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Research Paper

Digital Accessibility in Education: A Bibliometric Analysis

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ABSTRACT

This study uses bibliometric analysis to examine the relationship between Digital Accessibility and Education. Two different search queries were applied using two keywords in the research process: (1) "Digital Accessibility" and (2) "Digital Accessibility" and Education. These searches were conducted in the Web of Science (WoS), Scopus, and ERIC databases. Searches cover all areas, languages and types of publications between 2013 and 2024. The initial search yielded 1,544 records for the keywords "Digital Accessibility" and "Digital Accessibility and 924 records for Education". The results from all three databases are filtered according to scientific studies published in the specified period to narrow down the data set. This research aims to contribute to the academic literature on Digital Accessibility and Education and provide a roadmap for future research, considering the critical effects of digital accessibility in education. Emphasizing the role of digital accessibility in education, this study also demonstrates the importance of increasing the quality and quantity of research in the field of digital accessibility. In this study, the data obtained using VOSviewer 1.6.20 software was visualized, and the trends in academic publications related to Digital Accessibility and Education were analyzed. In addition, scientific trends, academic collaborations and global contributions to Digital Accessibility and Education have been examined. This study aims to identify gaps in training related to digital accessibility and provide a roadmap for future research.

INTRODUCTION

The rapid development of information and communication technologies (ICT) does not go unnoticed in the lives of people and society. Digitization in many areas of the economy and efficient use of information resources in this direction occupy a decisive place in the application of innovations. The role and importance of the digital infrastructure and the corresponding digital content in the lives of all the world's citizens is in sight. Digital infrastructure means network equipment, technical infrastructure and software complex used by both the provider and the consumer of digital information services. Digital content includes any information suitable for human-oriented presentation, with or without software, stored in digital form on an electronic carrier. The continuity and continuous expansion of the digitization process requires people to become participants in this process, either voluntarily or involuntarily. Among the participants are those who need special care, as well as representatives of the older generation, who in one way or another are deprived of the opportunities to use the digital infrastructure at an appropriate level.

Studying the effect of digitization on the sphere of education, as well as on all areas of society, is of great relevance in modern times. Issues related to "digital accessibility" are brought to the fore in the scientific research conducted around the world on this issue. In recent years, the number of studies on "digital accessibility", its nature and its contribution to distance education has been increasing in scientific publications.

The term "digital accessibility" is more commonly used in the context of access to information technology (IT) services for all members of society. This concept expresses a broad content and essence: providing physical access to all computer systems, it also includes features of users with different needs. The concept aims to create and use the content of IT products and services in an inclusive manner so that every member of society does not feel left out. "Digital accessibility" also refers to the universality associated with creating websites and digital services that can be accessed and used by people with different abilities on different devices and in different environments.

The basis of the concept is consideration of the needs of users with physical or mental disabilities, language barriers, creation of intuitive interfaces convenient for users of different categories, provision of appropriate educational materials for the purpose of increasing computer literacy, preparation of text, visual and audio resources that are easy to be understood by different users, as well as It aims to create equal opportunities for all citizens in education, employment and information exchange by developing broadband Internet access, educational programs and user-friendly interfaces, and ensuring privacy and security when working with information.

It should be noted that since the 1980s, mainly in Western countries, the number of digital services began to increase because of the expansion of the visual and also functional capabilities of the Internet, such as interactive elements, podcasts, audio and videos. The rapid provision of access to information on the Internet in terms of time and space and, starting from the 2000s, with the increase in the number of Internet users, the transition to the online execution of services was directed towards development as one of the broad manifestations of digitalization. The field of education in the digital society acquired qualitatively new characteristics with the dynamism of information exchange and the unique features of the online environment. During the recent years, during the COVID-19 pandemic, which shook the whole world, the application of certain restrictions arising from the requirements of the quarantine regime led to the strengthening of virtual communication in social networks and messengers not only among young people, but also among the middle and elderly generation, and the expansion of rapid communication activities in the virtual space.

Today, labor activity, education, medical and social services, necessary services in the household sphere, etc. social and economic activities such as social and economic activities in many cases exist in digital form or even only in digital form. Among the assessment models of this integration, it is necessary to have an individual integration model for the development of human resources and enterprises (Ifenthaler et al., 2021). In an era where human and business relationships are evolving and existing businesses are undergoing fundamental transformative changes to compete with smaller, "lighter" and more agile companies that can quickly maneuver to meet changing consumer demands" (Skinner, 2018), the next generation of humanity during its evolution, a visionary road map is proposed for the establishment of activity in the financial world. Here, the issue of digital man meeting the requirements of our time is connected with his comprehensive development.

Digital integration is important not only for communication and management, but also for the learning and teaching process. The integration of ICT into all aspects of educational activity creates new opportunities for educational institutions and teachers to improve the educational process and enrich the learning experience. In this process, taking into account the needs and learning speed of each student, as well as the teacher (Aliyeva et al., 2023), and creating various online courses and virtual databases that help to learn the educational material more effectively, as well as more convenient broadband access to information, which is technically the most valuable resource, and extension makes education more globally accessible, in other words, it provides distance learning from anywhere in the world. From this point of view, the difficulties arising in the teaching and learning process are determined by the provision of digital accessibility in one form or another. The purpose of conducting this research is to reveal the needs of conducting new research to fill the identified gaps in the field of education related to digital accessibility in the direction of regulating the physical, communicative, instrumental, methodical and behavioral dimensions and thereby predicting future research.

Purpose of the Research

To contribute to the literature and guide future investigations, the scholarly landscape focuses on bibliometric analysis concerning Digital Accessibility in Education within the existing literature. Given the profound impact of Digital Accessibility, enhancing the quality and quantity of research in this domain is paramount. In pursuit of this objective, this study delineates trends in academic articles on Digital Accessibility in Education, aiming to provide a roadmap for future research endeavors.

In alignment with the research objectives, the study addresses the following inquiries.

