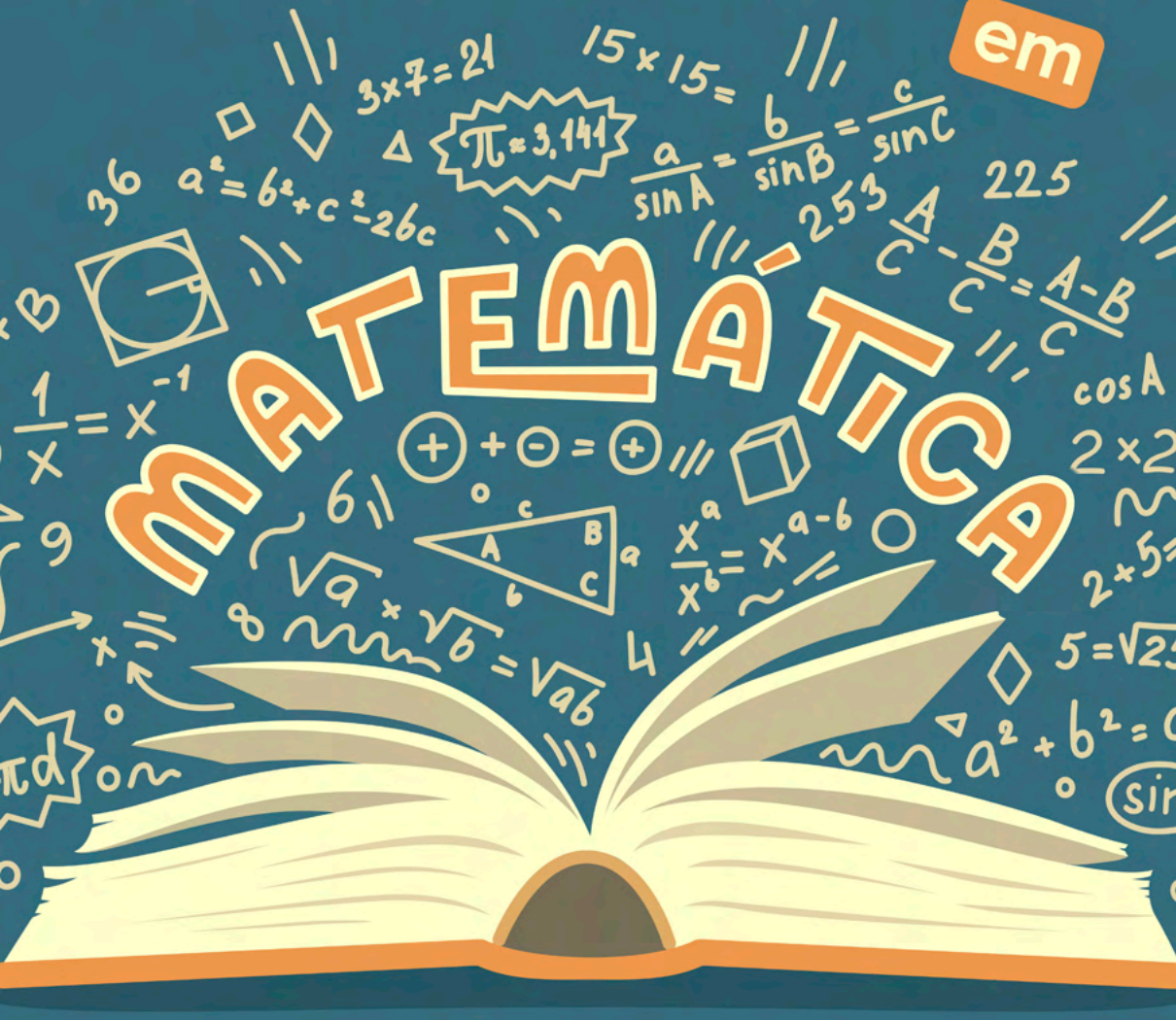
Américo Junior Nunes da Silva
André Ricardo Lucas Vieira
(Organizadores)

