



# Autism Spectrum Disorder: Learning & Social Behavior of Children with ASD During COVID-19

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## Introduction

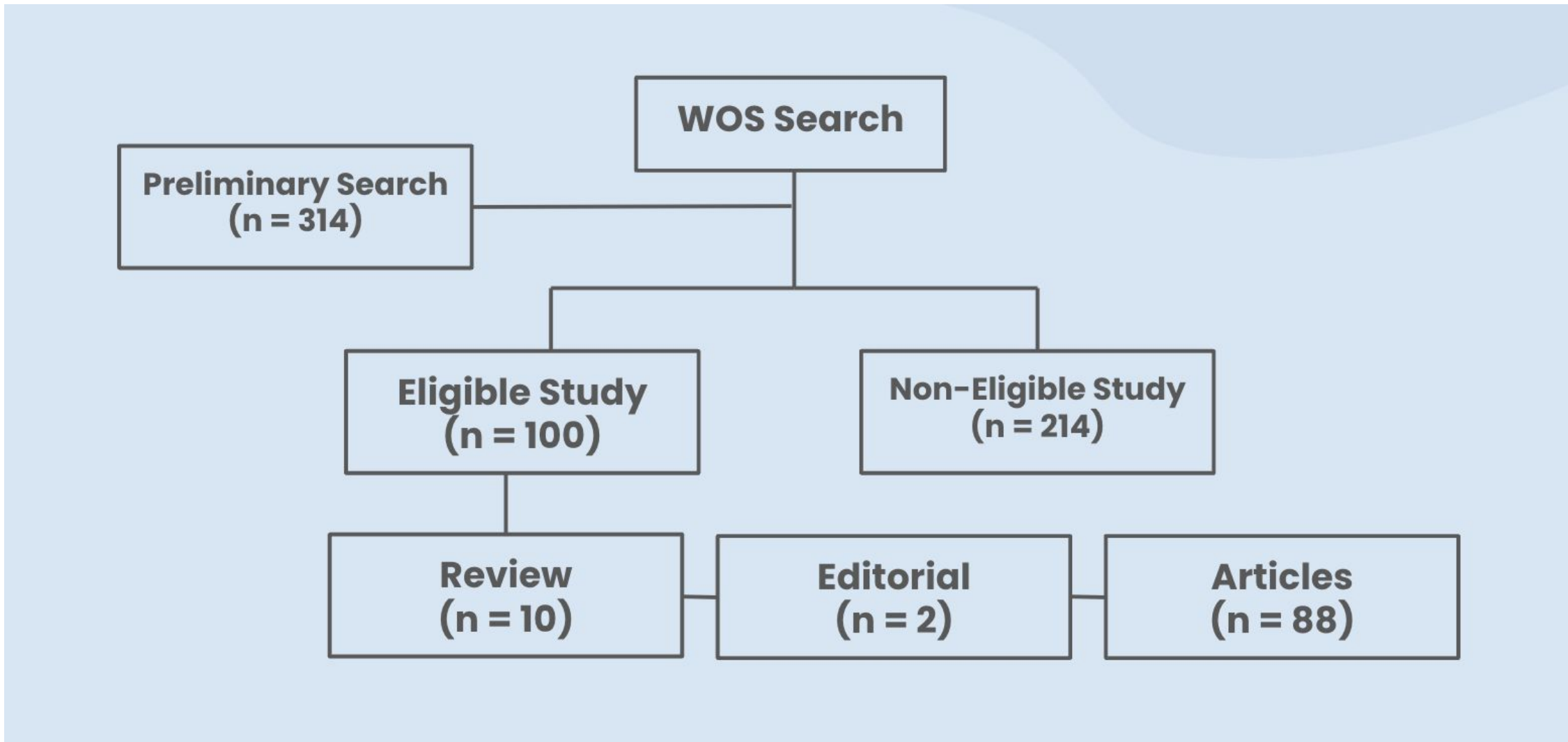
Autism Spectrum Disorder is a neurodevelopmental disorder that may have a significant effect on social, behavioral and learning capabilities. Our research project focuses on understanding ASD and its involvement with youths in the post-COVID era and the learning and social behavior implications that may have arose.

