

# Exploring the potential of Artificial Intelligence in Special Education: a bibliometric analysis to support educators and students with Autism Spectrum Disorder (ASD)

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**Abstract**— This full paper describes a complete article in the research category. This work presents a Bibliometric Review that aims to characterize the current scenario of academic research in Artificial Intelligence in education to support educators in the teaching and learning processes in Special Education in different contexts, becoming a tool with potential use in cases of students with Autism Spectrum Disorder (ASD). In this sense, this work aims to contribute to a better understanding of research associated with the area of Artificial Intelligence aimed at educational processes involving students with autism. To do this, we used the EndNote reference manager, an online tool designed to support researchers in conducting Literature Reviews, following the bibliometric protocol proposed by Guedes and Borschiver (2005). From the definition of search strings, ("artificial intelligence") AND ("autism" OR "ASD" OR "autism spectrum disorder") AND ("education" OR "teaching"), scientific databases were explored like Web of Science (WoS), Scopus, ERIC, Emerald, Scielo, Portal CAPES, and IEEE, to locate existing studies on the topic, between 2019 and 2024. As a result, 298 articles were mapped and 20 scientific works were selected that address the aforementioned specific theme, written by 89 authors belonging to 50 institutions in 19 countries on four continents, enabling the creation of a significant theoretical basis. By analyzing the information contained in scientific publications in this specific field, it was possible to infer that research is divided into distinct areas of concentration: 1) the exploration of algorithms and data analysis based on Artificial Intelligence for analytical-predictive issues in the field of special education; 2) the use of robots in the teaching and learning processes of students with autism; 3) the development of personalized educational intervention models for learning pedagogical, social and communication skills. The data

show that research on the use of Artificial Intelligence in the education of autistic people can still be explored, presenting itself as a promising area for future investigations. The present study facilitates understanding of the current state of knowledge in this area, by identifying gaps in areas that require investigation, thus promoting the development of further research. Finally, the data observed with this research will serve as a basis for the development of future AI projects in the teaching and learning process for autistic students.

**Keywords**— *Artificial Intelligence; Autism Spectrum Disorder; Special Education; Bibliometric Review*

## I. INTRODUCTION

Global studies have shown an increase in cases of Autism Spectrum Disorder (ASD) [1]. A survey [2] was carried out by the Center of Disease Control and Prevention<sup>1</sup> (CDC), which monitors statistical data on ASD in the United States, and pointed out in its most recent report, published in 2023, that 1 in every 36 8-year-old children is autistic in that country, which represents 2.8% of that population. This data presents a significant increase in relation to the statistics previously released in 2021, when it was observed that 1 in every 44 children had the diagnosis. Currently, Brazil is still awaiting the release of official autism prevalence figures in the country, collected in the 2022 demographic census. However, it is estimated that the Brazilian population follows the North American trend of occurrences.

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<sup>1</sup> <https://www.cdc.gov/ncbddd/autism/data.html>

According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-V-TR) [3], ASD is a neurodevelopmental disorder, characterized by persistent impairments in reciprocal communication and social interaction in multiple contexts. The diagnosis of the disorder is clinical and its etiology is still partially unknown, relating to a series of genetic factors [1].

Due to the wide variety of characteristics from the first years of life, students with ASD may require different teaching and learning approaches, often supported by technology, according to studies presented by [4], [5] and [6]. This scenario has mobilized families and professionals in the areas of health and education [7], highlighting the contribution of the most recent digital technologies in this process. As a result, the exploration of Artificial Intelligence (AI) related to ASD has been observed in the academic community.

AI can be described as a set of intelligent systems that have the ability to think and learn [8]. And, despite being a topic of interest and study in several areas, including Computing, Linguistics, Philosophy, Mathematics, Neuroscience, among others, there is still no widely accepted definition of AI in the literature [9].

Associated with language, intelligence, reasoning, learning and problem-solving, AI is present in different stages of research development and applications in different fields, including autonomous vehicles, voice recognition, games, robotics, language processing, among others [10].