1. What is the annual distribution of academic publications on digital accessibility between 2013 and 2024?
2. What is the distribution of academic articles on Digital Accessibility in Education by year?
3. How does type distribute academic studies on Digital Accessibility in Education?
4. How does the research area distribute academic studies on Digital Accessibility in Education?
5. How does language distribute academic publications on Digital Accessibility in Education?
6. How do studies on Digital Accessibility in Education vary across various educational levels (e.g., primary, secondary, higher education, lifelong learning)
7. Which countries and regions have produced the most publications on Digital Accessibility in Education?
8. How are citation relationships on Digital Accessibility in Education distributed among documents in the Web of Science (WoS) database?
9. How are citation relationships among authors in the academic literature on digital accessibility in education distributed in the Web of Science (WoS) database?
10. How are citation relationships between countries in the field of Digital Accessibility in Education distributed in the Web of Science (WoS) database?

METHOD

The research was conducted using the bibliometric analysis method.

Bibliometric analysis uses statistical methods to identify qualitative and quantitative changes in a particular scientific research topic, create a general profile of publications on the subject, and determine trends in a discipline (De Bakker et al., 2005). This method analyses bibliometric indicators such as references, publication years, publication type, research areas, publication languages, education level, and country regions.

The database for the research process was obtained from the WoS, Scopus and Eric platforms and was selected as a result of filtering operations according to the following criteria (fig. 1):

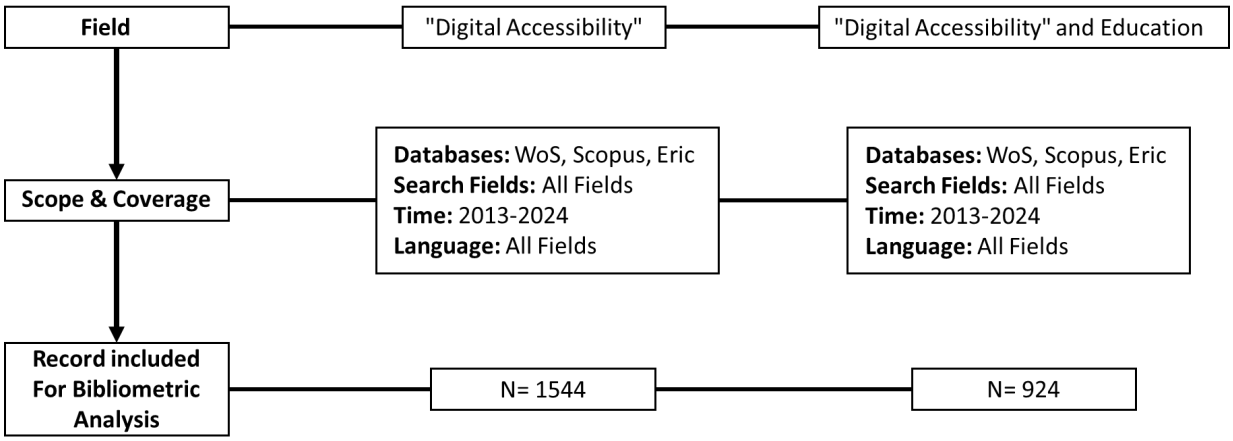

Figure 1. Flow diagram of the search strategy

The bibliometric analysis process for research on "Digital Accessibility" and its relationship with education is summarized through a flowchart. In this study, two distinct search queries were employed:

(1) "Digital Accessibility" and (2) "Digital Accessibility" AND Education.

These searches were conducted across three major academic databases—Web of Science (WoS), Scopus, and ERIC—covering all fields, languages, and publications from 2013 to 2024.

The initial search retrieved 1,544 records for the keyword "Digital Accessibility" and 924 records when combined with "Education." To refine the dataset, the results from all three databases were filtered to include scientific studies published in all languages within the specified period. For data analysis and visualization, VOSviewer 1.6.20 software was utilized.

The study aims to identify patterns in the development of existing scientific research, assess the effectiveness of academic collaboration, and examine the significance of author citations, published works, and journals. Additionally, it seeks to analyze contributions from authors across different countries, thereby providing insights into the global research landscape on digital accessibility and its educational implications.

FINDINGS

Academic Publications on Digital Accessibility

Analyzing academic publications on Digital Accessibility is important to understand the evolution of this field in education and technology. In the last decade, integrating digital technologies into education has emphasized the need for accessible learning environments, and academic interest has increased. This study aims to reveal trends, growth and shifts in scholarly attention by examining the annual distribution of digital accessibility publications between 2013 and 2024. Analyzing the number of publications will help identify the pace of research development and important trends, contributing to an in-depth understanding of the evolution of digital accessibility research and its impact on educational practice.

Table 1 shows the distribution of academic publications on "Digital Accessibility" by year between 2013 and 2024. The study includes data from Web of Science (WoS), Scopus and Eric databases and presents the total number of articles annually.

Table 1. Year-by-year distribution of academic publications on digital accessibility between 2013-2024

Publication Years	Databases			Total
	WoS	Scopus	Eric	
2024	85	400	17	502
2023	48	252	6	306
2022	41	155	5	201
2021	35	108	3	146
2020	28	91	2	121
2019	18	57	2	77

2018	17	47	1	65
2017	10	36	0	46
2016	6	20	1	27
2015	9	16	0	25
2014	6	10	0	16
2013	5	7	0	12
Total	**308**	**1199**	**37**	**1544**

There has been a significant increase in the number of academic publications in digital accessibility over the years. From 12 publications in 2013, the number reached 502 by 2024, showing a remarkable increase. Starting in 2020, in the post-pandemic period, studies in this field are increasing rapidly. This increase indicates that digital accessibility is becoming increasingly essential and attracting academic attention.

When the distribution of academic publications according to databases is analyzed, it is seen that the highest number of studies on digital accessibility are included in the Scopus database. Scopus, which hosts 1199 publications, contains a large part of the academic production in this field. The Web of Science (WoS) database ranks second with 308 publications, while the Eric database contributes the least with 37 publications. This shows that digital accessibility is mainly addressed from technical and multidisciplinary perspectives, while education-oriented studies are relatively limited.

The year with the highest number of publications on digital accessibility is 2024, with 502 articles. Three hundred six articles were published in 2023 and two hundred one in 2022, and these years also stand out for their high number of publications. These data show that digital accessibility attracts increasing academic interest and has become one of today's essential research areas. The significant number of publications, especially in recent years, reveals that the topic is discussed more in scientific circles, and research is intensifying.