## Objectives

The objective of our research was to investigate the relationship between autism spectrum disorder and the development of learning ability and social skills in children, with an emphasis on how this relationship may have evolved in response to the heightened social isolation of the COVID-19 pandemic. Through our analysis of current autism research, we aim to illuminate where gaps between children with neurotypical brains and children with autism spectrum disorder can be addressed by further research.

## Methods

Using R Studio and Bibliometrix, we extracted the top 314 articles from Web of Science. We utilized tools like excel and google sheets to create the figures representing our data. We also narrowed down our research articles using keywords such as “autism”, “learning”, “social”, and “COVID-19”. We analyzed our findings according to our research question. We further sought into how future research can be improved. Below is a mapping analysis of our methodical approach for our research.



## Data & Results

Title	Authors	Source Title	Publication Date	Publication Year
Perovskite quantum theory-guided protein engineering	Qin, Yuhui, Wu, Qian, Wei	NATURE COMPUTATIONAL SCIENCE	2023	2023
Virtual scanning light-field microscopy for robust snapshot high-resolution volumetric imaging	Li, Zhi, Liu, Yu, Jin, Manchang, Luo, Xiu	NATURE METHODS	2023	2023
Exploiting systematic orthographic-orthographic similarities to enhance foreign language vocabulary learning	Hicks, Nina Selma	LANGUAGE TEACHING RESEARCH	2023	2023
On the automated learning of air pollution prediction models from data collected by public sensor networks	Morales, Pablo, Almeida, Susana, Martins, J.	ENERGY SOURCES PART A: RECOVERY UTILIZATION AND ENVIRONMENTAL EFFECTS	2023	2023
Deep learning-based obstacle-avoiding autonomous UAV with fiducial marker-based localization for structural health monitoring	Waqas, Ali, Kang, Daoguo, Chu, Yong-H	STRUCTURAL HEALTH MONITORING-AN INTERNATIONAL JOURNAL	2023	2023
Decoupling of clinical variance in CAR-T cell pharmacology and response	Kirwan, Daniel C. C., Zourosch, Cole, D	NATURE BIOTECHNOLOGY	2023	2023
NMR-Challenge.com: An Interactive Website with Exercises in Solving Structures from NMR Spectra	Drewniak, Martin, Suck, Ondrej, Odujo	JOURNAL OF CHEMICAL EDUCATION	2023	2023
Deep learning unlearning for robust sub-salt waveform inversion	Abdi, Abdallah, Kassi, Vladimir, Kalin, J	GEOPHYSICAL PROSPECTING	2022	2022
Hybrid classification structures for automatic COVID-19 detection	Shah, Mohamed R., Elmag, Hiba M. H	JOURNAL OF AMBIENT INTELLIGENCE AND HUMANIZED COMPUTING	2022	2022
Integrating deep learning, binding alignment, and a multi-NMR strategy for high-quality protein monomer and complex structure prediction	Zhang, Wei, Wu, Qing, Frohlich, J	PROTEINS: STRUCTURE, FUNCTION, AND BIOINFORMATICS	2023	2023
Long-term changes in forest response to extreme atmospheric dynamics	Shukla, Ankit, Hartwig, Lukas, Buchen	GLOBAL CHANGE BIOLOGY	2023	2023
Machine Learning-Based Human-Driven Prioritization of Features in Noninvasive Screening of Environmental High-Resolution Mass Spectrometry	Kutay, Emre, Koc, Mustafa, Koc, Mustafa	ENVIRONMENTAL SCIENCE & TECHNOLOGY	2023	2023
Parametric and Machine Learning-Based Analysis of the Seismic Vulnerability of Adobe Historical Buildings Damaged After the September 2 Earthquake	Elmag, Hiba M., Elmag, Hiba M., Elmag, Hiba M.	INTERNATIONAL JOURNAL OF ARCHITECTURAL HERITAGE	2023	2023