Studies point to the use of AI to support diagnosis [11], treatment [12] and education of people with autism [13]. In the context of special education, Artificial Intelligence has been addressed in the face of issues related to the development of skills, focusing on cognitive and affective factors of people with disabilities [13].

Therefore, by using bibliometric and bibliographic procedures, this article aimed to map the overall picture of scientific studies that investigate the use of Artificial Intelligence in educational contexts for students with Autism Spectrum Disorder. This literature analysis not only intended to deepen understanding of the topic, but also aimed to identify ongoing initiatives, new lines of research and highlight the main authors and institutions involved in this field. This study was conducted in the context of Brazilian research, based on the collaboration between two institutions located in the south of the country. In this scenario, the researchers sought to explore research on AI in special education, since their institutions are at an early stage of research in this field.

Next, the methodological procedures adopted will be presented (in section 2), as well as their results and discussion through the analysis of the data collected (section 3) and conclusions based on the methods applied (section 4).

## II. METHODOLOGICAL PROCEDURES

Through the combination of bibliometric and bibliographic techniques, the development of this research was divided into two phases: data collection and analysis. Bibliometrics is a tool that allows mapping and analyzing scientific and technical

activities [14], providing statistical management of the information and knowledge collected in this article [15].

By using this procedure, it was possible to visualize and quantify the recent academic contribution of the scientific community to the proposed theme. In addition, bibliographic analysis procedures [16] were used to understand the theoretical contributions that surround the productions regarding the use of Artificial Intelligence in the education of students with ASD.

In the first phase, after defining the search terms and scientific databases to be explored, a systematic literature search was carried out, enabling the collection and organization of data in a digital bibliographic reference management tool. In the second phase, descriptive analysis of the data was carried out, comprising the selection, standardization and treatment of the collected data, resulting in the final product of this study. Next, each stage of the methodological procedures will be described.

### A. Data collection - 1<sup>st</sup> Phase

#### First Step 1 - Defining search strings

To carry out bibliographic searches in scientific databases, three search keys were used, each with its synonyms or acronyms: the 1st key ("artificial intelligence"), the 2nd key ("autism" OR "ASD" OR "autism spectrum disorder") and the 3rd key ("education" OR "teaching").

#### Step 2 - Consultation on scientific bases

The selection of databases was based on the consistency of the records returned for the search terms and the condition or possibility to export the data to bibliographic reference management software. Furthermore, scientific databases of a multidisciplinary nature were selected [17]. Based on these criteria, data collection was carried out in the following Brazilian and foreign databases: Portal de Periódicos Capes, Scopus, IEEE, Web of Science (WoS), Emerald, Eric and Scielo.

The research required different search strategies, since each of the databases searched has its own structure and method of indexing search terms. Starting from the last five years (2019-2024), the investigation was based on scientific articles published in journals and conference publications in the areas of Technology, Education, Psychology, Computing and Sciences.

#### Step 3 - Exporting records to EndNote

The results of bibliographic searches in scientific databases were exported and loaded into the EndNote bibliographic reference management tool, resulting in a single set containing all articles. The tool, developed by Thomson Reuters, allows the export of information such as title, authors, institution, place and year of publication, which were used in this work.

### B. Data analysis - 2<sup>nd</sup> Phase

#### Step 4 - Application of selection and exclusion criteria

At this stage of the research, the following selection/exclusion criteria were applied: 1) elimination of duplicate articles, that is, articles indexed in more than one database; 2) exclusion of articles without authorship, abstract and keywords; 3) discarding of articles which full texts were not

freely available for download; and 4) removal of articles that were not aligned with the context of this research.

#### Step 5 - Standardization of collected data

To ensure the integrity and uniformity of information from multiple bibliographic sources, it was essential to standardize the results. For example, while the Scopus database often presents records with abbreviations of authors' names, Web of Science tends to provide full names. This step is crucial for the cohesion and accuracy of the data present in the selected publications.

