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A bibliometric analysis of autism research in the field of education in Ibero-America: A WOS perspective

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Introduction. Education is a key tool for promoting the personal and socioemotional development of individuals with autism. However, to date, no bibliometric analysis has been conducted on this topic in the Ibero-American context. *Aim*. The purpose of this study was to analyze the annual production of original articles, productive journals, funding agencies, authors, research trends, and the most influential articles in the field of education and autism. *Method*. The WoS database (Education & Educational Research, Psychology Educational, Education Special, Education Scientific Disciplines) was used, and a total of 352 documents were analyzed. *Results*. The results showed a growing trend in annual publications. Elsevier, Spain, the funding agency Spanish Government, author Lorenzo G, the journal Research in Autism Spectrum Disorders, and Spanish and Brazilian universities were the most productive contributors. The main research trends focused on educational intervention, special and/or inclusive education, intellectual disability, and technology. *Conclusion*. This work reflects a significant increase in scientific production in Ibero-America in the field of education and autism, which is evident in research topics related to various socialization areas such as school, technology, and family. However, further research and evidence collection in this direction are still needed, particularly in Latin American countries that are in the process of development.

Keywords: autism, education, bibliometric analysis

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Introduction

Autism Spectrum Disorder (hereafter referred to as autism) is a neurodevelopmental condition that variably affects social relationships and communication while also being characterized by restricted interests and repetitive behaviors [American Psychiatric Association, 2013]. Autism can be diagnosed in early developmental stages (18 to 24 months of age) since during this vital period, the core symptoms can be distinguished from the expected functional development based on cultural norms and other developmental conditions. The prevalence of this neurodevelopmental condition is a relevant factor for planning public policies, raising awareness, and setting research priorities (Zeidan et al., 2022). Currently, one in fifty-four children lives with some degree of autism that hinders their cognitive and socio-emotional development (Knopf, 2020). The socialization difficulties faced by children, youth, and adults with autism can lead to their educational needs diverging from conventional expectations for individuals with "neurotypical" development (Stenhoff et al., 2020; Waldman et al., 2023).

Different studies have shown that advancements in the teaching-learning process, both in early education stages and higher education, are key opportunities to promote the inclusion of students with autism towards a more adaptive stage of development (Parsons et al., 2011; Roberts-Yates et al., 2019). However, there is also evidence highlighting that students with autism face challenges in communicating with their teachers and classmates, participating in group work, cultural activities, making presentations, and grasping abstract or complex concepts (Elias et al., 2019; Knott & Taylor, 2014). The combination of the exponential growth in autism prevalence and the international rise of inclusive education in line with the United Nations Convention on the Rights of Persons with Disabilities (United Nations, 2006) has led to many students with autism being enrolled in mainstream educational settings. This, in turn, has spurred research related to the experiences of teachers and students with autism (Adams et al., 2019). Although there is currently a prevailing positive attitude towards the inclusion of students with autism in the discourse of international organizations, they continue to face a wide range of problems and needs in the educational context, demanding further research to understand the breadth of these difficulties and their impact on the students' educational experience (Anglim et al., 2018; Garrad et al., 2019).

Numerous studies have investigated the educational inclusion of students with autism in primary, secondary, and university contexts (Anderson et al., 2017; Anderson et al., 2018; Harrower & Dunlap, 2001; Roberts & Simpson, 2016; Sarrett, 2018; Watkins et al., 2015), sexual education (Sala et al., 2019), and the use of ICT in schools (Virnes et al., 2015; Valencia et al., 2019). Narrative and systematic reviews have also been conducted on key socializing agents in the education of students with autism, such as teachers (Alexander et al., 2015;

Gómez-Marí et al., 2021; Gunn & Delafield-Butt, 2016) and parents (Majoko & Dudu, 2022; Rispoli et al., 2019). However, to date, only one bibliometric analysis has been conducted on autism research trends in the field of education (Carmona-Serrano et al., 2020). This study was carried out from an international perspective, and due to the socio-economic characteristics of Ibero-American countries, their reality remains underrepresented in the results, as countries like the USA, England, Australia, and Canada dominate the production. Given that a bibliometric analysis contributes to providing a set of indicators that allow us to understand the trends and regularities of scientific activity and, in turn, aids in the creation of programs, decision-making, and the planning of new lines of research (Kim et al., 2020), this work aims to comprehend, from a historical and updated perspective, the evolution and research trends in education in Ibero-America. This will provide guidance for establishing new research directions in the field and making comparisons in scientific production with other locations worldwide.

Based on the aforementioned, the objective of this study was to analyze the scientific production of documents related to autism and education in Ibero-America published in WoS. The following research questions were posed: RQ 1. What is the overall volume and growth rate of published documents? RQ 2. What are the most relevant publishers, countries, and funding agencies? RQ 3. Who are the most productive authors and journals? RQ 4. Which documents have had the greatest influence and what are the most studied research topics? RQ 5. What is the relationship between the authors, institutions, and countries involved in this field of study?

Aim

The purpose of this study was to analyze the annual production of original articles, productive journals, funding agencies, authors, research trends, and the most influential articles in the field of education and autism.