Academic Publications on Digital Accessibility in Education

The annual distribution of academic articles on Digital Accessibility in Education shows this field's evolution and growing importance. By identifying the number of publications, trends, periods of growth and key years of increase in research, the impact of global initiatives, developments in educational technology and policy changes can be examined. In recent years, with increasing pressures on inclusive education and equitable access to digital resources, tools and methodologies have been developed that increase accessibility in digital learning environments. This breakdown contributes to understanding the ongoing importance of this field by presenting shifts in research focus and insights into the inclusion of students with disabilities on digital platforms.

An analysis of the distribution of publications on “Digital Accessibility in Education” in academic databases over the years reveals a significant upward trend. In 2024, 339 articles were published, marking the highest number. In 2023, 200 articles were published, while 128 articles were recorded in 2022, demonstrating a notable increase, particularly since 2019 (Table 2).

Table 2. Year-by-year distribution of academic articles on Digital Accessibility in Education

Publication Years	**Databases**			**Total**
	WoS	**Scopus**	**Eric**	
2024	34	292	13	339
2023	19	176	5	200
2022	16	107	5	128
2021	11	68	2	81
2020	9	43	2	54
2019	9	34	1	44
2018	5	26	0	31
2017	1	15	0	16
2016	1	11	1	13
2015	4	5	0	9
2014	3	2	0	5
2013	1	3	0	4
Total	**113**	**782**	**29**	**924**

This upward trajectory indicates the growing significance of Digital Accessibility in Education and the increasing academic focus. Before 2018, the number of publications remained relatively low, suggesting that digital accessibility had not yet emerged as a widely studied topic in educational research. However, a sharp rise in publications began in 2019 and has continued to increase annually. This trend reflects the broader impact of digital transformation on accessibility in education and the heightened academic awareness of the issue, particularly in the post-pandemic period.

Types of Academic Publication in Digital Accessibility in Education

The distribution of academic studies in the field of Digital Accessibility in Education reflects a variety of research approaches addressing challenges and opportunities in integrating accessibility into educational contexts. Empirical studies assess the impact of digital tools, while theoretical studies aim to develop new models. Literature reviews present trends and research gaps, while case studies provide examples of successful implementation. Conceptual papers offer innovative ideas about future directions. The distribution of these study types contributes to understanding the field's research priorities and emerging trends.

Analyzing academic publications on Digital Accessibility and Education shows that these fields are increasingly gaining ground in the scholarly literature. According to the analyzed data, 961 academic publications were identified. Most of these publications are in the Scopus database (782), with a more limited number in the Web of Science (WoS) database (122) and the Eric database (57). The fact that Scopus has a broad coverage of journal and conference publications is one of the main reasons for this distribution (Table 3).

Table 3. Distribution of academic studies published in Digital Accessibility in Education by types

Publication Type	Databases			Total
	WoS	Scopus	Eric	
Journal Articles	68	376	24	468
Conference Paper	40	232	2	274
Dissertation Thesis	0	0	3	3
Review	3	40	0	43
Book Chapter	2	103	0	105
Book	0	21	0	21
Editorial	1	4	0	5
Reports – Research	0	0	20	20
Reports – Descriptive	0	0	4	4
Information Analyses	0	0	3	3
Early Access	5	0	0	5
Other	3	6	1	10
Total	**122**	**782**	**57**	**961**

In terms of publication types, the most preferred type is journal articles. With 468 articles, this type reveals that academic studies in digital accessibility are primarily published in refereed journals. Conference papers, with 274 publications, ranked second with 274 publications, enabling academic research to be presented and discussed in a conference setting. Book chapters with 105 publications follow this, and articles with 43 publications are reviewed.

When the distribution of publication types according to databases is analyzed, it is seen that most article publications are in Scopus (376), followed by WoS (68) and Eric (24) databases. Similarly, in terms of conference proceedings, Scopus has the highest number (232), with a more limited contribution from WoS (40) and Eric (2). Book chapters are found mainly in Scopus (103), with only two in WoS. Review articles are primarily published in Scopus (40) and, to a limited extent, in WoS (3).

Research Areas Published in Digital Accessibility in Education

Academic work on Digital Accessibility in Education spans various research areas, including technology design, pedagogy, policy development, user experience and inclusive education. Studies often examine the accessibility of digital platforms, tools and content for students with disabilities, focusing on making these resources more equitable and effective. They also address the integration of adaptive learning technologies, digital accessibility standards and universal design principles. Social and cultural aspects of the digital divide and socio-economic factors are also explored. Analyzing this distribution helps to identify key trends in digital accessibility development.

The dataset comprises 2,258 publications, highlighting the diverse academic engagement with Digital Accessibility and Education. Most of these publications are indexed in the Scopus database (2,040), followed by 163 publications in the Web of Science (WoS) and 55 in ERIC. This distribution can be attributed to Scopus' broader coverage of journal articles and conference proceedings (Table 4).

Table 4. Distribution of academic studies on Digital Accessibility in Education according to research areas

Research Areas	Databases			Total
	WoS	Scopus	Eric	
Digital Accessibility and Inclusion	0	428	10	438
Education, Higher Education and Social Sciences	57	315	13	385
E-Learning and Distance Education	0	191	10	201
Computer Science and Engineering Sciences	70	270	0	340
Digital Transformation and Technology	0	140	8	148
Teaching Methods and Pedagogy	0	125	0	125
Training Materials and Resources	0	87	0	87
Students and Academics	0	142	0	142
Art, Global and Socio-Cultural Issues	4	49	9	62
Research and Publishing	0	58	0	58
COVID-19 and Infectious Diseases	0	147	5	152
Environment, Geography and Economy	15	21	0	36
Health and Biological Sciences	17	21	0	38
Social Behavioral Sciences and Psychology	0	28	0	28
Other	0	18	0	18
Total	**163**	**2040**	**55**	**2258**

Research on Digital Accessibility and Education spans 15 distinct research areas. The highest concentration of publications is observed in "Digital Accessibility and Inclusion" (438), followed by "Education, Higher Education, and Social Sciences" (385) and "Computer Science and Engineering Sciences" (340).

