

Conceptual Structure and Trend Topics of the Education and Information Technologies Journal: A Bibliometrics Analysis

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Abstract

Education and Information Technologies Journal (EAIT) serves as a vital platform for researchers to disseminate their work and for educators to stay updated on the latest advancements in educational technology. This paper presents a comprehensive bibliometric analysis to explore the conceptual structure and trend topics of EAIT. 3171 publications were sourced from the Scopus database from 1996 to 2023. The study involved VOSviewer for co-occurrence network visualization and biblioshiny software for trending topics mapping. The analysis revealed the presence of nine subject areas of EAIT: role of ICT and technology in education, blended learning and teacher training, e-learning and mobile learning, engaging and motivating learning environments, educational data mining and machine learning, distance education in different academic settings, education during the COVID-19 pandemic, educational technology in higher education and developing countries, and the use of social media in education. The trend topics map highlights the transition from collaborative learning to self-regulated learning, the increasing focus on online learning, the emergence of computational thinking and artificial intelligence as prominent research areas, and the impact of the COVID-19 pandemic on education. In conclusion, the comprehensive bibliometric analysis of Educational Technology sheds light on the research themes and trends in EAIT.

Keywords: Bibliometric Analysis, Conceptual Structure, Education and Information Technologies Journal, Educational Technology, Trend Topics.

Introduction

There has been a growing interest in leveraging technology to enhance teaching and learning practices in recent years. Various relevant studies have contributed to the expanding body of research on the impact of technology on education. For instance, Barrot (2022) examined social media as a learning environment, while Crompton and Burke (2023) investigated the utilization of artificial intelligence in higher education. Furthermore, significant research has been conducted by Kerimbayev, Kultan, Abdykarimova and Akramova (2017), Guppy, Verpoorten, Boud, Lin, Tai, and Bartolic, (2022), Carpenter, Morrison,

Rosenberg and Hawthorne (2023), Oliveira et al. (2023), Pedroso, Oducado, Ocampo, Tan and Tamdang (2023), Sayed et al. (2023), and Wang et al. (2023). These studies contribute to the growing body of knowledge on leveraging technology in education and its effects on teaching and learning outcomes.

In this context, The Education and Information Technologies Journal (EAIT, ISSN 1360-2357) plays a crucial role by providing a reputable platform for researchers to disseminate their work and for educators to stay updated on the latest developments in educational technology. EAIT is a peer-reviewed academic journal that focuses explicitly on the intersection of education and technology. It covers a wide range of topics related to educational technology, including the design and development of educational software, technology integration in the classroom, online learning, digital learning environments, and distance education. Published by Springer, a leading global publisher of scientific, technical, and medical literature, EAIT contributes significantly to advancing knowledge in educational technology. EAIT emerged in 1996 and has since become a prominent publication in educational technology. It is indexed in central citation databases such as Web of Science and Scopus, making it easily accessible to researchers, educators, and practitioners in educational technology.

Over the years, the EAIT has established a strong reputation within the academic community and has experienced consistent growth and development in education and information technology. In 2020, the journal consistently ranked in the Q1 quartile for three disciplines: Education, E-learning, and Library and Information Sciences, according to the Scimago Journal & Country Rank. This recognition demonstrates the journal's high standing and impact in the academic community. Furthermore, the EAIT achieved an impressive impact factor of 5.15 in 2022, indicating its significant influence and importance in the field.

The number of publications in the EAIT has grown substantially since its inception in 1996, as shown in Figure 1. This trend reflects the increasing volume of research in educational technology and E-learning and the higher submission rate (Tatnall & Fluck, 2022). Figure 1 also shows a parallel rise in the citation count, indicating the growing impact and recognition of the EAIT among scholars. These impressive achievements demonstrate the progress and development of the field. However, to further improve the scientific value and rigor of research, more efforts are needed to conduct evaluation research and bibliometric analysis.

