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PAPER

Education towards equity: adapting assessment practices in the multicultural context of mathematics education

Educação em prol da equidade: a adaptação de práticas avaliativas no contexto multicultural do ensino de matemática

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ABSTRACT

Nowadays, considerable challenges have been faced in teaching mathematics, especially concerning historically excluded groups and diverse linguistically distinct communities. Traditional pedagogical practices often ignore such cultural diversity throughout Latin America, leading to the introduction of mathematical concepts not directly related to students' lives. Thus, a participatory educational model emerges where the educator takes an active role and motivates students as a way of confronting such inequalities and establishing a more relevant educational environment for all. This work seeks to analyze and propose adaptations in assessment practices encompassing the cultural diversity of students to promote reflection on equity in mathematics education in multicultural contexts in Latin America. Such analysis is based on a systematic literature review, in addition to textual analyzes to investigate the influence of adaptations on assessment practices sensitive to their cultural context, since such adaptations are fundamental to create a more inclusive and equitable environment in educational institutions. The study highlights the urgency of these adaptations to achieve educational equity, in addition to highlighting the importance of students' different backgrounds and experiences in learning mathematics. Such adaptations not only value the cultural diversity of students, but also strengthen their self-esteem by recognizing and valuing their origins.

Keywords: Inclusion. Learning. Assessment. Diversity. Pedagogical Practices.

RESUMO

Nos dias de hoje, desafios consideráveis têm sido enfrentados no ensino de matemática, especialmente para grupos historicamente excluídos e diversas comunidades linguisticamente distintas. Práticas pedagógicas tradicionais frequentemente ignoram essa diversidade cultural ao longo de toda a América Latina, levando à exposição de conceitos matemáticos não diretamente conectados à vida dos estudantes. Assim, emerge um modelo educacional participativo onde o professor assume um papel ativo e motiva os alunos como forma de enfrentar tais desigualdades e estabelecer um ambiente educacional mais relevante para todos. Este trabalho busca analisar e propor adaptações nas práticas avaliativas que considerem a diversidade cultural dos alunos a fim de promover uma reflexão sobre a equidade no ensino de matemática em contextos multiculturais na América Latina. A análise se baseia em uma revisão sistemática da literatura, além de análises textuais para

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investigar a influência das adaptações nas práticas avaliativas sensíveis ao contexto cultural, uma vez que tais adaptações são fundamentais para criar um ambiente educacional mais inclusivo e equitativo nas instituições de ensino. O estudo salienta a urgência dessas adaptações para alcançar a equidade educacional, além de realçar a importância das diferentes origens e experiências de alunos no aprendizado de matemática. Tais adaptações não só valorizam a diversidade cultural dos estudantes, como também fortalecem sua autoestima ao reconhecer e valorizar suas origens.

Palavras-chave: Inclusão. Aprendizado. Avaliação. Diversidade. Práticas Pedagógicas.

Introduction

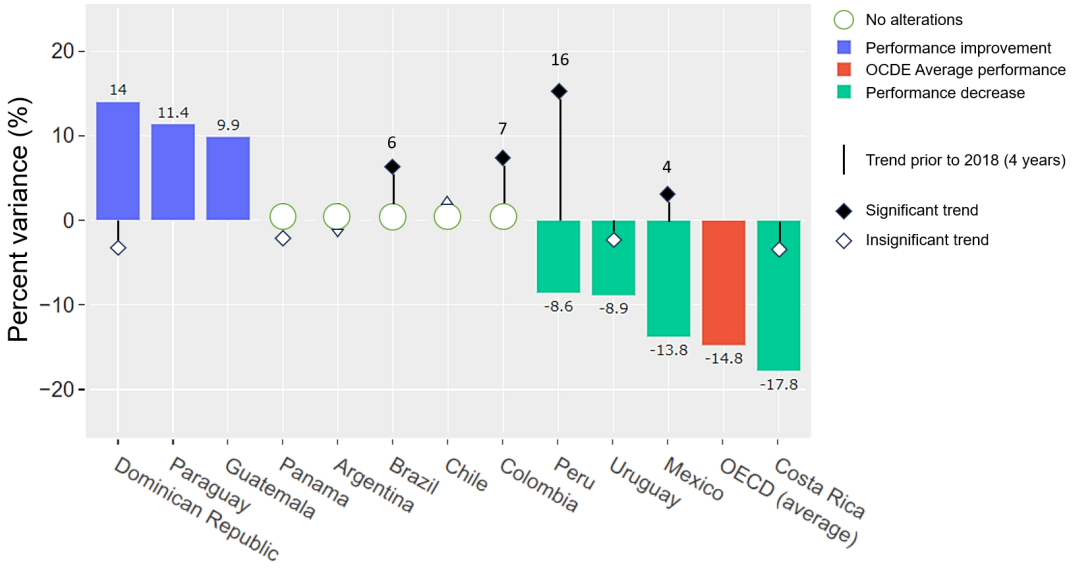
In Latin America, ethnic minority groups, linguistically diverse communities and vulnerable populations face profound inequalities in mathematics education, which in turn are reflected in the results of systemic educational assessments quite notably in several countries in the region (Parra *et al.*, 2016; Mendes; Esquincalha, 2021).