Employee Adherence to Unethical Instructions from Human Than AI Supervisors: Complementing Experimental Evidence with Machine Learning	Lane, Lukas, Bhat, Raman, Corbett, Fab	JOURNAL OF BUSINESS ETHICS	2023	2023
Synthetic data accelerates the development of generalizable learning-based algorithms for X-ray image analysis	Guo, Cong, Kellom, Benjamin D. D. H.	NATURE MACHINE INTELLIGENCE	2023	2023
Targeted Learning: Toward a Future Informed by Real-World Evidence	Grober, Susan, Phillips, Rachel V., Lee, J	STATISTICS IN BIOPHARMACEUTICAL RESEARCH	2023	2023
Examining children's questions and parents' responses about COVID-19 pandemic in Turkey	Unlutrakul, Buree, Vilasit, Haydi	CURRENT PSYCHOLOGY	2022	2022
DFGL: A flexible distributed algorithm for generalized linear mixed model with application to privacy-preserving hospital profiling	Lee, Changhyun, Han, Min, Nam, Shi	JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION	2022	2022
Tertiary structure assessment at CASP15	Simkin, Adam J., Moudgali, Shashank, B	PROTEINS: STRUCTURE, FUNCTION AND BIOINFORMATICS	2022	2022
Atomic cluster expansion for Pb-Bi catalysts: From ab initio to the simulation of nanofabrication in low steps	Liang, Yanyan, Mores, Matteo, Lyngby	JOURNAL OF MATERIALS RESEARCH	2023	2023
Estimation of model accuracy in CASP15 using the MolScribe server	Elmag, Hiba M., Elmag, Hiba M., Elmag, Hiba M.	PROTEINS: STRUCTURE, FUNCTION AND BIOINFORMATICS	2023	2023
Comparing linear discriminant analysis and supervised learning algorithms for binary classification: A method comparison study	Graf, Ricardo, Zakharenko, Marina, Friedberg, BIOMETRICAL JOURNAL	2022	2022	2022
A Bayesian latent Dirichlet approach for modeling memory decay in dynamic social networks	Arora, Gaurav, Mahajan, Jyoti, Lohar, S	SOCIOLOGICAL METHODS & RESEARCH	2022	2022
Subjective machine: Probabilistic risk assessment based on deep learning of self-information	Bhat, Nisha P., Sreenivas, Matthew, Bhat, Nisha P.	ANALYSIS	2022	2022
Multivariate anomaly detection based on prediction intervals constructed using deep learning	Mahesh, Thabang, van Zyl, Terence L.	NEURAL COMPUTING & APPLICATIONS	2022	2022
Assessment of three-dimensional RNA structure prediction in CASP15	Doe, Brian, Kermel, Rachel C., Simkin, Adam J.	PROTEINS: STRUCTURE, FUNCTION AND BIOINFORMATICS	2023	2023
From leaves to labels: Building modular machine learning networks for rapid herbarium specimen analysis with LeafMachine2	Weaver, William N., Smith, Stephen A.	APPLICATIONS IN PLANT SCIENCES	2023	2023
FieldPrint: A system for creating snapshot vouchers from field images using photogrammetric markers and QR codes	Weaver, William N., Smith, Stephen A.	APPLICATIONS IN PLANT SCIENCES	2023	2023
Improving protein structure prediction with extended sequence similarity searches and deep learning-based refinement in CASP15	Oh, Taehyung	PROTEINS: STRUCTURE, FUNCTION AND BIOINFORMATICS	2023	2023
Predicting predator-prey interactions in terrestrial ecosystems using random forest	Llewellyn, John, Strona, Giovanni, Dickens, C	ECOGRAPHY	2023	2023
A Bayesian inverse approach to identify and quantify organisms from fisheries acoustic data	Uney, Samuel S., De Robertis, Alex, Bass, J	JOURNAL OF MARINE SCIENCE	2023	2023
