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EDUCATION, PSYCHOLOGY
AND COUNSELLING
(IJEPC)**www.ijepe.com**RESEARCH TRENDS IN INSTRUCTIONAL TECHNOLOGY
FOR SPECIAL EDUCATIONAL NEEDS:
A GLOBAL BIBLIOMETRIC PERSPECTIVE**Nur Syifaa Mohd Nawi¹, Mahizer Hamzah^{2*}, Muhammad Ihsan Rokeman³¹ Department of Human Development, Universiti Pendidikan Sultan Idris, Malaysia
Email: p20231000029@siswa.upsi.edu.my² Department of Human Development, Universiti Pendidikan Sultan Idris, Malaysia
Email: mahizer@fpm.upsi.edu.my³ Department of Human Development, Universiti Pendidikan Sultan Idris, Malaysia
Email: ihsan@fpm.upsi.edu.my

* Corresponding Author

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This work is licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/)**Abstract:**

An advanced search strategy was executed, resulting in 1,261 documents for analysis. The methodology includes multiple stages: Scopus Analyser generated statistical distributions and graphical insights; OpenRefine was employed to clean, refine, and harmonise bibliographic data for precision; and VOSviewer software visualised co-authorship, keyword co-occurrence, and country collaboration networks. Hence, the results indicate an increasing trend in publications from 2015 to 2025, with significant peaks in 2022 and 2024, reflecting a growing global scholarly emphasis on technology-enhanced interventions for special needs learners. Computer Science and Social Sciences have emerged as the major disciplines, together representing more than fifty percent of total publications. The United Kingdom, the United States, Spain, and China were identified as the main contributors in terms of output and international collaboration. Keyword analysis revealed that “technology,” “special education,” “e-learning,” and “assistive technology” are central themes, with emerging clusters linked to artificial intelligence, immersive technologies, and universal design for learning. The current study helps to fill the gap in the body of knowledge, offering a thorough study of the trends in publications. Key contributors and thematic developments, thereby serving as a valuable resource for researchers, practitioners, and policymakers focused on advancing technology-driven special education needs.

Keywords:

Multimedia, Technology, Special Education, Instructional Technology, Assistive Technology, E-Learning, Autism

Introduction

Over the past decade, research on instructional technology for special educational needs (SEN) has seen significant growth and diversification. This trend is driven by the increasing recognition of the potential of technology to address the unique challenges faced by these students. Studies have shown that technology-supported learning, including augmented reality (AR), virtual reality (VR), and robot-assisted learning, has been particularly effective in improving communication and social skills among students with intellectual disabilities and autism (Kalemkuş, 2025). The research has been centered on the student population aged 5-25, although in recent years, the number of publications has significantly increased, which is why the increased interest and progress in the given field are highlighted (Kalemkuş, 2025).

Use of technology in special education has been used in various areas of learning and levels of education. Though researchers have adopted different learning devices and strategies, the majority still apply guided learning methods (Cheng & Lai, 2020). Touchscreen technology and digital resources have increasingly been utilized to develop dynamic and interactive learning environments, which can be used to meet the diverse needs of students with disabilities (Viner et al., 2021). However, the gap in the researches that completely cover all types of disabilities and all education levels remains enormous, and, therefore, more broad and inclusive researches are needed. (Checa-Domene et al., 2024).

New technologies such as augmented reality (AR) and virtual reality (VR) have demonstrated the possibility of the use of an immersive and adaptive learning experience that will contribute to the inclusion and academic success of students with learning disabilities (Odunga et al., 2025). These technologies introduce novel contexts of learning, and education becomes more friendly and entertaining. However, despite such positive outcomes, further research is required to enhance these technological tools and study their long-term impacts on academic outcomes (Mukhtarkyzy et al., 2025). Moreover, a hybrid of artificial intelligence (AI) and AR and VR can deliver personal and customized learning experiences, which are real-time and overcome the constraints of traditional education methods. (Barbu et al., 2025).

The assistive technologies (AT) have also played a significant role in supporting the students with special needs. It has been noted that the application of AT in the learning process can enhance the learning process and help with behavioral change (Emerling et al., 2021). However, these technologies rely on the access to the appropriate training and support of teachers and the development of the curriculum that incorporates such tools in the proper way to be operational (Viner et al., 2021). It has been established that preservice teachers can be equipped with competencies needed to create an inclusive learning environment by including AT in such models as the Technological Pedagogical and Content Knowledge (TPACK) model (Wang & Sitthiworachart, 2025). These developments have seen the obstacles of accessibility, usability, and the ongoing need of research and innovation to be highly significant when it

comes to the achievement of the full potential of the instructional technology to the student with SEN (Mukhtarkyzy et al., 2025) (Arias-Flores et al., 2025).