#### Step 6 - Analysis of collected data

After comprehensive data standardization, it became feasible to conduct analyses efficiently. Among the bibliometric data extracted from publications, the following stand out: the number of publications per year, the nature of the publication sources (whether conferences or journals), as well as information about the authors, including the quantity, affiliated institutions and countries of origin. This collected data facilitates, for example, the identification of the main researchers involved in studying the use of Artificial Intelligence in the education of students with ASD.

Furthermore, the authors read the abstracts of the articles or, when necessary, the full text, in order to obtain an adequate understanding of the topic covered in each article. As a result of this process, the main approaches adopted by the authors were identified, as well as the macro themes and themes of interest within the context of the use of Artificial Intelligence in the education of students with Autism Spectrum Disorder.

#### Step 7 - Preparation of final considerations

Based on the information collected, the section that encompasses all the findings, descriptions and results of the analyses were prepared. In the subsequent sections of this document, the results obtained through the execution of each of the previously described steps will be detailed.

### III. RESULTS AND DISCUSSION

#### A. Bibliometric data on AI & Education & ASD research

As a general result of the bibliometric search in the databases Scopus, IEEE, Web of Science (WoS), Emerald, Eric, Scielo and Portal de Periódicos Capes, a total of 298 registered works were obtained. After applying the selection and exclusion criteria, 20 articles remained for the complete analysis to be carried out during this research. It is understood that the number of samples was reduced due to the narrowing of the chosen theme in the specific field of special education. Table I demonstrates the procedures (P) adopted for the final selection of studies related to the researched topic: location of articles (P1), exclusion of repeated articles (P2), Exclusion of Articles without authorship, Keywords, Abstract (P3), Exclusion of Articles without Full Text (P4), Exclusion of Articles Out of Context (P5) and, finally, the total selection of articles (P6).

TABLE I. NUMBER OF PUBLICATIONS SELECTED IN THE DATABASES

Data Base	P1	P2	P3	P4	P5	P6
Portal Capes	39	8	17	6	7	1
Scopus	55	4	2	7	28	14
WoS	93	17	8	7	60	1
Eric	12	4	1	4	0	3
Emerald	39	0	14	4	21	0
Scielo	2	0	0	1	1	0
IEEE	58	10	9	1	37	1
<b>Total</b>	<b>298</b>	<b>255</b>	<b>204</b>	<b>174</b>	<b>20</b>	<b>20</b>

Source: authors.

Given the 20 selected works, it was possible to observe that 7 are conference articles and 13 are indexed in scientific journals. The publications were written by 89 authors, linked to 50 institutions from 19 different countries spread across 4 continents. In total, 113 keywords were used to index the works and 1,007 references to support the studies (average of 50 references cited per publication). Table II summarizes the research data.

TABLE II. GENERAL BIBLIOMETRIC DATA OF PUBLICATIONS

Bibliometric data	Frequency
Publications	20
Sources of publications	20
Authors	89
Institutions	50
Countries	19
Continents	4
Keywords	113
References	1,007

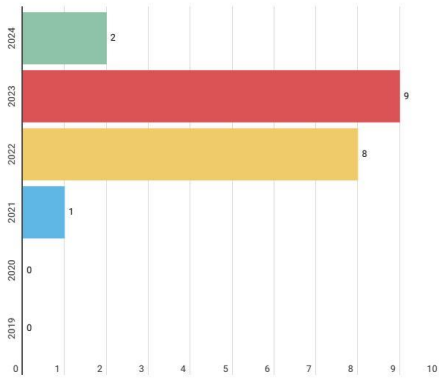
Source: authors.

The analysis of the bibliometric data provided in Table II will be detailed in the following topics.

#### B. Publications per year

Given the time period researched, 2023 stands out as the year in which there was the largest number of publications related to the topic, totaling 9 articles (45%) of the 20 selected. It is evident that the majority of articles that year (66%) were published through journals focusing on areas related to disabilities and physical, cognitive and technological development: Journal of Developmental and Physical Disabilities, International journal of online and biomedical engineering, Journal of Special Education Technology and the International Journal of Developmental Disabilities.

