual research review: Harms experienced by child users of online and mobile technologies: The nature, prevalence and management	2014	Journal of Child Psychology and Psychiatry and Allied Disciplines	365

	of sexual and aggressive risks in the digital age			
W.L., Bennett, W. Lance; C., Wells, Chris; A.D., Rank, Allison D. (Bennett et al., 2009)	Young citizens and civic learning: Two paradigms of citizenship in the digital age	2009	Citizenship Studies	274
M., Choi, Moonsun (Choi, 2016)	A Concept Analysis of Digital Citizenship for Democratic Citizenship Education in the Internet Age	2016	Theory and Research in Social Education	209
N.K., Yee, Nicholas K. (Yee, 2014)	The Proteus Paradox: How online games and virtual worlds change us - And how they don't	2014		146
B.M., Kyaw, Bhone Myint; P.P., Posadzki, Pawel Przemyslaw; S., Paddock, Sophie; J., Car, Josip; J., Campbell, James; L., Tudor Car, Lorainne (Kyaw, Posadzki, et al., 2019)	Effectiveness of digital education on communication skills among medical students: Systematic review and meta-analysis by the digital health education collaboration	2019	Journal of Medical Internet Research	142
S.E., Peacock, Sylvia E.; H., Künemund, Harald (Peacock & Künemund, 2007)	Senior citizens and Internet technology: Reasons and correlates of access versus non-access in a European comparative perspective	2007	European Journal of Ageing	140

RQ4: Where Is The Top 10 Countries Based On Number Of Publication?

Table 4: Number of Publication Based on Countries

Country/Territory	Number of publications	Percentage
China	155	16.67
United States	128	13.76
India	93	10.00
United Kingdom	74	7.96

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Indonesia	62	6.67
Russian Federation	44	4.73
Germany	31	3.33
Australia	28	3.01
Spain	26	2.80
Canada	25	2.69

Based on table 4, the country-wise distribution of publications indicates that China (16.67%), the United States (13.76%), and India (10.00%) are the top three contributors to research on offline digital education, collectively accounting for over 40% of the global output. China's leading position reflects its strong investment in educational technology and policies to bridge the digital divide, particularly in rural and underserved areas. Similarly, the United States demonstrates significant output driven by advanced research institutions and a focus on innovative pedagogical models integrating offline digital tools. India's strong representation highlights its urgent need for scalable offline digital solutions to serve diverse populations across urban and rural regions, particularly in contexts of uneven internet accessibility.

Other countries also make notable contributions, underscoring the global interest in this research area. The United Kingdom (7.96%) and Indonesia (6.67%) reflect growing academic engagement, with the UK focusing on blended learning innovations and Indonesia leveraging offline digital tools to support education in remote regions. Contributions from the Russian Federation (4.73%), Germany (3.33%), and Australia (3.01%) emphasize the role of research collaborations and infrastructure development in advancing the field. Meanwhile, Spain (2.80%) and Canada (2.69%) contribute steadily, often exploring niche applications such as language education, teacher training, and accessibility design. Overall, the data illustrates a globally distributed research landscape, where both developed and developing nations are driving innovations in offline digital education to address local educational challenges while contributing to the broader theoretical and practical advancements in the field.

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RQ5: What Are The Popular Keywords Related To The Study?