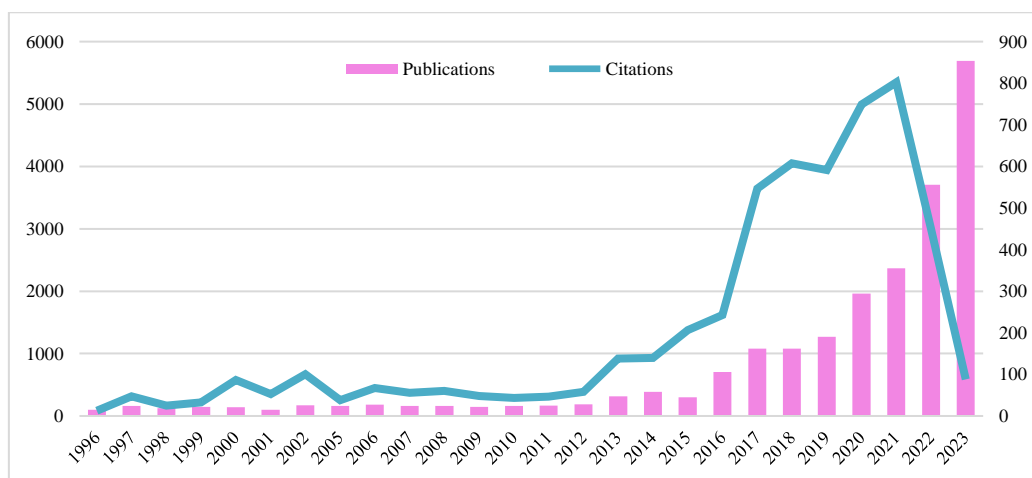


Figure 1: The publications and citations in the EAIT, 1996, as of July 2023 (source: Scopus)

Bibliometric analysis has evolved into an efficient tool for reviewing and analyzing vast scientific research output (Gazali, Sofyan, Perdima, Abdullah, Cendra & Bangun, 2023). Its popularity has grown among researchers who seek to analyze previously published research works, as it provides valuable insights into the research domains covered and the performance of specific journals (Ninkov, Frank & Maggio, 2022). It provides objective and reliable research output, impact, and visibility metrics. Co-occurrence analysis identifies the most important themes and keywords used in publications and maps the conceptual structure of a research field or journal (Cheng, Huang, Yu & Wu, 2018). This information helps researchers identify research gaps, emerging trends, and potential collaborators. These studies offer a systematic and quantitative analysis of publications, citations, authors, and collaborations, enabling researchers to comprehensively understand the research landscape (Van Raan, 2019). In recent years, the application of bibliometric analysis has gained prominence in the academic community, facilitating the examination of scholarly productivity and providing valuable insights into publication trends and impact.

Research Objectives

The objective of this study is to conduct a thorough analysis of EAiT to achieve the following goals through the examination of its conceptual structure and trend topics:

1: Analyzing the conceptual structure of EAiT: Identifying frequent topics, subject areas, and hot topics to understand the thematic landscape of the journal.

2: Investigating the trend topics of EAiT: Examining the evolution, interrelationships, and temporal patterns of topics to gain insights into the journal's dynamic nature of research themes.

Conducting the proposed research offers valuable benefits, including enhanced clarity and transparency in the journal's thematic landscape, improved quality and attractiveness of articles, better planning and content management, identification of research trends and hot topics, facilitation of innovation and impact, strategic focus on areas of interest and alignment with the scholarly community's needs, and more significant influence within the journal.

Literature Review

Academic journals provide a medium for the scientific community and industry professionals to enhance their understanding (Xiao & Smith, 2006; Farrukh, Meng, Raza & Tahir, 2020). In academia, it is customary to perform comprehensive evaluations of longstanding journals, as this critical analysis of the past helps to validate and shape future progress (Barley, 2015; Rialp, Merigó, Cancino & Urbano, 2019; Khan, Pattnaik, Ashraf, Ali, Kumar & Donthu, 2021). Several bibliometric studies have been conducted in the field of educational technology. Mustapha, Thuy Van, Shahverdi, Qureshi, and Khan (2021) examined the effectiveness of digital technology in education during the COVID-19 pandemic. Donmus Kaya (2022) focused on using Web 2.0 tools in educational research. Chen et al. (2023) visualized trends in computational thinking research. Rojas-Sánchez, Palos-Sánchez, and Folgado-Fernández (2023) conducted a systematic review and bibliometric analysis of virtual reality (VR) in education. Hincapie, Diaz, Valencia, Conter, and Güemes-Castorena (2021) explored the educational applications of augmented reality. Kushairi and Ahmi (2021) analyzed the flipped classroom approach. Abuhassna et al. (2023) studied the trends of using the Technology Acceptance Model (TAM) for online learning. Gupta, Abbas and Srivastava (2022) conducted a bibliometric analysis on TAM. Zhang, Carter Jr, Qian, Yang, Rujimora and Wen

(2022) examined literature on online learning in higher education during the pandemic. Goksu (2021) mapped mobile learning research. Khan and Gupta (2022) focused on mobile learning in the education sector. Schöbel, Saqr, and Janson (2021) studied game concepts in digital learning environments. These studies contribute to our understanding of educational technologies' research landscape, trends, and applications.