According to data from the Program for International Student Assessment (PISA), a global initiative created by the Organization for Economic Co-operation and Development (OECD) in 2022, it was found that three out of four students in Latin America and the Caribbean were unable to acquire elementary skills in the subject of mathematics (OECD, 2023). In this region, according to Ortiz *et al.* (2023), 88% of students from economically disadvantaged families demonstrate below-expected performance, compared to the 55% of students having greater purchasing power. These systemic disparities have a direct impact on students' academic performance and learning trajectory, especially in elementary school subjects such as mathematics, resulting in negative consequences throughout their educational journey.

Figure 1 shows the variation in the average PISA score of students from this region between 2018 and 2022, in addition to a comparison of these results with the trends observed in the four years prior to 2018.

According to Figure 1, before the COVID-19 pandemic, most countries showed a small improvement in student performance in mathematics. However, this trend was reduced or reversed between 2018 and 2022, and today Latin American countries show different trends, while the OECD records a significant drop in mathematics performance. Countries such as Colombia, Brazil, Chile, Argentina and Panama managed to maintain their performance levels compared to 2018. On the other hand, Peru and Mexico showed an upward trend until 2018, but this was reversed in 2022. Costa Rica and Uruguay maintained stability until 2018, but there was a drop in performance in 2022. Only three countries in the region show consistently positive trends in mathematics performance, but in the long term.

Figure 1 - Variation in the average score of Latin American and Caribbean students in mathematics in PISA between 2018 and 2022, and trends observed in the four years prior to 2018.



Source: Adapted from OECD (2023).

It is widely accepted that socioeconomic conditions exert considerable influence on students' academic performance and have been the subject of extensive research aimed at understanding the mechanisms of an economic and cultural nature that relate such conditions to student performance in systemic assessments with elevated degree of precision (OECD, 2023). Several studies indicate a correlation between countries' Gross Domestic Product (GDP) per capita and students' average scores on mathematics examinations (Eriksson *et al.*, 2021; Kholid *et al.*, 2022). According to this logic, economically prosperous countries (or more developed regions within a country) have the financial capacity to allocate more resources to educational systems, in addition to investing in infrastructure, technology and well-being. This often results in better educational opportunities, access to quality materials, and more enriching learning environments.

However, according to Eriksson *et al.* (2021), it is necessary to emphasize that this relationship is not deterministic, since there are several other factors, such as educational policies, direct investment in teacher training, school curriculum, among others, which play equally important roles. In this sense, localities with lower incomes can support strategic investments and innovative pedagogical approaches to make up for these limitations, revealing that quality education is not exclusively established by students' income levels.

Therefore, considering the need for innovative strategies in education, it is necessary to recognize the importance of their adoption given the limitations inherent to traditional pedagogical practices, which often neglect the cultural richness of historically marginalized groups. Additionally, a separation between mathematics education and the daily reality of students, reinforced by traditional approaches, ends up perpetuating the idea of natural talent instead of other skills. Such a limiting paradigm not only distances students from learning, but also restricts equal and equitable access to educational opportunities (Boaler, 2017).

To address this issue, Cohen and Lotan (2017) propose a transition to a more participatory teaching model, in which educators act as knowledge facilitators, offering guidance, feedback and encouragement to students to promote active learning. However, Kalinec-Craig (2017) suggests that a transformation of this scenario requires educators to recognize and value mathematical thinking on the part of students, defending the implementation of formative assessments as a strategy to achieve equity. For this, both the curriculum and pedagogical practices must be based on the conviction that everyone has intellectual, social and cultural resources, as well as an intrinsic potential to learn.

According to Bennett (2011), formative assessment, also known as 'assessment for learning', stands out for actively prioritizing student development, differentiating itself from assessments focused on accountability, classification or certification. In an education towards equity context, this model becomes even more valuable while providing practical information, both for teachers and students, as it allows self-evaluation and continuous improvements in teaching and learning practices. Assessment becomes 'formative assessment' when the evidence collected is skillfully used to adapt teaching to the individual needs of students, thus strengthening the recognition of each student's knowledge (Black *et al.*, 2019).

