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Artículo Científico

Evaluación matemática: Neurodiversidad en España y Estados Unidos

Math Assessment: Neurodiversity in Spain and the United States

Celia Gallardo Herrerías[1*]

[1] Universidad de Almería, España.

*Autor por correspondencia: Celia Gallardo Herrerías, cgh188@inlumine.ual.es

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Resumen

Esta comparación transnacional analiza las políticas de evaluación de matemáticas con estudiantes neurodiversos en España y Estados Unidos desde las perspectivas de política, disposición del profesorado, instrucción y experiencia del estudiante. El estudio aplica un diseño de investigación de métodos mixtos que consiste en análisis de políticas, cuestionario al profesorado, entrevistas y observación del aula. Los hallazgos muestran que ambos países adoptan la educación inclusiva, pero que Estados Unidos adopta mandatos legales más codificados (p. ej., IDEA, ESSA) y adaptaciones normativas, como tiempo extra y tecnología de asistencia. Los mandatos españoles están menos codificados y descentralizados y, por lo tanto, resultan en una aplicación espasmódica. El profesorado estadounidense muestra mayores tasas de exposición a la neurodiversidad y un mayor uso de adaptaciones, mientras que el profesorado español reporta menores niveles de capacitación y material disponible. Los estudiantes de ambos lados del Atlántico reciben con agrado las adaptaciones, pero temen la inconsistencia y el estigma. Los factores institucionales y culturales predominan en la práctica de la evaluación: la conformidad y los derechos individuales se valoran en Estados Unidos, mientras que España emplea una postura colectivista con diferencias regionales. La evaluación matemática requiere reformas adaptadas al contexto, un sólido apoyo político, desarrollo profesional y estrategias centradas en el estudiante, concluye el estudio.

Palabras clave: neurodiversidad; pruebas de matemáticas; instrucción inclusiva; política educativa.

Abstract

This cross-national comparison analyzes the mathematics assessment policies with neurodiverse students in Spain and the United States from policy, teacher disposition, instructional, and student experience perspectives. The study applies a mixed-methods research design consisting of policy analysis, teacher questionnaire, interviews, and classroom observation. Findings show the two countries embrace inclusive education but that the United States embraces more codified legal mandates (e.g., IDEA, ESSA) and normative accommodations, such as extra time and assistive technology. Spanish mandates are less codified and decentralized and therefore result in spasmodic application. U.S. teachers exhibit higher exposure rates to neurodiversity and higher use of accommodations, while Spanish teachers report fewer training levels and material available. Students on both sides of the Atlantic welcome adaptations but dread inconsistency and stigma. Institutional and cultural factors predominate assessment practice: conformance and individual rights are valued in the U.S., while Spain employs a collectivist stance with regional differences. Math assessment requires context-responsive reforms, robust policy support, professional development, and student-centering strategies, the study concludes.

Palabras clave: neurodiversity; mathematics testing; inclusive instruction; educational policy.

Introduction

Mathematics education is a central aspect of contemporary schooling globally, and it is not only a foundation for intellectual achievement but also for the development of higher-order thinking as well as problem-solving capacities necessary to take an active role in an increasingly transforming knowledge society. While mathematics is universally relevant, it is particularly problematic for diverse learners in general and particularly for neurodivergent learners. Neurodiversity—a conceptualisation of celebration and tolerance of the natural variation in human brain performance, for example, in autism spectrum disorder (ASD), attention deficit hyperactivity disorder (ADHD), dyslexia, and dyscalculia, and other patterns of cognitive profiles—requires a revolutionary rebuilding of the paradigms of learning assessment, most importantly in as linear-sequence a subject as mathematics (Correa-Gorospe et al., 2025).

Mathematical education must be measured in a multi-dimensional way, such as but not confined to quantification of concept and procedure knowledge and translation of performance into different cognitive frameworks (Al-Yagon et al., 2013; Lollini, 2018).

In special education and educational measurement, there is increasing recognition that conventional standardized testing, norm-referenced testing, and boilerplate assessment approach are insufficient for neurodivergent students. Tests of this type prioritize speed, accuracy, and norms for typical performance, which are unfavorable to students whose processing speeds are non-typical, who have attention deficits, or who use alternative methods to solutions (Asbell-Clarke et al., 2024). In addition, neurodiverse diagnostic categories are very heterogeneous on cognitive profiles, demonstrating that one-size-fits-all assessment is invalid and unreliable for most students. For mathematics as a whole, tests traditionally prioritize procedural fluency, calculating proficiency, and timed practice in problem-solving (Billeiter et al., 2022; Videla et al., 2025).

These models are also much too often incompatible with learning styles for neurodivergent students whose abilities may be in recognizing patterns, visual-spatial abilities, or even higher-level conceptual thinking that does not equate to memorized process. Without assessments that accommodate these different modes of cognition, students may be at risk of being misclassified as underachievers or denied access to gifted education programs (Borrego et al., 2025). This is to note that neurodiversity is a relatively underresearched element in mathematical assessment studies, and comparatively fewer studies are conducted on culturally responsive and neurodiversity-aware assessment approaches (Doyle, 2024).