Method

Search strategy and inclusion/exclusion criteria

A cross-sectional descriptive analysis of scientific production related to autism and education in Ibero-America published in WoS was conducted. The choice of the WoS database was justified by its extensive coverage of academic literature and international prestige (Pranckutė, 2021) as of May 4, 2023. The literature search was computerized. Inclusion criteria consisted of documents published in WoS falling within the following categories: (1) Education & Educational Research (E&ER) / E&ER encompasses resources covering the full spectrum of education, from theory to application, from early childhood to doctoral studies. This category includes

resources on pedagogy and methodology, as well as the history of education, reading, curriculum studies, educational policy, sociology, economics of education, and the use of computers in the classroom; (2) Educational Psychology (PE) / PE includes resources on educational psychology, educational measurement, creative behavior, educational science, and school psychology; (3) Special Education (ES) / ES gathers resources related to the education and development of individuals with special needs, including gifted individuals and those with learning disabilities; and (4) Education Scientific Disciplines (ESD) / ESD comprises all educational resources in specific disciplines, including biology, pharmacy, biochemistry, engineering, chemistry, nutrition, and medicine. The Citation Topics Micro (autism), Documents Types, and Country filters were applied to select Ibero-American countries and documents in the format of original articles, as this format identifies research trends in each country and is essential for creating public policies and making local decisions. There were no restrictions on the publication timeframe. Documents published by non-Ibero-American countries, as well as editorials, letters to the editor, conference proceedings, and opinion articles, were excluded.

Bibliometric indicators

In this study, the following bibliometric indicators were used: (1) Annual production of original articles; (2) Main publishers, countries, and funding agencies; (3) Most productive authors, including Articles (n), Fractionalized Articles, TC (total citations), Institution; (4) Lotka's law (shows the distribution of authors according to their productivity); (5) Most productive journals, including Articles (n), Language, Region, 1ST ELECTRONIC JCR YEAR, and Quartile according to Journal Citation Reports™; (6) Bradford's law (the hypothesis is that research citations will be clustered such that approximately one-third of the citations will occur within a small core of journals. This law is expressed mathematically as N1:N2:N3 1:a: a2, where a = coefficient of proportionality of titles between zones and Nn = number of articles from journal titles in zones 1, 2, and 3 with approximately one-third of articles each); This law is mathematically expressed as the number of authors, An, who publish n articles on a subject is inversely proportional to the square of n, i.e., An = A1/n2, where A1 is the number of authors who publish only one article on that subject; (7) Most relevant articles, including Title, Total Citations, TC per Year, Normalized TC.

Ethical statement and statistical treatment

Data from WoS were exported into a BibTeX file, and then Excel software was used for complete tabulation. VOSviewer (version 1.6.15) and R packages (Biblioshiny, version 2.0) were used to describe the literature, calculate mathematical laws, and establish relationships between the bibliometric indicators used. This study used documents published in WoS as the units of analysis and, therefore, does not require approval from an ethics committee.

Results

The computerized literature search in WoS yielded 352 documents from Ibero-American countries between 1976 and 2023. The number of annual publications in recent years shows a developmental trend in research related to the education of children, youth, and adults with autism. The years with the highest literature production were 2020 (n=60 articles), 2021 (n=48 articles), and 2016 (n=40 articles). The annual growth rate of the literature was 4.79%. The most relevant publishers were Elsevier (n=68 articles), Taylor & Francis (n=44 articles), and Wiley (n=31 articles). Regarding countries, Spain (n=235 articles), Brazil (n=61 articles), and Portugal (n=27 articles) topped the list of document production. It is crucial to underline that the USA (n=47 articles) is the country that has collaborated the most with Ibero-American countries. Regarding the agencies that funded document production, the most prominent were the Spanish Government (n = 17 articles), the Fundação para a Ciência e a Tecnologia (FCT) of Portugal (n = 10 articles), and the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) of Brazil (n = 8 articles), as showed in Table 1, it is possible to observe the results obtained in terms of annual production, publishers, countries, and funding agencies.

Table 1

Annual production, publishers, countries, and funding agencies

Publ.years	Rec Count	% of 352	Publishers	Rec Count	% of 352	Countries/ Regions	Rec Count	% of 352	Funding Agencies	Rec Count	% of 352
2020	60	17.045%	Elsevier	68	19.318%	ESP	235	66.761%	Gov. of Spain	17	4.830%
2021	48	13.636%	Taylor & Francis	44	12.500%	BRA	61	17.330%	Portugal (FCT)	10	2.841%
2016	40	11.364%	Wiley	31	8.807%	USA	47	13.352%	CAPES (Brazil)	8	2.273%
2022	28	7.955%	Springer Nature	28	7.955%	PRT	27	7.670%	European Comm.	8	2.273%
2017	27	7.670%	Univ Almeria	18	5.114%	ENG	19	5.398%	MICINN	6	1.705%
2018	25	7.102%	Sage	13	3.693%	CHL	13	3.693%	FAPESP (Brazil)	5	1.420%
2019	22	6.250%	UNESP–FCLA (Brazil)	9	2.557%	ARG	9	2.557%	U.S. HHS	5	1.420%
2015	16	4.545%	IATED	7	1.989%	FRA	7	1.989%	UV (Spain)	5	1.420%
2013	15	4.261%	EditUM (UM)	6	1.705%	PER	7	1.989%	CNPq (Brazil)	4	1.136%
2010	12	3.409%	IEEE	6	1.705%	CAN	5	1.420%	GV (Spain)	4	1.136%