In summary, technology-enhanced learning for students with SEN has made significant strides over the past decade. The integration of diverse technologies and the focus on higher-order skills have transformed educational practices. However, challenges remain in addressing the needs of all SEN groups and ensuring effective long-term interventions. Continued research Instructional Technology For Special Educational Needs: A Global Bibliometric Perspective and development are essential to optimize technology use in special education and provide equitable learning opportunities for all students.

Research Question

RQ1 – What is the research trend of instructional technology for special educational needs according to the year of publications?

RQ2 - What are the popular subject areas related to the study and how much percentages are for each subject?

RQ3 – What are the top 10 countries based on the number of publications?

RQ4 - What are the popular keywords related to the study?

RQ5 – What is the co-authorship by countries collaboration?

Methodology

Bibliometrics refers to the systematic process of collecting, organizing, and analyzing bibliographic data derived from scientific publications (Alves et al., 2021; Assyakur & Rosa, 2022; Verbeek et al., 2002). While basic bibliometric indicators often focus on descriptive statistics such as the identification of publishing journals, publication years, and leading authors (Wu & Wu, 2017), more advanced approaches include sophisticated analytical techniques such as document co-citation analysis. A rigorous bibliometric study demands a careful, iterative process that begins with the selection of suitable keywords, followed by comprehensive literature searches and in-depth data analysis. Such a methodological approach ensures the development of a complete and reliable bibliography while also allowing for meaningful insights into the intellectual structure of the field (Fahimnia et al., 2015)

In this study, attention was given to high-impact publications, as they provide stronger theoretical grounding and deeper perspectives on the frameworks that influence the research domain. The Scopus database of Elsevier was selected as the primary source of bibliographic data to avoid any mistakes in the data since it is exhaustive and very credible (Al-Khoury et al., 2022; di Stefano et al., 2010; Khiste & Paithankar, 2017). Peer-reviewed journal articles were also used as inclusion criteria to guarantee the integrity of data, and all non-scholarly sources, including books, conference abstracts, and lecture notes, were excluded (Gu et al., 2019)

Moreover, the raw bibliographic data retrieved in Scopus was thoroughly cleaned with the OpenRefine. It was needed in the correction of the common data discrepancies including duplication of records, variations in the authors, changes in the institutional affiliation, and the variations in the use of keywords. OpenRefine enhanced the validity and consistency of the next bibliometric analysis, by standardizing and refining the data. The data set comprising of publications published within the period of the year 2015 to 2025 was then consolidated and was now prepared to undergo more analytic procedures.

Data Search

The bibliometric search strategy was well designed to ensure systematic and reproducible literature retrieval. Search string was carried out in the Scopus database, with attention paid to such areas as title, abstract, and keywords (TITLE -ABS-KEY). The last search string was the combination of the keywords such as multimedia, technology, and instructional technology with the prefix Autism as this way, only the articles that explicitly mentioned the collaboration between multimedia technologies and studies in the field of autism were retrieved. To sustain the quality and relevance of the dataset, filters reduced the results to English-language publications at the most recent publication stage, therefore, excluding works-in-progress, early-access articles, and non-peer-reviewed sources. This type of systematic process enabled establishing the relevant studies correctly and gave a clear view of the research directions within a period of several years and science disciplines.

The search in September 2025 resulted in 1,261 documents, which indicates the great amount of scholarly interest that has been paid to the issue of autism and multimedia-based learning instructional technologies. This dataset forms the empirical foundation of bibliometric inquiry, so that it is possible to analyse the dynamics of temporal publications, the most common authors, the most significant institutions, the most important thematic trends. Placing the dataset in a systematic search procedure guarantees reliability and transparency- conditions of strong bibliometric studies. In turn, the collected literature provides a rich platform to explain intellectual frameworks, identify new trends, and delimitate gaps in knowledge in the area of autism-friendly instructional technology and multimedia learning settings.