In early research, the organization of a new urban hierarchy that revealed the periphery model in Europe due to the extensive development of ICT within the digital economy (Tranos et al., 2013), the digital exclusion within a densely populated city (Bunyan et al., 2013) where access is less likely to be a barrier for users, and safer walking technologies and monitoring in the treatment of dementia some ethical problems and methodological obstacles (Altendorf et al., 2015) that arise when testing and using their devices are considered. Later, several studies developed a model for providing digital accessibility in higher education in response to the complaints of students with disabilities (Sieben-Schneider et al., 2016), solving software accessibility problems in software engineering (Silva et al., 2016), and five levels of digital to identify factors associated with the digital exclusion of people with neurodevelopmental disorders. Building an accessibility pyramid (Normand et al., 2016), identifying the various barriers faced by researchers and educators with disabilities or chronic health conditions (RWD) in the academic environment, as well as the requirements for an inclusive ICT environment (Darvishy, 2017) to overcome these barriers.

These studies also focus on the importance of making beneficial changes to improve transportation services (Ringenson et al., 2018), studying the impact of digital accessibility on assistive technology users (Draffan et al., 2018), and exploring the usability and accessibility perspectives of library metadata by identifying the search problems of users with print disabilities (Beyene et al., 2018).

The state of digital accessibility in India (Kulkarni, 2019), despite efforts to promote accessible design, aims to identify gaps in the knowledge necessary to develop accessible products, helping local and global developer communities throughout the process of creating accessible user interfaces (UI) targeting multiple emerging platforms. Research on a carrier model-based approach (Bouraoui et al., 2019) and the provision of existing training and courses (Rajsp et al., 2019) identified for mastering the digital accessibility discipline is of great interest.

From the lack of infrastructure particularly vulnerable to digital deprivation in Poland due to the COVID-19 pandemic (Kuc-Czarnecka, 2020), the impact of recent changes in the regulation of digital services on vulnerable people in the UK (Lewthwaite et al., 2020), the role of librarians in making e-resources more accessible to users with disabilities (O'Reilly, 2020) and specially designed for disabled people addressing accessibility issues in the early stages of software development (Pellegrini et al., 2020) is discussed.

It is evident from the high number of publications, especially in digital accessibility and inclusion, that digital accessibility is recognized as an important issue in the academic world and is increasingly being addressed. Digital accessibility studies in education emphasize the growing importance of accessibility in education. Research from a technical perspective allows digital accessibility to be examined from an engineering and computer science perspective. In addition, the growing importance of digital accessibility in distance education and during the COVID-19 pandemic is also highlighted in the publications. The table also includes research in various research areas, such as digital transformation, teaching methods, and educational materials, demonstrating the impact of digital accessibility in different disciplines.

Languages of Publications in Digital Accessibility in Education

The distribution of academic publications on digital accessibility in education by language reflects the global reach and inclusiveness of research in this area. While English is the dominant language in international journals and conferences, publications in other languages highlight regional efforts and local policy developments. The linguistic diversity of publications shows how digital accessibility issues are addressed in different geographical and cultural contexts. Analyzing this distribution helps us understand how digital accessibility challenges and solutions are framed in different education systems and reveals the impact of linguistic barriers or opportunities.

Table 5 presents the distribution of academic publications in Digital Accessibility and Education by language and an analysis of their number in different databases (Web of Science - WoS, Scopus, Eric). There are 924 publications reflecting the diversity of academic work in different languages.

Table 5. Distribution of academic publications on Digital Accessibility in Education according to their languages

Publication Languages	Databases			Total
	WoS	Scopus	Eric	
English	104	740	29	873
Portuguese	5	12	0	17
Spanish	3	17	0	20
Russian	1	7	0	8
Turkish	0	2	0	2
German	0	2	0	2
Korean	0	1	0	1
Chinese	0	1	0	1
Total	**113**	**782**	**29**	**924**

Most publications are in the Scopus database (782), followed by WoS (113) and Eric (29). This distribution can be attributed to Scopus covering a broader range of journal and conference publications. In terms of language distribution, English is the most common language used in academic publications, with a total of 873 publications in this language. There are 740 publications in English in Scopus, 104 in WoS and 29 in Eric.

Among other languages, Portuguese ranks second with 17 publications and Spanish third with 20. Russia ranks fourth with eight publications. Turkish and German are in fifth place with two publications each. Korean and Chinese are among the least used languages, with one publication each, and these publications are only included in the Scopus database. This linguistic distribution reveals that English is the dominant universal language for academic publications, with relatively fewer publications in other languages.

Distribution of Educational Levels of Digital Accessibility in Education Publications

The variation of studies on Digital Accessibility in Education at different educational levels (primary, secondary, higher education, lifelong learning) offers valuable insights into how digital accessibility challenges and solutions should be adapted to the specific needs of student populations. Primary and secondary education research emphasizes the basic skills required for students with disabilities, while higher education studies address more complex issues. Lifelong learning reflects the importance of accessible learning environments for adult learners. This analysis helps us better understand the role of digital accessibility in education.

Table 6 presents the distribution of academic publications by educational level and an analysis of their number in different databases (Web of Science - WoS, Scopus, Eric). There are 694 publications, which shows the diversity of academic work done at various educational levels. Many publications are in the Scopus database (586), followed by WoS (68) and Eric (40). This distribution can be attributed to Scopus covering a broader range of journal and conference publications. In terms of educational levels, the highest number of publications were made in “Higher Education” (469) and “High School” (73). The number of publications at other education levels remains relatively low. Higher education is the education level with the highest number of publications, with 469 publications in total.