Recent studies highlight the importance of adapting to assessment practices to boost students' cognitive development (Fowler; Brown, 2018; Frangella, 2020; Hadji, 2021; Adewusi *et al.*, 2023). However, despite notable advances in this field, the issue of equal opportunities for all, regardless of their cultural origins, remains a critical and urgent challenge in many Latin American countries, including Brazil. Underestimating the importance of equitable assessments in mathematics education is an error, as the manner in which students are assessed can directly influence their access to educational opportunities in the present and future. This raises the following question: how can an adaptation of assessment practices contribute to ensuring equity in mathematics learning among students from different cultural backgrounds?

To promote reflection on equity in mathematics education, we seek to analyze and propose adaptations in assessment practices considering the cultural diversity of students. The 'Methodological Approach' section details the systematic literature review and textual analysis used to investigate the impact of adaptations on culturally sensitive assessment practices. Next, the results of these analyzes are presented, followed by a discussion on the relevance of these adaptations in promoting equity in mathematics education in multicultural contexts. Finally, considerations are highlighted that emphasize the need for these adaptations to establish a fairer, more inclusive and equitable educational environment in mathematics teaching.

Methodology

This research encompasses the area of "Teacher Training for Elementary Education" of the Professional Master's Degree in Education (MPE) at the University of Taubaté (UNITAU) in the line of research "Pedagogical Practices towards Equity". Its theoretical framework was established in accordance with Boaler (2017) and Lotan (2022), as they are widely recognized for their fundamental contributions to promoting educational equity in mathematics teaching.

A systematic literature review was carried out to examine the adaptation of assessment practices in favor of equity in mathematics teaching, as it is a widely disseminated approach aimed at compiling, evaluating and critically analyzing existing studies (Ramos; Faria; Faria, 2014).

Data collection was carried out through a search on the Scopus database using the terms "Educational assessment" and (Boolean operator 'AND') "Mathematics", both in Portuguese and English, and the search was restricted to articles published in peer-reviewed scientific journals over a period of 10 years (2013-2022). Articles in English were translated and adapted by a suitably qualified professional who is proficient in both languages. Given the length of publications found, the selection was refined to include articles that also incorporate the descriptors "equity" or (Boolean operator 'OR') "equity" in their titles, abstracts or abstract keywords. To ensure the quality and relevance of the selected material, publications that did not contain at least one of the additional terms mentioned above were disregarded, as well as monographs, dissertations, theses and editorials.

Selected texts were organized and subjected to careful reading to create individual expanded abstracts according to a methodology adapted from Nóbrega *et al.* (2022). Then, the abstracts were processed using a natural language processing (NLP) algorithm in Python based on tokenization, removal of stopwords and normalization of manuscripts according to the approach described by Ferreira *et al.* (2023).

Afterwards, a lexicometric analysis was carried out including Correspondence Factor Analysis (CFA) using the IraMuTeQ software (Interface de R pour les Analyzes Multidimensionnelles de Textes et de Questionnaires). CFA is a statistical technique used to evaluate the association between two categorical variables in a dataset able to identify relationships between words or terms in a textual corpus in the context of IraMuTeQ (Martins; Gomes; Paula, 2022). Grounded in the proposal of Medeiros and Amorim (2017), a discursive textual analysis was carried out, which encouraged reflections on how an adaptation of assessment practices sensitive to cultural diversity contributes to equity in mathematics education.

Result and Discussion

After linking all the descriptors in the Scopus database, 236 publications were identified. The inclusion and exclusion criteria were then applied, resulting in the selection of 45 articles. Of these, six were removed due to duplication and another six were excluded because they did not directly address the objectives of this study. Thus, in accordance with the procedures outlined in the Methodological Approach section, Table 1 shows the 33 articles selected according to the inclusion and exclusion criteria, which constitute the main collection of textual corpora for this research.

Once the corpora were prepared, CFA was performed using the IraMuTeQ software to identify frequent associations between terms in the analyzed publications.

According to Marchand and Ratinaud (2013), CFA assesses the association between categorical variables in a dataset, identifying relationships between words based on the premise that relationships between parts of a manuscript and linguistic forms used can be reduced to some factors. In this procedure, the initial step is to compile a contingency table summarizing the frequency of the occurrence of words. Therefrom, the proportion of occurrences of each word in relation to

the total number of observations is calculated to assist in standardizing data.

Then, CFA uses the chi-square distance to measure the dissimilarity between rows and columns of the contingency table. A standard frequency matrix is then decomposed using singular value decomposition, resulting in principal components representing the directions of maximum data variation. These components are used to plot points in a lower dimensional space (typically 2D or 3D) to ease visualization of relationships between categories. In the context of this study, CFA generated a graphical representation of the structure of corpora, identifying the proximity relationship between articles and revealing common areas, particularities and linguistic patterns in manuscripts.