In When it comes to conferences, it was noticed that 34% of the articles in 2023 focus on different areas of computer science, data communication, information technologies, biomedical engineering and the internet of things. The analyzed data was condensed in Fig. 1, below.



The general numbers for the total period point to the same trend evident in 2023, since 65% of the selected articles were published in journals and only 35% came from conferences around the world.

Furthermore, given the data collected, it is observed that the theme that intersects the three search keys (AI & Education & TEA) found its way into publications after 2021. The first article related to this study in 2021 was published at the AHFE Conferences on Human Factors in Software and Systems Engineering, Artificial Intelligence and Social Computing, and Energy, held in New York, United States.

### C. Authors, institutions and countries

The articles analyzed in this review were written by 89 authors affiliated with 50 institutions. Nottingham Trent University (UK) and the University of Oregon (USA) stand out, both with more than one work selected in the sample collected. The United States (19), China (12), Australia (6), the United Kingdom (6) and Turkey (6) lead as the countries with the highest number of article authors. Furthermore, there is the participation of authors from Thailand (5), India (4), Bulgaria (3), Ecuador (2), Singapore (2), Malaysia (2), Spain (2), Bangladesh (2), Greece (2), United Arab Emirates (2), Taiwan (1), Japan (1), Italy (1) and the Netherlands (1). Fig. 2 presents the map with the geographic distribution of the institutions present in the articles analyzed.



Fig. 2. Geographic distribution of institutions mapped in selected articles

In view of the map presented, it is possible to see that the topic of interest in this bibliometric analysis is addressed by institutions around the world, distributed across America, Europe, Asia and Oceania. The United States is the country with the greatest diversity of institutions interested in the area researched. Yunnan University of Chinese Medicine (China) is the institution with the largest number of affiliates (6), followed by the British Nottingham Trent University (5) and the Thai King Mongkut's University of Technology (3).

#### D. Main keywords and themes covered by the works

The articles analyzed used 113 keywords. The main indexing terms were: Autism (15); Artificial intelligence (14); Special education (8); Machine learning (4) and Education (3). From Fig. 3, it is possible to observe the other keywords used by the authors in the selected works.

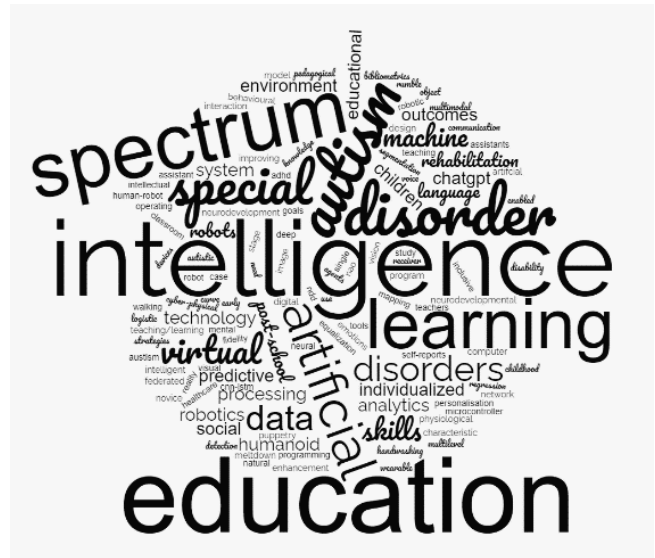


Fig. 3. Geographic distribution of institutions mapped in selected articles

The analysis of the keywords used in the articles allowed us to identify topics of interest within the context of the use of Artificial Intelligence in the education of students with Autism Spectrum Disorder. The themes can be divided into five topics:

- *Autism and Developmental Disorders*: the prevalence of the keywords "Autism", "Autism Spectrum Disorder" and "Neurodevelopmental disorders" indicates there is a significant focus on issues related to autism and other developmental disorders;
- *Artificial Intelligence and Machine Learning*: Keywords such as "Artificial intelligence", "Machine learning", "Deep Learning", "CNN-LSTM" indicate a strong interest in applying AI and machine learning technologies in contexts related to education, health and human-robot interaction;
- *Special Education and Educational Technology*: "Special education", "Educational technology", "Individualized education program goals" point to an interest in the application of educational technologies to meet the specific needs of students with disabilities, especially in the context of autism;

- *Human-Robot Interaction*: Keywords such as "Human-robot Interaction", "Social robotics", "Virtual agents" indicate an exploration of how interaction between humans and robots can be used to improve learning and social interaction, especially for individuals with autism;
- *Image Processing and Computer Vision*: "Computer Vision", "Image processing", "Segmentation" suggest an interest in using image processing and computer vision technologies in contexts related to autism, such as analyzing facial expressions and recognizing behavioral patterns.

Given this information and, from reading the abstracts and, when necessary, the full articles, it was possible to infer that research is divided into distinct areas of concentration: 1) in the exploration of algorithms and data analysis based on Artificial Intelligence for analytical-predictive issues in the field of special education; 2) the use of robots in the teaching and learning processes of students with autism; 3) in the development of personalized educational intervention models for learning pedagogical, social and communication skills.

It is believed that the objective of the bibliometric review is to provide an overview of the field of study, through statistical data, graphs and tables that demonstrate the trends and research patterns found. However, it is understood that the individual mentions of the articles are a valid complement that can also contribute to the understanding of the study, through the identification of concrete examples about the directions and gaps in the development of research on the use of AI in special education. Since it is a theme of inclusion, the detailed view makes the analysis more accessible and understandable, increasing the chances that this study will be more inclusive to the reading public. Thus, it is considered that the results of this work can motivate other research that brings insights into a theme that, for now, presents paths that must be explored, perceived and properly mapped. Furthermore, it is understood that the collection of recent articles corroborates the idea that research on the use and implications of Artificial Intelligence in the educational context has been boosted in recent years. Although it is not the purpose of this study to identify the reasons for this achievement, it is assumed that facilitated access to AI tools on a global scale may have expanded studies on the subject.

1) The exploration of algorithms and data analysis based on Artificial Intelligence:

Three (3) selected papers addressed the topic related to data collection for predictive analysis. In 2022, the article *From High School to Postsecondary Education, Training, and Employment: Predicting Outcomes for Young Adults with Autism Spectrum Disorder* [18], explored data and concluded that research findings on Artificial Intelligence can be used to support state and local educators to make decisions about policies, programs, and practices for exited high school students with ASD, to help them successfully transition to adult life.

In 2023, the same authors continued the studies in the paper *Post-High School Outcomes of Students with Autism Spectrum Disorder and Students with Intellectual Disability: Utilizing Predictive Analytics and State Data for Decision-Making* [19],

identifying limitations of the research and confirming the accuracy of their findings.

In the same year, the paper *Towards the Development of a Machine Learning-Based Action Recognition Model to Support Positive Behavioral Outcomes in Students with Autism* [20] focused on developing a predictive action recognition model to detect and distinguish the most common actions that children with autism exhibit when approaching a meltdown. With this, caregivers and teachers would be able to intervene with evidence-based practices to address such issues before they escalate and decrease the frequency and intensity of such events.

2) the use of robots in the teaching and learning processes of students with autism: in this area of concentration, six (6) studies were identified that mentioned the use of Artificial Intelligence in the construction of robots to be used in the educational context.

In 2021, the paper *AsiRo-μ: A Multi-purpose Robotic Assistant for Educational Inclusion of Children with Multiple Disabilities* [21], used a 3D printed robot for hand gesture recognition, automatic speech recognition and text conversion function in speech to dialogue with children and motivate them to carry out rehabilitation exercises/activities and in therapy sessions (for children with disabilities).