PESQUISAS DE VANGUARDA em MATEMÁTICA



e suas aplicações

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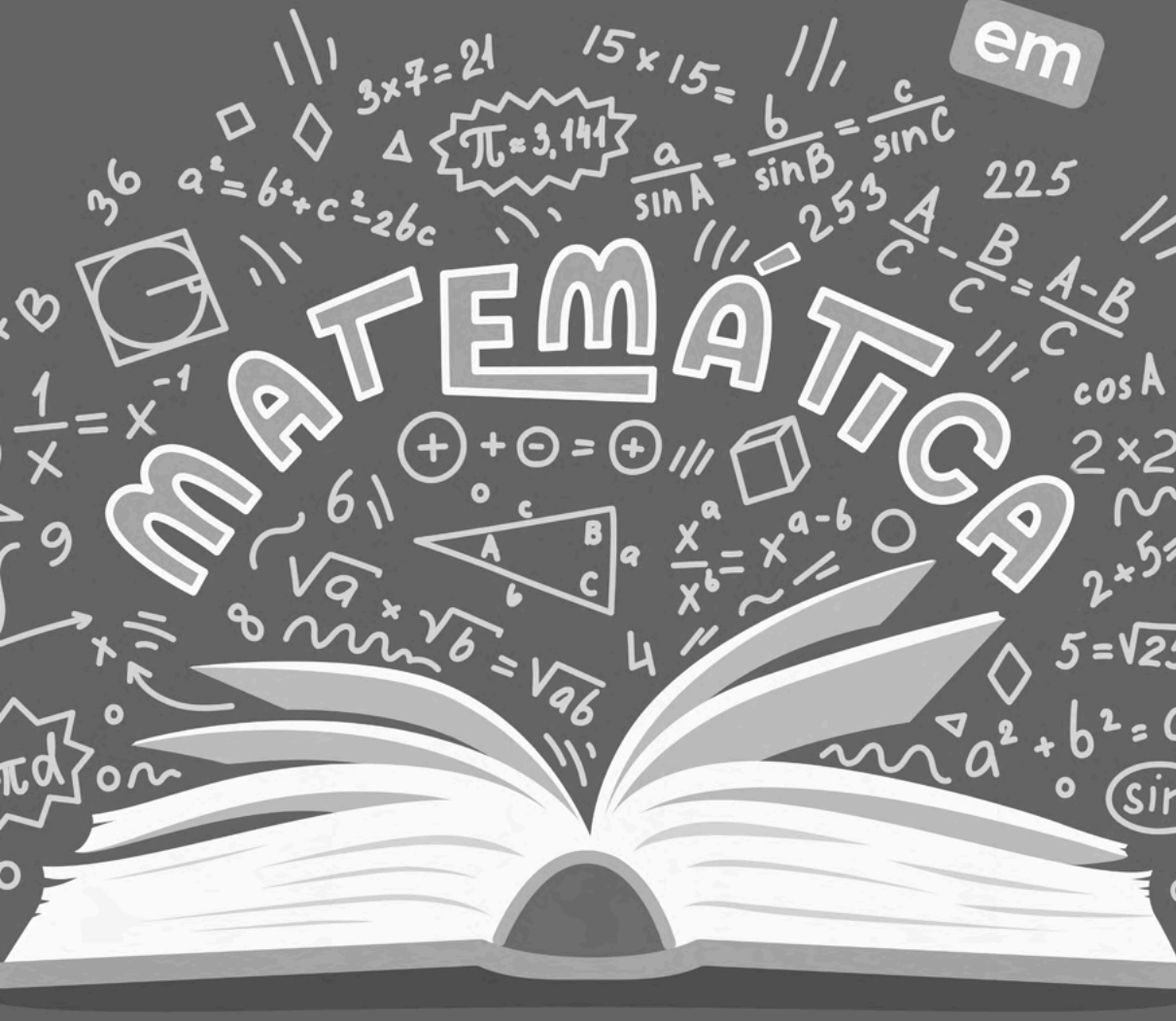

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APRESENTAÇÃO

A Pandemia do novo coronavírus pegou todos de surpresa. De repente, ainda no início de 2020, tivemos que mudar as nossas rotinas de vida e profissional e nos adaptar a um "novo normal", onde o distanciamento social foi posto enquanto a principal medida para barrar o contágio da doença. As escolas e universidades, por exemplo, na mão do que era posto pelas autoridades de saúde, precisaram repensar as suas atividades.

Da lida diária, no que tange as questões educacionais, e das dificuldades de inclusão de todos nesse "novo normal", é que contexto pandêmico começa a escancarar um cenário de destrato que já existia antes mesmo da pandemia. Esse período pandêmico só desvelou, por exemplo, o quanto a Educação no Brasil acaba, muitas vezes, sendo uma reprodutora de Desigualdades.

O contexto social, político e cultural, como evidenciaram Silva, Nery e Nogueira (2020), tem demandado questões muito particulares para a escola e, sobretudo, para a formação, trabalho e prática docente. Isso, de certa forma, tem levado os gestores educacionais a olharem para os cursos de licenciatura e para a Educação Básica com outros olhos. A sociedade mudou, nesse cenário de inclusão, tecnologia e de um "novo normal"; com isso, é importante olhar mais atentamente para os espaços formativos, em um movimento dialógico e pendular de (re)pensar as diversas formas de se fazer ciências no país. A pesquisa, nesse interim, tem se constituído como um importante lugar de ampliar o olhar acerca das inúmeras problemáticas, sobretudo no que tange ao conhecimento matemático (SILVA; OLIVEIRA, 2020).