Table 1 - Publications selected for compiling textual corpora

n	Researchers	Research focus	Journal
0001	Costa and Prottis (2019)	PISA exploratory analyzes	Studies on Educational Assessment
0002	Primi *et al.* (2020)	Attitude towards mathematics inventory	Studies on Educational Evaluation
0003	Oliveira Júnior and Ignácio Calderón (2014)	Assessment of school performance in the state of São Paulo	Essay: Assessment and Public Policies in Education
0004	Furtado and Soares (2018)	Impact of educational bonus in Pernambuco	Australasian Journal of Educ. Technology
0005	Büchele (2020)	Assessments in higher-level mathematics courses	Studies on Educational Assessment
0006	Tavares, Carvalho and Leite (2016)	Item response theory	Studies on Educational Assessment
0007	Dutra *et al.* (2019)	Educational performance of Federal Institutes in ENEM	Education and Research
0008	Sousa *et al.* (2019)	Grades obtained by Brazilian institutions in ENEM	Pedagogical Trends
0009	Viana (2015)	Assessment of geometric figures in elementary education	Studies on Educational Assessment
0010	Bacca and Flores (2022)	The issue of statistical discourse in mathematics education	Alexandria
0011	Hottzet, Ferreira e Vilardi (2018)	Reviews at EJA	Studies on Educational Assessment
0012	Piton-Gonçalves and Almeida (2018)	Mathematical difficulty in ENEM	Electronic Mathematics Magazine
0013	Travitzki (2017)	ENEM quality assessment using psychometric techniques	Studies on Educational Assessment
0014	Vinha, Karino and Laros (2019)	Performance in Mathematics at Brazilian elementary education	Psico
0015	Brooke *et al.* (2014)	Student assessment in early years in Brazil	Education and Research
0016	Ngo e Melguizo (2016)	Assessment of recovery exam grades in mathematics	Education Evaluation and Policy Analysis
0017	Almeida, Dalben and Freitas (2013)	Assessment at IDEB	Education & Society
0018	Garcia *et al.* (2018)	Impact of assessments on teaching natural sciences and mathematics	Studies on Educational Assessment
0019	Rabelo and Cavenaghi (2016)	Educational indicators for teacher training	Studies on Educational Assessment

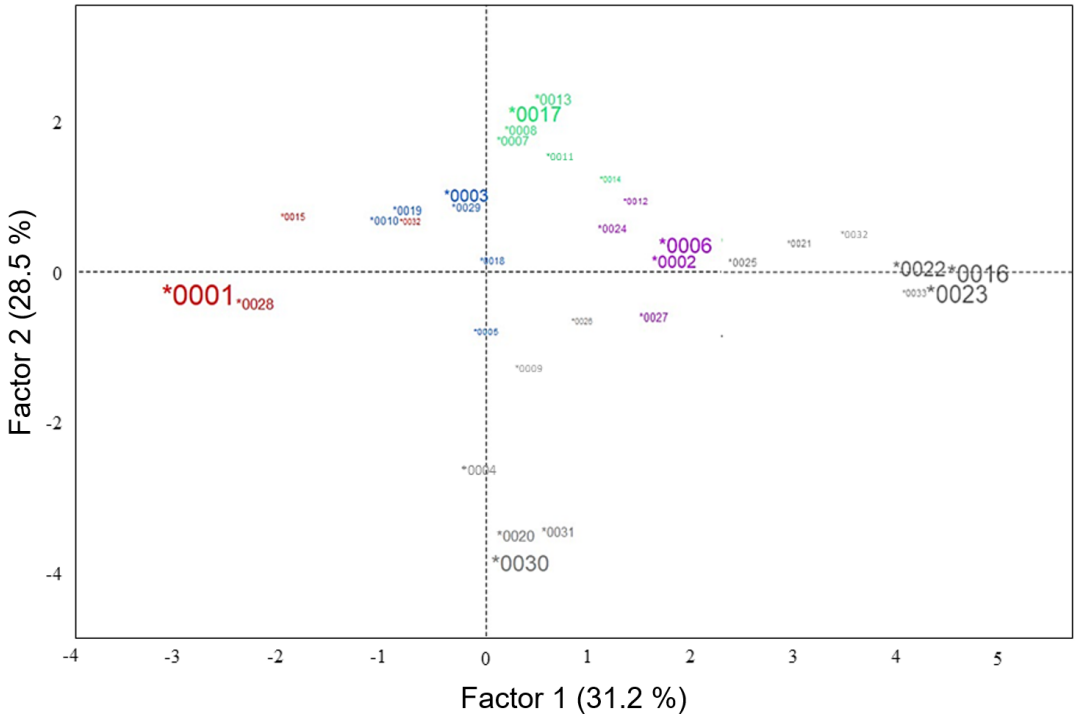
0020	Garrett and Hong (2016)	Educational game to stimulate sustainable thinking in education	Educational Evaluation and Policy Analysis
0021	Russell *et al.* (2020)	Evaluation of a mathematics coaching model	Educational Evaluation and Policy Analysis
0022	Park and Ngo (2021)	Equity and mathematics in the teaching of mathematics and natural sciences courses	Educational Evaluation and Policy Analysis
0023	Dougherty *et al.* (2015)	Equitable access to mathematics education in elementary schools	Educational Evaluation and Policy Analysis
0024	Fonseca *et al.* (2019)	Systematic assessments in education	Studies on Educational Assessment
0025	Louzano and Santos (2017)	Learning opportunities in mathematics education	Studies on Educational Assessment
0026	Bacchetto and Pinto Júnior (2017)	Learning opportunities in mathematics education with the PISA	Studies on Educational Assessment
0027	Lucena, Borralho and Dias (2018)	Mathematics education practices in early years	Studies on Educational Assessment
0028	Santos *et al.* (2017)	Evaluation in experimental projects in Rio de Janeiro	Studies on Educational Assessment
0029	Barbetta, Andrade and Tavares (2018)	Hierarchical quantile regression	Studies on Educational Assessment
0030	Im *et al.* (2020)	School-Level Standardized Testing Policy and Its Impact on Mathematics Performance	Studies on Educational Assessment
0031	Butcher and Visher (2013)	Impact of a mentoring program on student performance in mathematics classes	Educational Evaluation and Policy Analysis
0032	Lima *et al.* (2020)	Brazil in PISA	Tangram
0033	Andriola (2018)	The playfulness of educational games in higher education	Iberoamerican Journal of Educational Evaluation