Table 1: The Search String

Scopus	TITLE-ABS-KEY ((multimedia OR technology* OR instructional technology) AND (autism* OR special need*) AND education*) AND PUBYEAR > 2014 AND PUBYEAR < 2026 AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (SUBJAREA , "SOC") OR LIMIT-TO (SUBJAREA , "COMP") OR LIMIT-TO (SUBJAREA , "MATH")) AND (LIMIT-TO (EXACTKEYWORD , "Special Education") OR LIMIT-TO (EXACTKEYWORD , "Inclusive Education") OR LIMIT-TO (EXACTKEYWORD , "Education") OR LIMIT-TO (EXACTKEYWORD , "Technology") OR LIMIT-TO (EXACTKEYWORD , "Assistive Technology") OR LIMIT-TO (EXACTKEYWORD , "Educational Technology") OR LIMIT-TO (EXACTKEYWORD , "E-learning") OR LIMIT-TO (EXACTKEYWORD , "Artificial Intelligence") OR LIMIT-TO (EXACTKEYWORD , "Autism") OR LIMIT-TO (EXACTKEYWORD , "Special Educational Needs") OR LIMIT-TO (EXACTKEYWORD , "Augmented Reality") OR LIMIT-TO (EXACTKEYWORD , "Autism Spectrum Disorder")) OR LIMIT-TO (
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EXACTKEYWORD , "Inclusion") OR LIMIT-TO (EXACTKEYWORD , "Virtual Reality") OR LIMIT-TO (EXACTKEYWORD , "Special Needs") OR LIMIT-TO (EXACTKEYWORD , "Special Needs Education") OR LIMIT-TO (EXACTKEYWORD , "Students With Disabilities") OR LIMIT-TO (EXACTKEYWORD , "Digital Technologies") OR LIMIT-TO (EXACTKEYWORD , "Autism Spectrum Disorders") OR LIMIT-TO (EXACTKEYWORD , "Students With Special Needs") OR LIMIT-TO (EXACTKEYWORD , "Education Computing") OR LIMIT-TO (EXACTKEYWORD , "Digital Technology") OR LIMIT-TO (EXACTKEYWORD , "Information Technology") OR LIMIT-TO (EXACTKEYWORD , "Information And Communication Technologies") OR LIMIT-TO (EXACTKEYWORD , "Computer Aided Instruction") OR LIMIT-TO (EXACTKEYWORD , "Learning Disabilities") OR LIMIT-TO (EXACTKEYWORD , "Internet Of Things") OR LIMIT-TO (EXACTKEYWORD , "Digital Literacy") OR LIMIT-TO (EXACTKEYWORD , "Ict") OR LIMIT-TO (EXACTKEYWORD , "Children With Autisms") OR LIMIT-TO (EXACTKEYWORD , "Assistive Technologies") OR LIMIT-TO (EXACTKEYWORD , "Autism Spectrum Disorder (asd)") OR LIMIT-TO (EXACTKEYWORD , "Personalized Learning") OR LIMIT-TO (EXACTKEYWORD , "Universal Design For Learning") OR LIMIT-TO (EXACTKEYWORD , "Special Education Needs") OR LIMIT-TO (EXACTKEYWORD , "Motivation") OR LIMIT-TO (EXACTKEYWORD , "Mobile Learning") OR LIMIT-TO (EXACTKEYWORD , "Educational Technologies") OR LIMIT-TO (EXACTKEYWORD , "Digital Competence") OR LIMIT-TO (EXACTKEYWORD , "Systematic Review") OR LIMIT-TO (EXACTKEYWORD , "Mobile Applications") OR LIMIT-TO (EXACTKEYWORD , "Technology-enhanced Learning") OR LIMIT-TO (EXACTKEYWORD , "Social Robots") OR LIMIT-TO (EXACTKEYWORD , "Mathematics Education") OR LIMIT-TO (EXACTKEYWORD , "Music Education") OR LIMIT-TO (EXACTKEYWORD , "Intellectual Disabilities") OR LIMIT-TO (EXACTKEYWORD , "Instructional Design") OR LIMIT-TO (EXACTKEYWORD , "Educational Robots") OR LIMIT-TO (EXACTKEYWORD , "Education Technology") OR LIMIT-TO (EXACTKEYWORD , "Digital Education") OR LIMIT-TO (EXACTKEYWORD , "Children With Disabilities") OR LIMIT-TO (EXACTKEYWORD , "Bibliometric

Analysis") OR LIMIT-TO (EXACTKEYWORD ,
"Educational Robotics") OR LIMIT-TO (EXACTKEYWORD , "Educational Innovations") OR
LIMIT-TO (EXACTKEYWORD , "Children With Special Needs") OR LIMIT-TO (EXACTKEYWORD , "Digital Competencies") OR LIMIT-TO (EXACTKEYWORD , "Big Data") OR LIMIT-TO (EXACTKEYWORD , "Bibliometric") OR LIMIT-TO (EXACTKEYWORD , "Augmentative And Alternative Communication") OR
LIMIT-TO (EXACTKEYWORD , "Artificial Intelligence Technologies") OR LIMIT-TO (EXACTKEYWORD , "Artificial Intelligence (ai)")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (PUBSTAGE , "final"))

Table 2: The Selection Criteria Is Searching

Criterion	Inclusion	Exclusion
Language	English	Non-English
Publication Stage	Final	In Press
Years	2015-2025	<2015

Data Analysis

VOSviewer is a bibliometric software that is easy to use and was created by Nees Jan van Eck and Ludo Waltman at Leiden University, the Netherlands (van Eck & Waltman, 2010, 2017). The tool is frequently used to visualise and analyse scientific literature, and it is specifically useful to create intuitive network visualisations, cluster related items, and create density maps. It is broad and enables the investigation of the networks of co-authorship, co-citation, and keyword co-occurrence, which will give a researcher a comprehensive overview of research landscapes. The dynamic updates and the interactive interface enable effective and dynamic exploration of large datasets. The opportunity to compute metrics, the possibility to customize visualisation, and the fact that VOSviewer can be combined with a vast amount of bibliometric data allow considering it as one of the significant sources that should be utilised by researchers who intend to obtain an idea of a complex research field.

