

ARTÍCULO DE INVESTIGACIÓN

TEACHER TRAINING AND INCLUSIVE TEACHING STRATEGIES IN MATHEMATICS: ANALYSIS OF PROGRAMS IN SPAIN AND ECUADOR

FORMACIÓN DOCENTE Y ESTRATEGIAS DE ENSEÑANZA INCLUSIVA EN MATEMÁTICAS:
ANÁLISIS DE PROGRAMAS EN ESPAÑA Y ECUADOR

FORMAÇÃO DE PROFESSORES E ESTRATÉGIAS DE ENSINO INCLUSIVO EM MATEMÁTICA:
ANÁLISE DE PROGRAMAS EM ESPANHA E NO EQUADOR

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ABSTRACT

This study contrasts the inclusion of inclusive teaching practice in mathematics within teacher training in Spain and Ecuador on the basis of their similarities, differences, and context factors that surround them. Through the mixed-method design, the survey, interviews, and focus group interviews were carried out among the pre-service teachers and the teacher trainers. The results show that while both countries have achieved some improvement in the implementation of inclusive practices, Spain shows more usage and effectiveness in these practices compared to Ecuador. The four most significant factors in determining implementation are national education policy, resources, school culture, and teacher attitude. Decentralized policies generate uneven implementation in Spain, and resource constraint and bureaucratic inefficiency impede effective implementation in Ecuador. By drawing attention to teacher education, school collaborative cultures, and access to technology as means of enhancing inclusive mathematics teaching, the study provides some of the following suggestions: ensuring stronger teacher preparation, establishing cooperative networks, and filling gaps in resources for consideration of more inclusive and more equitable practices.

Key words: *inclusive education; teacher training; mathematics teaching; educational policies; pedagogical strategies.*

RESUMEN

Este estudio contrasta la inclusión de prácticas docentes inclusivas en matemáticas en la formación docente en España y Ecuador, basándose en sus similitudes, diferencias y factores contextuales. Mediante un diseño de método mixto, se realizaron encuestas, entrevistas y grupos focales entre docentes en prácticas y formadores. Los resultados muestran que, si bien ambos países han logrado mejoras en la implementación de prácticas inclusivas, España muestra mayor uso y efectividad en estas prácticas que Ecuador. Los cuatro factores más significativos para determinar la implementación son la política educativa nacional, los recursos, la cultura escolar y la actitud docente. Las políticas descentralizadas generan una implementación desigual en España, mientras que la limitación de recursos y la ineficiencia burocrática impiden una implementación efectiva en Ecuador. Al destacar la formación docente, las culturas de colaboración escolar y el acceso a la tecnología como medios para mejorar la enseñanza inclusiva de las matemáticas, el estudio ofrece algunas de las siguientes sugerencias: garantizar una formación docente más sólida, establecer redes de cooperación y subsanar la falta de recursos para considerar prácticas más inclusivas y equitativas.

Palabras Claves: *educación inclusiva; formación docente; enseñanza de matemáticas; políticas educativas; estrategias pedagógicas.*

RESUMO

Este estudo contrasta a inclusão de práticas de ensino inclusivas em matemática na formação de professores em Espanha e no Equador, com base nas suas semelhanças, diferenças e fatores contextuais. Utilizando um desenho de método misto, foram realizados inquéritos, entrevistas e grupos de foco entre professores e formadores de formação inicial. Os resultados mostram que, embora ambos os países tenham alcançado melhorias na implementação de práticas inclusivas, a Espanha apresenta uma maior utilização e eficácia nestas práticas do que o Equador. Os quatro factores mais significativos na determinação da implementação são a política educativa nacional, os recursos, a cultura escolar e a atitude dos professores. As políticas descentralizadas geram uma implementação desigual em Espanha, enquanto as limitações de recursos e a ineficiência burocrática impedem uma implementação eficaz no Equador. Ao destacar a formação de professores, as culturas de colaboração escolar e o acesso à tecnologia como meios para melhorar o ensino inclusivo da matemática, o estudo oferece algumas das seguintes sugestões: garantir uma formação de professores mais forte, estabelecer redes de cooperação e colmatar a falta de recursos para considerar práticas mais inclusivas e equitativas.

Palavras chaves: *educação inclusiva; formação de professores; ensino da matemática; políticas educativas; estratégias pedagógicas.*

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1. INTRODUCCIÓN

Teacher training and pedagogies for inclusive math education are now critical concerns in contemporary education, particularly within an intercultural environment where student diversity is steadily increasing. In this study, inclusive mathematics is understood as a pedagogical approach that seeks to ensure the participation and meaningful learning of all students, particularly those who have been historically marginalized or excluded due to disability, learning differences, or sociocultural background (Booth et al., 2000). This conceptualization goes beyond physical access to schooling and emphasizes eliminating barriers within the teaching and learning process.