In this regard, Chen, Yu, Cheng, and Hao (2019) conducted a bibliometric analysis focusing on the top-ranked journal on educational technology over the past 40 years. They explored research topics, author profiles, and collaboration networks within the field. Chen, Zou and Xie (2020) took a topic modeling-based bibliometric perspective to examine the British Journal of Educational Technology and its content over a span of fifty years. Tatnall and Fluck (2022) reflected on the past and future of the Education and Information Technologies journal, discussing its contributions to the field. Ozyurt and Ayaz (2022) employed a topic modeling-based bibliometric analysis to gain insights into EAIT over twenty-five years. Additionally, Al Mamun, Azad, and Boyle (2021) and Al Mamun, Azad, Al Mamun, and Boyle (2022) contributed to the field with their articles on flipped learning in engineering education and the identification and evaluation of technology trends in K-12 education.

Also, Dao, Tran, Van Le, Nguyen, and Trinh (2021) conducted a bibliometric analysis of Research on Education 4.0 during the 2017–2021 period, highlighting the current state of research in this area. This study offers valuable insights into the evolving landscape of educational technology. Furthermore, Bardakci, Soyulu, Akkoynlu and Deryakulu (2022) explored collaborations, concepts, and citations in educational technology, providing a trend study through bibliographic mapping. This research contributes to our understanding of the interconnectedness and evolving concepts in the field. Raman, Achuthan, Nair, and Nedungadi (2022) conducted a historical review and bibliometric analysis of virtual laboratories over the past three decades, offering a comprehensive perspective on the development and impact of this technology in educational settings. These studies contribute to the growing body of knowledge in educational technology and provide valuable insights into the advancements, trends, and impact of technology in education.

Materials and Methods

Data source and search method

The bibliographic data for EAIT was extracted from the Scopus database, encompassing the journal's publications from 1996 to 2023. The search was conducted on July 28, 2023. While the publications for 2023 were not fully available, 506 articles in press were recorded in the Scopus database. The search strategy involved searching the ISSN field using the ISSN number specific to EAIT.

The search strategy: ISSN= (13602357), 3,171 documents found (on July 28, 2023).

Data extraction

The bibliographic data of 3171 EAIT publications was obtained by downloading a CSV format file from Scopus. The data was meticulously prepared by ensuring the accuracy of keywords, including addressing variations such as different spellings and singular/plural forms. VOSviewer version 1.6.19.0 and BiblioShiny from the bibliometrix package version 4.1.3 were employed to analyze the data.

Data analysis

A bibliometric analysis of EAIT was conducted using various software tools and methods. The information and publication age were extracted from an Excel format. The VOSviewer software and a CSV file were utilized to draw the co-occurrence network of keywords. VOSviewer, a free Java software, can map the scientific networks and structures within a collection of publications. The trending topics map of EAIT was also generated using the Biblioshiny software. Biblioshiny is a web interface for the bibliometrix R package, enabling bibliometric analysis and visualization of scientific publications.

Naming of the clusters

In this study, the naming of the clusters was based on a combination of objective criteria and three experts' judgments. Initially, descriptive keywords or phrases within each cluster were examined to identify common themes or topics. These keywords served as a starting point for understanding the main focus of each cluster. Subsequently, expert judgment was employed to refine and finalize the cluster names. Domain experts familiar with the study's subject reviewed each cluster's composition and provided their insights. Their expertise helped determine the most appropriate and representative names for the clusters, ensuring they accurately captured the underlying themes or concepts. It is important to note that the naming process is somewhat subjective and may involve interpretation and subjective judgment. However, efforts were made to maintain consistency and objectivity by involving multiple experts and considering the overall coherence and relevance of the keywords within each cluster. The final names assigned to the clusters were documented and presented in the results section, enabling readers to easily identify and comprehend each cluster's main topics or themes in the co-occurrence network of keywords.

Results

Most frequent keywords

Table 1 shows the 23 most frequent keywords in EAIT, ranked by their occurrence in the publications. The keywords "higher education," "e-learning," "online learning," "ICT," and "education" appear the most often in the publications. Among the 23 top keywords, the ones with the highest average citations per document are "education," "TAM," "mobile learning", "covid-19", and "e-learning." The last column shows the average normalized citations for each keyword,

a refined indicator that adjusts for the variations in citation patterns across fields and publication years. It is computed by dividing the average citations by the average number of citations received by all items in the same field and publication year. A value of 1 means that the items have an average impact, while a value greater than 1 means that the items have higher than average impact.