Table 6. Distribution of academic publications on Digital Accessibility in Education according to education levels

Education Level	Databases			Total
	WoS	Scopus	Eric	
Higher Education	50	402	17	469
Postsecondary Education	4	65	17	86
Elementary Secondary Education	0	0	2	2
Adult Education	7	18	1	26
High Schools	6	66	1	73
Secondary Education	1	35	1	37
Two Year Colleges	0	0	1	1
Total	**68**	**586**	**40**	**694**

There are 402 publications in Scopus, 50 in WoS and 17 in Eric. At the high school level, there are 73 publications, 66 in Scopus, 6 in WoS and 1 in Eric. There are only two publications at the primary and secondary levels, both in the Eric database. At the adult education level, there are 26 publications, 18 in Scopus, 7 in WoS and 1 in Eric. There are 86 publications at the level of post-secondary education, 65 of which are in Scopus, 4 in WoS and 17 in Eric. At the secondary education level, there are 37 publications, 35 of which are in Scopus, 1 in WoS and 1 in Eric.

At the level of two-year colleges, only one publication has been made, and this publication is in the Eric database. This distribution shows that higher education dominates academic publications, while the number of publications at other education levels remains relatively low.

Digital Accessibility in Education Publications Countries and Regions Distribution

The academic contributions of countries and regions on Digital Accessibility in Education vary significantly in the research volume and the development of global inclusive education practices. Different socio-economic contexts, education systems, and technological infrastructures influence the study of digital accessibility. While developed countries are leading the field with strong education policies and advanced technological infrastructures, developing regions are increasingly contributing, presenting context-specific challenges and opportunities.

Table 7 provides a detailed breakdown of academic publications by country and region and their numbers in different databases (Web of Science - WoS, Scopus, Eric). One thousand one hundred sixty-nine publications show the diversity of academic work from different countries and regions. Most publications are in the Scopus database (988), with 164 in WoS and 17 in Eric. This may be explained by the fact that Scopus covers a broader range of journal and conference publications. In terms of country and region distribution, most of the publications are from countries such as the USA (236), the UK (104) and Spain (74). The number of publications from other countries and regions is significantly lower compared to the first three countries.

Table 7: Distribution of academic publications on Digital Accessibility in Education by country and region

Countries-Regions	Databases			Total	Countries-Regions	Databases			Total
	WoS	Scopus	Eric			WoS	Scopus	Eric	
Usa	15	218	3	236	Saudi Arabia	3	9	0	12
Uk-England	16	86	2	104	Qatar	3	8	0	11
Spain	12	61	1	74	Russia	2	9	0	11
Germany	12	33	1	46	France	1	10	0	11
India	4	38	2	44	Tunisia	3	7	0	10
Brazil	11	29	0	40	Sweden	2	8	0	10
Norway	9	24	0	33	South Africa	0	9	0	9
China	5	25	0	30	Uae	1	8	0	9
Portugal	2	28	0	30	Ukraine	1	7	0	8
Canada	2	26	0	28	Egypt	2	5	0	7
Australia	1	23	0	24	Austria	0	7	0	7

Bulgaria	6	14	0	20	Romania	1	6	0	7
Malaysia	3	16	1	20	Latvia	1	6	0	7
Italy	2	16	0	18	Belgium	0	6	0	6
Indonesia	0	18	0	18	Peru	1	5	0	6
Poland	4	13	0	17	Pakistan	1	5	0	6
Greece	2	13	0	15	Cyprus	1	5	0	6
Finland	2	13	0	15	Chile	2	3	0	5
Switzerland	4	10	0	14	Mexico	0	5	0	5
South Korea	3	11	0	14	Israel	0	5	0	5
Turkiye	1	11	2	14	Bolivia	2	2	0	4
Ireland	3	10	0	13	Other	15	86	5	106
Colombia	3	10	0	13	Undefined	0	21	0	21
Total	**WoS**		**Scopus**		**Eric**	**Overall Total**			
	164		**988**		**17**	**1169**			

The USA is the country with the highest number of publications, with a total of 236 publications. Two hundred eighteen publications are in Scopus, 15 in WoS and 3 in Eric. The UK ranks second with 104 publications, 86 in Scopus, 10 in WoS and 2 in Eric. Spain ranks third with 74 publications, 61 in Scopus, 12 in WoS and 1 in Eric. Other countries include Germany, India, Brazil, Norway, Norway, China, Portugal, Canada, Australia, and many others. However, the number of publications from these countries is lower than in the USA, UK and Spain. The table also includes 106 publications under the category "Other", which includes publications that cannot be attributed to a specific country or region. In addition, 21 publications under the "Undefined" category represent publications for which no country or region information is provided. This distribution shows that academic publications are primarily concentrated in specific countries and that some publications are published without providing country information.

Studies published post-2020 include developing digital accessibility management mechanisms (Pellegrini et al., 2020), exploring the unprecedented volunteer-led disability support network emerging in response to COVID-19 (Lazar, 2021), student-accessible and inclusive digital in higher education, improving faculty competence in providing learning materials and environments (Dai, 2022) and building accessible environments and systems and creating improved research methodology for people with disabilities in the interdisciplinary research project "Digital Accessibility for People with Special Needs: Methodology, Conceptual Models, and Innovative Ecosystems" (Bong, 2021) are addressed.

These studies include making cities accessible and inclusive for everyone, especially the most vulnerable, to overcome the digital divide created during the transition to digital city management, improving the experiences of people with disabilities regarding digital inclusion and access to essential urban services (Noev et al., 2021) and protecting the world cultural heritage. The development of a new Historical Geographical Information System specifically developed in Scotland (NL) to facilitate dynamic heritage management and the provision of digital accessibility (Kolotouchkina et al., 2022) and the mapping of digital opportunities applicable to the education sector (Van Lanen et al., 2022) are also extensively covered.

Citation Relationship with Documents in the Web of Science (WoS) Database

The distribution of citation relationships in the Web of Science (WoS) database provides important insights into the intellectual structure and impact of research in Digital Accessibility in Education. Citation analysis is critical for highlighting key studies and examining connections and collaboration between research. This analysis helps identify influential works, trends, and growing interest in digital accessibility. Studying citation patterns is important to understanding the diffusion and evolution of knowledge in the field.

Figure 2 and Table 8 present the distribution of citation relationships between academic documents in Digital Accessibility and Education. The analysis reveals several important observations. First, highly cited documents are noteworthy. “Gorriz (2023)” has the highest number of citations in the list, with 74 citations, indicating that the document is an important reference source in the field. In addition, “Kuc-Czarnecka (2020)” and “Bong (2024)” received 40 and 33 citations, respectively, indicating that these studies constitute other important contributions to the field.