A Longitudinal Analysis of Informal Digital Learning of English, Willingness to Communicate and Foreign Language Borrowers: A Latent Class Analysis	Chen, Yuhui, Tahir, Shireen, Maged, Elmag, Hiba M.	ASIA-PACIFIC EDUCATION RESEARCHER	2023	2023
A Randomized Trial of the Accuracy of Novel Telehealth Instruments for the Assessment of Autism in Toddlers	Correa, Laura L., Wagner, Liliane, Hoops, J	JOURNAL OF AUTISM AND DEVELOPMENTAL DISORDERS	2023	2023
A Within-Group Approach to Ensemble Machine Learning Methods for Causal Inference in Multilevel Studies	Sak, Yumi	JOURNAL OF EDUCATIONAL AND BEHAVIORAL STATISTICS	2023	2023
Integrating presence-only and presence-absence data to model changes in species geographic range: An example in the Neotropics	Ortiz-Sanchez, Fernando, Borchert, Diana E. K.	JOURNAL OF BIOGEOGRAPHY	2023	2023
Invasive ant learning is not affected by seven potential noncognitive chemicals	Galante, Henrique, Cruzes, Tamer J.	CURRENT ZOOLOGY	2023	2023
Quantifying and analyzing rock trait distributions of rocky fall mounds using deep learning	Chen, Zhang, Scott, Chelton, Keating, D	EARTH SURFACE PROCESSES AND LANDFORMS	2023	2023
Exploring teachers' perceptions of critical digital literacy and how these are manifested in their teaching practices	Goncalves, Anaestina, Lakshmi, Minna, Ruffa	EDUCATIONAL REVIEW	2023	2023
A Demonstration of Modified Treatment Policies to Evaluate Shifts in Mobility and COVID-19 Case Rates in US Counties	Nagari, Joshua R., Bhat, Laura B.	AMERICAN JOURNAL OF EPIDEMIOLOGY	2023	2023
Robust Federated Learning for accurate time-based device model identification under label flipping attack	Sankar, Sankar, Pado, Miguel, Huang, Y	CLUSTER COMPUTING: THE JOURNAL OF NETWORKS SOFTWARE TOOLS AND APPLICATIONS	2023	2023
Near-term forecasts of stream temperatures using deep learning and data assimilation in support of management decisions	Zwart, Jacob A. A., Oliver, Samantha K. J	JOURNAL OF THE AMERICAN WATER RESOURCES ASSOCIATION	2022	2022
Deep learning multiphysics network for imaging COVID-19 radiological situations and estimating uncertainty in geological carbon storage	Ull, Evan, Schaefer, Alenbach, David, J	GEOPHYSICAL PROSPECTING	2022	2022
Bayesian Classification through a Multimodal Fusion Framework and Ensemble Learning	Ahli, Abdelmajid, Fathi, Gadi, Hani, N	INFORMATION SYSTEMS FRONTIERS	2022	2022
Development of a model to predict antidepressant treatment response for depression among Veterans	Puro-Palacios, Victor, Zakharenko, Marina, Friedberg, BIOMETRICAL JOURNAL	2022	2022	2022
Investigating machine learning's capacity to enhance the prediction of cancer choices	Song, Q. Chuan, Shi, Huan, Jie, Tang, J	PERSONNEL PSYCHOLOGY	2022	2022
Spatial, temporal and climatic drivers of nonthermal sedimentary organic carbon release	Lopez-Gonzalez, Cecilia, Bhat, Nisha P.	SEDIMENTOLOGY	2023	2023
Multi-layered maps of neuropil with segmentation-guided contrastive learning	Dokken, Soren, Li, Peter H., Janssen, N	NATURE METHODS	2023	2023
Tree machine learning on the edge: A framework for transfer learning empowered unmanned aerial vehicle assisted smart farming	Hoyt, A. M., Alalade, Sani A., JET	SMART CITIES	2023	2023
Global mapping of river sediment loss	Carmona, Patricia E., Bhat, Nisha P.	EARTH SURFACE PROCESSES AND LANDFORMS	2023	2023
Breaking the conformational ensemble barrier: Ensemble structure modeling challenges in CASP15	Kryzhanovskiy, Andrey, Monteleone, G	PROTEINS: STRUCTURE, FUNCTION AND BIOINFORMATICS	2023	2023