Progress in research on educational inclusion has highlighted pedagogical transformation from traditional norms to accommodate each learner's need, to facilitate his/her equal learning and participation. However, effective inclusive mathematics teaching is inherently challenging, both at the pre-service and in-service teacher education levels.

Inclusive education, as the process of seeking and responding to learners' diversity of needs through

enhancing their learning participation, cultures, and communities and reducing exclusion from and within education (UNESCO, 2017), has been a top agenda in education policy in most nations. Both the Spanish and Ecuadorian processes have played a key role in the establishment of regulatory agencies that have fostered multiple ways of achieving equity of access to education and implementing inclusive methodologies in schools. However, the effective implementation of such policies requires not only regulatory support but also adequate teacher training to enable the development and application of inclusive pedagogical practices, particularly for such math subjects as mathematics, which have traditionally presented huge barriers to learning for students with special educational needs.

Mathematics, being sequential and abstract, has been considered a subject of extremely high difficulty for the majority of students. Research such as Boaler (2016) has also indicated that traditional pedagogical practices, founded on memorization and the use of algorithms in a context-free manner, have the potential to act as exclusionary tools for some student groups. Among the explanations for the existence of these barriers are information processing limitations, unavailability of

materials, and the absence of learning variation-specific methodologies. Mathematics teacher training must, therefore, go beyond pedagogy of disciplinary content and include strategies for managing diversity in the classroom.

Among the biggest challenges of inclusive mathematical teaching is inadequate preparation of teachers to deal with diversity in classrooms. A number of studies has testified that the majority of teacher-training courses do not have specific modules on inclusion, which serves to impair the capacity of teachers to adapt their practices for dealing with students who have learning disabilities, disabilities, or come from difficult backgrounds (Sharma, Loreman, & Forlin, 2017).

In addition, teachers' attitudes and beliefs regarding teaching mathematics and inclusion determine the choice of implementing inclusive pedagogical strategies. Heyd-Metzuyanım (2015) argues that those teachers who believe that mathematics is a rigorous subject based only on logic and memorization find it harder to implement inclusive methodologies. In contrast, more constructivist and open-minded mathematics teachers tend to be more willing to adapt their teaching strategies to accommodate the needs of their students.

The other major hindrance to the implementation of inclusive mathematics approaches is the lack of proper teaching materials. Although the use of technology and manipulative materials to facilitate mathematical learning has been promoted in recent decades, in most classrooms, these materials are not present or teachers have not received proper training to implement them effectively (NCTM, 2021). Accessibility of content in workable form and preparedness of materials for differing skill levels is an essential aspect of facilitating inclusion in mathematics teaching.

Administrative workload and conditions of work among teachers also determine the practice of inclusive practices. Teachers in the majority of education systems are beset by overloads of work that disrupt planning and implementation of differentiated strategies to address diversity in classrooms. Furthermore, the lack of institutional support and poor continuous training in inclusive education is responsible for the sustainability

of uniform pedagogy practices that are not appropriate for all learners (Florian, 2019).

Literature in mathematics education aimed for inclusivity purposes has referenced several strategies that guarantee maximum learning and participation for all learners. Universal Design for Learning (UDL) is one of them, which is an instruction pedagogy that implies diversifying instruction to present information in different forms of representation, expressions, and modes of engagement (Meyer, Rose, & Gordon, 2014). In math, UDL indicates applying visual, manipulative, and technology-based representations for presenting information in a way to make students with diverse learning requirements perceive mathematical ideas.

One of the most recommended is problem- and project-based learning, in which students build their own learning by solving real-world problems buried in contexts. It not only assists in empowering deep math understanding but also ensures inclusivity insofar as it enables all the students to engage in collective knowledge building (Boaler, 2016).

Similarly, the application of collaborative methods in teaching mathematics has been a great inclusion tool. Cooperative learning, where students are assigned heterogeneous groups to solve math problems, promotes students' interaction and support with one another, reducing exclusion of struggling students with the topic (Slavin, 2018).

Particularly with students with disabilities, the necessity of using assistive technologies and curriculum accommodations to make mathematics content accessible has been highlighted in research. The visually impaired, hard-of-hearing, or literacy-impaired students' research can be facilitated through the utilization of special software, interactive materials, and audiovisual aids (Burgstahler, 2015).