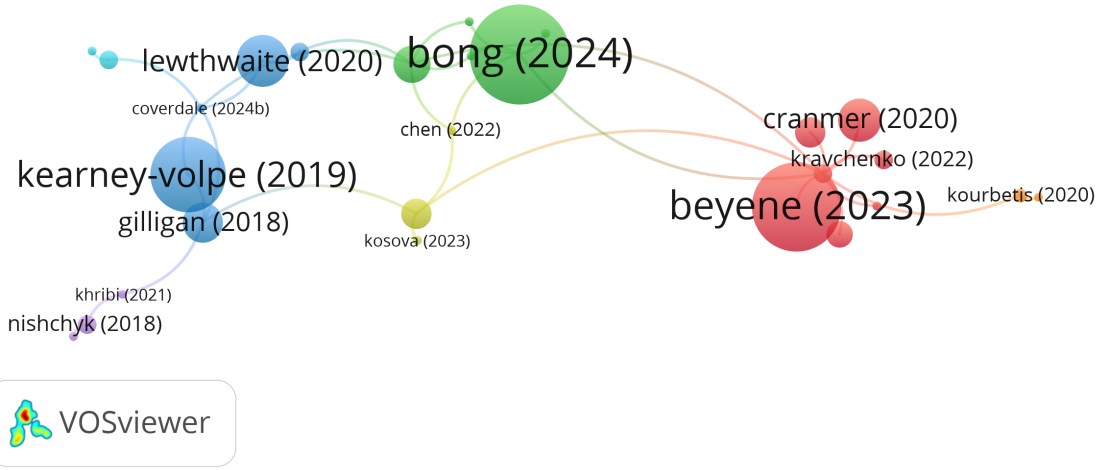

Figure 2. Network visualization for the citation relationship with documents in the Web of Science (WoS) Database

Table 8. The ratio of references for some documents

Documents	Citations	Total Link Strength
geniz (2023)	74	1
kuc-czarnecka (2020)	40	0
bong (2024)	33	5
beyene (2023)	28	1
dai (2022)	25	0
wong-lo (2014)	23	0
kearney-volpe (2019)	22	2
alcaraz martinez (2022)	18	0
bunyan (2013)	15	0
gaber (2020)	15	0
lewthwaite (2020)	13	2
cranmer (2020)	10	1
gilligan (2018)	9	4
costa (2019)	9	0
othman (2023)	9	0
sanderson (2022)	8	6
patel (2022)	8	0
gilligan (2020)	6	4
kaarakainen (2023)	6	1
sieben-schneider (2016)	6	0
piedad gasca-hurtado (2021)	6	0

The considerable variation in the number of citations shows that, as is typical of the literature, some are highly cited, while others have lower citation counts. Looking at the distribution of links, the "Links" column indicates the number of links where each document is potentially cited or co-cited with other documents in the list. In particular, the documents "Bong (2024)" and "Sanderson (2022)" have 5 and 6 links, respectively, indicating that these documents are firmly integrated into the research network in the field. On the other hand, many documents have only 0 or 1 link, indicating that their interactions in the field are more limited.

Authors Citation Relationship in Web of Science (WoS) Database

The distribution of citation relationships among authors on Digital Accessibility in Education in the Web of Science (WoS) database provides valuable insights into the research's collaborative nature and intellectual structure. This analysis reveals the authors'

contributions to digital accessibility and the connections between their works. By examining citation relationships, central figures in the field, patterns of co-authorship and co-citation can be identified, understanding how ideas spread across different academics and institutions. The citation network highlights the most influential authors in digital accessibility. It shows the diversity of academic collaboration and perspectives, thus providing an in-depth understanding of the dynamics of knowledge exchange.

When Figure 3 and Table 9 are examined, if we examine the distribution of citation relationships between authors in the academic literature in the field of Digital Accessibility in Education based on the studies in the Web of Science (WoS) database, several important points draw attention. First, the citation distribution is quite uneven.

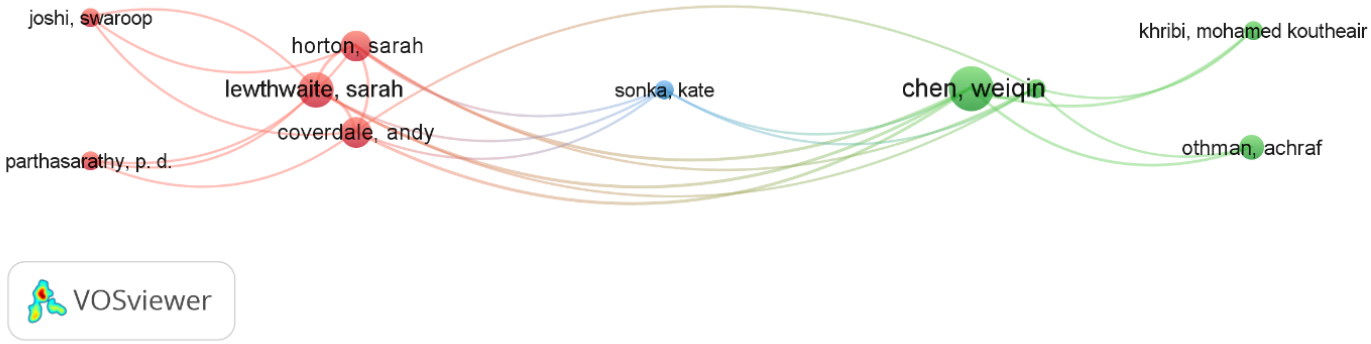

Figure 3. Network visualization for author citation relationships in Web of Science (WoS) Database

Table 9. The ratio of references for some author

Author	Documents	Citations	Total Link Strength
chen, weiqin	7	58	16
sonka, kate	2	22	5
alcaraz martinez, ruben	2	18	0
turro, mireia ribera	2	18	0
lewthwaite, sarah	5	17	13
gilligan, john	2	15	8
othman, achraf	3	13	3
jemni, mohamed	2	6	0
coverdale, andy	4	4	12
horton, sarah	4	4	12
khribi, mohamed koutheair	2	2	3
ribera turro, mireia	2	2	0
bogdanova, galina	3	1	0
darvishy, alireza	2	1	0
pierres, oriane	2	1	0
todorov, todor	3	1	0
todorova-ekmekci, mirena	2	1	0
joshi, swaroop	2	0	3
parthasarathy, p. d.	2	0	3
baumann. lukas	4	0	0

Chen Weiqin is the most cited author, with 58 citations, indicating that he is an influential and important researcher in the field. Sonka, Kate (22 citations), Alcaraz Martinez, Ruben and Turro, and Mireia Ribera (18 citations each) are authors who have made significant contributions after Chen but with lower citation numbers. It is also observed that many authors have low citation counts, and some authors have no citations at all. This indicates that the citation distribution in the field is very uneven, with few authors receiving most citations.