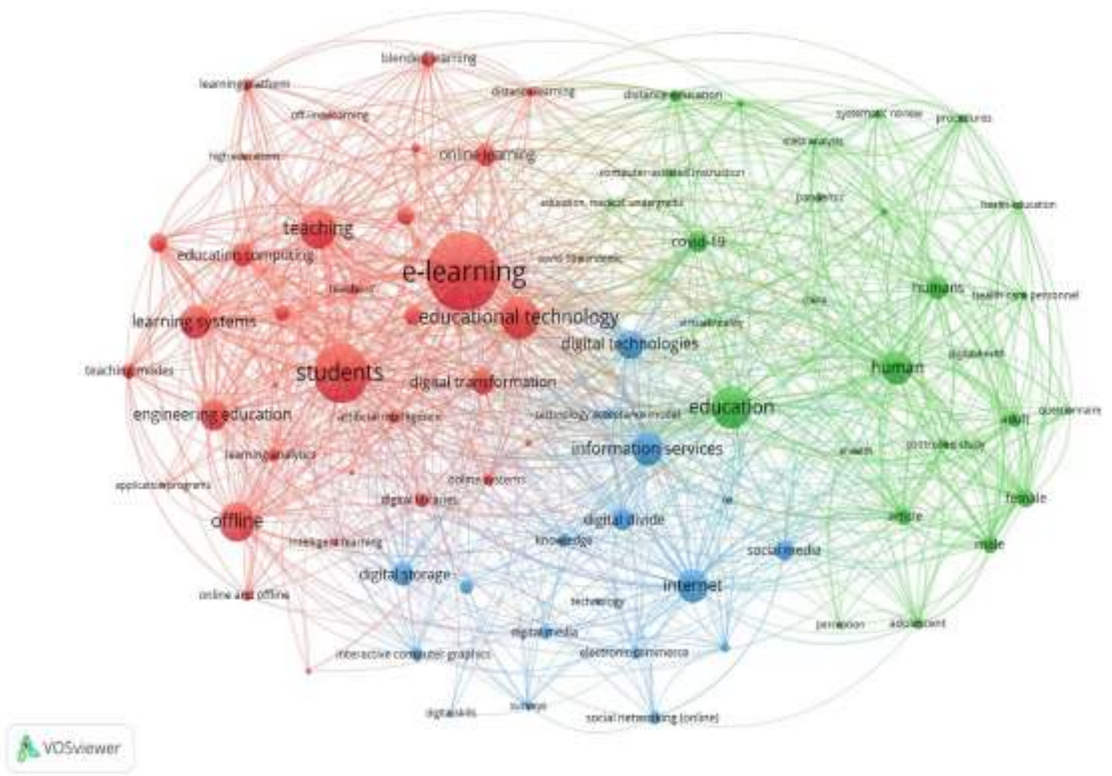

Figure 4: Network Visualization Map of Keywords' Co-Occurrence

As shown above, figure 4 about the co-occurrence analysis of author keywords in VOSviewer is a bibliometric technique used to explore how frequently certain keywords appear together in the same publications, revealing relationships, themes, and emerging research trends. By mapping these relationships visually, researchers can identify central concepts and how they interact within the body of literature. In this study, the co-occurrence map shows how terms like "e-learning," "students," "education," "offline," and "digital technologies" are interconnected, indicating the primary focus areas in offline digital education research. This approach helps scholars uncover the structural patterns of the field, identify dominant research clusters, and highlight gaps for future exploration, making it a valuable tool for understanding the intellectual landscape of the topic.

The map was generated using the full counting method, where each co-occurrence of a keyword is counted equally, ensuring that the analysis captures the breadth of connections rather than weighting by frequency of publication. A minimum threshold of 15 occurrences was applied, which refined the dataset from 3,197 keywords to 367 significant ones, ensuring that only frequently used and impactful terms were included in the analysis. Additionally, the minimum cluster size was set to 1, allowing all relevant terms meeting the threshold to form or join clusters. Based on these settings, three clusters were generated, each representing different thematic areas within the field of offline digital education. This clustering enhances the interpretability of the network map by grouping related keywords, thereby facilitating a deeper understanding of the core and emerging themes driving research in this domain.

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The findings from this co-occurrence analysis contribute significantly to the body of knowledge by highlighting the evolution and diversification of research in offline digital education. Keywords such as “e-learning” (224 occurrences, link strength 1304), “students” (165 occurrences), and “education” (118 occurrences) reflect the foundational focus on digital learning environments and their users. Emerging terms like “digital transformation,” “digital competence,” and “machine learning” indicate a shift toward integrating advanced technologies and addressing the skills required for effective offline digital education. Additionally, the inclusion of “digital divide,” “health education,” and “professional development” suggests a broader interdisciplinary reach, addressing equity, specialized training, and workforce upskilling. These insights not only map current research priorities but also guide scholars and policymakers toward unexplored areas, ensuring that future studies address practical challenges and leverage new opportunities in offline digital education.

RQ6: What Are Co-Authorship By Countries Collaboration?

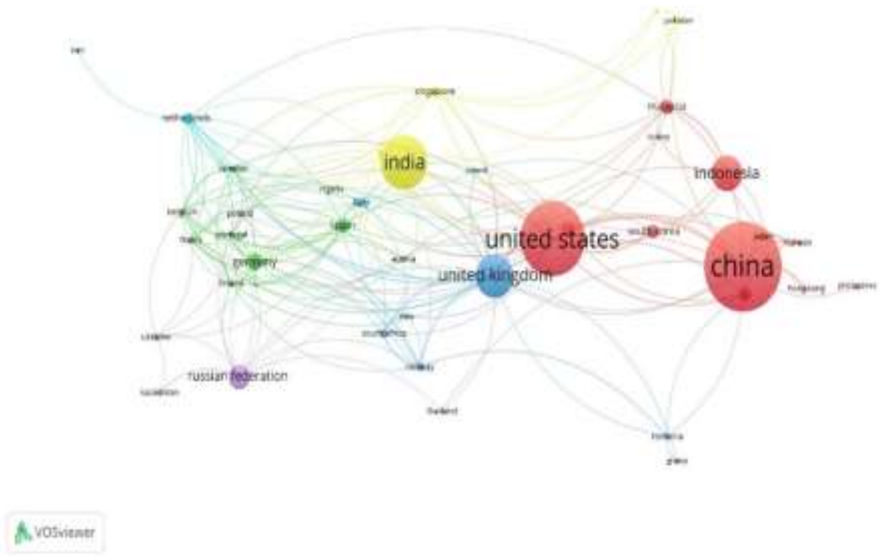

Figure 5: Network Visualization Map Of Keywords’ Co-Authorship

Based on figure 5, the co-authorship analysis by countries in VOSviewer is a bibliometric technique that examines collaboration patterns between researchers across different nations. By mapping these networks, the analysis highlights how countries work together, the strength of their collaborative ties, and the overall impact of their research output. This approach provides a visual and analytical representation of international research partnerships, indicating which countries are central to advancing the field of offline digital education and how these collaborations contribute to the global body of knowledge. Through co-authorship mapping, it becomes easier to identify hubs of innovation, key partnerships, and opportunities to strengthen underrepresented regions in collaborative networks.