Figure 1. represents the top 50 articles that were extracted and most related to our research findings. All of these articles helped us focus on our answer to our posed research question and helped us appreciate the research findings that were done post the heightened COVID-19 pandemic.

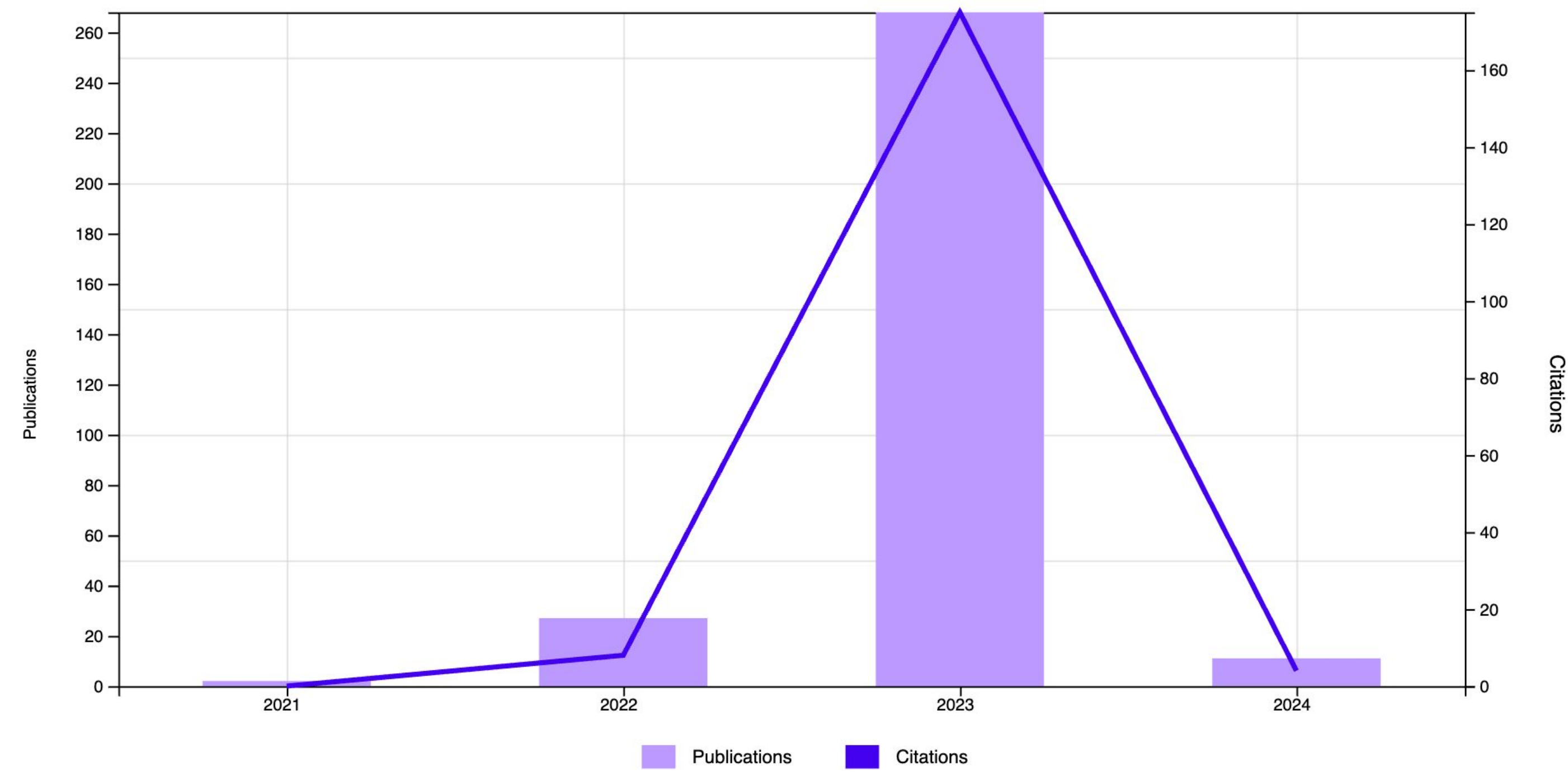


Figure 2. represents the number of citations and publications per year. We noticed that there is a significant amount of citations and publication within the last year.