Despite continuous research into mathematics education for inclusive society, there is a general knowledge gap concerning how the teacher training schools in different country contexts, such as in Spain and Ecuador, are intervening in these issues. Specifically, comparative studies into how mathematics teacher training in these countries are integrating inclusive approaches in

mathematics pedagogy have been wanting.

Also, most of the existing work that has been done is on uptake of policies or teacher attitudes rather than the effectiveness of the policies in the classroom. This is a weakness of research that is flawed as it restricts ascertaining best practice and providing evidence-informed recommendations that can be applied in different school settings (Shulman, 2018).

In consideration of the critical role of teacher training in making inclusive education an effective intervention, and consistent with the nature of difficulties math entails for most learners, there is a need to undertake a study examining how Ecuadorian and Spanish teacher training curricula address such issues.

This study will not only serve to close the gap in knowledge identified but also provide valuable information for improving such programs towards the ultimate goal of promoting more equitable and inclusive mathematics education. It will also develop contextual determinants that influence the implementation of inclusive strategies to mathematics, such as national education policy, school culture, and teaching resource availability.

The findings of this research will be used to construct some recommendations for mathematics teacher training programs improvement, thus preparing future mathematics teachers to better handle classroom diversity. In addition, the study will contribute to the formulation of more inclusive pedagogies, removing the barriers to mathematics learning and enabling all students to gain required mathematical skills for life and professional success at the university level.

The general hypothesis of this study is that Spanish and Ecuadorean teacher education courses use more inclusive methods of teaching mathematics, and that these differences are due to contextual influences, e.g., national education policy and school cultures. For this purpose hypothesis in the research, the following research question holds: How and in what respects Ecuador and Spanish mathematics teacher preparation programs are embracing inclusive teaching of mathematics, and with which determinants in a given context?

To structure the comparison between teacher training programs in Spain and Ecuador, the PICO model was applied. Table 1 summarizes its main components:

Table 1. *PICO Elements*

- Population (P): Math teacher educators and pre-service math teachers enrolled in Spanish and Ecuadorian math education programs.
- Intervention (I): Inclusive teaching of mathematics.
- Comparison (C): Spanish and Ecuadorian teacher education.
- Outcomes (O): Effects of the application of inclusive teaching methods to mathematics to student learning and participation.

This structure allowed us to clearly define the components of the research, ensuring a coherent comparative approach between the contexts of Spain and Ecuador.

1.1. Objectives

To compare how inclusive teaching methods in mathematics are incorporated into Spanish and Ecuadorian teacher education programs, highlighting their similarities, differences, and the contextual determinants that influence them. On the other hand, the specific objectives are:

- To establish the inclusive teaching practices in mathematics that are in use in Spanish and Ecuadorian teacher education programs.
- To compare the performance of the practices in the students' learning and engagement in the two environments.

2. METHOD

The study employed a sequential explanatory mixed-methods design, combining quantitative and qualitative approaches to explore how inclusive teaching practices in mathematics are incorporated into teacher training programs in Spanish and Ecuadorean universities. This

approach also examined the contextual conditions that influence their implementation. The selection of Spain and Ecuador as comparative cases was based on their shared historical, linguistic, and educational ties, as well as their differing levels of policy implementation and institutional development in inclusive education. These contrasts allowed for a meaningful comparative framework that could highlight contextual determinants and best practices in each national setting.

The target population consisted of teacher educators and pre-service teachers involved in mathematics education programs in both countries. Institutions were selected based on typological variation, including public and private universities across different geographical regions, to ensure comparability, representativeness, and contextual diversity. A total of 350 participants responded to the survey, with a balanced distribution between Spain and Ecuador and an 85% response rate during the quantitative phase.

For data collection in the quantitative phase, an online questionnaire composed of close-ended Likert-scale items was developed, drawing from validated instruments used in previous inclusive education research. This questionnaire aimed to measure four dimensions: inclusive pedagogical practices, curriculum adaptations, use of technological tools, and the availability of professional training in inclusion. The instrument was pilot-tested with 30 participants from both countries to ensure clarity, contextual relevance, and cultural appropriateness. The pilot test resulted in a Cronbach's alpha of 0.89, indicating high internal consistency.

Data collection was conducted over three months using the Qualtrics platform. Responses were cleaned and analyzed using SPSS software. Descriptive statistics summarized the demographic and institutional characteristics of the sample. Inferential tests such as t-tests and ANOVA were conducted to identify differences between the countries and between types of institutions. To assess construct validity, an Exploratory Factor Analysis (EFA) was carried out using principal component extraction and Varimax rotation. This analysis identified three primary factors: inclusive

classroom practices, teacher training in inclusion, and accessible technology use, with all items loading above 0.40.