Table 1

The 23 most frequent keywords in EAIT

| Rank* | Keywords | Occurrences | Avg. citations (Rank**) | Avg. norm. citations (Rank**) |
|-------|------------------|-------------|-------------------------|-------------------------------|
| 1 | higher education | 270 | 14.30 (15) | 1.34 (10) |
| 2 | e-learning | 140 | 19.54 (5) | 1.53 (5) |

| | | | | |
|----|------------------------|-----|------------|-----------|
| 3 | online learning | 112 | 17.90 (8) | 1.60 (4) |
| 4 | ICT | 110 | 14.61 (14) | 0.91 (20) |
| 5 | education | 90 | 21.04 (1) | 1.44 (7) |
| 6 | covid-19 | 79 | 19.87 (4) | 3.04 (1) |
| 7 | blended learning | 75 | 19.05 (7) | 1.28 (13) |
| 8 | computational thinking | 74 | 15.55 (12) | 1.30 (12) |
| 9 | mobile learning | 72 | 20.46 (3) | 1.41 (9) |
| 10 | TAM | 70 | 20.60 (2) | 1.66 (3) |
| | technology | 70 | 11.41 (17) | 0.89 (21) |
| 11 | educational technology | 63 | 16.33 (11) | 1.70 (2) |
| 12 | teacher | 60 | 19.45 (6) | 1.26 (14) |
| 13 | pre-service teacher | 59 | 7.51 (23) | 0.63 (23) |
| 14 | distance learning | 55 | 9.51 (21) | 0.95 (19) |
| | collaborative learning | 55 | 9.45 (22) | 0.76 (22) |
| 15 | motivation | 52 | 12.25 (16) | 1.18 (16) |
| 16 | MOOCs | 49 | 10.82 (20) | 0.97 (18) |
| 17 | virtual reality | 48 | 16.90 (9) | 1.48 (6) |
| | augmented reality | 48 | 10.92 (19) | 1.43 (8) |
| | social media | 48 | 16.81 (10) | 1.32 (11) |
| | distance education | 48 | 15.19 (13) | 1.25 (15) |
| | self-efficacy | 48 | 11.19 (18) | 1.01 (17) |

*Rank Based on Publications count and the tie publications have the same rank.

**Rank based on 23 top keywords listed according to count of occurrence in publications.

Figure 2 shows the keyword density map. Keywords with higher densities are colored in red, while keywords with lower densities are colored in green. This visualization can more effectively highlight which keywords are the main topics in the research field.

Table 2 presents the topics within each cluster.