É nessa sociedade complexa e plural que a Matemática subsidia as bases do raciocínio e as ferramentas para se trabalhar em outras áreas; é percebida enquanto parte de um movimento de construção humana e histórica e constitui-se importante e auxiliar na compreensão das diversas situações que nos cerca e das inúmeras problemáticas que se desencadeiam diuturnamente. É importante refletir sobre tudo isso e entender como acontece o ensino desta ciência e o movimento humanístico possibilitado pelo seu trabalho.

Ensinar Matemática vai muito além de aplicar fórmulas e regras. Existe uma dinâmica em sua construção que precisa ser percebida. Importante, nos processos de ensino e aprendizagem da Matemática, priorizar e não perder de vista o prazer da descoberta, algo peculiar e importante no processo de matematizar. Isso, a que nos referimos anteriormente, configura-se como um dos principais desafios do educador matemático, como assevera D'Ambrósio (1993), e sobre isso, de uma forma muito particular, abordaremos nesta obra.

É neste sentido, que o volume 2 do livro "***Pesquisas de Vanguarda em Matemática e suas Aplicações***" nasceu: como forma de permitir que as diferentes experiências do professor pesquisador que ensina Matemática e do pesquisador em Matemática aplicada sejam apresentadas e constituam-se enquanto canal de formação para educadores da

Educação Básica e outros sujeitos. Reunimos aqui trabalhos de pesquisa e relatos de experiências de diferentes práticas que surgiram no interior da universidade e escola, por estudantes e professores pesquisadores de diferentes instituições do país.

Esperamos que esta obra, da forma como a organizamos, desperte nos leitores provocações, inquietações, reflexões e o (re)pensar da própria prática docente, para quem já é docente, e das trajetórias de suas formações iniciais para quem encontra-se matriculado em algum curso de licenciatura. Que, após esta leitura, possamos olhar para a sala de aula e para o ensino de Matemática com outros olhos, contribuindo de forma mais significativa com todo o processo educativo. Desejamos, portanto, uma ótima leitura.

Américo Junior Nunes da Silva
André Ricardo Lucas Vieira

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SUMÁRIO

CAPÍTULO 2

ASSESSMENT BELIEFS AND PRACTICES IN PRIMARY SCHOOL MATHEMATICS EDUCATION IN BRAZIL

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ABSTRACT: To gain further knowledge about how Brazilian primary school teachers perform and conceive assessment in mathematics education, we carried out an updated review of research literature on assessment in Brazil. Our scope on assessment was broad and included both large-scale assessment and classroom assessment. The research question was: *What does recent research reveal about Brazilian primary school mathematics assessment practices and teachers' beliefs?* The review covered publications between 2010 and 2017 in proceedings of Brazilian scientific conferences and the national database of PhD theses and master dissertations. The influence of large-scale assessments changes in the school curriculum, such as adding content or emphasizing certain content. Teachers feel controlled and evaluated by external assessments. When comparing assessment practices with assessment beliefs, we can see a mismatch between what is done and what Brazilian primary schoolteachers think. The teachers mostly believe classroom assessment is a process that occurs in many moments in the classroom and uses different instruments. Nevertheless, the most used practice is testing students at the end of a school period. The recommendations of the researchers point to teachers' in-service education. We understand that the mathematics assessment practices in Brazil still maintain some distance from what is understood by formative assessment.

KEYWORDS: Classroom assessment; Large-scale assessment; Brazilian research; Mathematics education; Primary school.

CRENÇAS E PRÁTICAS DE AVALIAÇÃO EM EDUCAÇÃO MATEMÁTICA NOS ANOS INICIAIS NO BRASIL

RESUMO: Para obter mais conhecimento sobre as crenças e práticas de avaliação em educação matemática de professores dos anos iniciais no Brasil, realizamos uma revisão atualizada da literatura de pesquisa sobre avaliação no Brasil.

O escopo de avaliação foi amplo e incluiu avaliação em larga escala e avaliação em sala de aula. A questão de pesquisa foi: O que pesquisas recentes revelam sobre as práticas de avaliação em matemática e as crenças dos professores nos anos iniciais no Brasil? A revisão abrangeu publicações entre 2010 e 2017 em anais de congressos e no catálogo de teses e dissertações da Capes. Avaliações em larga escala influenciam mudanças no currículo, tais como adicionar ou enfatizar conteúdos específicos. Os professores sentem-se controlados pelos resultados dessas avaliações. Ao comparar as práticas com as crenças de avaliação, podemos ver um descompasso entre o que é feito e o que pensam os professores. Os professores dos anos iniciais acreditam que a avaliação em sala de aula é um processo que ocorre em muitos momentos e usa diferentes instrumentos. No entanto, a prática mais utilizada é testar os alunos no final do período escolar. As recomendações apontam para a formação continuada. Entendemos que as práticas de avaliação matemática no Brasil ainda mantêm alguma distância daquilo que é entendido por avaliação formativa.
PALAVRAS-CHAVE: Avaliação em sala de aula; Avaliação em larga escala; Brasil; Educação matemática; Anos iniciais.