One of the most striking features of VOSviewer is the possibility to convert rather complex bibliometric information into visually simple to comprehend maps and charts. The software is very effective in visualizing networks that group similar items, studying the pattern of co-occurrence of keywords and generating density maps. The fact that it has a convenient interface is helpful to the researcher because both the inexperienced and the experienced users are able to navigate research landscapes effectively. The creation of VOSviewer ensures that it remains at the forefront of bibliometric analysis by ensuring that it provides valuable information as computations of metrics and visualisations that are customisable. The ability to support

different kinds of bibliometric data such as co-authorship and citation networks renders VOSviewer a versatile and indispensable resource in the possession of researchers who must be able to understand their research field better and gain deeper insights into it.

The Plain Text files of the datasets on the publication year, title, author name, journal, citation, and keywords of the databases were obtained in the Scopus database of 1976 to the month of September 2025. They were subsequently analyzed using VOSviewer software 1.6.19. The software allowed the analysis and the construction of the visual representations by using VOS clustering and mapping. Presenting a variation of the multi-dimensional scaling (MDS) method, VOSviewer is focused on the placement of items into the low-dimensional space, therefore, ensuring that the proximity between any two items is reflecting the corresponding relatedness and similarity appropriately (van Eck & Waltman, 2010). VOSViewer in this aspect resembles a parallel with the Multi-Dimensional Scaling (MDS) method (Appio et al., 2014). As opposed to MDS, which mainly aims at computing similarity measures to, among others, the cosine and Jaccard indices, VOS uses a more suitable way of normalizing co-occurrence frequencies, which is association strength (AS_{ij}) as follows (Van Eck & Waltman, 2007):

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

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

Result And Discussion

RQ1 – What Is The Research Trend Of Instructional Technology For Special Educational Needs According To The Year Of Publications?

Documents by year

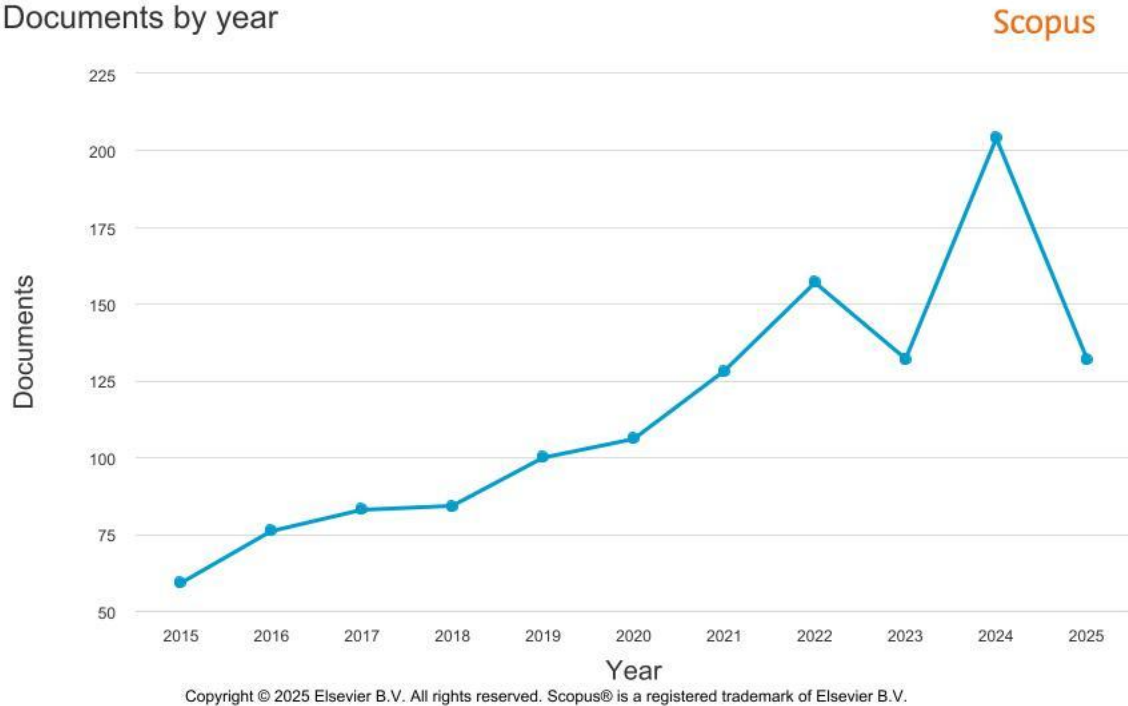


Figure 1: Trend Of Research On Instructional Technology For Special Educational Needs According To The Year Of Publication