Publ.years	Rec Count	% of 352	Publishers	Rec Count	% of 352	Countries/ Regions	Rec Count	% of 352	Funding Agencies	Rec Count	% of 352
2014	11	3.125%	UFRGS–EEF (Brazil)	5	1.420%	COL	5	1.420%	NIH (USA)	4	1.136%
2023	8	2.273%	UGR (Spain)	5	1.420%	ITA	5	1.420%	EC-JRC	3	0.852%
2009	6	1.705%	Mdpi	4	1.136%	MEX	5	1.420%	NIH/ NICHD	3	0.852%
2011	6	1.705%	UNICAMP–FE (Brazil)	4	1.136%	AUS	4	1.136%	ARC (Australia)	2	0.568%
2005	5	1.420%	C. Of. Psico Madrid	3	0.852%	SCT	4	1.136%	CIEd (U. Minho/ FCT, PT)	2	0.568%
2007	5	1.420%	IATED (Spain)	3	0.852%	SWE	4	1.136%	FSSB (Spain)	2	0.568%
2008	5	1.420%	OEI (Ibero-America)	3	0.852%	CRI	3	0.852%	FCT (Portugal)	2	0.568%
2012	5	1.420%	Univ Cienfuegos	3	0.852%	ECU	3	0.852%	GC (Spain)	2	0.568%
1976	1	0.284%	Univ Cordoba Fac. Ed.	3	0.852%	DEU	3	0.852%	ISCIII (Spain)	2	0.568%
1980	1	0.284%	UCR Edit.	3	0.852%	NLD	3	0.852%	LTCSA (NSW)	2	0.568%
1987	1	0.284%	UFMS (Brazil)	3	0.852%	CHE	3	0.852%	MINECO (Spain)	2	0.568%
1999	1	0.284%	Univ Murcia	3	0.852%	URY	3	0.852%	ANID (Chile)	2	0.568%
2000	1	0.284%	AAIDD (USA)	2	0.568%	BEL	2	0.568%	CIDMA (Portugal)	2	0.568%
2001	1	0.284%	AUFOP (Spain)	2	0.568%	CUB	2	0.568%	AEI–FEDER (Spain/EU)	2	0.568%
2002	1	0.284%	CEP Cuevas-Olula (Spain)	2	0.568%	DOM	2	0.568%	VRIPCUVa	2	0.568%

Note: The table shows that the most productive years were 2020 (n=60; 17.0%), 2021 (n=48; 13.6%), and 2016 (n=40; 11.4%), reflecting sustained growth in interest in this topic over the last decade. From 2010 onwards, there has been a clear trend in publications.

The Ten Most Productive Authors

A total of 1.026 authors participated in the production of the 352 analyzed documents. Table 2 shows the ten most productive authors in the studied field. The most productive authors were Lorenzo, G. (n=10 articles, University of

Alicante), Garcia-Villamisar, D. (n=8 articles, Complutense University of Madrid), and Tarraga-Minguez, R. (n=8 articles, University of Valencia). Among the ten authors, Lorenzo, G. received the highest number of citations (TC=249 citations). Using the R packages (Biblioshiny, version 2.0), it was observed that the number of authors of single-authored documents was 36, and the rate of international co-authorship was 27.84%.

Table 2

The ten most productive authors

Authors	Articles	Articles Fractionalized	TC	Institución
Lorenzo, G.	10	3.12	249	UA (Spain)
Garcia-Villamisar, D.	8	2.90	201	UCM (Spain)
Tarraga-Minguez, R.	8	2.42	109	UV (Spain)
LLedo, A.	7	2.03	188	UA (Spain)
Dattilo, J.	6	2.07	137	Penn State (USA)
Lozano Martinez, J.	6	2.37	9	UM (Spain)
Manolov, R.	6	1.50	128	UB (Spain)
Simo-Pinatella, D.	6	1.57	30	URL (Spain)
Alcaraz Garcia, S.	5	2.67	9	UM (Spain)
Matson, J.L.	5	1.01	28	LSU (USA)

The Lotka's Law refers to the distribution of authors according to their productivity (Bahamonde, 2022). Table 3 shows the approximation between the observed and expected values of the author's productivity distribution. There is correspondence between the observed and expected scientific production, confirming the compliance with Lotka's Law. This means that only a small proportion of authors publish a large number of documents.

Table 3

Lotka's Law, used to calculate the correlation of the number of authors with the published articles

Documents written	N. of Authors	Proportion of Authors
1	878	0.856
2	102	0.099
3	28	0.027
4	6	0.006
5	4	0.004
6	4	0.004
7	1	0.001
8	2	0.002
10	1	0.001

The Top Ten Journals

A total of 138 journals were involved in the production of documents published in WoS in autism and education research. Research in Autism Spectrum Disorders, a specialized journal publishing high-quality empirical studies and reviews that contribute to a better understanding of Autism Spectrum Disorders (ASD) at all levels of description – genetic, neurobiological, cognitive, and behavioral – ranked first (n=35 articles). In second place, we find Research in Developmental Disabilities, which focuses on publishing original interdisciplinary research directly related to understanding or addressing developmental disabilities (n=25 articles). In third place, we have the Journal of Inclusive Education, which aims to highlight quality research and studies by authors related to inclusion (n=15 articles). Regarding the regions, five journals were from England, three from the USA, one from Spain, and one from Brazil. Out of the ten journals, five are in Q1, one in Q2, one in Q3, and three in Q4 according to the Journal Citation Reports™. For more details, see Table 4.

Table 4

Top ten active journals in publishing literature

Sources	Articles	Language*	Región*	1ST* ELECTRONIC JCR YEAR	Quartil*
Research in Autism Spectrum Disorders	35	English	England	2008	Q1
Research in Developmental Disabilities	25	English	USA	1997	Q1
Revista de Educación Inclusiva	15	Español	España	2020	Q4
Journal of Intellectual Disability Research	14	English	England	1997	Q1
Journal for the Study of Education and Development	12	Multi-Language	England	2020	Q4
International Journal of Developmental Disabilities	9	English	England	2013	Q2
Revista Ibero-Americana de Estudos em Educacao	9	Multi-Language	Brazil	2020	Q4
Education and Information Technologies	8	English	USA	2020	Q1
Journal of Developmental and Physical Disabilities	7	English	USA	1997	Q3
Journal of Research in Special Educational needs	7	English	England	2020	Q1

Note: * According to Journal Citation Reports™

Bradford's Law highlights that citations of documents in any field of study cluster in such a way that one-third of the citations will occur within a small core of journals (Bahamonde, 2022). Our results suggest that Core 1 (the main core of journals) comprises 6 journals, and the list is led by Research in Autism Spectrum Disorders, Research in Developmental Disabilities, and Journal of Inclusive Education (see Table 5).