However, a limitation of the study was the previously missing detailed description of the data collection instrument. This revised version addresses that gap by providing the full structure, dimensional focus, and pilot validation process of the questionnaire. Moreover, the criteria for interpreting the collected data were grounded in existing frameworks for inclusive education and were validated through expert review.

In the qualitative phase, 25 semi-structured interviews and four focus groups were conducted with a subsample of survey participants selected based on maximum variation sampling. The interviews explored contextual factors influencing inclusive practices, such as education policies, school culture, and teacher beliefs. Interviews, lasting between 45 and 60 minutes, were recorded and transcribed verbatim. Focus groups of 6–8 participants provided collective perspectives on barriers and enablers for inclusive mathematics teaching.

Qualitative data were thematically analyzed using NVivo. Open coding was first applied to identify key ideas, followed by axial coding to link codes into broader themes. These themes were then integrated into a coherent framework addressing the central research question. Triangulation of survey results, interview transcripts, focus group data, and official teacher training program documents strengthened the validity of the findings.

To ensure reliability and validity, multiple strategies were implemented throughout the research. Previously validated instruments were adapted for the questionnaire, with linguistic and cultural adjustments for both national contexts. Reliability was confirmed with Cronbach's alpha values above 0.85 for all four dimensions. Construct and content validity were reinforced through factor analysis and expert review by three scholars specializing in research methodology and inclusive education.

Peer debriefing was also employed: two independent qualitative researchers reviewed the coding structure

and thematic map, achieving over 90% agreement, thereby supporting the reliability of the interpretation process. Transferability was addressed through rich contextual descriptions, including institutional profiles and participant backgrounds, enabling replication of the study in similar contexts.

In terms of ethics, the research complied with the Declaration of Helsinki and with the ethical standards of participating universities. Written informed consent was obtained from all participants, and confidentiality was ensured by assigning numerical codes to responses. Audio files were deleted post-transcription, and no risks were identified during data collection. Participants were provided with support contacts in case of psychological discomfort, even though sensitive or intimate topics were explicitly avoided during the interviews and focus groups. These ethical safeguards enhanced participant trust and contributed to the reliability of the data collected.

3. RESULTS

The results of the study are divided into two main sections: one corresponding to the quantitative phase and the other to the qualitative phase of the research. Under the quantitative phase, quantitative data gathered from the structured questionnaire were tabulated in terms of the presence, occurrence, and perceived strength of inclusive pedagogies in mathematics in Spanish and Ecuadorian teacher education programs. During the qualitative process, contextual determinants influencing the implementation of such strategies were investigated using semi-structured interviews and focus groups.

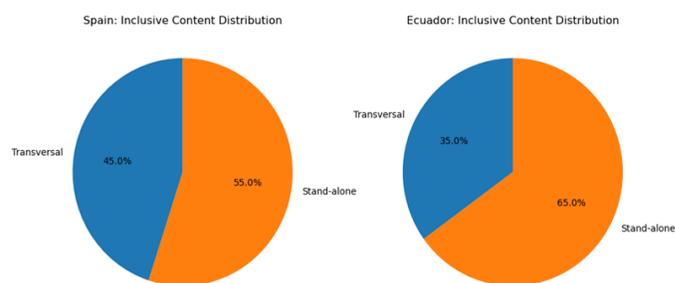
A total of 350 trainee teachers and teacher trainers participated in the quantitative phase, evenly distributed between Spain (175) and Ecuador (175). An 85% response rate ensured a strong and representative sample for analysis. Data was processed via the SPSS program to carry out descriptive, inferential, and factorial analysis.

Regarding the inclusion of inclusive teaching practices in mathematics, 78% of Spanish and 65% of Ecuadorian respondents reported that their pre-service teacher

education programs included direct content on inclusive education. Furthermore, 45% of Spanish and 35% of Ecuadorian participants indicated that these contents were integrated transversally throughout the curriculum, while the rest reported it was instructed in stand-alone modules or courses.

As can be seen in Figure 1, the distribution of inclusive content in the curriculum varies between Spain and Ecuador, with greater transversality being highlighted in the Spanish approach.