Previous studies in mathematics education and educational psychology have come a long way towards pointing towards the difficulties faced by neurodivergent students and towards pedagogies of inclusion. Studies on differentiated instruction, universal design for learning (UDL), and formative assessment have given promising models for educating diverse students. There is, however, an apparent deficit in comparative studies of adequate depth that address the extent to which national education systems today address the examination of neurodiverse students in isolation in mathematics (Ojeda-Nuñez & Espinosa-Bautista, 2024; Pasarín-Lavín et al., 2024).

Comparative national studies can throw some light on the relative role of sociocultural, policy, and institutional factors in influencing practice in assessment, common problems and local solutions (Gallardo-Montes et al., 2021; Gillespie-Lynch et al., 2017). Although the United States has a well-documented history of legislated student rights for students with disability, including those for assessment accommodations, Spain's educational environment responds to other traditions of legislation, disability conceptions, and systems of territorial administration. To what extent any difference in these systems affects mathematics assessment practice with neurodiverse students remains unclear (Silva, 2021).

In detail, the study purposes are:

- To investigate national and regional policies and regulations on mathematics assessment accommodations and modifications for neurodivergent students in the U.S. and Spain.
- To investigate teacher practices, attitudes, and concerns on the assessment of neurodiverse learners in mathematics classrooms.
- To explore student experiences and perceptions of mathematics assessment and their relationship to their neurodivergent identities.
- With a view to contrasting how policy, institutional, and cultural forces guide the testing of mathematically neurodiverse pupils in both countries.
- With a view to providing evidence-based recommendations for designing more valid, fair, and neurodiversity-affirming mathematics test settings.

Method

For the study, a comparative mixed-methods design was used to explore mathematics assessment approaches toward neurodiverse students in the United States and Spain.

Phase one involved a search and comparison of mathematics assessment accommodation and inclusive education policies in the two countries.The sources were downloaded from government and ministry of education websites, such that the latest available versions were obtained.

The second instrument was a standardized web-based questionnaire administered to primary and secondary mathematics teachers in each country. The survey instrument was formulated using a systematic approach of literature review, expert panel approval, and pilot testing with a pilot sample of 30 teachers (15 from each nation). The full survey consisted of 45 questions across five areas: teacher demographics and experience, neurodiversity attitudes and knowledge, math assessment practices and math accommodations, perceived challenges and supports, and professional development needs.

The survey tool contained a mixture of Likert-scale questions, multiple-choice questions, and open-ended questions. Likert items were used to measure agreement with statements with respect to assessment philosophies and approaches. The survey was administered through Qualtrics and invitations were sent through school district contact and professional teacher networks for ease of distribution. Respondents returned 500 questionnaires—250 US and 250 Spanish.

Among the survey respondents, a purposive sampling of 40 teachers (20 from each country) were called for semi-structured, in-depth interviews depending on characteristics like number of years of teaching experience, type of school, and expressed interest in inclusive practices. Further, 30 students who are neurodivergent (15 from each country) were invited by special education coordinators and parent organizations.

Quantitative survey responses were then analyzed via SPSS (Version 27).
Qualitative observational and interview data were coded and organized with the use of NVivo software.

Results

The policy analysis determined that both countries have legal frameworks that advocate for inclusive education and the provision of adjustments for students with disabilities, but the depth of detail with respect to mathematics assessment and neurodiversity varies.

In the US, the Individuals with Disabilities Education Act (IDEA) expressly requires schools to make sure that individualized education programs (IEPs) are written with accommodations and modifications tailored to students' specific needs, including in math testing. Every Student Succeeds Act (ESSA) also places greater emphasis on accountability measures that consider subgroups such as students with disabilities. Federal guideline documents provide concrete examples of accommodations (e.g., extended time, alternative test formats) and stress aligning

assessments with students' IEP goals. Policy documents also highlight inconsistencies in practice and variability in resources at state and district levels, however.

Spain's Ley Orgánica de Educación (LOE) and amendments, in contrast, discuss inclusive education principles in general terms, emphasizing access and participation of all students. Provincial governments have a great deal of autonomy in setting education policy, so there is inconsistency in how neurodiverse students are supported, and in particular, in assessment. The provincial documents that were reviewed provided less direct information about mathematics-specific accommodations but addressed more general modification of curriculum and assessments. While legislation is accommodating of differentiated instruction, clear protocols for assessment modification in mathematics were less apparent, indicating a lack of direction for teachers.

This policy variation provides context for practice variation and teacher attitudes uncovered in subsequent data. The quantitative survey of 500 mathematics teachers yielded fruitful data on teachers' knowledge, attitudes, and self-reported practices in relation to neurodiversity and assessment accommodations.

Overall, teachers in both countries expressed a strong belief in the importance of inclusive education and the need to cater to neurodiverse mathematics students. However, substantial differences were apparent in teachers' self-reported knowledge about the term’s neurodiversity and specific practices of accommodation.