Table 5

The top core journals in research on motherhood and autism spectrum disorders, according to Bradford's Law

SO	Rank	Freq	cumFreq	Zone
Research in Autism Spectrum Disorders	1	35	35	Zone 1
Research in Developmental Disabilities	2	25	60	Zone 1
Revista de Educacion Inclusiva	3	15	75	Zone 1
journal of Intellectual Disability Research	4	14	89	Zone 1
Journal for the study of Education and Development	5	12	101	Zone 1
International Journal of Developmental Disabilities	6	9	110	Zone 1
Revista Ibero-Americana de Estudos em Educacao	7	9	119	Zone 1
Education and Information Technologies	8	8	127	Zone 2
Journal of Developmental and Physical Disabilities	9	7	134	Zone 2
Journal of Research in Special Educational Needs	10	7	141	Zone 2

The Ten Most Influential Original Articles in Autism Research in the field of Ibero-American Education

Table 6 presents the work of Fernández et al. (2013), titled "Mobile learning technology based on iOS devices to support students with special education needs," which was the most influential article with 164 citations and an average of 14.91 citations per year. The article was published in the journal Computers & Education (Q1). All ten articles involved multiple authors and covered topics related to learning technology, cognitive performance, prevalence, quality of life, life narratives, sensory processing, and virtual learning environments.

Table 6

The ten most influential original articles in the publication of literature related to education and autism in Ibero-America

Paper	Title	Total Citations	TC per Year	Normalized TC	Journal
Fernández et al., (2013)	Mobile learning technology based on iOS	164	14.91	6.39	Computers & Education
Lorenzo et al., (2016)	Design and application of an immersive virtual reality system	98	12.25	12.48	Computers & Education
García & Hughes (2007)	Supported employment improves cognitive performance	82	4.82	4.18	Of Intellectual Disability Research
Lugo et al., (2019)	Prevalence of psychiatric disorders	76	15.20	6.08	Research in Autism Spectrum Disorders
García & Dattilo (2010)	Effects of a leisure programme on QoL	76	5.43	6.08	Of Intellectual Disability Research
Baixauli et al., (2016)	Narratives of children with high-functioning	64	8.00	8.15	Research in Developmental Disabilities
González et al., (2013)	Cognitive variability in adults with ADHD and AS	60	5.45	2.34	Research in Developmental Disabilities
Tate et al., (2016)	The Single-Case Reporting	51	6.38	6.50	Of School Psychology
Lorenzo et al., (2013)	Inclusion of immersive virtual learning	51	4.64	1.99	Computers & Education
Fernández et al., (2015)	A comparative study of sensory processing	45	5.00	3.46	Research in Developmental Disabilities

Note. The second column shows the first words of each article title. Full titles can be consulted in the reference list of this manuscript.

Also, a content analysis of all selected documents was carried out, allowing the grouping of literature findings into 16 thematic axes in order to present the main areas of research, as shown in Table 6. Below, we will describe the most relevant elements of each thematic axis, which highlight essential aspects of the articles within the dataset.

Table 7

Definitions of thematic axes, codes of included articles, and total number of articles

Themes Axes*	Articles	Total
1	3; 5; 6; 7; 8; 16; 19; 30; 31; 34; 35; 42; 44; 45; 47; 49; 54; 55; 59; 62; 67; 69; 71; 73; 77; 79; 81; 82; 84; 87; 89; 90; 91; 92; 94; 95; 96; 102; 103; 104; 105; 108; 115; 120; 128; 129; 130; 131; 132; 133; 135; 137; 138; 140; 141; 142; 143; 145; 146; 149; 150; 154; 156; 157; 161; 163; 164; 166; 171; 174; 178; 179; 181; 182; 186; 187; 188; 189; 190; 193; 197; 199; 202; 206; 207; 208; 209; 211; 212; 216; 218; 222; 226; 227; 228; 231; 234; 235; 237; 238; 242; 245; 250; 251; 252; 253; 256; 263; 264; 270; 273; 281; 285; 288; 289; 294; 295; 298; 299; 300; 302; 303; 306; 307; 308; 309; 311; 313; 316; 318; 319; 321; 323; 326; 328; 329; 330; 332; 333; 336; 340; 341; 346; 347; 349	160
2	10; 13; 27; 53; 56; 63; 65; 72; 75; 83; 100; 101; 106; 111; 112; 113; 118; 124; 125; 139; 148; 151; 153; 170; 177; 191; 192; 194; 202; 204; 210; 244; 260; 261; 266; 268; 301; 304; 312; 327; 334	48
3	4; 14; 17; 21; 37; 48; 51; 52; 74; 116; 117; 134; 144; 158; 162; 183; 196; 200; 205; 223; 233; 239; 240; 248; 254; 265; 274; 280; 282; 292; 293; 320; 339; 343; 345; 351	39
4	2; 61; 121; 122; 123; 175; 221; 225; 230; 232; 247; 249; 255; 267; 322; 335; 344; 348	18
5	68; 70; 86; 93; 147; 160; 165; 168; 172; 176; 185; 198;	12
6	9; 22; 50; 99; 159; 167; 169; 229; 246; 269; 324; 350	12
7	1;23; 25; 40; 60; 98; 107; 127; 214; 277; 286	11
8	11; 12; 29; 58; 136; 215; 257; 287; 310; 314	10
9	15; 28; 36; 57; 64; 76; 80	7
10	26; 173; 258; 275; 284; 291; 337	7
11	32; 39; 97; 119; 278; 283; 297	7
12	18; 43; 46; 78; 331; 338	6
13	126; 152; 259; 271; 272	5
14	109; 110; 195; 219; 290	5
15	24; 38; 241	3
16	155	1

Note. The thematic axes were coded numerically and are presented in parentheses in the following paragraph*

In thematic axis 1 (Emotional regulation on the autism spectrum), the texts depict variables related to emotional regulation in Autism Spectrum Disorder (ASD). One of the most notable characteristics of individuals diagnosed with ASD is behavioral disorders dominated by irritability or emotional dysregulation. Beneytez (2023) proposes the need to develop explanatory models considering all factors involved in anxiety's development and maintenance, along with its expression through typical ASD characteristics. On the other hand, thematic axis 2 (Educational policies and inclusion in the stages of the educational

system) comprises works on educational policies and inclusive education, as expressed by Echeita et al. (2022), who investigated the barriers and supports faced by families with children with ASD during their first educational transition, revealing weaknesses that endanger inclusion. Concerning higher education, Ojea et al. (2016) propose the need to establish basic criteria and educational guidelines to support the design of programs consistent with this inclusive process at this educational level.