Figure 1. *Distribution of inclusive content in curriculum*



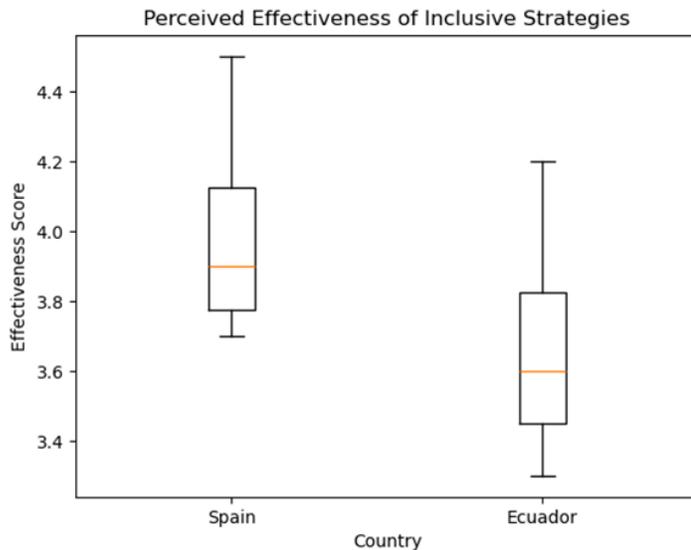
This suggests that, although both countries include inclusive education training, Spain tends to integrate it more transversally into its programs, which could foster a more holistic understanding among future teachers.

According to frequency of use in the classroom of inclusive practices, the two countries were distinctly different. 70% of the interviewees in Spain reported that inclusive practices were being utilized "frequently" or "very frequently," while in Ecuador 55% did. The most common methods used in both countries were material adaptation (85% in Spain, 75% in Ecuador) and the use of available technologies (80% in Spain, 65% in Ecuador). Cooperative learning and peer tutoring were less popular, at 50% in Spain and 40% in Ecuador.

As for the perceived effectiveness of inclusive strategies, respondents from both countries were positive, with a mean of 4.2 out of 5 in Spain and 3.9 in Ecuador. The differences were, however, significant by type of strategy. For example, materials adaptation was scored as the most effective strategy (4.5 in Spain and 4.2 in Ecuador), whereas the application of existing technologies scored somewhat lower (4.0 in Spain and 3.7 in Ecuador).

Figure 2 presents the average scores that participants assigned to the effectiveness of different inclusive strategies, revealing a higher perception in Spain than in Ecuador.

Figure 2. *Perceived effectiveness of inclusive strategies*



The data show that participants in Spain perceive inclusive strategies as more effective, possibly due to greater teacher training and the availability of adapted teaching resources.

To compare responses between countries for Spain and Ecuador, ANOVA and t-tests were conducted. Contrasts revealed differences ($p < 0.05$) between countries for the application frequency of the inclusive strategies with an effect size (Cohen's d) of 0.45 revealing a moderate difference. Differences also arose in how effective the strategies were thought to be, with an effect size of 0.35.

In both countries, regression analysis was conducted to assess the relationship between perceived effectiveness and institution type (public or private) and geographic location. In Spain, public institution members indicated inclusive strategy as more effective ($\beta = 0.25$, $p < 0.01$), while in Ecuador institution type was not significant. Geographically, some significant differences within countries with higher use and performance ratings of inclusive tactics were reported for urban as well as rural areas.

According to exploratory factor analysis (EFA), it was determined that there were three latent factors responsible for explaining 68% of the overall data variance. The first factor, "Inclusive Classroom Practices," retained items concerning content adaptation, peer tutoring, and collaborative learning with factor loadings of greater than 0.70. The second factor, "Teacher Training in Inclusion," retained items on training received for inclusive practices and self-reported readiness to put them into practice, with factor loadings of 0.65-0.80. The third item, "Use of Accessible Technologies," consisted of items on the use of technology tools for facilitating learning by students with special education needs, with factor loadings above 0.60. These results demonstrated the construct validity of the questionnaire and provided a clear framework for interpreting the data.

The qualitative aspect of the study provided a clearer picture of how inclusive approaches were being integrated within maths teaching as part of teacher training in Spain and Ecuador. Trends, perceptions, and issues not captured by the quantitative data emerged through the semi-structured interviews and focus groups with trainers and trainee teachers.

The qualitative findings were supplemented by three salient factors underpinning inclusive approach adoption: education policy and regulation, school and teacher culture and beliefs, and implementation challenges and opportunities. All had an impact on the trainee teachers' and the teacher trainers' attitudes towards teaching mathematics inclusively, differing between and within both nations.