1 | INTRODUCTION

In the last half of the 20th century, educational reforms have taken place in many countries worldwide. Most of these educational reforms also advocated an assessment reform (BERRY, 2011) in the view that assessment is an ongoing process interconnected with teaching and learning (e.g., SHEPARD, 2000; SUURTAMM; KOCH; ARDEN, 2010; VAN DEN HEUVEL-PANHUIZEN, 1996). This means that assessment "is a complex, all-encompassing process that fulfils a central role in instruction" (VELDHUIS; VAN DEN HEUVEL-PANHUIZEN, 2014, p. 3). However, not all studies that investigated the implementation of this approach to assessment came to positive findings. Berry (2011) concluded that only limited changes in assessment practices were found following such reforms, as shown by the continuing emphasis on grading students and little focus on supporting their learning.

Also in Brazil, reform in education and assessment took place. In the 1990s, the National Curriculum Parameters (Parâmetros Curriculares Nacionais – (hereafter PCN; MINISTÉRIO DA EDUCAÇÃO, 1997) was meant to provide schools and systems with indications for elaborating their curriculum. The document emphasized that there should also be more attention to classroom assessment in addition to large-scale assessment. This assessment was understood as "a part of the process of teaching and learning" (MINISTÉRIO DA EDUCAÇÃO, 1997, p. 20). However, it is still not entirely clear whether and how this broad interpretation of assessment in which large-scale and classroom assessments are both deemed significant has found its way into primary school classrooms in Brazil.

Costa (2013) conducted a literature review addressing assessment in primary school mathematics education. The reviewer found the publications in databases, including papers presented at scientific conferences in Brazil, master's dissertations, and PhD theses

appeared between 2000 and 2012. Costa (2013) concluded that in the Brazilian research on mathematics assessment in primary school, there is a strong focus on large-scale assessment and that classroom assessment is a missing topic.

For large-scale assessment, since 1990, Brazil had the National Basic Education Assessment System (SAEB), which currently contains the following examinations: National Assessment of Basic Education (Aneb), the National Assessment of School Performance (Anresc), known as Prova Brasil, and the Assessment National Literacy (ANA). In addition, Brazil uses large-scale assessments for monitoring education and identifying factors that may interfere with student performance. The National Institute for Educational Studies and Research (hereafter INEP) elaborates examinations and monitoring assessments. The INEP also elaborated a large-scale assessment test as a didactic tool. The main objective of this test is to provide information to teachers, managers and teaching networks of the level of literacy of students in the second year of schooling at two moments, namely at the beginning and the end of the school year. In addition, Provinha Brasil can be applied and corrected by the class teacher so that the teacher has immediate access to the results obtained by students.

In the current study, we wanted to gain further knowledge about how Brazilian primary school teachers perform and conceive assessment in mathematics education. For this, we carried out a new updated review of research literature on assessment in Brazil. Our scope in this research on assessment was broad and included both large-scale external assessment and classroom assessment for which the teacher is responsible. Our leading research question was: What does recent research reveal about Brazilian primary school mathematics assessment practices and teachers' beliefs?

2 | METHOD

To investigate what recent research reveals about Brazilian primary school mathematics assessment practices and teachers' beliefs, we built on Costa's (2013) study and continued where she ended her literature review. This means that our review covered publications on assessment that were published between 2010 and 2017. First, we examined the proceedings of Brazilian scientific conferences on mathematics education and assessment. We started with the proceedings of two conferences that the Brazilian Society of Mathematical Education governs: the International Seminar of Research in Mathematics Education[1]and the National Meeting of Mathematics Education[2]. Then, we examined the proceedings of two independent educational research conferences: the National Meeting of the National Association of Post-Graduate Research in Education[3] and the National

1 http://www.sbembrasil.org.br/sbembrasil/index.php/anais/sipem
2 http://www.sbembrasil.org.br/sbembrasil/index.php/anais/enem
3 http://www.anped.org.br/reunioes-cientificas/nacional

Congress of Educational Assessment[4]. Finally, we searched for relevant publications in the national database of PhD theses and master dissertations[5]. All the queries that were carried out consisted of the keywords “Assessment”, “Mathematics”, and “Primary School” in the title, the keywords, and the abstract.

In the next step, we read the titles and abstracts that resulted from all these searches. Based on this reading, we found 54 publications, consisting of 34 papers from conference proceedings and 20 dissertations and theses. As a further step, we read the full texts to identify those publications that addressed the assessment practice or the teachers’ beliefs on assessment. We excluded publications addressing document analyses, teacher training, textbook analyses, and sociological analysis related to assessment.