Thematic axis 3 (Strategies and tools for care and intervention in individual and educational processes) concentrates the highest number of texts related to strategies and tools for attention and intervention in individual and educational processes. It is predominant to find topics associated with the use of technology, the design, and implementation of programs aiming to improve daily and school activities for individuals with ASD and other neurodevelopmental disorders. Regarding this, De Alvarenga et al. (2023) conducted a systematic review to gather information about interventions promoting and enhancing learning abilities. Another similar study was conducted by Pérez et al. (2020), who demonstrated that robots have been employed in interventions with children with ASD, proving to be more frequently used and effective tools in promoting communicative interaction.

Thematic axis 4 (Instruments and scales for the evaluation of ASD and other neurodevelopmental disorders) covers instruments and scales for assessing ASD and other neurodevelopmental disorders. The growing interest in identifying and diagnosing these disorders led DuBay et al. (2023) to provide a comprehensive evidence map of screening and diagnostic tools for ASD in Spanish, especially concerning development/translation aspects and empirical testing. The results showed that a significant number of translations lacked details about the translation process in published locations, and most studies used a traditional forward-backward approach rather than cultural adaptation procedures.

Regarding thematic axes 5 (Psychiatric comorbidity in ASD and other neurodevelopmental disorders), 10 (Oral health in autism spectrum disorder), 12 (Access and attention to services for people with ASD), and 14 (Anthropometric measurements, nutrition and food selectivity in autism spectrum disorder), we can say there is a relationship due to the topics' focus on comorbidity. In thematic axis 5, works covering psychiatric comorbidity in ASD and other neurodevelopmental disorders are prevalent (Peña et al., 2022). As stated by Lugo et al. (2019), attention deficit hyperactivity disorder is the most prevalent psychiatric disorder in adults with ASD, and mood and anxiety disorders are also common in this population. Another aspect studied is related to oral health in Autism Spectrum Disorder, corresponding to thematic axis 10, where Barbosa et al. (2022) conducted a scoping review to identify the main oral health concerns of children and adolescents with ASD. The results show that different

degrees of socio-behavioral impairment can directly influence oral hygiene and the consequent accumulation of biofilm.

Thematic axes 6 (Symptoms, executive functions, linguistic and social skills in ASD and other neurodevelopmental disorders) and 11 (Interpersonal relationships in autism spectrum disorder) are related to topics associated with symptoms, executive functions, language skills, and interpersonal relationships. Spaniol et al. (2021) argue that individuals diagnosed with ASD present difficulties in establishing good social interactions, exhibit challenging behaviors, and have difficulties in cognitive skills that could affect attention and nonverbal intelligence, all of which are associated with academic difficulties. In this regard, González & Ruiz (2021) demonstrated that sensory overload stimuli can limit attention and academic performance, triggering a state of hyper-vigilance, restlessness, and stress in school-aged children with ASD. Additionally, we want to highlight the study conducted by Jatkar et al. (2023), who assert that there is limited information on the role of the child's sensory and language characteristics in treatment outcomes.

Thematic axes 7 (Pedagogical competencies and professional teaching practice in teaching students diagnosed with ASD), 8 (Experiences and effects of the Covid-19 pandemic on autism spectrum disorder), 9 (Physical and sports activities in autism spectrum disorder), and 13 (Educational processes in autism spectrum disorder) cover topics related to educational practices and the impact of the Covid-19 pandemic. In this regard, Martínez et al. (2022) demonstrated the fundamental role of teachers' prior experience in the inclusion process. Regarding the implications of the pandemic, Martínez et al. (2021) found higher levels of aggression, irritability, hyperactivity, impulsivity, inattention, and anxiety in individuals with ASD. They also found higher levels of repetitive, restrictive, and stereotyped behaviors when compared to pre-pandemic assessments.

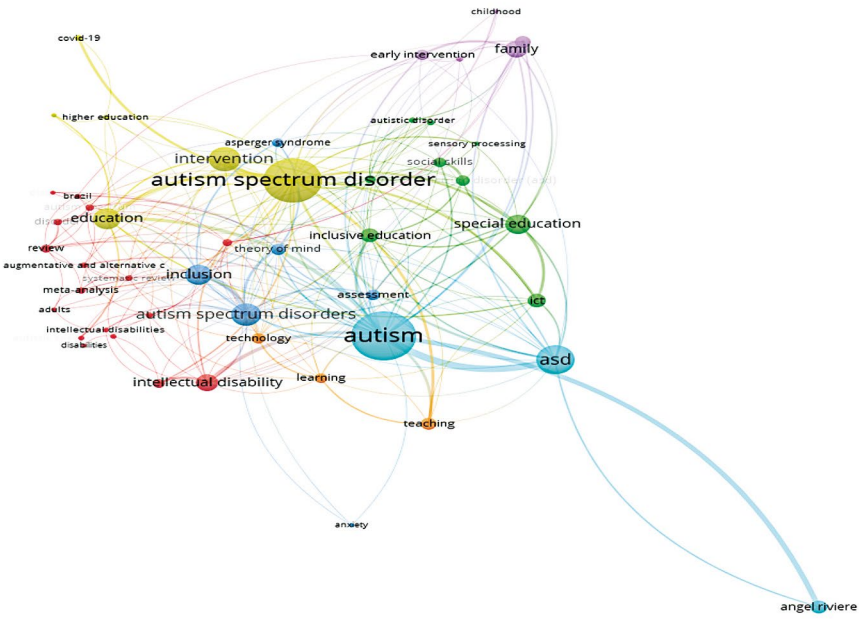
Finally, we want to highlight the findings in thematic axes 15 (Experiences and life narratives of people with ASD) and 16 (Sexuality in autism spectrum disorder), concerning experiences, life narratives, and sexuality in Autism Spectrum Disorder. Regarding the latter topic, only one investigation was found, addressed by Vieira & Bortolozzi (2019), who presented a theoretical review and concluded the existence of some data indicating the identification of sexual desires, especially focused on solitary experiences and less frequent sexual practices. Regarding experiences and life narratives, Belinchon (2020) emphasizes the very personal way of presenting the complex challenges of defining and scientifically explaining autism through the narratives of Ángel Riviere, inviting reflection on the claims that autism is a construct.