Source: The authors.

Figure 2 depicts the graphical result thereof, in which axes represent the factors extracted by CFA. 'Factor 1' (31.2%) denotes the main dimension of an association between terms, while 'Factor 2' (28.5%) reveals secondary associations. The percentage values assigned to each factor indicate its contribution to explaining data variation. The variability captured by the two axes (approximately 60%) ensures that the positions and distances between points in it are reliable and reveal the underlying relationships in corpora. Different colors in it highlight patterns and relationships between terms in the analyzed corpora. The most relevant articles, according to the terms defined by the inclusion criteria in the initial search, are represented using larger fonts.

According to Figure 2, twelve articles reveal a significant thematic, methodological and/or theoretical connection between them, bringing relevant contributions to study assessment practices aimed at equity in Mathematics Education. For a more in-depth understanding of the lexicometric analysis, the articles were categorized into different classes: class 1 (highlighted in red), class 2 (in gray), class 3 (in green), class 4 (in blue), class 5 (in lilac) and class 6 (in black). Each class highlights the main ideas of the most relevant articles in the analysis, representing different sets of contributions and topics covered.

Figure 2 - Correspondence Factor Analysis (CFA) obtained from textual corpora. The different colors show patterns and relationships between words or terms present in these corpora



Source: The authors.

Class 1, represented in green in Figure 2, is based on studies by Travitzki (2017) and Almeida *et al.* (2013), articles *0013 and *0017, respectively. The authors emphasize the complexity of educational assessments, especially considering the use of large-scale assessments, such as the Ideb (Index of Development of Basic Education) and the Enem (Brazilian National High School Examination). Furthermore, the authors portray the intricate nature of assessments, highlighting not only their importance, but also the complexities inherent in their use in broad contexts of educational assessment. Both highlight a lack of consideration regarding the socioeconomic level of students in assessments, revealing such an omission can distort the perception of quality of educational institutions. Furthermore, they highlight the limitation of evaluating the quality of education exclusively based on performances on standardized tests, as this approach neglects essential aspects of educational processes, such as the development of students social, emotional and cultural skills.

Class 2 (blue), based on research by Oliveira Júnior and Ignácio Calderón (2014), article *0003, highlights different approaches in relation to the System of School Performance Evaluation of the State of São Paulo (SARESP), therefore there is a prevalence from critical perspectives associating the system with excessive emphasis on pre-determined mathematical skills and abilities. This research highlights a predominance of critical views questioning the structure of SARESP, revealing the need for deeper reflection on assessment approaches and their impact on teaching and learning. Oliveira Júnior and Ignácio Calderón (2014), while highlighting the epistemic community, also emphasizes the importance of a critical evaluation of educational policies, especially in the context of Brazil where

the educational system is in constant transformation. The study also highlights the importance of analyzing these policies to promote more equitable and inclusive assessments in the educational system, benefiting both students and teachers.