Year	No of publication	Year	No of Publication
2025	132	2019	100
2024	204	2018	84
2023	132	2017	83
2022	157	2016	76
2021	128	2015	59
2020	106		

Between 2015 and 2025, there has been an increasing trend in academic publications that concentrate on instructional technology for students with special educational needs, with a significant acceleration emerging after 2018. The years 2015–2017 show limited outputs (59–83 publications), reflecting an emerging phase in which technology adoption in special education was under development. Starting in 2018, there was a significant increase in numbers, reflecting an increased integration of digital tools and an enhanced global recognition of the importance of inclusive education. The increase from 2018 to 2022, reaching a peak of 157 publications in 2022, aligns with the expansion of accessible technologies, augmented funding, and rising demand for remote or hybrid learning solutions due to the COVID-19 pandemic.

The data reveals two major peaks in scholarly engagement in 2024 (204) and 2025 (132), indicating the highest levels of the decade. The notable rise in 2024 can be attributed to post-pandemic reflections, the emergent of educational technology tools, and a policy-driven emphasis on equity and inclusion in education. The slight decrease in 2025, while still exceeding the majority of prior years, may indicate a normalisation of research activity or incomplete indexing for the current year. The trend indicates a transition from niche exploration to mainstream educational discourse, indicating that instructional technology has become crucial for meeting the diverse educational needs of students with disabilities. This trajectory contributes to the existing knowledge base by showing the rapid development of digital interventions and shaping future strategies for inclusive pedagogical practices.

RQ2 - What Are The Popular Subject Areas Related To The Study And How Much Percentages Are For Each Subject?

Documents by subject area

Scopus

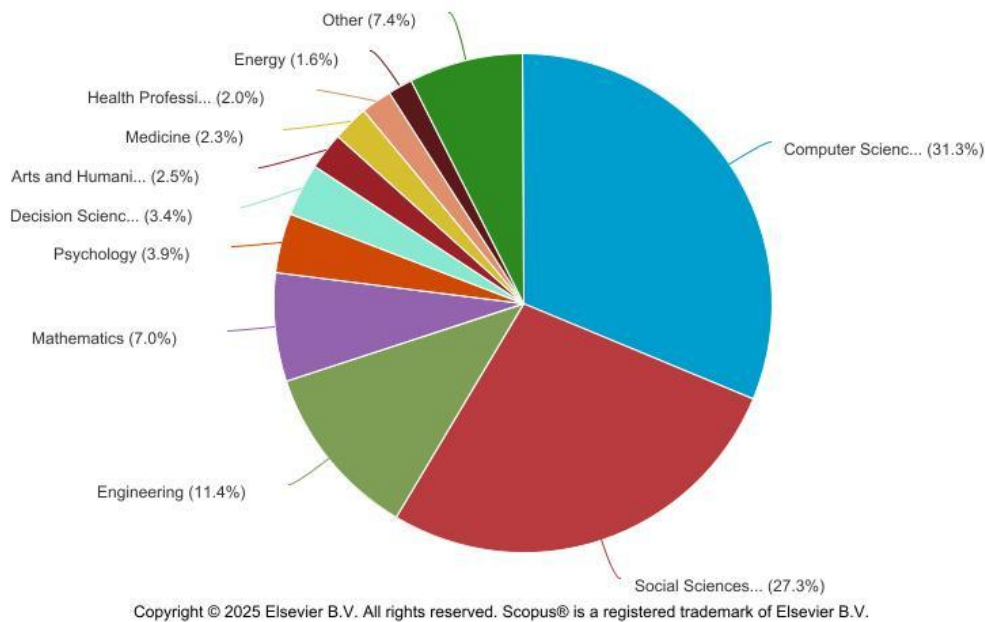
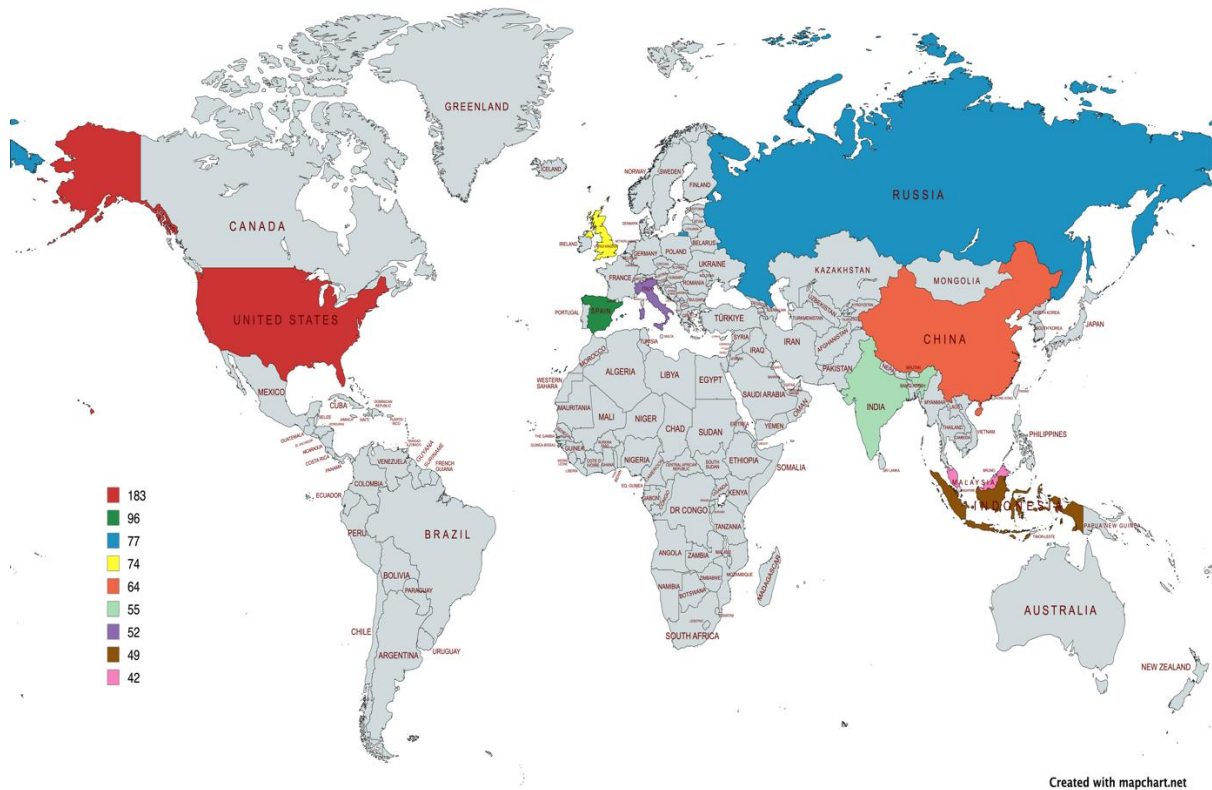