Themes of Research in Literature Related to Education and Autism

The mapping of the most frequent terms used by authors in the literature related to education and autism revealed 39 terms distributed into clusters representing 7 main research themes. According to Figure 1, the yellow cluster showed a research trend in educational intervention, higher education, and also included the international public health situation (COVID). The purple cluster revealed a research trend in childhood, early intervention, and family. The green cluster highlighted a research trend in special and inclusive education, social skills, and sensory processing. The blue cluster indicated a research trend in inclusion, assessment, theory of mind, and to a lesser extent, anxiety. The red cluster unveiled a research trend in the overlap of autism with intellectual disability, adulthood, and with a documental methodological approach. Another red cluster showed a research trend in learning technologies. Lastly, the light blue cluster was linked to the historical work of scholar Ángel Rivière. As can be seen in Figure 1.

Figure 1

Keyword concurrency visualization map

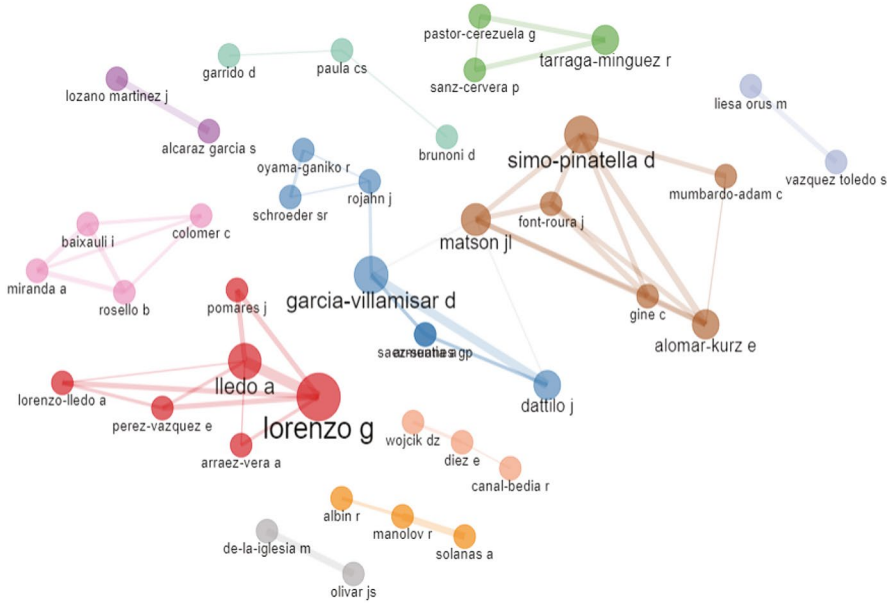


Social Structure: Author, Institutions, and Countries Collaboration Network

Within the main collaboration network of authors, there are a total of 41 scholars. This network exhibits 11 working groups. The primary working groups are visualized through the red group, consisting of Lorenzo; Lledo; Lorenzo-Lledo; Perez-Vazquez; Arraez-Vera; and Pomares. The blue group, formed by Garcia-Villamisar; Dattilo; Saez-Suanes; Armentia, closely collaborates with Oyama-Ganiko; Rojahn; and Schroeder. The Carmelite group, represented by Simo-Pinatella; Matson; Alomar-Kurz; Mumbardo-Adam; Font-Roura, and Gine also shares connections with the blue working group through the collaboration between Garcia-Villamisar and Matson. Lastly, the green group, represented by Tarraga-Minguez; Pastor-Cerezuela and SanzCervera. To review more details of the collaboration network, see Figure 2.

Figure 2

Collaboration network of the most prominent authors in the field of education and autism