Class 3 (lilac), based on studies carried out by Primi *et al.* (2020) and Tavares, Carvalho and Leite (2016), articles *0002 and *0006, respectively, focuses on the assessment of mathematical skills and points out the importance of changing students' attitude towards the subject and applying the Item Response Theory (IRT) for a more accurate and comprehensive assessment of the development of these skills over time. Primi *et al.* (2020) highlights that such a change in attitude has a significant influence on student performance in the classroom, emphasizing the importance of exploring this aspect to improve their performance. On the other hand, Tavares, Carvalho and Leite highlights that IRT enables a direct comparison of assessment results at different times, thus enabling a more accurate measurement of the development of mathematical skills over time.

These first three classes are aligned while discussing equity in educational assessments, each focusing on different aspects, nonetheless they all highlight the importance of considering the complexity of the assessment process to promote equity in mathematics education. All classes highlight the need for assessment approaches that are sensitive to the diversity of students and their individual circumstances, in addition to the inherent complexity of the educational environment, aiming to establish an assessment system that is fairer and equitable.

Located at one of the extremes of the CFA (Figure 2), class 4 (gray), represented by the studies by Garret and Hong (2016), Im *et al.* (2020) and Butcher and Visher (2013), articles *0020, *0030 and *0031, respectively, observe the influence of teaching methods on students' performance in mathematics. Garret and Hong (2016) focus on the results of grouping linguistic minority students and the time spent on mathematics classes, showing that homogeneous grouping has a negative impact on developing their mathematics skills, highlighting that an ideal instructional approach would involve the use of heterogeneous grouping, along with a relatively larger amount of class time. Im *et al.* (2020) explore the frequency of standardized testing policy in primary schools and report that an early exposure to these tests can have varying impacts on mathematical performance, showing that the benefit is not sustainable in the long term. On the other hand, Butcher and Visher (2013) analyze an intervention program with pedagogical practices adaptable to the specific needs of students aiming to improve their performance in community colleges, thus showing that this approach has positive effects in mathematics courses, since rates of dropouts were reduced in addition to an increase in approval rates.

Class 5, represented in red, is supported by Costa and Prottis (2019), article *0001. In this class, the importance of teacher satisfaction and engagement in favor of educational quality and achieving more significant results in systemic evaluations is highlighted. Furthermore, the existence of elements able to contribute to maintaining teachers' engagement is evident, such as job satisfaction, promising career perspective and constructive interactions with colleagues and school coordination.

The relevance of this study for conducting research under development is notable, as it offers an in-depth analysis of challenges faced by teachers in such a complex educational context, such

as the Brazilian one. Above all, information about the relationship between teacher engagement and educational quality has direct repercussions on the search for equity in mathematics education involving students from diverse cultural and linguistic backgrounds in Latin America. Regarding student-teacher relationships, educational innovation and the creation of an inclusive learning environment, Costa and Prottis (2019) highlight the direct influence of teacher satisfaction and job motivation, in addition to offering solid basis for discussion on the adaptation of equitable assessment practices.

Class 6, located on the far right of CFA (Figure 2) and represented in black, is based on studies by Ngo and Melguizo (2016), Park and Ngo (2021), and Dougherty *et al.* (2015), articles *0016, *0020 and *0023, respectively. This class focuses on the assessment of students in higher-level courses, especially educational policies affecting students' equitable access to undergraduate education.

Ngo and Melguizo (2016), and Park and Ngo (2021) affirm the importance of assessment policies to promote equity, recognizing the impact of these decisions on students' educational trajectory and access to academic opportunities. These authors state that, adequate assessment, or its absence, is a determining factor for student success in advanced mathematics and exact sciences courses. Furthermore, these studies address challenges related to the equitable representation of groups that have historically been excluded or underrepresented, such as low-income students, ethnic minorities, among others.

An important point worth discussing about this class is the accuracy of evaluation policies. Their articles highlight that there must be a careful selection of assessment instruments in defining entry reduction in enrollment exam, as it is a fundamental aspect for verifying the effectiveness of educational policies. Park and Ngo (2021) particularly emphasize that inaccurate assessment policies can result in errors in exam classifications, which is extremely harmful for students. Furthermore, Dougherty *et al.* (2015) emphasize the importance of collaboration between researchers and school districts in evaluating innovative policies. Thus, there should be an interdependence between academic research and implementation of educational policies, highlighting that collaboration is essential to evaluate the long-term impact of these policies.

Given the lexicometric analysis presented, the categorization of classes in the CFA presents a robust intersection of ideas highlighting the significant influence of educational policies, teaching practices, assessments and statistics in the field of mathematics education. A convergence between these classes reveals the importance of considering equity in assessment and access to academic opportunities, especially in the multicultural context of mathematics education. Examining these classes highlights how educational policies determine not only access to education, but also the quality and equity of such education. This convergence highlights the need for a holistic approach encompassing not only teaching and assessment practices, but also educational policies to promote a fairer, more inclusive and equitable educational environment.