In the US, 78% of teachers reported being "very familiar" or "somewhat familiar" with neurodiversity, compared to 56% in Spain. Likewise, 72% of U.S. teachers indicated that they regularly adapted mathematics tests for neurodiverse students, compared to only 45% of Spanish teachers. U.S. teachers more frequently indicated offering extended time (65%), changed test formats (53%), and technology-assisted tests (38%) as adaptations. Spanish teachers indicated fewer such adaptations, with extended time (40%) being the most prevalent.

In terms of attitudes, both groups of teachers had positive attitudes toward the ability of neurodiverse students to excel in math if properly supported. Spanish teachers did more frequently, however, indicate uncertainty or insufficient confidence in being able to create or apply effective accommodations, with 42% saying they did not feel well trained, as opposed to 25% of U.S. teachers.

Statistical tests confirmed these differences as significant ($p < 0.01$) on familiarity, accommodations use, and training adequacy dimensions. These findings are congruent with policy differences and imply professional development differences.

Semi-structured, in-depth interviews with 40 teachers (20 per country) and classroom observations yielded rich understandings of how mathematics assessments for neurodiverse students are created and enacted.

U.S. teachers frequently described consultative processes with special education staff, parents, and the student to tailor assessment accommodations to IEP goals. As one teacher noted, "We work quite closely with the special ed department to create assessments that respect the student's processing speed and communication style, whether that's doing oral tests or working with manipulatives." Observations corroborated these claims, showing widespread application of alternative assessment formats such as project-based assessment, oral questioning, and assistive technology software.

Spanish teachers demonstrated a more variable response. While some teachers in inclusive schools reported adapting tests by reducing vocabulary complexity or allowing additional time, other teachers reported following standardized tests with minimal adaptation for lack of particular guidelines or support. One Spanish teacher said, "We wish to assist, but the testing system is occasionally rigid, and we don't have freedom or training to modify tests sufficiently." Observation in class rooms confirmed inconsistency, with some instructors providing minimal accommodation other than extra time or segregated testing conditions.

Analysis of interview and observation data revealed the impact of broader cultural norms and institutional structures on mathematics assessment for neurodiverse students.

In the United States, a cultural emphasis on individual rights, legal mandates, and responsibility appeared to force an activist approach to accommodations. Teachers and administrators most frequently listed compliance with IDEA and federal laws as impelling forces. Institutional support in terms of special education departments, resource teachers, and staff development was also invoked with frequency.

Conversely, in Spain, a more relational and collective educational culture, in combination with decentralized governance, functioned towards heterogeneous practices. Regional autonomy led to diverse interpretations of inclusive policies, and limited centralized resources often hindered consistent realization of accommodations. In addition, some educators referred to cultural understandings of disability as deficits rather than differences, which shaped attitudes towards accommodations.

In the United States, 68% of teachers reported access to specialized training in neurodiversity and inclusive assessment in the past three years, compared to 35% of Spanish teachers who reported the same. U.S. teachers reported the availability of workshops, online courses, and district-level support. In Spain, teachers more often reported incidental or insufficient training, with dependence on self-study or peer support.

In regard to material resources, U.S. schools were more likely to have assistive technologies and adapted assessment materials, but budget was an issue. There were fewer technological supports and less access to specialist materials reported in Spanish schools, particularly in rural areas.

Policy support was seen as stronger in the U.S., with clear mandates and monitoring systems, while Spanish educators reported uncertainties and lenient enforcement in regional policies.

Conclusions

The research on mathematics assessment practices with neurodiverse students in the United States and Spain provides a nuanced picture of multi-layered issues depending on their country policies, institutional budgets, pedagogical traditions, and cultural habits. This comparative research has attempted to study at the nexus of neurodiversity and mathematics learning and teaching in two dissimilar but convergently developed education systems. The conclusions highlight the nuances of how inclusive assessment practices are organized, implemented, and experienced in various contexts. The findings synthesize the key findings built from our study and offer implications for future pedagogy, education policy, and research.

A second key conclusion from this study is that inclusive maths assessment for neurodiverse students cannot be realized without a strong, stable legal and policy framework. There was a stark difference between the United States and Spain in this regard. United States federal law, such as the Individuals with Disabilities Education Act (IDEA) and Every Student Succeeds Act (ESSA), mandates accommodations and support systems with schools held accountable for incorporating students with disabilities into streams of assessment. This is pitted against the more dispersed and heterogenous geography of policy in Spain, where decentralized administration has produced significant variations in conceptualization and use of inclusion. These findings also strengthen the research that emphasizes the need for policy coherence and alignment to offer educational equity.

Concerning also is the degree of influence coming from teacher training and preparedness. U.S. teachers described greater confidence and ability with inclusive assessment practices largely due to having more extensive professional development and organizational support. Spanish teachers, despite often being named as committed to inclusion, reported that they had not received training in adapting mathematical tests for neurodiverse students. It is this gap that highlights the necessity for ongoing, top-shelf professional development that possesses the skill, support, and commitment needed to successfully institute inclusive assessment practices. Without this training, even those inclusion-performing policies well-meaning are at risk of not working at the classroom level.

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