In 2022, three (3) studies were identified that explored the topic. The paper *Design of Educational Scenarios with BigFoot Walking Robot: a Cyber-physical System Perspective to Pedagogical Rehabilitation* [22], presents a walking robot, called BigFoot, which has a system of sensors developed to apply it appropriately in educational scenarios from a cyber-physical system perspective for pedagogical rehabilitation.

The work *Inclusive Education for Young Children with Autism Spectrum Disorder: use of Humanoid Robots and Virtual Agents to Alleviate Symptoms and Improve Skills, and a Pilot Study* [23], discusses the use of robots and virtual agents for inclusive education. Through sessions, the study assessed that children with ASD can benefit from a humanoid robot to improve their symbolic gaming skills.

Still in 2022, the paper *Design a Cloud-enabled Humanoid Robot Application System to Assess the ABA Learning for Autistic Children* [24], reports the difficulties with therapies for autism in China, citing high market demand, high prices and teachers unsuitable for autism. With this, the authors applied cloud-based robotics and the practical needs of learning Applied Behavior Analysis (ABA) for autistic children, designing a humanoid robot system to recognize the emotions and actions of autistic children in order to assess the cognitive progress in their learning and reducing the teacher's workload. The prototype developed demonstrated the viability of the project in monitoring children with ASD.

In 2023, the paper *Using Robot-Assisting Personalized Learning for Children with Autism: a Pilot Study of Robot's Actions* [25], aimed to help parents and caregivers using a robot to assist personalized learning for children with autism. Using a robot with a program based on artificial intelligence, the study revealed the possibility of choosing actions suited to the user's style or preference, aiding learning.

In 2024, the paper *The use of artificial intelligence for detecting the duration of autistic students' emotions in social interaction with the NAO robot: a case study* [26], aimed to explore the application of robotics to check the emotions of children autistic people and promote their communication and social interaction. To this end, an automatic system based on neural networks was designed to identify the emotions expressed by autistic children throughout the process of interaction with the NAO robot. The results showed that, based on imitation, play and social interaction activities, the emotions of sadness and anger were expressed by students for a longer period of time.

3) the development of personalized educational intervention models for learning pedagogical, social and communication skills was the topic with the largest number of studies found, in a total of 12, four (4) in 2022, six (6) in 2023 and one (1) in 2024.

In 2022, the paper *Artificial Intelligence Enabled Personalized Assistive Tools to Enhance Education of Children with Neurodevelopmental Disorders—A Review* [27], identified that children with ASD have social and communication impairments and also difficulties adapting to changes in their environment, which can affect your ability to learn effectively. Therefore, it sought to review the range and effectiveness of AI-assisted tools, developed using machine learning models, applied to address learning challenges in students with disabilities. In this way, the authors were able to provide recommendations for the development of future AI tools focused on providing personalized learning.

In the same year, the paper *RAISE: Robotics & AI to improve STEM and social skills for elementary school students* [28], presented the design and implementation of an exploratory virtual learning environment that helps children with autism in learning skills in science, technology, engineering and mathematics (STEM), as well as improving social-emotional and communication skills.

The study *Towards Explainable and Privacy-Preserving Artificial Intelligence for Personalization in Autism Spectrum Disorder* [29], sought to explore developments in Artificial Intelligence and machine learning techniques with a focus on the administration of personalized treatments, cognitive-behavioral therapies and educational interventions. The paper sought to understand the advancement of privacy-preserving methods aimed at people with ASD.

In the last study listed in 2022, *A bibliometric analysis of research trends of artificial intelligence in the treatment of autistic spectrum disorders* [30], the global situation of AI research in the treatment of ASD from 1995 to 2022 was observed, to investigate the global circumstance research and frontier trends in this field. With this, the authors concluded that the theme is of global interest, mainly in relation to education, social function and joint care for children with ASD.