Table 2
Topics in Clusters Based on Keyword Analysis

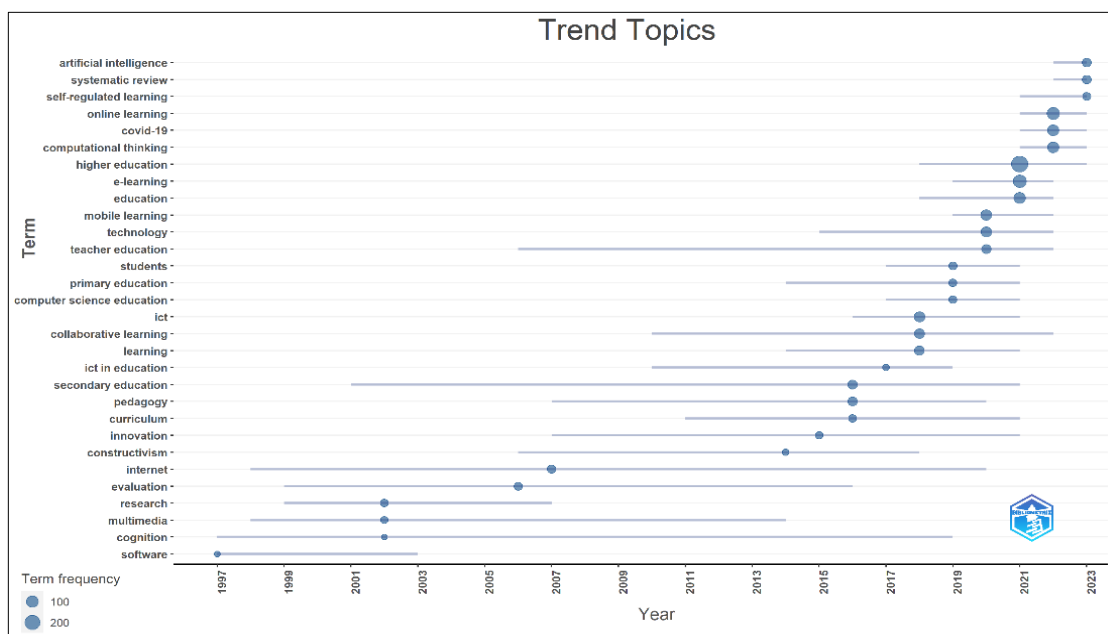
| Cluster No. | Title of Cluster | Topics in Cluster |
|-------------|--|--|
| 1 | The Role of ICT and Technology in Education | <ul style="list-style-type: none"> - Computational Thinking: Empowering Students' Problem-Solving Skills - Programming in Education: Fostering Creativity and Innovation - Digital Technology and Assessment: Enhancing Learning Outcomes - Integrating Web 2.0 Tools in the Curriculum. |
| 2 | Blended Learning and Teacher Training | <ul style="list-style-type: none"> - Preparing Pre-Service Teachers for Technology Integration - Exploring Virtual Reality and Augmented Reality in Education - TPACK: Integrating Technology, Pedagogy, and Content Knowledge - Flipped Classroom Approach: Enhancing Learning Experiences |
| 3 | E-Learning and Mobile Learning | <ul style="list-style-type: none"> - TAM Framework: Understanding Technology Acceptance in Education - MOOCs and Online Learning: Opportunities and Challenges - Mobile Learning: Leveraging Mobile Technology in Education - Moodle and LMS: Enhancing Learning Management Systems |
| 4 | Engaging and Motivating Learning Environments | <ul style="list-style-type: none"> - Gamification in Education: Motivating Students through Game Elements - Teacher Education: Fostering Collaborative Learning Environments - Engaging Students through Artificial Intelligence and Serious Games - Self-Regulated Learning: Promoting Autonomy and Motivation |
| 5 | Educational Data Mining and Machine Learning | <ul style="list-style-type: none"> - Learning Analytics: Leveraging Data for Educational Insights - Deep Learning in Education: Advancements and Applications - Adaptive Learning: Personalizing Education through Intelligent Systems - Decision Trees and Classification: Analyzing Learning Patterns |
| 6 | Distance Education in Different Educational Settings: Teaching/Learning Strategies | <ul style="list-style-type: none"> - Teaching/Learning Strategies in Different Educational Settings: Children, Elementary Education, and Adult Education - Pedagogical Challenges and Solutions in Distance Education - Interactive Learning Environments: Enhancing Engagement in Virtual Settings |
| 7 | Education during the COVID-19 Pandemic | <ul style="list-style-type: none"> - Online Teaching and Learning: Lessons from Emergency Online Education - Enhancing Social Presence in Remote Learning Environments - Challenges and Opportunities of distance Learning during the Pandemic - Learning Experience in the Context of COVID-19: Reflections and Innovations |
| 8 | Educational Technology in Higher Education and Developing Countries | <ul style="list-style-type: none"> - Bridging the Digital Divide: Access to ICT in Education - Digital Literacy: Empowering Learners and Communities - Educational Innovation |
| 9 | Social media in | <ul style="list-style-type: none"> - Academic Performance and Social Networking Sites: Exploring |

Trend topics

Figure 5 depicts the trend topics map of EAIT with 31 keywords. Trend topics identified the main themes, concepts, and research areas in the EAIT. They also show the relationships and evolution of these topics over time. Upon further examination, it is evident that various educational topics have experienced shifts and transformations over the years. Collaborative Learning, which held prominence in the early years, has gradually given way to Self-Regulated Learning, indicating a change in instructional approaches and strategies.

Moreover, the topic of the internet has witnessed a gradual replacement by E-Learning and Online Learning, with Online Learning garnering increasing attention over time. In educational media, software initially garnered significant attention but has been gradually supplanted by multimedia, highlighting the evolving nature of instructional resources and materials. Similarly, in the field of technology and computer-related topics, there has been a gradual transition from the emphasis on Information and Communication Technology (ICT) to the emergence of Computational Thinking and subsequently Artificial Intelligence as prominent subjects of study and research. The Research topic has shown a need for more stability over the years. However, emerging areas such as computational thinking, artificial intelligence, and systematic review have gained popularity and have been considered potential alternatives or complementary components to research efforts in various contexts. As for educational levels, Secondary Education, Students, Primary Education, Teacher Education, and Higher Education have consistently remained central topics, highlighting their continued importance in educational discussions. Furthermore, the influence of digitalization and remote learning is evident in the increasing attention given to ICT in Education, Computer Science Education, Mobile Learning, Technology, E-Learning, and Online Learning. The global impact of the COVID-19 pandemic has also led to a surge in research and discussions surrounding the topic of COVID-19 within the educational landscape. Overall, these observed shifts and transformations reflect the evolving nature of educational paradigms, instructional approaches, technological advancements, and the ever-changing needs and challenges within the field of education.

Figure 5: Trend topics in EAIT. Some keywords are not visible due to overlapping.