Teachers’ assessment beliefs		The focus of the publications		
		Assessment practices	Both	
Type of assessment	Large-scale assessment	Blengini (2015)* Matos (2012)* Martins (2012)* Oliveira (2012)*		
	Classroom assessment	Silva (2014)* Zanon (2011)*	Borralho e Lucena (2015)** Mandarino (2012)**	Costa (2013)* Barbosa (2013)** Côrtes e Muniz (2016)**

* Master’s dissertation.

** Conference paper.

Table 1. Publications on assessment in primary school mathematics education in Brazil published between 2010 and 2017.

In the end, the search for and selection of relevant publications resulted in 11 publications to be included in the review (see Table 1), including four publications on large-scale assessment and seven on classroom assessment. The publications on large-scale assessment all deal with teachers’ beliefs, while the publications on classroom assessment either address teachers’ beliefs or the assessment practice or both.

To determine what research has revealed about assessment practice and teachers’ beliefs on assessment, we summarized each of the selected publications taking the type of assessment as a starting point. Then we analyzed the papers by focus, assessment practice, and teachers’ beliefs on assessment, in two sections of findings related to large-scale assessment or classroom assessment.

4 http://wwwp.fc.unesp.br/#!/conave

5 http://catalogodeteses.capes.gov.br/catalogo-teses/#!/

3 | RESULTS AND DISCUSSION

3.1 Findings related to large-scale assessment

Four studies focused on teachers' opinions and beliefs about the results and usefulness of large-scale assessments. Matos (2012) investigated by administering a questionnaire by 17 primary school teachers' ideas about student results on the Prova Brasil in the northeastern of Brazil. Most teachers appeared not to understand this assessment's results and opposed a test only focusing on problem-solving like Prova Brasil. For the teachers, problem-solving was just one of the many methodologies they use in their classes. It also became clear that the teachers were not familiar with the standards used to elaborate the Prova Brasil.

In Oliveira's (2012) study, teachers' ideas about using Provinha Brasil's results were further investigated by five teacher interviews conducted individually. She investigated how the teachers analyzed their students' understanding based on their answers to the items that involved Statistics and their suggestions for activities to overcome difficulties. The teachers considered the test items a curriculum, stating that they work more on the content presented. They had difficulties interpreting the results of the Provinha Brasil test. According to the author, teachers have to be better prepared for using the results of this test to avoid misinterpretations. Furthermore, because many teachers wrongfully attributed students' mistakes to misconceptions, it is necessary to complement their mathematical training.

Through interviews, Martins (2015) investigated teachers' opinions about different large-scale assessments, namely the Prova Brasil, Provinha Brasil, and Saresp, the external evaluation used in São Paulo State. The publication of the results of this large-scale assessment bothered teachers as it leads to comparisons between schools. Additionally, the teachers considered it unfair that the state guided its educational policies by this external assessment. They were also quite divided on the usefulness of the assessment results.

Finally, Blengini (2015) interviewed primary school teachers, focusing on their beliefs about the importance of large-scale assessments for the quality of education. The teachers did not favour such external evaluations because they believed them to be a form of control, interfering with their curriculum content choices. It was clear that the assessment model used was more of a measurement instrument than an assessment tool to guide schools in overcoming the students' difficulties.

These four studies highlight that the teachers are not convinced about the usefulness of large-scale assessments. They appeared to consider external assessment as State intervention in school and doubted the effectiveness of this type of evaluation. Moreover, the studies showed that many teachers could not understand the assessment results and relate the standards of the tests to the school curriculum. Therefore, the researchers concluded that it is necessary to improve teacher education and offer opportunities for professional development.

3.2 Findings related to classroom assessment

Seven studies focused on teachers' classroom assessment beliefs and practices. In a questionnaire study, Mandarino (2012) investigated how often teachers whose classes participated in the Prova Brasil adopted a particular correction style in their assessment practice. The type of correction that teachers favoured distinguished into four groups: individual correction, collective correction, collective correction with attention to students' difficulties, or the focus on the correct response provided by the teacher. In the first group, teachers individually corrected student activities by checking students' notebooks or collecting individual activities to be corrected over time. Teachers from the second group made the collective correction of activities on the board, and the students fix by themselves in their notebooks. In the third group, the predominant correction was collective and happened on the blackboard by the teachers through discussing problems in which students have difficulties. At times, students were also called upon to present their answers on the blackboard. The teachers in the fourth group most often did the written correction on the blackboard, asking the answers to the students. These teachers did not make individualized corrections of student activities or even the correction of notebooks. The author raised the concern that students should develop self-confidence in their mathematics knowledge from the earliest years of schooling and have the autonomy to create and test hypotheses. They must be allowed to solve a problem and validate their responses. Also, several other factors, such as the types of activities proposed, the used textbook, and what the teachers do while students solve tasks, should be considered when interpreting the correction style a teacher adopts.