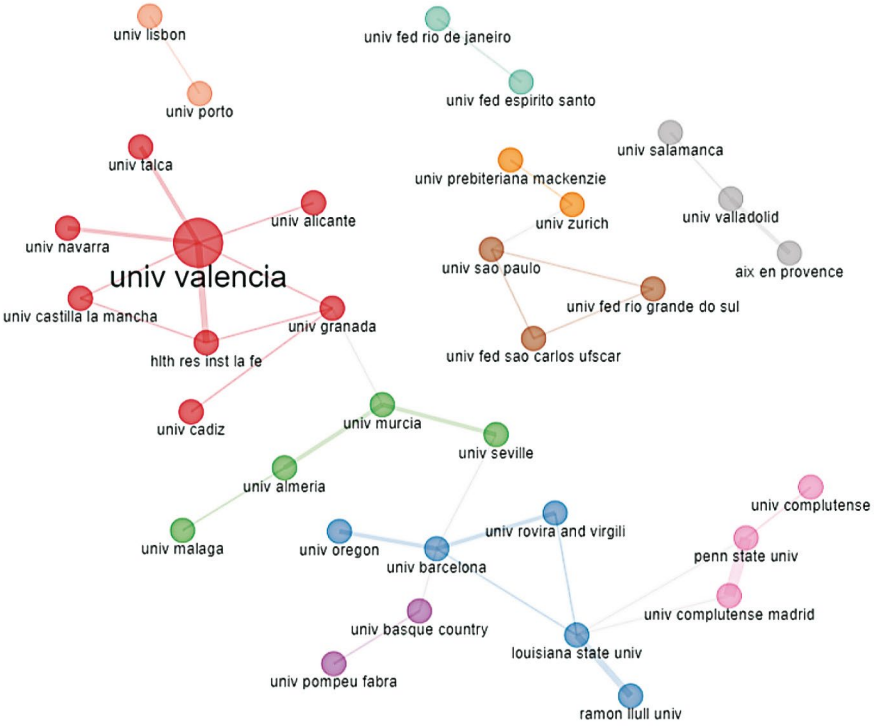


A total of 34 institutions participated in the scientific production on education and autism in the selected categories studied in WoS. In Figure 3, it can be observed that the main networks of institutional collaboration are primarily grouped into 8 clusters. The most representative institutions of each cluster are University of Valencia (red cluster), University of Murcia (blue cluster), University of Barcelona (purple cluster), Federal University of Rio

Grande do Sul (pink cluster), University of Salamanca (green cluster), Federal University of Rio de Janeiro (carmine cluster), and Complutense University of Madrid (orange cluster).

Figure 3

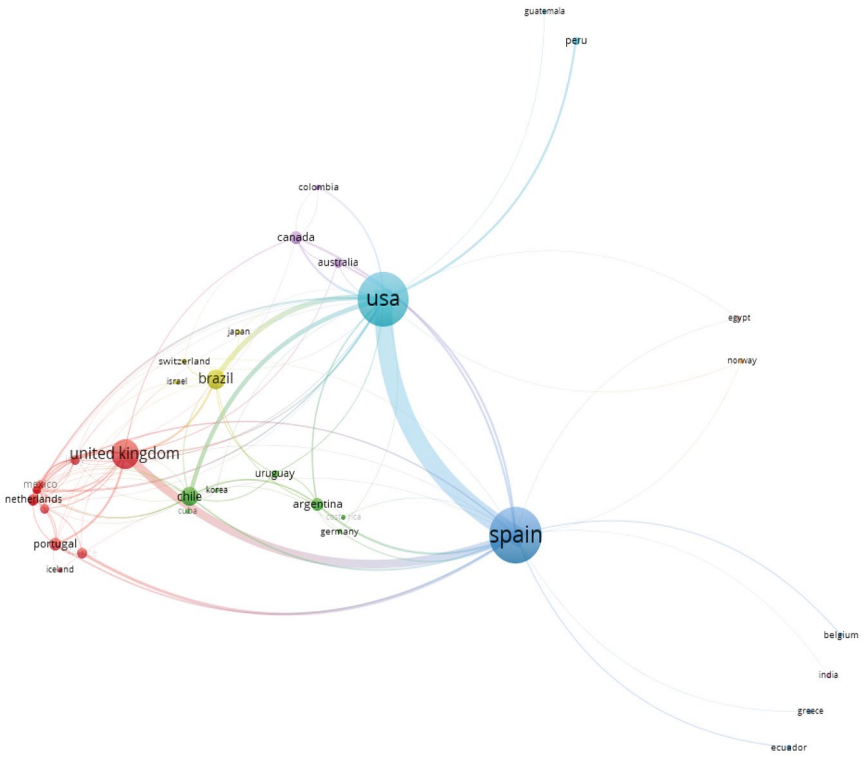
Collaboration network of the most representative institutions in education and autism



A total of 40 countries participated in the production of documents related to education and autism in the educational categories of WoS. Among the Ibero-American countries, Spain stands out as the main contributor and maintains close collaboration in this area with the USA and England. Another contributing country is Brazil, primarily collaborating with the U.S., followed by Chile in the same vein. To review in more detail the collaboration network of the most representative countries in education and autism, see Figure 4.

Figure 4

Collaboration network of the most representative countries in education and autism



Discussion

This bibliometric study allows us to gain a global and holistic understanding of research trends in the field of autism and education in Ibero-America indexed in WoS. In the volumes of annual scientific production, it can be observed that the publication of documents increased from 2015 onwards. The growth in literature during this period can be explained by the increasing international attention given to autism in government agendas and public inclusion policies (Nunes et al., 2021). However, when comparing the production of documents in the field of education and autism with other bibliometric analyses conducted in Ibero-America (Dias, 2019; Macías-Quiroga et al., 2021), it can be observed that it remains low, indicating an area for improvement in Ibero-America. The most relevant publishing houses were Elsevier, Taylor & Francis, and Wiley. Spain, Brazil, and Portugal emerged as the most productive countries in the

studied field. However, a bibliometric study on Educational Production in Ibero-America (Maz-Machado et al., 2022) observed that Brazil remained in the first position, while Chile and Mexico displaced Spain and Portugal from the top positions. The relatively low production of Cuba in WoS is surprising, considering the historical attention given to education and disability in the country (Maiga, 2022; Vila et al., 2019). It is also noteworthy that some South and Central American countries, such as Bolivia, Honduras, and El Salvador, have no indexed academic production in WoS, which could serve as a basis and a pending goal for local researchers. Understanding autism research from the socio-economic particularities of each culture is crucial for the international community. On another note, the three most active funding agencies were public and state entities, the Spanish Government, Fundacao Para A Ciencia E A Tecnologia Fct, Coordenacao De Aperfeicoamento De Pessoal De Nivel Superior Capes, which aligns with the most productive countries.