In 2023, the year with the most significant number of works collected, the paper *The Effects of Artificial Intelligence on Implementers' Fidelity of Instructional Strategies During Handwashing Acquisition in Children with Autism* [31], explored the development of a tablet-based application that used AI in implementation of behavioral request and task chaining

techniques during the acquisition of a learning program with children with autism. The authors discussed the limitations of the study, user design, and provided considerations and directions for future related research.

The paper *Artificial intelligence in special education: a systematic review* [32], examined trends in research on artificial intelligence in special education through the systematic review method. Given the studies mapped between 2008 and 2020, the authors pointed out that the main type of disability examined in the articles was ASD. They also reported that most studies deal with skill development using software-based methods.

Still in 2023, the paper *AI Tools Like ChatGPT for People with Neurodevelopmental Disorders* [33], researched the potential of AI tools, such as ChatGPT, for individuals with neurodevelopmental disorders, from the perspective of improving learning, personalized assessment and diagnosis. The authors highlighted that there is currently no research evidence to suggest that AI tools can replace therapists and healthcare professionals in this context.

The paper *Artificial Intelligence in Children with Special Need Education* [34], through the implementation of a data-driven approach to classify patients with ASD and participants with typical development, identified whether the literature covered the topics of AI's influence on special education and, regarding the potential of AI to empower instructors to promote special educational needs, the authors focus on how AI affects education.

The study *Chatting with GPT: Enhancing Individualized Education Program Goal Development for Novice Special Education Teachers* [35] investigated the impact of ChatGPT on the quality, content and time spent developing Individualized Education Program goals for beginning special education teachers. The results showed that the use of the AI tool had a positive impact on improvement, time reduction and identification of specific needs of children with autism, suggesting that the use of ChatGPT can be a valuable tool in supporting special education teachers.

The paper *Virtual voice assistant improved applications expressive verbal abilities and social interactions in children with autism spectrum disorder: a Single-Subject experimental study* [36], examined the effects of using the Virtual Voice Assistant with a focus on the development of speech and social interaction skills, demonstrating that the results of the applications had positive effects on the skills of autistic children.

Finalizing the selection of papers for this study, in 2024, the work entitled *The key artificial intelligence technologies in early childhood education: a review* [37], provided an updated overview of the main AI technologies used in early childhood education, providing a historical perspective, summarizing work and discussing the trends and challenges of the topic through a bibliometric analysis focusing on children with ASD.

#### *E. Main references used*

From the review of the selected articles, it was possible to count 1,007 references used, demonstrating a significant engagement with varied literature. The author Drigas proved to be the most cited, with a total of 14 mentions, followed by other



references such as Moraiti (6), Zheng (5), Dimitrova (5) and Boucenna (4).

Autism Spectrum Disorder was the most frequent topic in references, being mentioned 338 times, indicating a significant concentration of academic interest in this topic. In addition, other topics such as early childhood education, educational technology and robotics were also explored, reflecting current trends in research that seek to integrate advanced technology and innovative pedagogical methods to improve learning and educational support, indicating a trend towards understanding and applying technological solutions for complex educational challenges, especially in contexts related to special education.

To investigate the contribution of the authors and institutions of the selected papers, the ResearchRabbit<sup>2</sup> tool was used, a software based on Artificial Intelligence that cross-references articles and authors, monitoring the literature and visualizing research scenarios. From the selection of works in this article, it was possible to infer that La Trobe University (Australia), through the author Islam, M. S., has the highest number of citations in the context of scientific research (39,175 citations), followed by the National University of Singapore (Singapore), through the author Acharya, U. R. (30,759 citations) and Nottingham Trent University (United Kingdom), with the author Brown, D. (5,262 citations).

Using the same tool, it was still possible to cross-reference the scientific production of the selected authors, highlighting the existing research connections in the analyzed context. Fig. 4 illustrates groups of researchers clustered according to connections and research interests.