Although there is usually a correspondence between the number of publications and the number of citations, for example, Lewthwaite, Sarah has five publications but only 17 citations, suggesting that the quality and impact of publications, rather than their quantity, is an important determinant of success in citation counts.

The Total Link Strength column measures an author's connectedness to other authors in the network, with a higher number indicating more co-authorship or co-citation relationships. Chen, Weiqin stands out as the author with the highest number of links to other authors in the network, with a link strength of 16, while other authors such as Lewthwaite, Sarah (13), Coverdale, Andy (12) and Horton, Sarah (12) have similarly high link strengths, indicating that they interact more in the research network and collaborate more with other researchers. However, many authors remain isolated with low or zero link strengths, indicating less interactive or under-recognized work in the field.

Citation Relations with Countries in the Web of Science (WoS) Database

Based on studies in the Web of Science (WoS) database, the distribution of cross-national citation relationships in Digital Accessibility in Education provides important insights into global collaboration and knowledge exchange. Citation relationships highlight the connectivity of academic work across borders, revealing which nations are leading the field of digital accessibility and how research influences each other. By assessing the international reach and impact of key studies, this review helps to identify research hubs and understand the dynamics of collaboration. It also highlights the global nature of digital accessibility challenges and countries' roles in this field. The country-by-country citation analysis comprehensively reviews citations in 16 different countries. This analysis reveals the global impact of the digital accessibility discourse and the engagement of different countries in this area. In particular, the United States stands out as the most cited country, followed by England, Poland, Spain, Norway, Scotland, Colombia, Germany, Chile, Czech Republic, Czech Republic, Switzerland, Bolivia, Portugal, South Korea, Italy and China. This distribution reflects the diversity of international participation in contributing to and citing digital accessibility literature. Notably, while some countries have significant citations, this review also reveals a significant need for enhanced collaborative efforts.

When Figure 4 and Table 10 analyze the distribution of citation relationships between countries in the field of Digital Accessibility in Education, based on data from the Web of Science (WoS) database, several important observations stand out.

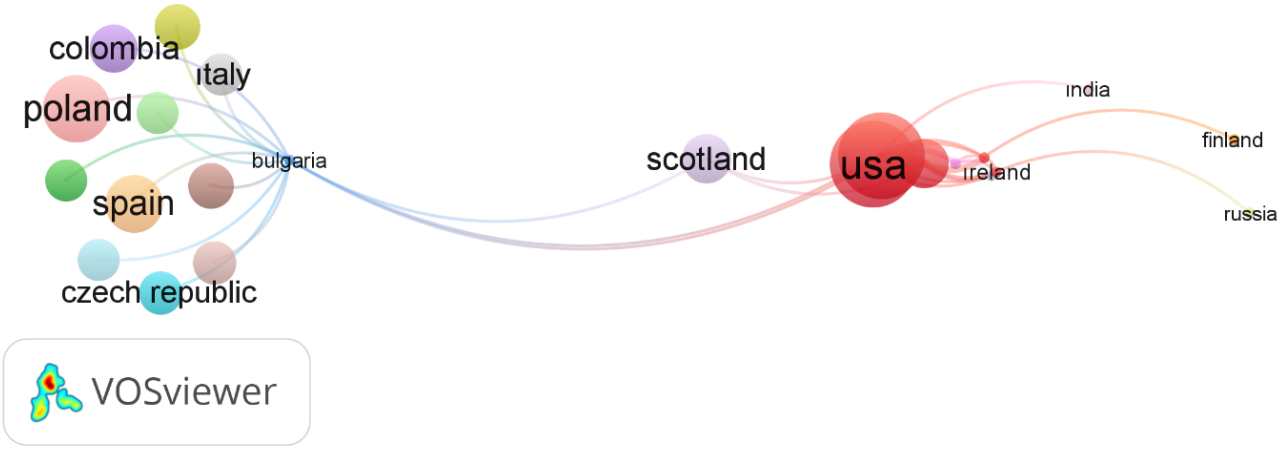

Figure 4. Network visualization for citation relationships with countries in the Web of Science (WoS) Database

Table 10. The ratio of references for some countries

Country	Documents	Citations	Total Link Strength
USA	15	156	9
England	16	155	11
Poland	4	120	1
Spain	12	101	1
Norway	9	86	15
Scotland	3	86	3
Colombia	3	85	1
Germany	12	81	1
Chile	2	80	1
Czech Republic	2	76	1
Switzerland	4	75	1
Bolivia	2	74	1
Portugal	2	74	1
South Korea	3	74	1
Italy	2	74	1
Chine	5	30	0

First, the USA and the UK are clearly at the forefront in both aspects (number of publications and citations). The USA is the most significant contributor in the field, with 15 publications and 156 citations, while the UK is close behind with 16 publications and 155 citations. This shows that these two countries are the largest and most influential research centres in Digital Accessibility in Education.

However, some countries show low citation numbers in proportion to their publication numbers. For example, Brazil received only 11 citations despite having 13 publications; this indicates that the impact of the publications may be variable. On the other hand, although Poland has only four publications, it has made a high impact by receiving 120 citations, which shows that the number of publications is not always directly proportional to the number of citations.

Regarding link strength (connection power), Norway stands out as the country with the strongest connections with 15 link strengths; he said this shows a strong connection with other countries regarding cooperation or common attribution relations. England is another country with high levels of cooperation and 11 link-power. Ireland and Brazil show moderate cooperation with eight link strengths. The fact that many countries have low link strength (1 or 0) suggests that these countries have more isolated research efforts.