Costa (2013) investigated the assessment practices of 5th-grade primary school teachers by providing a questionnaire to nineteen teachers and interviewing and observing two teachers. Teachers assessed students' learning mostly with paper-and-pencil tests. They also observed students' activities in an informal and unsystematic way. Some teachers pointed out that they evaluated their teaching daily by doing and redoing their practices. They considered classroom assessment part of the more democratic teaching practices that were generally not carried out systematically and occurred spontaneously. One teacher pleaded for teaching mathematics mechanically, which was considered necessary to prepare students for large-scale assessments. Practising similar problems in class was like preparing students for the external test. This teacher explained that such a routine-marked procedure, as in large-scale assessments, becomes more accessible when practised frequently. The author's comment to what she found in her study is that teachers could mobilize many important classroom activities as assessment moments, such as homework and other production of written records by students (texts in games and group activities). According to the author, these activities can provide the teacher with evidence about the development of students' knowledge. She concluded that it is necessary to improve

mathematics assessment and that continuous education should build on teachers' current assessment practices, possibly leading to reflection on and systematic appropriation of new teaching guidelines.

Borralho and Lucena (2015) investigated the relations between teaching and assessment practices, as well as the improvement of students' learning by classroom observations and interviews with teachers in Portugal and Brazil. In both countries, teachers did not use so much formative assessment in their teaching. The assessment was not deliberately, systematically, or consciously present in the teachers' teaching. Teachers' use of assessment was sporadic and not focused. They did not use assessment to plan and replan their practices and generally not used to improve students' learning. The instruments used were summative tests and complemented by opinions of activities carried out in the classroom. The most used was to classifying and grading students at the end of the school period.

Using a questionnaire with open-ended questions, Barbosa (2013) investigated the beliefs on assessment in mathematics and the assessment instruments used by nine primary school teachers of a public school in Southeast Brazil. Most of them considered assessment helpful in diagnosing students' learning and used day-to-day activities, such as participation in class and the use of concrete material, to assess their students' learning. Other teachers, who believed assessment to measure student knowledge, used more formal assessment activities, such as bimonthly tests. Four teachers thought that students' mistakes are a way of guiding further instruction. Five teachers saw errors as a help for making students aware of their achievement and their need for improvement.

Côrtes and Muniz (2016) analyzed two teachers' mathematics assessment practices as observed in their classroom and their assessment beliefs as expressed in a semi-structured interview, group meetings, and observations. The only formal assessment instruments that both teachers used were bimonthly written tests. The questions in these tests were reproductions of tasks already taught in the classroom. Also, from the observations, it seemed that assessment mainly was to measure student learning. Teachers used a linear approach to the taught and used tests to assess this process at the end. The authors believed that one of the necessary actions is to transform the schools' pedagogical coordinators responsible for the in-service education and consolidation of teachers' collective work. Furthermore, they emphasized that it is necessary to further detailed assessment by promoting the interaction between students, discussing different processes and solution strategies, and offering metacognitive hints. Finally, they advocated that teaching and learning mathematics will have more meaning for students by mobilizing students' knowledge, creating chances, being free to make mistakes, thinking about errors, and creating the necessary experiences.

Zanon (2011) used questionnaires and group meetings to understand primary school teachers' knowledge, beliefs, and conceptions about mathematics and its assessment. Participants were 23 teachers who worked in rural schools in the east of Brazil. They

believed that assessment should happen in a procedural way, that it is an instrument to verify student learning, and that it is necessary despite being permeated by negative feelings and effects. The teachers had difficulties and doubts about the specific content of mathematics. The author also noted that they had a traditional view of mathematics assessment and had negative feelings about mathematics assessments. To assess their students, most participants mentioned using classroom games, individual tests, and mechanical math activities in the classroom and by homework, supplemented by individual observation of the students' work. The author advised that it is necessary to teach with understanding and provide continuous education about practical assessment problems and the metacognitive processes of teaching, learning, and assessment in mathematics.

Silva (2014) investigated how assessment contributed to mathematics teaching in a primary school in the South of Brazil. Assessment activities were used by planning and implementing a school trip with 5th-grade students. As assessment instruments, the teacher used the students' competence in data collection and the clarity of organizing the data. The students had to present the data collection results through graphs and a small explanatory text in a newspaper format. The study revealed that the teacher's conceptions of assessment were broad and permeated the entire teaching and learning processes. Silva (2014) stated that when the teachers take the role of teacher-researchers, they may be teaching supported by knowledge gained through the constant assessment of their instructional practice and student learning. She concluded that ongoing assessment, providing the teachers with more insight into student learning, was considered fundamental to improving the quality of teaching and, consequently, teacher and student learning.