Figure 2: Popular Subject Area Related To The Study And Percentages For Each Subject

Subject Area	Number of publications	Percentage
Computer Science	816	31.3%
Social Sciences	711	27.3%
Engineering	297	11.4%
Mathematics	183	7.0%
Psychology	101	3.9%
Decision Sciences	89	3.4%
Arts and Humanities	64	2.5%
Medicine	60	2.3%
Health Professions	52	2.0%
Energy	41	1.6%
Others	194	7.4%

The analysis of subject distribution from 2015 to 2025 indicates that Computer Science (31.3%) and Social Sciences (27.3%) are predominant fields in research on instructional technology for students with special educational needs, together representing more than half of the total publications. This balance illustrates the field's interdisciplinary nature: Computer Science facilitates the technical advancement of multimedia, AI-driven tools, and adaptive learning systems, while Social Science emphasise pedagogy, inclusive education and the societal impacts of technology integration. The significant representation of Engineering (11.4%) and Mathematics (7.0%) highlights the technical aspect, indicating a sustained interest in system design, algorithms, and quantitative modelling within instructional technologies.

Psychology (3.9%) and Decision Sciences (3.4%) emphasise the significance of learner behaviour, motivation and evidence-based decision-making in the integration of technology in special needs education. Minor contribution from the Arts and Humanities (2.5%), Medicine (2.3%), and Health Professions (2.0%) indicates cross-disciplinary engagement in areas such as accessibility ethics, cognitive health, and therapy-oriented interventions. Fields such as Energy (1.6%) and the Sum of Others (7.4%) demonstrate specialised explorations, possibly associated with sustainability in technological applications or peripheral uses. The data reveal a distinct technological-pedagogical duality: the field is grounded in technical innovation while influenced by educational theory and social context, illustrating a comprehensive approach to addressing the learning needs of diverse populations

RQ3 – What Are The Top 10 Countries Based On The Number Of Publications?**Figure 3: Top 10 Countries Based On The Number Of Publications.**

Country/Territory	Total Publication
United States	183
Spain	96
Russian Federation	77
United Kingdom	74
China	64
India	55
Italy	52
Ukraine	51
Indonesia	49
Malaysia	42

The data reveal that the United States, with 183 publications, is among the top nations in research on instructional technology for students with special educational needs. This is followed by Spain with 96 publications, the Russian Federation with 77, and the United

The involvement of Italy and Ukraine signifies European initiatives in collaborative research and inclusive educational frameworks, whereas Southeast Asian countries like Indonesia and Malaysia demonstrate a growing regional commitment to technology-assisted learning. Emerging contributions indicate that countries in the global South are increasing investments in accessible technologies to meet various learning needs. The data indicate a concentration of research in technologically advanced nations alongside an increasing involvement of developing countries, suggesting a more balanced international research landscape in recent years.