## References

Web of Science, R Studio, BiblioShiny

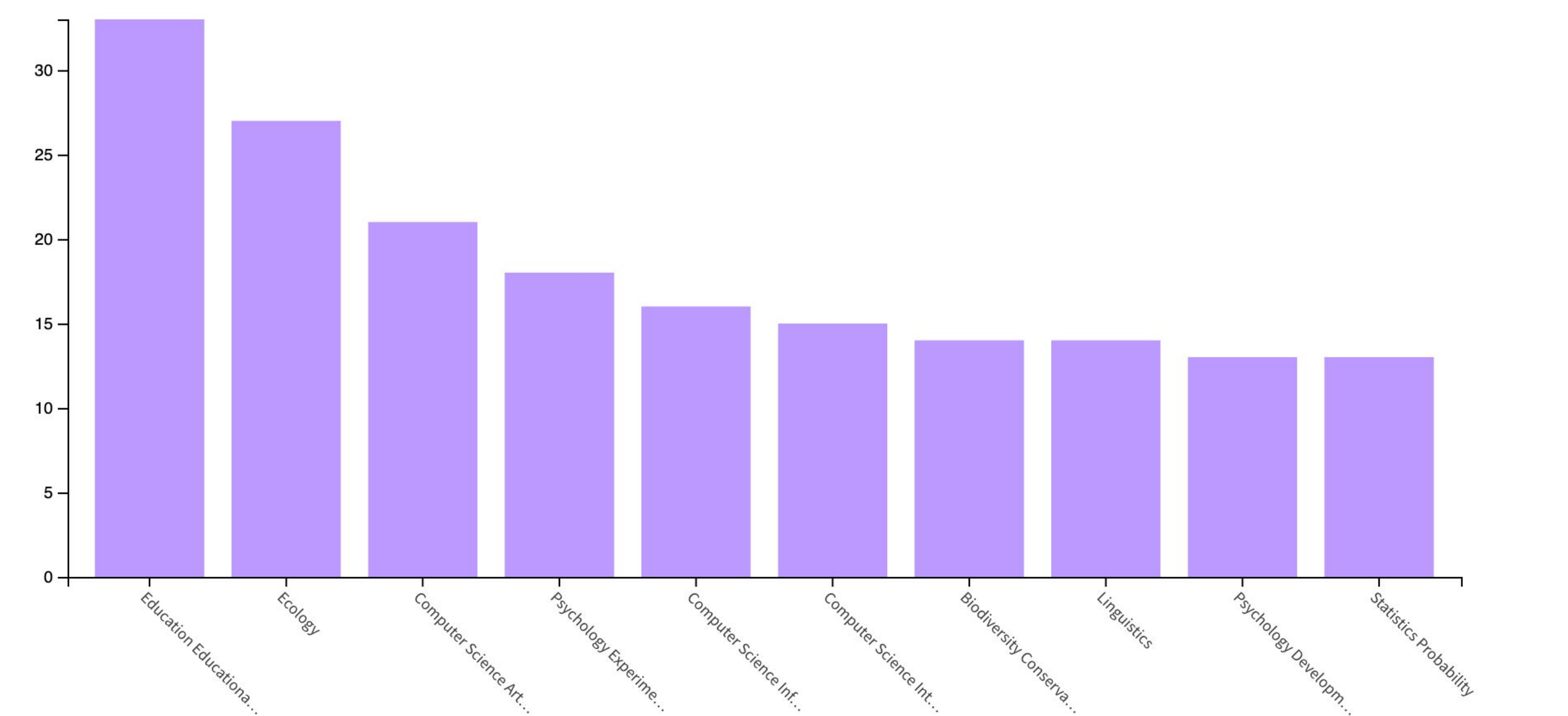


Figure 3. represents the breakdown of topics each of the articles we found categorized into. Majority of the articles are part of the education outreach category showing that there have been a lot of studying done on the case of children with autism and how their learning has been affected during COVID-19.