Considering the intersection between these classes is vital for adapting assessment practices to foster equity in multicultural mathematics education. In this sense, it is understood that it is necessary to consider educational policies and the implementation of student-centered teaching practices, as well as the need for accurate and impartial assessments. A subsequent reflection on this adaptation enables us to identify strategies and approaches able to be implemented to ensure that

assessment in mathematics education transcends a mere measurement of performance, becoming, as a matter of fact, an essential instrument in promoting educational equity in contexts multicultural.

The importance of adapting assessment practices towards equity in the multicultural context of mathematics education

As a central value and essential goal in educational policy, equity represents not only an ethical principle linked to the notion of justice, but also to a normative concept advocating equal opportunities for all, regardless of their origin, ensuring full achievement of the potential of every individual (OECD, 2023).

The search for equity in education does not imply a homogenization of results among students, since, even in highly equitable educational systems, it is natural to find variations in individual performances. The objective of equity policies is not limited to lowering the highest performing students or standardizing results, but rather to assist all students in reaching their maximum potential in the classroom. However, such pursuit faces considerable challenges, especially in multicultural environments such as those found in Latin America where there is a lack of consideration for the cultural and linguistic diversity of students, coupled with socioeconomic challenges which have a direct impact on the quality of education.

The persistence of traditional teaching methods in mathematics education is one of the main obstacles to achieving equity. These approaches tend to emphasize the memorization of formulas and algorithmic strategies, jeopardizing representativeness and equity in the teaching and learning process (Hadji, 2021). In line with these concerns, Unger (2018) argues that an overemphasis on memorization and algorithmic application drastically reduces students' understanding of mathematics and undermines their development of creativity and critical thinking. This emphasis often inhibits students' deeper understanding and creative exploration, which is paramount to the development of mathematical and problem-solving skills.

In the multifaceted context of mathematics education in Latin America, it is essential to reflect on assessment practices, as they only stimulate the quality of the educational process and promote equity among students. As argued by Souza Pacheco (2020), traditional assessments, as summative assessments, lack adequate representation of students' cultural diversity. They usually consist of a global judgment that leads to a decision, usually related to the approval of students, classifying them based on the levels of performance achieved. Therefore, more inclusive and contextually sensitive assessment strategies emerge as guiding elements for a fair and accurate assessment in the educational environment and, at this point, an integration of methods such as formative assessments, portfolios and projects, which value the diverse manifestations of students' mathematical thinking, proves to be crucial for capturing and recognizing the diversity of cultural perspectives in the mathematics learning process.

Aligned with Cohen and Lotan (2017), Hadji (2021) highlights that an adaptation of assessment instruments should not be limited solely to regional diversities, but must encompass the different traditions, customs, identities and narratives present in each country. These adaptations

must seek equitable representation of historically excluded groups in Latin American society, such as low-income students, ethnic minorities, indigenous peoples, people of African descent, rural and peripheral communities, women and LGBTQIA+ people, among others. Recognizing differences is not equivalent to understanding the fundamental processes generating inequalities in education. However, to plan didactic-pedagogical processes promoting critical reflection, reduction and elimination of disparities in mathematics education, it is necessary to deepen theoretical knowledge about how such disparities manifest themselves. From this perspective, the integration of students' socio-emotional skills is considered an element of extreme relevance. However, the continuous training of educators plays a key role in achieving this objective.

Darling-Hammond (2017), for instance, highlight the pressing need for investments in continuous training programs for educators, emphasizing the importance of enabling teachers not only to master the content, but also to understand and manage the cultural and linguistic diversity that permeates learning environments. Furthermore, according to Durlak *et al.* (2011), community involvement is also a very important resource to strengthen equity in mathematics teaching, since partnerships between schools and local communities allow a contextualization of mathematical content, promoting more effective learning by integrating examples students' daily lives.

Given these assumptions, measuring results in mathematics education should not be restricted solely to the assessment of theoretical mathematical knowledge, but should also cover a wider range of essential skills. Research, such as those by Elias and Haynes (2008), Cohen and Lotan (2017) and Boaler (2017), demonstrate the importance of socio-emotional development in learning, highlighting the need to include the assessment of these skills in the educational context. Likewise, measuring creativity and the ability to solve problems, as highlighted by Plucker, Beghetto and Dow (2004), not only reveals the depth of mathematical understanding, but also promotes a practical application of this knowledge in solving problems in the world real. In this context, there is a pressing need to broaden mathematics assessments beyond the technical domain, highlighting the importance of adapting assessment practices that encourage more contextualized learning, stimulating an in-depth and applied view of the subject.