Discussion

Based on the co-occurrence network analysis, this paper provides a comprehensive examination of the conceptual structure and trend topics of the EAIT through a bibliometric and visualization approach. The identified clusters shed light on the prominent themes and research areas within education and technology. These clusters include the role of ICT and technology in education, blended learning and teacher training, e-learning and mobile learning, engaging and motivating learning environments, educational data mining and machine learning, distance education in different educational settings, education during the COVID-19 pandemic, educational technology in higher education and developing countries, and the use of social media in education. The formation of these clusters reflects the significance and interconnections between various topics, providing insights into the key keywords and addressing the research questions of this study. The following keywords, such as higher education, ICT, distance learning, mobile learning, education, collaborative learning, and blended learning, overlap with a research paper in the field of education and technology by Tatnall and Fluck (2022) contributing to the knowledge and findings related to these research areas.

Cluster 1, titled "The Role of ICT and Technology in Education," emerged due to the increasing recognition of the transformative potential of technology in enhancing teaching and learning processes. Integrating information and communication technologies (ICT) and technology in education has gained significant attention in recent years. Scholars and researchers have conducted studies exploring various aspects of this integration, such as computational thinking, programming in education, and incorporating web 2.0 tools in the curriculum. The high frequency of keywords related to ICT and technology in this cluster indicates the importance of leveraging technological advancements to create innovative educational experiences. For instance, Mustapha et al. (2021) conducted a bibliometric analysis of the effectiveness of digital technology in education during the COVID-19 pandemic, shedding light on its impact. Donmus Kaya (2022) performed a bibliometric analysis on web 2.0 tools in educational research, providing insights into this area. Chen, Sun, Hsu, Yang, and Sun (2023) visualized trends in computational thinking research from 2012 to 2021, offering a comprehensive field analysis.

Cluster 2, titled "Blended Learning and Teacher Training," delves into implementing blended learning approaches and practical teacher training in education. It explores a range of topics, including the preparation of pre-service teachers for technology integration, virtual reality, augmented reality, and the flipped classroom approach. This cluster holds significant relevance as there is an increasing emphasis on enhancing pedagogical practices through a combination of traditional and online learning methods. The presence of numerous related keywords highlights the imperative to equip educators with the requisite skills to leverage blended learning environments proficiently. Several studies contribute to the discourse surrounding this cluster, providing valuable research evidence. For instance, Rojas-Sánchez et al. (2023) conducted a systematic literature review and bibliometric analysis on virtual reality and its applications in education, shedding light on its educational potential. Hincapie et al. (2021) performed a bibliometric study on the educational applications of augmented reality, offering insights into this specific area. Kushairi and Ahmi (2021) conducted a bibliometric analysis on the implementation of the flipped classroom approach, providing a comprehensive overview of its utilization.

Cluster 3, titled "E-Learning and Mobile Learning," explores the utilization of e-learning and mobile learning in education. It covers many topics, including massive open online courses (MOOCs), learning management systems (LMS), and mobile technology for learning purposes. This cluster holds significant importance as there is a growing reliance on digital platforms and mobile devices to facilitate flexible and accessible learning experiences. The abundance of keywords related to e-learning and mobile learning reflects the increasing interest in leveraging digital technologies for educational delivery. Several studies contribute to the discussion of this cluster, providing valuable research evidence. Abuhassna et al. (2023) conducted a bibliometric and content analysis, shedding light on the trends of using the Technology Acceptance Model (TAM) for online learning and offering insights into its application. Gupta et al. (2022) performed a comprehensive bibliometric analysis on the Technology Acceptance Model (TAM), providing an overview of its development. Zhang et al. (2022) conducted a bibliometric analysis of the literature concerning online learning in higher education during the COVID-19 crisis, shedding light on academia's responses. Goksu (2021) mapped the field of mobile learning through a bibliometric analysis, providing a comprehensive overview of the topic. Khan and Gupta (2022) conducted a bibliometric analysis focused on mobile learning in the education sector, offering insights into its implementation.

Cluster 4, titled "Engaging and Motivating Learning Environments," emphasizes the creation of stimulating learning environments and explores various topics such as gamification, collaborative learning, artificial intelligence, serious games, and self-regulated learning. This cluster significantly recognizes the importance of fostering active participation and intrinsic motivation among learners. The prevalence of keywords related to engagement and motivation underscores the value of employing innovative pedagogical approaches and integrating technology to create dynamic learning environments. Within this research focus, Schöbel et al. (2021) conducted a bibliometric study and research agenda on game concepts in digital learning environments, providing valuable insights. Their comprehensive analysis of two decades of game concepts offers a deeper understanding of their application in educational contexts. This research contributes to developing engaging and motivating learning environments by examining the effectiveness and impact of game-based approaches.