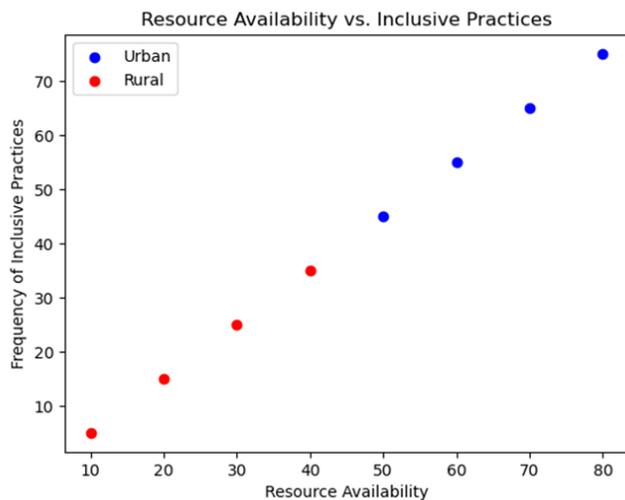
National education policies were viewed as a central pillar for embedding inclusive pedagogy in teacher training. Organic Law on Education (LOE) and Organic Law for the Improvement of Educational Quality (LOMCE) in Spain were introduced as flagship legislation for inclusive education. The participants recognized that there was a massive divergence in policy implementation across autonomous communities. Spanish system decentralization has enabled every community to shape inclusion policies in terms of their own needs and circumstances and therefore generate inequalities in applying them. According to one Spanish

trainee teacher: "In my self-governing region, training for inclusion is really strong, but talking to other teachers in other regions, I know that not everyone receives equal training. There is a lot of disparity in implementing inclusion policy."

In Ecuador, the National Plan for Inclusive Education and the Organic Law on Intercultural Education (LOEI) have been the dominant regulatory policies to advance inclusive education. The attendees from Ecuador acknowledged these policies as wonderful feats in education policy due to their efforts in delivering explicit guidelines toward inclusion at all levels of education. Nevertheless, many teachers came with evidence indicating that insufficient resources and bureaucratic responsibilities have deterred true implementation of the policies. One Ecuadorian teacher trainer averred: "The LOEI and the National Plan for Inclusive Education are great measures, but administratively, hassle and lack of resources limit the policy's implementation in practice. The teachers have no clue how they might implement what the regulations require at classroom level."

Figure 3 illustrates how resource availability directly influences the implementation of inclusive practices, especially in rural areas of Ecuador.

Figure 3. Relationship between resource availability and inclusive practices



A direct relationship is evident between the availability of resources and the frequency of implementation of inclusive practices, highlighting the urgent need for investment in technology and materials in the Ecuadorian context.

Teacher beliefs and school cultures were identified as most influential in inclusive approach implementation. Both in Spain and Sweden, the respondents concurred that a supportive school culture, as represented by institutional support and collaboration between teachers, promoted the execution of these strategies within the classroom. However, obstacles remained regarding teachers' beliefs and perceptions about inclusion in mathematics. In Spain, some of the teachers reported that, although inclusive legislation existed, conventional ways of teaching mathematics still prevailed. One of the Spanish practicing teachers said: "The school leadership is highly pro-inclusion, but there are some older teachers who think that maths must be done in the conventional manner. They think that employing technology or adapting resources is a waste of time."

School culture was also noted to be one of the significant issues in the implementation of inclusive education at the Ecuador school. The respondents stressed that where school leadership is making a conscious effort towards inclusion in schools, teachers embrace more inclusive practices. In the majority of schools, however, the lack of institutional and training support has led to teachers viewing inclusion as an additional complexity in their practice. One Ecuadorian practicum student teacher mentioned the following: "In my school, school culture is actually very collaborative, and it makes it less difficult to include. But in other schools where I have practiced, I could notice that teachers are not ready to work with special needs students. There is no preparation and self-confidence."

Participants identified several challenges in implementing inclusive strategies in mathematics. In Spain, the most frequent complaint was that there is not sufficient time to plan and implement inclusive strategies properly. There were many teachers who complained that the mathematics curriculum is too lengthy and that they have to cover a lot of content

within a short amount of time, thus it becomes difficult to adapt teaching in an effort to meet class diversity. A Spanish trainee teacher explained: "The mathematics curriculum is really broad, and we have no time to personalise the teaching. At times I feel as though I am being forced to decide between ensuring that I teach all the material or addressing special needs of the students."

Lack of access to accessible technology and adapted resources was the prime barrier identified in Ecuador. Members clarified that in most schools, there is limited availability of resources and teachers are compelled to be as innovative as they can be to come up with means of converting materials they have. This is particularly challenging in rural areas, where connectivity and infrastructure are poor. One of the Ecuadorian practicing teachers said: "Shortages of resources are a serious problem in rural areas. We cannot access technologies or customized materials, and that is really constraining what we can do to reach all learners."

Nevertheless, participants also identified opportunities to strengthen the implementation of inclusive practices in mathematics.

Both nations underscored the potential of web sites to share experience and resource about inclusive education. The building of teacher learning communities would be useful in learning from each other and creating new ways appropriate for different school environments. One of the Spanish teacher trainers claimed:

"Digital platforms have been an excellent way to exchange resources and best practices between teachers." I think that such tools might be applied more to coordinate training in inclusion."