Among these practices, formative assessment and the use of rubrics are essential to achieving equity in classrooms. If, on the one hand, formative assessment stimulates students' self-reflection and develops metacognitive skills (Kalinec-Craig, 2017), on the other hand, rubrics offer an objective and clear approach to evaluating student performance, identifying specific difficulties (Boaler, 2017). Clearly, by integrating these practices into traditional approaches, teachers can provide specific, targeted feedback to students, identifying knowledge gaps and offering additional support to those who need it. This is fundamental for personalized and equitable education in the multicultural context of mathematics education in Latin America.

In this challenging scenario, several initiatives in Latin America aim to promote equity in education, especially in the multicultural context of mathematics education. One of which is the Specialist Teaching Programme (PED *Brasil* acronym in Brazilian Portuguese), known for adapting assessment practices and creating more inclusive and equitable environments in this area. PED *Brasil* is a postgraduate course, lato sensu, aimed at teachers in the initial and final years of Elementary and High School education working in the areas of teaching mathematics or natural sciences. This

course is offered by higher education institutions in partnership with municipal and state education departments in different regions of Brazil, which currently counts on the participation of 22 institutions in the program network. PED *Brasil* incorporates theories and pedagogical approaches from different educational thinkers, guiding teachers to create an environment that encourages the participation of everyone involved in the academic discussion of equity (Canoa, 2023).

In 2023, the introduction of PED *Brasil* at master's degree level represented a significant milestone in improving pedagogical training nationwide. Implemented in a pioneering way by a municipal public university in *Vale do Paraíba, São Paulo* state inland, the program demonstrates commitment and concern as it offers teachers more robust and comprehensive training in pedagogical practices focused on equity and prepares them to effectively address the inequalities present in mathematics education in Brazil. At the same time, educational programs in other Latin American countries, such as *Proyecto Explora in Chile, La Ciencia en tu Escuela in Mexico and Programa de Popularización de la Ciencia y la Innovación in Argentina*, have focused on strengthening mathematics and science teaching natural. All of them provide resources, workshops and activities for both teachers and students, with the aim of promoting more practical and contextualized pedagogical approaches aimed to face the challenges of the multicultural context, adapting assessment methods to better meet the cultural and linguistic diversity of students.

Given the reflections presented above, it is observed that the adaptation of assessment practices to promote equity in the multicultural context of mathematics education is fundamental to validating students' unique experiences. In this context, an implementation of assessments sensitive to cultural diversity not only facilitates the construction of more inclusive and representative learning environments, but also recognizes the importance of cultural inclusion in mathematics education (Gómez; Sáenz, 2022). However, a practical application of these strategies still requires greater depth, as few studies have explored how different cultural perspectives influence assessment practices in detail, especially in mathematics classrooms (Faustino; Novak; Borges, 2022). Therefore, it is essential to conduct broader and deeper investigations, using qualitative and quantitative methods, to provide a detailed understanding of the nuances involved in these assessment strategies.

Future research should examine the long-term effects of adapted practices, including bolstering students' confidence in their mathematical skills and their continued motivation in the subject throughout their educational trajectory. Understanding these aspects is highly significant for filling gaps in knowledge and guiding more equitable educational policies in mathematics teaching.

Final considerations

After a thorough analysis of assessment practices in the context of teaching mathematics in multicultural environments, results revealed a significant gap in conventional assessment approaches and the diverse reality of students. The findings emphasize that there is still a certain persistence in traditional methods based on standardized tests that do not adequately capture cultural and linguistic diversity, reaffirming the urgency of adaptations in assessment practices considering the plurality of students' experiences and knowledge.

The importance of adapting assessment practices to promote equity in mathematics teaching stands out clearly. Initially on account of being fundamental to ensure a fair and inclusive assessment of students, especially when the cultural and linguistic diversity of students are considered. Secondly, it is because a validation and appreciation of these students' multiple forms of mathematical expression emerge as elements of great importance for educational equity, as well as for the recognition of their cultural identities.

In this scenario, there are vast implications of these reflections for educational practice and the formulation of educational policies, given that more inclusive and culturally sensitive assessment strategies not only promote fairer assessment, but also enrich learning environments, making them more inclusive and significant. It is understood that this can inspire and encourage the implementation of educational policies valuing and incorporating cultural diversity in curricula, teacher training and the design of assessments more aligned with the reality of individuals.

The practical consequences of these findings indicate the need for a constant rethinking of pedagogical and assessment practices, after all, the path to equity in mathematics education requires a holistic and integrated approach capable of recognizing and celebrating the cultural diversity of students. These changes promote a more inclusive and representative educational environment, in addition to strengthening students' cultural identity. It is clear that adapting assessment practices in the multicultural context of mathematics education is not limited to a question of educational justice but represents an urgent need to guarantee equal access to quality education. Through these adaptations, our classrooms become spaces where each student feels valued and motivated to reach their full academic and personal potential.

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