Oliveira et al. (2023) also conducted a literature review and future agenda on tailored gamification in education. Their study explores the customization of gamification techniques to cater to learners' specific needs and preferences. By personalizing gamification, educators can enhance engagement and motivation in educational settings.

Cluster 5, titled "Educational Data Mining and Machine Learning," focuses on using educational data mining and machine learning techniques in education. This cluster explores learning analytics, deep learning, adaptive learning, and decision trees. Its significance lies in the increasing availability of educational data and the potential to extract meaningful insights to inform instructional decision-making. The high frequency of related keywords reflects the growing interest in leveraging data-driven approaches and intelligent systems to enhance personalized learning experiences. In line with this research, Sayed et al. (2023) conducted a study on an AI-based adaptive personalized content presentation and exercises navigation for an effective and engaging e-learning platform. Their research explores the use of artificial intelligence techniques to adapt learning content and exercises based on learners' individual needs, aiming to improve engagement and learning outcomes. This study highlights the

potential of leveraging AI in creating personalized and engaging learning experiences. Furthermore, Wang et al. (2023) compared the effectiveness of adaptive learning systems to teacher-led instruction. Their research investigates the benefits of adaptive learning approaches in improving learning outcomes, emphasizing the potential of personalized and tailored instruction. This study contributes to understanding how adaptive learning systems can enhance engagement and learning outcomes in educational settings.

Cluster 6, titled "Distance Education in Different Educational Settings," explores distance education in various educational contexts, focusing on teaching and learning strategies, pedagogical challenges and solutions, and interactive learning environments. The increasing relevance of online and remote learning necessitates addressing unique pedagogical considerations associated with delivering education at a distance. For instance, Santamaria-López and Ruiz (2023) conducted a study on distance education for children with disabilities and from vulnerable families, investigating the use of educational technologies to provide inclusive and accessible learning opportunities for these specific student populations. In a separate study, Pedroso et al. (2023) examined the factors influencing the intention to use videoconferencing tools in online distance education among students in Philippine maritime schools, contributing to understanding the acceptance and adoption of videoconferencing tools for remote learning. Additionally, Kim, Kwon, and Cho (2011) explored the factors influencing social presence and learning outcomes in distance higher education. Their research emphasized the role of social presence, interaction, and collaborative activities in enhancing the learning experience for distance education students.

Cluster 7, titled "Education during the COVID-19 Pandemic," focuses on the impact of the COVID-19 pandemic on education. It covers various topics such as online teaching and learning, social presence in remote learning environments, challenges and opportunities of distance learning during the pandemic, and reflections on learning experiences. This cluster is significant due to the unprecedented disruptions caused by the pandemic, which have required the adaptation of educational practices to remote and online modalities. The high frequency of related keywords highlights the importance of understanding the implications of the pandemic on teaching, learning, and student well-being. In this regard, Ng, Ching and Law (2023) conducted a study that delves into online learning in management education amid the pandemic, using a bibliometric and content analysis approach. Their research, published in *The International Journal of Management Education*, provides valuable insights into the implementation and effectiveness of online learning strategies during the pandemic. The study sheds light on the challenges faced and the opportunities that have emerged in the context of management education. Furthermore, Zhang et al. (2022) conducted a bibliometric analysis of the literature on online learning in higher education during COVID-19. Their research, published in the *British Journal of Educational Technology*, explores academia's responses to the crisis and provides insights into trends and patterns in the scholarly discourse on online learning in higher education during this period.

Cluster 8, titled "Educational Technology in Higher Education and Developing Countries," focuses on the role of educational technology in higher education, particularly in developing countries. It examines topics such as bridging the digital divide, digital literacy, and educational innovation. This cluster is significant as it highlights the importance of technology integration in higher education institutions and the need to address developing countries' challenges and opportunities in adopting educational technologies. The frequency of keywords related to

educational technology underscores the potential of technology to support equitable access to quality education. In this context, Guppy et al. (2022) conducted a study titled "The post-COVID-19 future of Digital Learning in higher education: Views from educators, students, and other professionals in Six Countries." Published in the *British Journal of Educational Technology*, their research provides insights into the perspectives of educators, students, and professionals from six countries regarding the future of digital learning in higher education in the post-COVID-19 era. Kerimbayev, Kultan, Abdykarimova and Akramova (2017) explored the use of Moodle's learning management system in distance international education through the collaboration of higher education institutions from different countries. Their research, published in *EAIT*, examines the implementation and effectiveness of Moodle as a platform for international education. Furthermore, Crompton and Burke (2023) investigated the state of artificial intelligence in higher education. Their study, published in the *International Journal of Educational Technology in Higher Education*, provides an overview of artificial intelligence's current state and potential applications in higher education.