Furthermore, school collaboration was referred to as an exemplar good practice in an effort to coordinate training in inclusion. In several cases, teachers said that this mentorship among well-trained experienced teachers in inclusion and less trained teachers has worked efficiently in support of enhanced deployment of inclusive practice in the classroom. One of the Ecuadorian student teachers explained: "Mentoring between teachers has been most significant to my training. I learned a lot from a teacher who had much

experience of inclusion, and that made me feel braver to attempt inclusive approaches in my maths lessons."

4. DISCUSSION

The study reveals that, although both countries have made progress in integrating inclusive teaching strategies into their teacher education programs, notable differences remain in how frequently these strategies are implemented and how effective they are perceived to be. The participants reported higher use of inclusive strategies such as modification of materials and utilization of accessible technology in Spain than in Ecuador. These findings are consistent with previous research that has highlighted the role of education policy and resources in impacting inclusive practice (Florian & Black-Hawkins, 2011; Heyd-Metzuyanim, 2015). However, the study also highlights that even in countries like Spain, where inclusive policies are more advanced, implementation remains uneven and is influenced by institutional type and geographic region. This means that, besides national policies, local and contextual determinants must be incorporated in successful inclusive strategies.

In Ecuador, there is evidence of a solid regulatory framework, with policies that promote inclusive education, but the lack of resources and proper training for teachers is a barrier in using such strategies effectively. These echo findings reported in earlier work that was done within low-resource environments and discovered that poor adapted material and accessible technology are a significant source of constraint when considering inclusion (Ainscow et al., 2019). But the research also points out that, while these are issues, teachers in Ecuador are positively oriented towards inclusion and are seeking innovative means of surmounting such issues as cooperation among institutions and employing digital platforms to exchange resources.

One of the key contributions of this research is the identification of contextual factors that facilitate inclusive mathematics education. Both countries have a common contextual factor cutting across both countries, national mathematics education policy, albeit differently

impacting the two countries. Decentralization at the autonomous community level in Spain resulted in non-uniform application of inclusion policy, in line with previous research emphasizing decentralization as a critical element in education (Eurydice, 2020). In Ecuador, funding constraints and bureaucratic burdens have limited the effectiveness of national policies, a finding consistent with research in other Latin American countries (UNESCO, 2017).

Secondly, inclusive school cultures and teacher belief contributed to the implementation of inclusive strategies. In the two countries, there was an inclusive school culture comprising supportive leadership and collaboration between teachers, which promoted the effectiveness of these strategies. This is in conformity with prior work that has upheld the work of school leadership and collaborative strategies towards promoting inclusion (Ainscow et al., 2019). However, the findings also suggest that teacher attitudes and beliefs can act as significant barriers to implementation, particularly if teachers believe that inclusion will create additional workload for them or have questions over whether they have the ability to provide mathematics teaching inclusive of everyone. This evidence concurs with the research which has found a lack of training and confidence as prominent barriers to inclusion (Florian & Black-Hawkins, 2011).

The present study offers valuable insights into the factors shaping inclusive mathematics education. It offers first a pointed distinction between two varying national settings in which analogues and antonyms can be taken in adopting inclusive teaching practice to mathematics pedagogy. The above comparison is extremely helpful since it addresses how background contexts such as education policy, resources provided, and organizational school cultures shape the practice to be effective. Second, the study incorporates quantitative and qualitative methods, which enable quantification of frequency and prevalence of inclusive approaches but also greater insight into what underpins their use. Third, the study offers practical guidance on how to construct improved courses for teacher training, based on empirical reality and on the language of teachers and

trainers themselves.

Although the study presents robust findings, several limitations must be acknowledged. First, the study relies on self-report measures by participants, and these are subject to social desirability bias. Even subsequent to efforts toward making this threat manageable, i.e., pointing out anonymity and confidentiality, individuals may have over-estimated frequency and effect of inclusive strategy usage. Second, the study was conducted in only two countries, which may limit the generalizability of the findings to other contexts. Although selecting Spain and Ecuador facilitated intensive comparison, future research in other countries must establish external validity of findings. Third, the study considered only the perspectives of teachers and trainers, excluding those of students, parents, or school administrators. Future studies should incorporate these perspectives to provide a more comprehensive understanding of the effectiveness of inclusive programs.