The network visualization map displays a dense web of relationships between various concepts. The nodes are categorized by color:

- Blue Nodes (Educational/Inclusive Themes):** visually impaired, inclusive education, universal design for learning, assistive technology, special needs, student with disabilities, special education.
- Red Nodes (Technology/Gaming Themes):** computer aided instruction, technology enhanced learning, ai, technology, computer games, user interfaces, game, human computer interaction, learning disabilities, websites.
- Green Nodes (E-learning/Mobile Themes):** e-learning, iot, covid-19, technology-based, mobile applications, mobile learning, asd, ict.
- Yellow Nodes (Immersive Technologies):** immersive technologies, vr, ar.

The connections (edges) show a highly interconnected network, particularly around the central nodes like "special education", "technology", and "e-learning". The map illustrates the interdisciplinary nature of research at the intersection of education, technology, and disability studies.

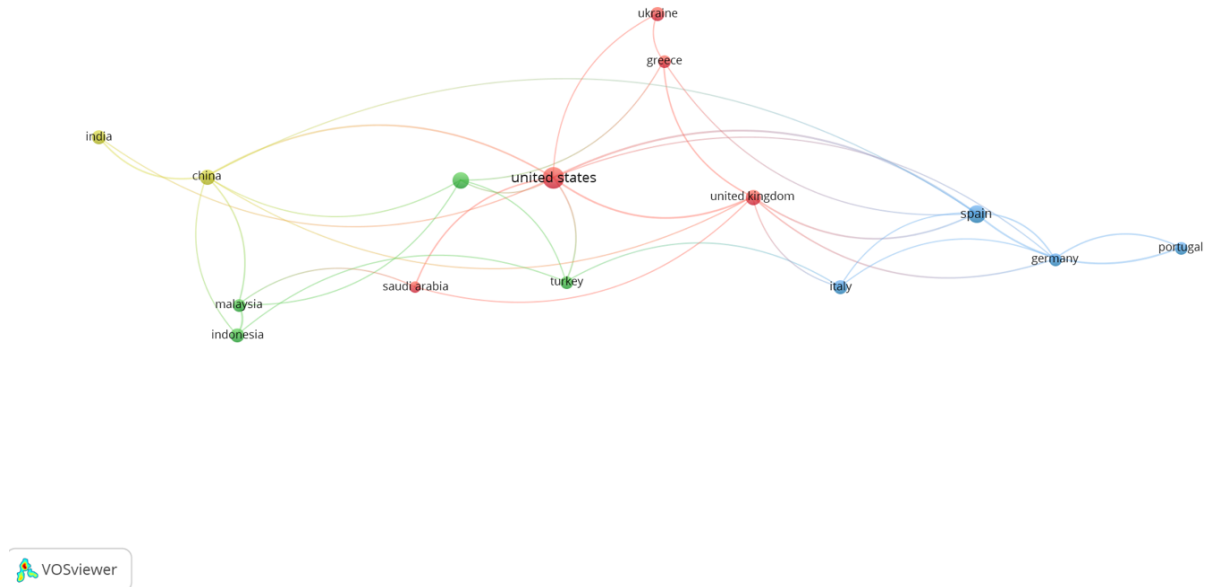
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The analysis of co-occurrence of author keywords using VOSviewer would explain the intellectual organization and development of research in instructional technology in special education needs. To this end, commonly used keywords in publications have been subjected to micro-examination to determine their recurrent patterns of co-occurrence of key themes and conceptual connections. As an example, keywords like technology (491 occurrences, 1,011 link strength), special education (342,765), and e-learning (228,582) are central nodes and summarize the main focus of the field.

The high search rates of ASD (233, 516), assistive technology (148, 345), and inclusive education (145, 348) are indications of the strong interconnection between digital technologies and inclusive learning conditions. This mapping will help the researchers outline the non-identical interrelationships between the distinct research strands, such as AI, VR and AR, and universal design, and the strands converging into the wider picture of special education needs.

The map has been built using a complete counting methodology, and the minimum occurrence threshold is 20. As a result, the keywords that appeared at least 20 times among the total number of 3,249 were included, which led to the selection of 29 out of 91 items. VOSviewer then classified the keywords into four different clusters, with one being the minimal cluster size, thus giving isolated thematic foci. Such clusters represent the classification of technology-based interventions, including immersive technologies, like AR, VR, and game-based interventions, as well as inclusive pedagogical models, such as universal design of learning and human-computer interaction, besides the traditional computer-aided instruction and the new e-learning and mobile application models. The respective clustering demonstrates the scope of methodological heterogeneity and the evolutionary path of the basic ICT research to the high-tech one, where AI is involved and offers immersive learning environments.