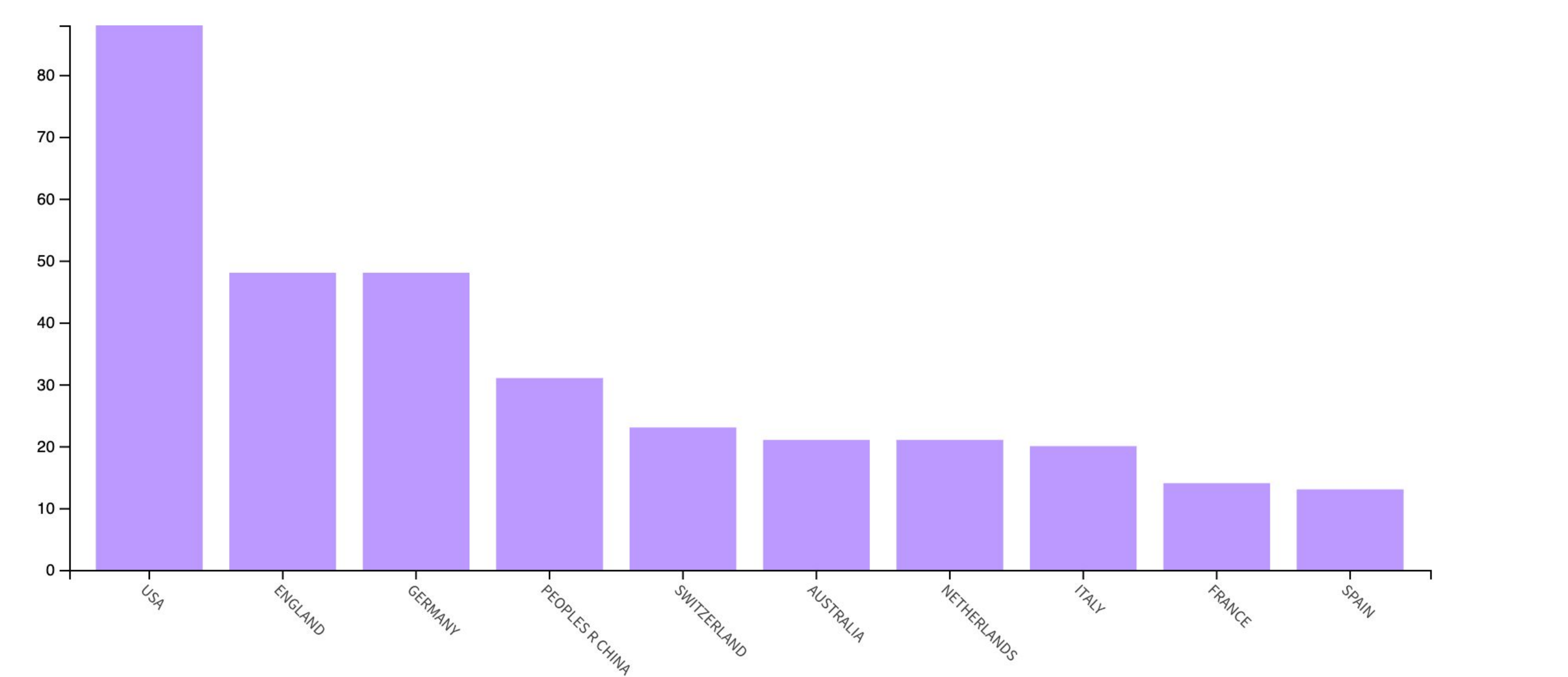


Figure 4. represents the breakdown of the countries and the frequency of research findings distributed across the world.

## Discussion & Conclusion

One article found by a Ohio State University found a correlation between more efficient learning with peer-assisted learning. Although this study did not focus on effects of COVID-19 on children with autism’s learning, because of the social isolation children experienced during the pandemic, it is possible children with autism experienced more trouble learning alone. While many social variables shifted during the pandemic time, research focusing on neurobiological causes of ASD has continued to focus on neurophysiological causes and their respective behaviors associated with autism. One paper from 2020 discusses a physiological mechanism associated with ASD in which the cingulate gyrus perpetuates “hyperfocus” by over stimulating the frontal lobe, which is known for control over executive functions (Rowland, 2020).