5. CONCLUSIONS

This study has closely examined how inclusive teaching practices in mathematics are addressed within Spanish and Ecuadorian teacher training programs, identifying both progress and ongoing challenges in each context. By employing a mixed-methods design that integrates quantitative and qualitative analyses, the study has generated a comparative and in-depth understanding of the current state of inclusive mathematics instruction in both countries. The findings not only support previous research but also contribute to the knowledge base and offer practical recommendations for improving teacher training programs. The findings most directly associated with the study are enumerated below, categorized in accordance with the broad topics covered.

First, the findings indicate that both Spain and Ecuador have made substantial progress in integrating inclusive pedagogical approaches into their initial teacher education programs, in alignment with national and international education policy towards inclusive education. In Spain, the Organic Law of Education

(LOE) and the Organic Law on the Improvement of Educational Quality (LOMCE) have been at the forefront in driving inclusion in the education system, while in Ecuador, the Organic Law of Intercultural Education (LOEI) and the National Plan for Inclusive Education have been at the forefront. However, the study confirms that implementation is highly dependent on local context and varies significantly across regions and institutions. For Spain, autonomy of autonomous communities at the regional level has brought about unequal attainment of the policy of inclusion since some regions have achieved more compared to others. In Ecuador, lack of resources and administrative weight have limited national policies' reach, and it has been difficult to put in place inclusive strategies in some environments, particularly in rural schools.

Second, the study concludes that the application of inclusive teaching strategies in mathematics occurs more often in Spain than Ecuador. In Spain, 70% of teachers reported using inclusive strategies "frequently" or "very frequently," while in Ecuador, the percentage was 55%. In both countries, the most commonly used strategies are material adaptation and the use of available technology, although variations occurred in other tactic implementations, such as peer tutoring and cooperative learning. Both of these variations can be explained partially due to the fact that Spain has greater resource availability and more centralized teachers' training than Ecuador. The research, however, points out that even in Spain, the application of these strategies is uneven and different across institution type and geography. This suggests that, beyond national policy, local and institutional factors are key determinants of the successful implementation of inclusive strategies.

Third, the outcomes of the research show that math inclusive strategies effectiveness as perceived was overall positive in both nations but with considerable difference between Spain and Ecuador. For Spain, participants perceived inclusive strategies to be more effective with an average of 4.2 on a 5-point scale, whereas Ecuador had 3.9. This discrepancy is accounted for by several reasons, including increased experience and training in Spanish instructors for inclusive strategies, as

well as increased levels of resources and institutional support. Additionally, the study shows that perceived effectiveness varies depending on the type of strategy employed in both countries. For instance, material adaptation was the top-ranked strategy, and use of available technologies ranked slightly below it. This indicates that, while technology can be an empowerment tool for inclusion, its success is highly contingent on the training and support that teachers are given to utilize it suitably.

Fourth, the study identifies that teacher attitudes and school climates are central predictors of the delivery of inclusive strategies in mathematics in both countries. In both countries, an inclusive school climate that was facilitated through collaborative leadership and teacher collaboration reinforced the delivery of these strategies. This is consonant with work that has described the importance of school leadership and teacher collaboration as drivers of inclusion. However, the study also identified that teacher attitudes and beliefs are also obstacles, particularly when teachers perceive inclusion as additional work or question their ability to include math. This aligns with prior research indicating that inadequate teacher preparation and lack of confidence are major barriers to inclusive education. Therefore, it is essential that teacher preparation programs not only provide prospective teachers with strategies and tools for inclusion but also try to change their beliefs and attitudes towards inclusion and diversity.

Fifth, the studies reveal that, despite advances in inclusive education advocacy in both countries, there are still relevant challenges in the two countries. In Spain, the respondents observed that teacher training for inclusion is conceptual and not hands-on, and therefore teachers cannot implement these strategies in classrooms. Implementation of the inclusion policies is also quite different in autonomous communities, and thus there is non-uniform implementation of inclusive strategies. In Ecuador, there was insufficient budget and inadequate professional training for instructors named as being the biggest constraint in implementing inclusive strategies. But, at the same time, potential for its solution was observed through online forum exchange

of materials and best practice as well as collaboration between schools to develop an inclusive project. These opportunities should be leveraged to strengthen teacher preparation and promote more inclusive and equitable mathematics education in both countries.

The findings of the research confirm that, although the two countries have made progressive efforts towards creating innovative methods of supporting inclusive education, there are still huge challenges related to teacher preparation, resources available, and school cultures. The results carry significant implications

for teacher training programme development and towards the promotion of more inclusive and equitable mathematics teaching in both nations. Despite its limitations, this study makes a valuable contribution to the existing literature by presenting empirical evidence and practical recommendations, grounded in the perspectives of teachers and trainers. Future studies might generalize these findings by incorporating student and other interest group viewpoints as well as validating the effectiveness of inclusive strategies through other contexts and subject matters.

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