The results will add to the knowledge as they will provide a systematic review of established and emerging research directions. The prominence of terms such as technology, special education and students with disabilities indicates that technology has transitioned from a peripheral role to a central one in tackling with educational challenges faced by diverse learners. The integration of AI, IoT, immersive technologies, and universal design signifies an evolution towards personalised, adaptive, and accessible learning systems. The inclusion of contextual keywords like COVID-19 highlights the influence of global events on the research landscape, leading to rapid advancements in digital learning solutions. This network visualisation maps current knowledge and highlights potential opportunities for interdisciplinary collaboration and innovation in inclusive education.

RQ5- What Is The Co-Authorship By Countries Collaboration?**Figure 5: Co-authorship By Countries Collaboration**

country	documents	citations	total link strength
united states	160	2418	20
spain	89	1473	17
russian federation	71	242	5
united kingdom	63	2001	14
china	57	395	12
india	45	321	4
indonesia	45	295	7
ukraine	45	325	2
italy	43	442	4
portugal	33	194	6
turkey	32	408	5
germany	31	390	8
greece	31	350	5
malaysia	30	323	9
saudi arabia	26	592	4

The concept of co-authorship by countries' collaboration in VOSviewer aims to illustrate and study the collaborative efforts of researchers from various nations in the production of academic publications. Each country represents a node with its size showing the number of produced documents, while the links between the nodes indicate the intensity of international collaboration calculated by total link strength. An elevated number of citations signifies the scholarly impact of a country's contributions. The United States (160 documents, 2418 citations, link strength 20), the United Kingdom (63, 2001, 14), and Spain (89, 1473, 17) appear

as prominent centres of collaboration and academic influence, reflecting their leadership in shaping global research agendas.

The map was generated using the full counting method, which ensures that each co-authored publication is assigned equal weight in the analysis. A minimum threshold of 25 documents was established, limiting the inclusion to 15 countries out of a total of 97 in the dataset. Setting the minimum cluster size at one resulted in the formation of seven clusters, which represent regional or thematic research alliances among the countries. China (57, 395, 12), India (45, 321, 4), and Indonesia (45, 295, 7) likely constitute a regional network in Asia, while European nations such as Germany, Greece, Italy, and Portugal are situated in distinct clusters. These clusters demonstrate the balance between global hubs and regional networks that facilitate research collaboration in this field.

The findings enhance the body of knowledge by highlighting how collaboration increases both productivity and impact in special education technology research. The countries that exhibit a high citation count, exemplified by Saudi Arabia with 592 citations despite only 26 documents, illustrate that the quality of collaboration can outweigh quantity regarding scholarly impact. Emerging contributors like Malaysia and Indonesia are demonstrating enhanced integration into global research networks, thereby reinforcing the presence of developing nations in this field. Overall, the co-authorship maps indicate that impactful advancements in instructional technology for students with special education needs result from both leading researchers and emerging regional partnerships, highlighting the critical role of cross-border collaboration in fostering innovation and inclusivity.

Conclusion

The bibliometric analysis reveals an increase trend of research on instructional technology for students with special educational needs over the past decade, with significant increases observed after 2018. The finding indicates that publication outputs are concentrated in fields like Computer Science and Social Sciences, highlighting a significant relationship between technological advancement and educational practices. According to the region, major contributions have arisen from technologically advanced nations, such as the United States, the United Kingdom, Spain, and China, as well as rising collaborations from emerging countries like Malaysia, Indonesia, and India. Keyword analysis was carried out using keywords to identify essential thematic clusters, such as technology, e-learning, assistive technology, and special education, and to reveal emerging trends, such as artificial intelligence, immersive technologies, and universal design of learning. These findings indicate that the field of study is moving towards a more interdisciplinary and globally partnering area of research.

The co-authorship analysis provided some understanding of the makeup of the international cooperation, showing that significant developments in the field are continuously made due to the partnership, which crosses national and regional borders. It has been observed that some of the new clusters of collaboration are being reshaped not only in the Western world but also in the Asian world which is a pointer that the world leaders and emerging economies are becoming more aligned to technology-enhanced learning. Most importantly, the research highlights that research influence is not just the amount of publications, but the quality of collaboration as is supported by the number of countries that have lower publication volumes, but are highly cited. Overall, the research study contributes to the academic field by tracking a pattern of publications, defining a prominent research theme, and shedding light on the

relationship in collaboration, which provides both a research direction and an application in special educational needs.

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