When comparing assessment practices with assessment beliefs, we can see a mismatch between what is done and what Brazilian primary schoolteachers think. The teachers mostly believe classroom assessment is a process that occurs in many moments in the classroom and uses different instruments. Nevertheless, the most used practice is testing students at the end of a school period. Considering the recommendations of the researchers, they mainly point to teachers' in-service education. In addition, the PCN affirm that some of the problems related to mathematics teaching are associated with the process of teacher education, concerning both initial and in-service training (MINISTÉRIO DA EDUCAÇÃO, 1997).

The researchers justify the need to improve mathematics teachers' training in the initial years of elementary school for different reasons, like the following. Teachers did not understand the results generated by large-scale assessments and cannot distinguish between the school curriculum and test's reference standards; teachers attributed students' mistakes to misconceptions about some content.

In addition, the researchers recommend that teacher training should: clarify the assessment structure, methodology and objectives, which makes the process of understanding and using the results easier; identify the relationships between different

contents and skills present in the large-scale assessment items; discuss how to use the results of large-scale assessments as an element of their planning to promote assessment to learning; discuss, plan and carry out activities involving teach math skills; complement teachers' training about mathematical knowledge; reflect on the practice developed by teachers; introduce new teaching guidelines.

4 | CONCLUSION

Even if not approved by teachers, large-scale assessments influence changes in the school curriculum, such as adding or emphasizing certain content. As found in the surveys, teachers feel controlled and evaluated by external assessments. As a result, they instruct students to these tests and use items like a guide to the curriculum. From the results of the researches, we understand that the mathematics assessment practices in Brazil still maintain some distance from what is understood by formative assessment. There is still a lot to do and research so that formative assessment practices reach the Brazilian classrooms. Despite the mostly teachers beliefs that assessment is a process to improve teaching and learning, the mathematics assessment practices carried out in Brazilian primary schools do not yet favour assessment to learning but are mainly used to determine students' classification at the end of school periods.

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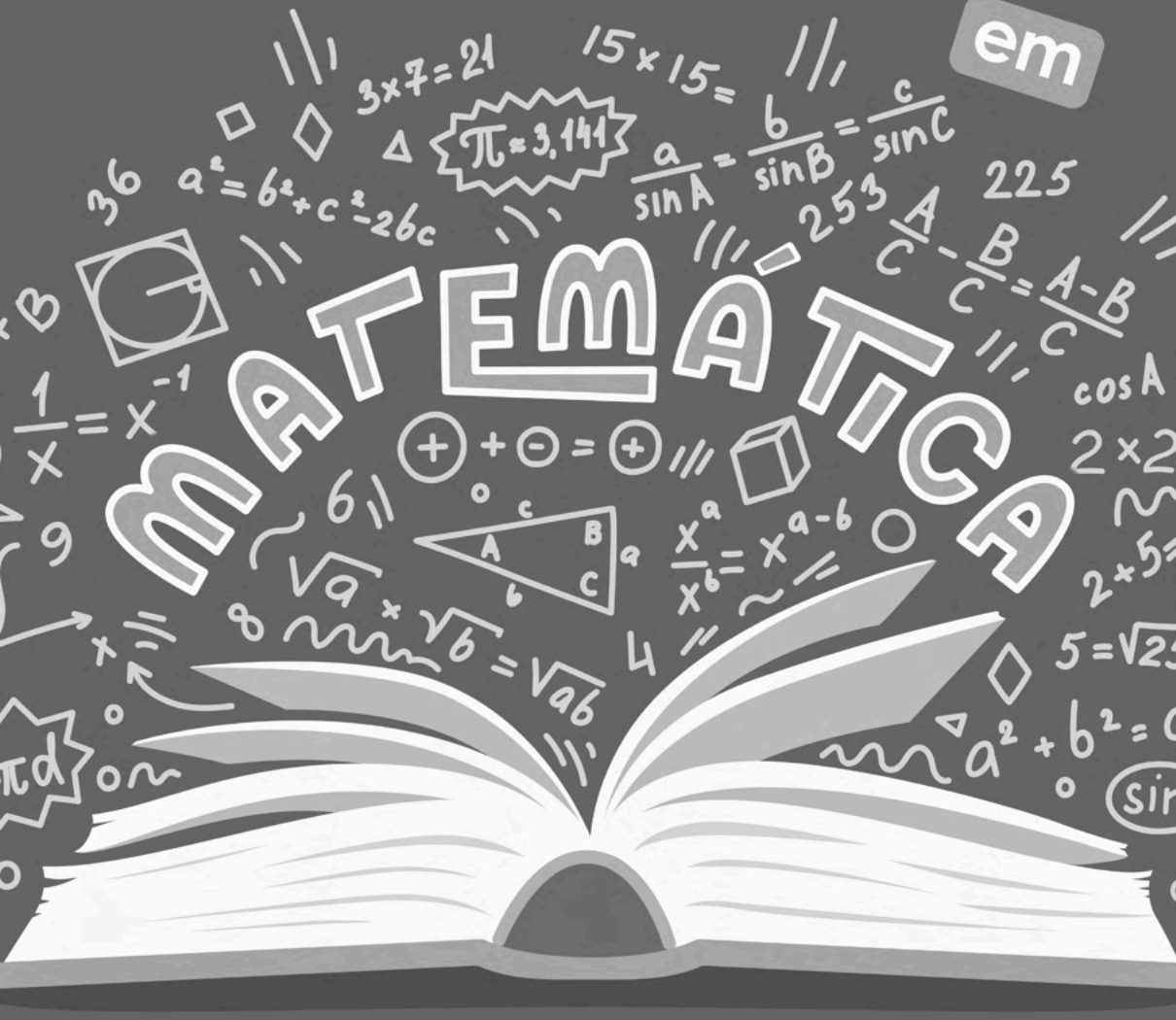