DISCUSSIONS AND CONCLUSION

Thanks to the digitization of every area of the economy, technologies are increasingly entering human life. This comprehensive digitalization extends to education, where the infusion of digital technologies enhances the learning experience, fosters efficiency, and cultivates essential knowledge and skills crucial for navigating the digital age. An integral aspect of this development is the concept of "digital accessibility," which is pivotal in ensuring inclusivity. However, the amalgamation of digital tools into education encounters hurdles, particularly in issues related to accessibility for individuals with visual impairments.

Digital accessibility has become an important research topic in the academic world in recent years. When the annual distribution of scholarly publications on digital accessibility was examined between 2013-2024, it was observed that academic production in this field had significantly increased. Significantly, since 2020, research on digital accessibility in the post-pandemic period has been growing rapidly, and this increase has become one of the most prominent research areas today. Future research orientations highlight various challenges and opportunities in digital accessibility.

Bibliometric analysis shows that this increase observed in post-2020 publications can be explained by the impact of the global COVID-19 pandemic and demonstrates the ability of academic discourse to adapt to contemporary challenges. With the study from 2021-2024, we will continue; it is of great importance that the evolving landscape in the field of digital accessibility is studied more deeply, considering external factors such as global crises, technological developments and social changes.

In 2013, only 12 articles were published, while in 2024, this number reached 502'. This increase shows that digital accessibility is becoming increasingly essential and draws on academic interest.

When the distribution according to the databases is examined, it is seen that a large part of the studies on digital accessibility are in the Scopus database. Scopus has a broad scope of journal and conference publications, which is essential in explaining this distribution. Web of Science (WoS) and Eric databases are the second and third most significant sources of academic production in digital accessibility. However, it is seen that the subject of digital accessibility is addressed more from a technical and multidisciplinary perspective, while education-oriented studies remain relatively limited.

In the analysis of the types of academic publications, it was observed that the most preferred type was the articles. Although conference proceedings have an essential place, most of the studies on digital accessibility have been published in peer-reviewed journals. This shows that an environment enables a deeper exploration of digital accessibility and that a permanent accumulation of literature is formed in this field in academic circles. In particular, the increase in publications on Digital Accessibility and Education reveals that scholarly interest in this field has intensified daily. Two thousand twenty-four articles, published in 339, show that digital accessibility in education is becoming increasingly important and has vast repercussions in the academic world.

When we examine the relationship between Digital Accessibility and Education, it has been observed that the effect of digital transformation processes on accessibility in education has become more pronounced in the post-pandemic period. After 2019, publications in this field have shown a significant increase; he points out that digital transformation is reshaping the understanding of accessibility in education. Digital Accessibility in Education has begun to take an important place not only in academic circles but also at the practice and policy levels.

When we look at the linguistic distribution of publications, it is seen that English is the universal language of academic publications on digital accessibility. English publications are one of the most potent factors that enable research in this field to be disseminated internationally. Publications in other languages, while remaining relatively limited, indicate a global knowledge sharing and collaboration on digital accessibility.

The distribution of publications on Digital Accessibility and Education by country and region reveals that academic research is primarily concentrated in certain countries. The U. S., UK and Spain are the countries that have contributed the most to research in

the field of digital accessibility, and research in these countries shows that digital accessibility policies and practices have improved. The number of broadcasts from other countries remains lower than these three countries. Although some countries are ahead in broadcast volume, the cooperation between these countries is limited; this indicates that international networks need to be strengthened.

The growing number of academic publications on Digital Accessibility and Education suggests that this field is becoming increasingly important and an important research topic for understanding the implications of digital transformation in education. This increase shows that digital accessibility is not only a technical issue but also solidifies its place in academic literature as a field to provide inclusivity and equality in education. The effects of Digital Accessibility in Education will continue to take an important place in educational research, implementation, and policy development processes.

Analyses reveal that citation relationships and inter-author interactions in the academic literature on Digital Accessibility and Education are significantly diversified. First, looking at the overall structure of the literature, the large variety in citation numbers is noteworthy. Studies such as "Gorriz (2023)" and "Kuc-Czarnecka (2020)" appear to be among the essential references in the field. These high citation numbers suggest that relevant studies have become the cornerstones of the field and that this research should be studied. In addition, the difference in citation numbers indicates that the literature in the field offers a heterogeneous structure, and some documents have a more limited effect.

The link distribution reveals the level of interactions in the field. Documents with high link strengths have interacted more widely in research networks and have referenced other essential studies in the field. The high linking power of documents such as "Bong (2024)" and "Sanderson (2022)" suggests that these studies play a decisive role in the direction of research in Digital Accessibility and Education. However, many documents have only 0 or 1 link, indicating that these studies may have been more isolated or not yet sufficiently recognized.

Citation relationships among authors also reflect the dynamic nature of the literature. "Highly cited authors such as "Chen and Weiqin" have established an effective research network and developed collaborations with other researchers. However, it has been observed that many authors have low citation numbers, and even some authors have no citations at all. This suggests that the contributions of a small number of authors mainly shape research in Digital Accessibility in Education. Still, more interaction and collaboration are needed in the field.

When the citation relations between the countries are examined, it is understood that the United States and Britain have the most influence in the field. These countries stand out as centres of significant research in Digital Accessibility in Education. However, although some countries show low citation numbers, some countries, such as Poland, have been significantly impacted despite the low number of publications. This indicates that the number of publications is not always directly proportional to the number of citations and that the quality of research is one of the determining factors in the citation.

As a result, the citation distribution of academic studies in Digital Accessibility and Education shows that significant researchers and countries in the field firmly integrate into their research networks. However, authors with irregular citation numbers and low link strength find that this area still needs more interaction and collaboration. These findings suggest that broader cooperation and interaction in the field should be encouraged. In addition, more quality work and joint research are required for the field's future development. The lack of robust legal frameworks for digital accessibility makes it essential for future research to contribute to creating and supporting laws. From an educational point of view, issues such as increasing computer literacy and motivation for students with disabilities should be central themes of future research efforts.

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