Through the WoS categories, it was observed that author Lorenzo, G. from the University of Alicante (Spain) emerges as the most productive researcher in the field of education and autism. This scholar works in the Department of Evolutionary Psychology and Didactics and is an Associate Professor at the University of Alicante. In 2023, he participated in four published studies titled: (1) "Creation of an immersive virtual reality environment for communication and social interaction: pilot study in students with autism spectrum disorder"; (2) "Designing virtual reality tools for students with Autism Spectrum Disorder: A systematic review"; (3) "Analysis of trends in the application of augmented reality in students with ASD: Intellectual, social and conceptual structure of scientific production through WoS and Scopus"; and (4) "The use of Augmented reality in people with ASD: A review". It would be advisable for Latin American countries that make significant contributions in this area of knowledge to establish new collaboration networks with Spain, specifically with the University of Alicante.

Regarding journals, Research in Autism Spectrum Disorders emerged as the most productive one, specializing in publishing original and documentary articles contributing to a better understanding of autism in fields related to genetics, neurobiology, cognition, and behavior. The journal's main focus is bridging the gap between basic research at these levels and practical questions and difficulties faced by individuals with ASD and their families, as well as caregivers, educators, and medical professionals. This journal has also been at the forefront of other bibliometric studies related to autism in themes such as motherhood (Hernández-González et al., 2023), traumatic experiences (Hernández-González et al., 2023), and physical activity (Feng et al., 2022). The institutions highlighted in the main institutional networks are University of Valencia, University of Murcia, University of Barcelona, Federal University of Rio Grande do Sul, University of Salamanca, Federal University of Rio de

Janeiro, and Complutense University of Madrid. However, according to QS Universities Rankings – Top Global Universities & Colleges, only the University of Barcelona is within the top 100 in the field of education.

The most influential original article titled "Mobile learning technology based on iOS devices to support students with special education needs", authored by Fernández-López et al. (2013), was highly cited and involved four authors. From a bibliometric analysis perspective, the number of authors of an article correlates with its impact and likelihood of citation (Herrera-Calderon et al., 2021). This theory is evident in this case, as the article is a product of a Spanish research team from the University of Granada and the University of Murcia. Highly cited articles are pivotal in generating new knowledge in their field of study, making them essential readings for researchers in Ibero-America. The most frequently used search terms were related to educational intervention, special and/or inclusive education, intellectual disability, learning technology, and family, suggesting that these have been central topics in academic production in Ibero-America. It would be relevant for Ibero-America to increase academic production in other trending areas of autism and education research, such as emotional regulation (Zaharia et al., 2021) and sexual education (Strnadová et al., 2022). The relationships among authors, countries, and institutions highlight national and international collaborations as a driving force for research trends in autism and education. In the case of countries, it is evident that there is not much collaboration among Latin American countries; rather, there is a clear tendency to seek support from the USA and Spain. These results could serve as a basis for reflection at the regional level and initiate plans for collaboration that showcase the educational reality of individuals with autism in developing countries, while also creating virtuous networks of work and cooperation.

Limitations

This study has some limitations that need to be explicitly stated for the sake of research clarity. The search was conducted only in the Web of Science, and although this database is one of the most relevant due to its extensive collection and the quality of its journals, a significant amount of high-quality research in the field of education and autism is not indexed here. Future studies should use other international databases, such as Scopus, to verify these findings. The bibliometric analysis is based on the general virtues of quantitative methods and, therefore, does not allow for the interpretation of the content or quality of the selected publications.

Conclusions

In conclusion, the Ibero-American scientific production indexed in WoS on education and autism has shown positive growth in recent years and has been concentrated mainly in Spain, Brazil, and Portugal. The documents have been published mostly in top-tier journals belonging to Q1, Q2, Q3, and Q4 categories; additionally, the most relevant funding agencies also come from these countries. Although education journals have grown significantly in recent decades, in this particular analysis, specialized journals in autism and disability emerged as the most relevant. However, it is necessary to continue leveraging the mathematical and statistical virtues of bibliometrics by expanding to other sources and information systems to corroborate these findings. This study allows for the development of cooperation policies and new lines of research, while systematizing academic production related to education and autism, serving as a guide for new studies that extend beyond the predominant research lines.

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Bibliometrijska analiza istraživanja autizma u oblasti obrazovanja u iberijsko-američkom regionu: Perspektiva WoS-a

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Uvod: Obrazovanje je ključni alat za unapređenje ličnog i socioemocionalnog razvoja osoba sa autizmom. Međutim, do danas nije sprovedena bibliometrijska analiza na ovu temu u iberoameričkom kontekstu. *Cilj*: Cilj ove studije bio je da analizira godišnju produkciju originalnih članaka, produktivne časopise, finansijske agencije, autore, istraživačke trendove i najuticajnije članke u oblasti obrazovanja i autizma. *Metod*: Korišćena je baza podataka WoS (Education & Educational Research, Psychology Educational, Education Special, Education Scientific Disciplines), a analizirano je ukupno 352 dokumenta. *Rezultati*: Rezultati su pokazali rastući trend u godišnjim publikacijama. *Elsevier*, Španija, finansijska agencija španska vlada, autor Lorenzo, G., časopis *Research in Autism Spectrum Disorders* i univerziteti iz Španije i Brazila bili su najproduktivniji saradnici. Glavni istraživački trendovi fokusirali su se na obrazovne intervencije, specijalno i/ili inkluzivno obrazovanje, intelektualne teškoće i tehnologiju. *Zaključak*: Ovaj rad odražava značajan porast naučne produkcije u iberoameričkom regionu u oblasti obrazovanja i autizma, što je očigledno u istraživačkim temama vezanim za različite aspekte socijalizacije, kao što su škola, tehnologija i porodica. Ipak, potrebno je dodatno istraživanje i prikupljanje dokaza u ovom pravcu, posebno u zemljama Latinske Amerike koje su u procesu razvoja.

Ključne reči: autizam, obrazovanje, bibliometrijska analiza

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