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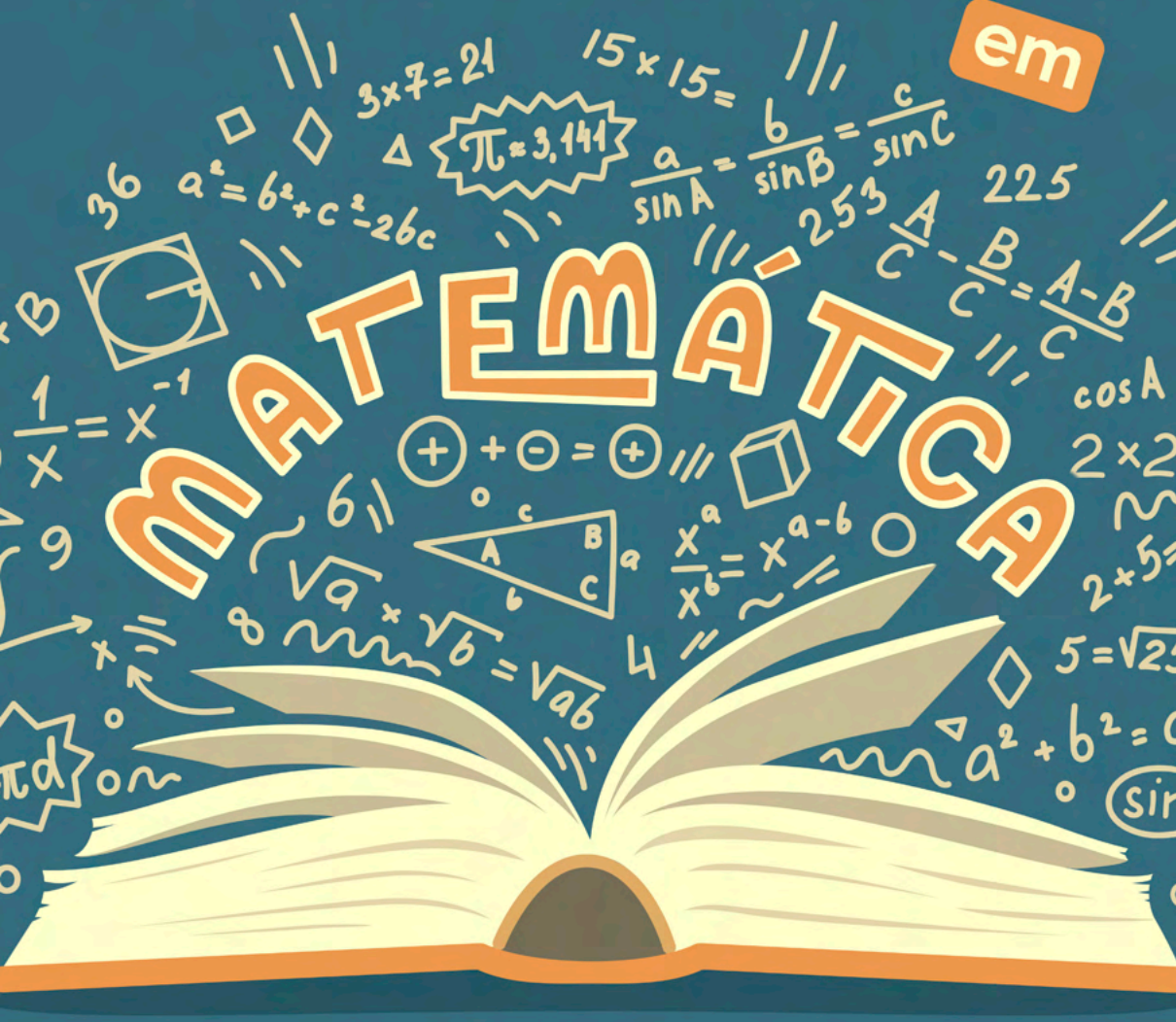

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