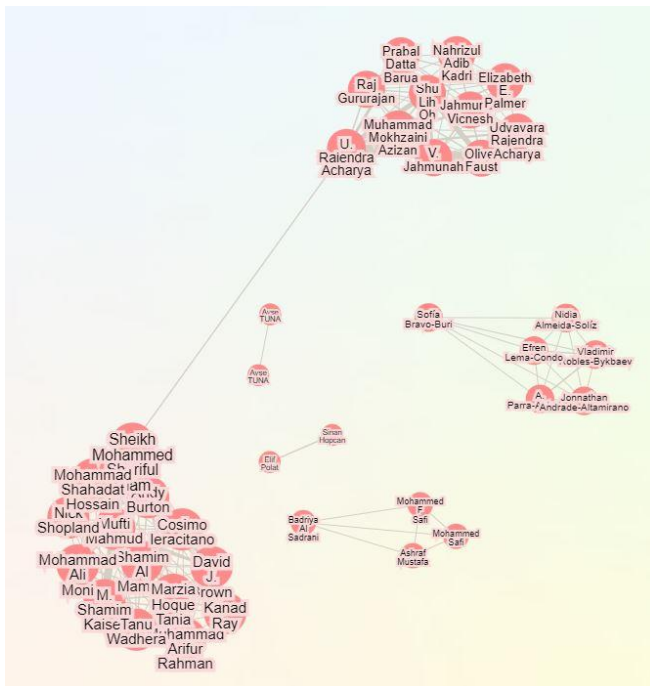


Fig. 4. Connection network between the authors of the selected works by ResearchRabbit

Furthermore, by exploring the tool, it was possible to identify the existence of another 507 suggested authors that could be related to the authors collected in this sample. This shows that there are still studies, authors and institutions with the potential to have their collaborations investigated.

#### IV. FINAL CONSIDERATIONS

This article presented the results of a research that used bibliometric and bibliographic procedures to map the trend of scientific studies that investigate the use of Artificial Intelligence in educational contexts for students with ASD. This made it possible to identify the authors, institutions and characteristics of the sample collected.

The research areas of concentration indicated that although there are advances in the analyzed topic, there are still topics to be explored: 1) Evaluating the effectiveness of educational approaches with AI in the long term (longitudinal studies), since most studies focus on short-term results, evaluating the impact of AI in weeks or months. It is assessed that this conduct limits the understanding of the real implications of AI in the development of students' skills and progress in the long term. Therefore, it is believed that it is essential to invest in longitudinal studies that follow students with autism throughout their educational paths, evaluating the implications of AI on learning, development and autonomy, which will allow us to understand whether the use of AI provides lasting benefits and whether it, in fact, contributes to the autonomy and inclusion of students; 2) Investigating the applicability of AI in different educational environments and cultural aspects, since the limitation of diverse environments prevents the generalization of results and the application of AI in different realities. Therefore, it is essential to expand research to investigate the adaptation of AI in different educational environments, taking into account the different needs of students with autism and the cultural, social and economic characteristics of the contexts in which they are inserted. Failure to pay attention to diversity can limit the applicability of AI in different contexts and perpetuate inequalities. In this scenario, it is necessary to integrate the cultural perspective and the consideration of the specific needs of students from different backgrounds and cultures in research, ensuring that AI is an inclusive resource that meets the needs of all students in question; 3) Discuss the ethical implications and guarantee the privacy of educators' and students' data, since the growing use of AI in education still requires incisive regulation of its use in order to protect the autonomy and well-being of those being researched. In this context, it is also important to expand studies that help to avoid the creation of discriminatory biases in data collection and analysis in research settings. Therefore, the gaps highlighted require a joint effort by researchers, educators, and AI experts to ensure that technology is used responsibly and ethically in the education of students with ASD. Overcoming these gaps can allow AI to become a transformative tool, contributing to the construction of a more inclusive and equitable education for special education students.

<sup>2</sup> <https://www.researchrabbit.ai/>

## ACKNOWLEDGMENT

The authors would like to thank the Foundation for Research Support of the State of Rio Grande do Sul (FAPERGS) for the financial support provided for this research, under grant number 23/2551-0001856-0.

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