Cluster 9, titled "Social Media in Education," explores the relationship between social media and education. It encompasses topics such as using social networking sites like Facebook and Twitter for educational purposes, promoting digital citizenship and online safety, and the impact of social media on learning outcomes. This cluster is prominent as it acknowledges the growing recognition of social media as a tool for educational communication, collaboration, and engagement. The high frequency of keywords related to social media signifies the need to explore its potential benefits and address the associated challenges in educational contexts. In this context, Carpenter et al. (2023) conducted a study titled "Using Social Media in pre-service teacher education: The Case of a Program-wide Twitter Hashtag," published in *Teaching and Teacher Education*. Their research explores the use of social media, specifically a program-wide Twitter hashtag, in pre-service teacher education. Furthermore, Barrot (2022) conducted a systematic review of the literature titled "Social Media as a Language Learning Environment: A systematic review of the literature (2008-2019)," published in *Computer Assisted Language Learning*. The study examines the role of social media as a language learning environment and provides a comprehensive review of relevant literature from 2008 to 2019.

The trend analysis of educational topics within the *EAIT* journal reveals notable shifts and transformations over time. The early prominence of Collaborative Learning has gradually given way to Self-Regulated Learning, indicating a change in instructional approaches. Furthermore, the topic of the internet has been progressively replaced by E-Learning and Online Learning, reflecting a shift in educational practices towards digital platforms. In the realm of educational media, there has been a gradual transition from a focus on software to multimedia, highlighting the evolving nature of instructional resources. Similarly, there has been a shift in technology and computer-related topics from the emphasis on Information and Communication Technology (ICT) to the emergence of Computational Thinking and Artificial Intelligence as prominent research subjects. The stability of the Research topic has been limited. Still, emerging areas such as Computational Thinking, Artificial Intelligence, and Systematic Review have gained popularity as potential alternatives or complementary components in research efforts.

Educational levels such as Secondary Education, Students, Primary Education, Teacher Education, and Higher Education have consistently remained central topics, underscoring their ongoing importance in educational discussions. Additionally, the influence of digitalization and

remote learning is evident in the increasing attention given to ICT in Education, Computer Science Education, Mobile Learning, Technology, E-Learning, and Online Learning. The global impact of the COVID-19 pandemic has further accelerated research and discussions on its influence on education. Our research findings are consistent with the study conducted by Ozyurt and Ayaz (2022), as both studies identified changes and evolutions in educational topics over time. Notably, the topic of the internet has been replaced by E-Learning and Online Learning, indicating a change in educational practices.

Additionally, Computational Thinking and Artificial Intelligence have emerged as prominent research subjects, reflecting the evolving landscape of technology in education. In addition, our findings highlight the significance of various educational levels, including Secondary Education, Students, Primary Education, Teacher Education, and Higher Education. Moreover, ICT in Education, Computer Science Education, Mobile Learning, Technology, E-Learning, blended learning, and online learning have gained significant attention due to the impact of digitalization and remote learning. Lastly, the COVID-19 pandemic has further accelerated research on its influence on education.

In this regard, the article by Tatnall and Flucke (2022) delves into examining technological advancements over the past 25 years. The authors explore changes in computer technologies, including the proliferation of internet usage and mobile technologies. Moreover, they address the transformations that have taken place in education and the integration of technology in teaching practices. This encompasses the utilization of emerging technologies, online collaborative activities, technology-enhanced learning, and blended learning. Tatnall and Flucke's article also sheds light on the shifts in topics explored within the Education and Information Technologies journal throughout the years. These changes encompass various subjects such as assessment and software, case studies and educational methodologies, collaboration and learning effectiveness, the emergence of e-learning, blended learning, and mobile learning. Hence, by referencing Tatnall and Flucke's article, it can be demonstrated that their analysis aligns with their exploration of educational developments and associated technologies.

Conclusions

This bibliometric analysis focuses on the conceptual structure of the EAIT and provides valuable insights into publication trends and topical focuses. The findings reveal a multidisciplinary, globally collaborative field experiencing dynamic evolutions in response to educational contexts, e-learning, and emerging technologies.

Together, these quantitative insights help map the structure and evolution of the EAIT research domain. They underscore the need for dual emphasis on enduring educational foundations and adaptable, forward-looking topics. The study methodology and visualizations provide a model for systematically tracking intellectual lineages and emerging directions. While limited to one journal, this analysis establishes a knowledge baseline and models analytic techniques applicable to other learning technology publications. Additional research across broader sources can further enrich our understanding of this dynamic, socially shaped field. The findings highlight that continuous evidence-based monitoring of scholarly activities is crucial for guiding purposeful research and advancing educational innovation.

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