In generating this map, the full counting method was applied, where each co-authored document counts fully for every country involved, ensuring that contributions are equally recognized regardless of collaboration frequency. A minimum threshold of five publications

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was set, reducing the dataset from 93 countries to 45 that met this criterion, thereby focusing on countries with significant research activity. The minimum cluster size was set to 1, allowing even countries with fewer collaborative ties to be visualized within the network. These settings resulted in the creation of six distinct clusters, each representing interconnected groups of countries with similar collaboration patterns. Such clustering enhances the interpretability of the map, revealing both regional and cross-regional networks that are shaping the research landscape in offline digital education.

The findings offer valuable insights into the global research ecosystem of this field. The United States (129 documents, 3,226 citations) and China (155 documents, 611 citations) emerge as major contributors, with the United States showing a higher impact in terms of citations, reflecting its influential role in shaping theoretical and practical advancements. The United Kingdom (2,145 citations) and Netherlands (1,254 citations) also demonstrate strong collaborative networks and high citation strength, indicating their roles as central hubs for impactful research partnerships. Countries like Singapore, Spain, and Germany show high link strengths, suggesting active collaboration with multiple regions, while emerging contributors such as Malaysia, Indonesia, and India highlight the increasing participation of developing nations in this domain. Collectively, these patterns contribute to the body of knowledge by promoting diversity in perspectives, fostering cross-border innovations, and encouraging inclusive solutions that address both global and local challenges in offline digital education.

Conclusion

The purpose of this study was to systematically examine and map the intellectual landscape, research patterns, and emerging trends in offline digital education, with the goal of providing a comprehensive overview of how this field has evolved and where it is heading. This bibliometric analysis addressed key research questions related to the annual growth of publications, the distribution of subject areas, the identification of influential keywords, the leading contributing countries, and patterns of collaboration that shape the development of this domain. By integrating advanced data collection, cleaning, and visualization techniques, this study delivers a structured assessment of the global research ecosystem supporting offline digital education.

The findings indicate that research in this area has grown steadily since its early emergence in the late 1980s, with a particularly sharp increase in publications after 2020. This surge highlights the heightened relevance of offline digital education as both a response to global educational disruptions and as a pathway for expanding access to underserved communities. Social Sciences and Computer Science emerged as the dominant subject areas, reflecting a balance between pedagogical exploration and technological innovation. China, the United States, and India were the leading contributors, while countries such as the United Kingdom, Indonesia, and Germany also played important roles, demonstrating the increasingly global nature of this research. Co-authorship and collaboration analyses further revealed that cross-border partnerships are strengthening, suggesting an increasing exchange of knowledge and expertise across regions. Keyword co-occurrence analysis revealed that foundational concepts like e-learning, education, and digital technologies remain central, while emerging themes such as digital transformation, digital competence, artificial intelligence, and blended learning highlight the diversification and maturity of the research landscape.

This study contributes to the body of knowledge by offering a detailed bibliometric framework that captures the evolution, current priorities, and potential future directions of offline digital education research. The findings hold significant implications for practice, particularly in guiding educators, policymakers, and technology developers toward strategies that enhance learning accessibility, address the digital divide, and foster innovation in teaching and learning models. By identifying collaboration patterns and highlighting emerging research themes, this study also provides a roadmap for future interdisciplinary and international research initiatives. Nonetheless, the study acknowledges certain limitations, such as the exclusive reliance on the Scopus database, which may omit relevant literature indexed elsewhere, and the quantitative nature of bibliometric analysis, which does not capture the full depth of thematic content. Future research could integrate multiple databases or complement bibliometric methods with qualitative analyses to gain deeper insights into the intellectual development and impact of this field.

Overall, this study underscores the significance of bibliometric approaches in understanding the trajectory of offline digital education research and its role in shaping inclusive and sustainable educational ecosystems. The comprehensive analysis presented here not only documents the rapid growth and diversification of the field but also lays a strong foundation for subsequent scholarly inquiry. By highlighting global collaboration, emerging themes, and critical gaps, this study provides valuable guidance for stakeholders aiming to harness offline digital education as a tool for equity, innovation, and resilience in the evolving landscape of global education.

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Ethics Statement: This study was conducted in accordance with ethical research standards. Informed consent was obtained from all participants prior to data collection. Participation was voluntary, and respondents were assured of confidentiality and anonymity. The data collected were used solely for academic purposes.

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