

Digital technologies in mathematics teaching: Teachers' perceptions and practices regarding the Matific platform, curriculum integration, and inclusive education

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ABSTRACT

Background: The integration of digital technologies into mathematics teaching has been widely encouraged; however, there is still limited empirical evidence on how these resources are incorporated into teaching practices, particularly regarding curriculum integration and inclusive education. **Objectives:** To analyse mathematics teachers' perceptions and practices regarding the use of the Matific platform, considering the curricular integration of this platform and its implications for inclusive education. **Design:** Qualitative interpretative study conducted through semi-structured interviews and thematic-categorical content analysis. **Setting and Participants:** The research was conducted in public state schools in Mato Grosso, Brazil, with ten mathematics teachers from the final years of elementary education, selected by purposive sampling. **Data collection and analysis:** Data were collected through interviews conducted remotely via Google Meet, recorded and fully transcribed, and subsequently analysed using thematic-categorical content analysis. **Results:** In the context investigated, the platform was used predominantly as a supplementary resource, with limited curricular integration, and its use depended on teachers' pedagogical mediation and on adaptations directed at student diversity. Although it fostered student engagement, the teachers' accounts suggest that such engagement does not always consistently translate into conceptual understanding or autonomy, especially in the absence of didactic intentionality and systematic pedagogical support. **Conclusions:** The results indicate that the pedagogical effectiveness of using the platform, in the context investigated, depends on didactic intentionality and teacher mediation strategies. The study highlights tensions between gamification, curriculum, and inclusion, pointing to the need for teacher training and pedagogical resources that support a more consistent integration of digital technologies into mathematics teaching, with the potential to inform analyses and interventions in similar contexts.

Keywords: mathematics education; digital technologies; curriculum integration; inclusive education; Matific platform.

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Tecnologias digitais no ensino de matemática: Percepções e práticas docentes sobre a plataforma Matific, integração curricular e educação inclusiva

RESUMO

Contexto: A integração de tecnologias digitais no ensino de matemática tem sido amplamente incentivada, porém ainda há poucas evidências empíricas sobre como esses recursos são incorporados às práticas docentes, especialmente no que se refere à integração curricular e à educação inclusiva. **Objetivos:** Analisar as percepções e práticas de professores de matemática acerca do uso da plataforma Matific, considerando a integração curricular dessa plataforma e suas implicações para a educação inclusiva. **Design:** Estudo qualitativo de natureza interpretativa, desenvolvido por meio de entrevistas semiestruturadas e análise de conteúdo temático-categorial. **Ambiente e participantes:** A pesquisa foi realizada em escolas públicas estaduais de Mato Grosso, Brasil, com dez professores de matemática dos anos finais do ensino fundamental, selecionados por amostragem intencional. **Coleta e análise de dados:** Os dados foram coletados por meio de entrevistas realizadas remotamente via Google Meet, gravadas e transcritas na íntegra, e posteriormente analisados por meio da análise de conteúdo temático-categorial. **Resultados:** No contexto investigado, a plataforma foi utilizada predominantemente como recurso complementar, com limitada integração ao currículo, e seu uso dependeu da mediação pedagógica dos professores e de adaptações voltadas à diversidade dos estudantes. Embora favoreça o engajamento discente, os relatos dos professores sugerem que esse engajamento nem sempre se traduz, de modo consistente, em compreensão conceitual ou autonomia, especialmente na ausência de intencionalidade didática e de suporte pedagógico sistemático. **Conclusões:** Os resultados indicam que a efetividade pedagógica do uso da plataforma, no contexto investigado, depende da intencionalidade didática e das estratégias de mediação docente. O estudo evidencia tensões entre gamificação, currículo e inclusão, apontando para a necessidade de formação docente e de recursos pedagógicos que favoreçam uma integração mais consistente das tecnologias digitais ao ensino de matemática, com potencial de subsidiar análises e intervenções em contextos semelhantes.

Palavras-chave: educação matemática; tecnologias digitais; integração curricular; educação inclusiva; plataforma Matific.

INTRODUCTION

The integration of digital technologies in mathematics education occupies a central place in contemporary educational debates and is often associated with pedagogical innovation and the promotion of inclusive practices. However, digital technologies do not automatically transform teaching, even though they are sustained by growing institutional investment and by their wide dissemination in different educational ecosystems, often driven by “a multibillion-dollar sector” (Selwyn, 2017b, p. 2).

As Selwyn (2017b) argues, the educational effects of technologies are conditioned by pedagogical, social and political factors, which require identifying the “difference between the potentiality and the reality of technology in education” (p. 10). This perspective demands analyses that transcend technocentric visions and understand the digital as a field crossed by disputes, pedagogical choices and concrete institutional conditions.

This problem highlights a central tension in mathematics education: the expansion of digital mediations is not always accompanied by effective changes in pedagogical practices. In the case of gamified platforms such as Matific, aimed at teaching mathematics and adopted across different public education networks, this tension becomes particularly relevant, to the extent that their pedagogical appropriation may not sufficiently account for the diversity of rhythms and learning conditions present in these contexts.

Engelbrecht et al. (2020) point out that although digital technologies expand didactic possibilities in mathematics teaching, their effective integration depends on how teachers appropriate them in concrete educational contexts. However, this potential does not always translate into structural changes in teaching practices, especially when the use of platforms is limited to complementary activities unrelated to broader curriculum objectives.

Despite the global expansion of platforms aimed at teaching mathematics, there is still little evidence on how these resources are integrated into pedagogical practices, especially in scenarios characterised by educational inequalities. This gap reveals not only the need for empirical investigations but also the importance of understanding how digital platforms are effectively articulated to curriculum and inclusion demands in real teaching contexts (Heidmann & Guedes, 2025).

Discussions about digital technologies become more complex when examined in light of inclusion. The presence of students with disabilities or specific needs requires practices that contemplate multiple rhythms and forms of learning. In this sense, access to technological resources does not ensure inclusive processes without intentional pedagogical intervention guided by principles that recognise diversity as a structuring condition of teaching. For Mantoan (2015), inclusion implies ensuring the effective participation of students and demands the reorganisation of pedagogical practices to consider the specificities of students with disabilities as a means of addressing educational disparities.

In this scenario, contexts marked by heterogeneity and structural challenges, such as the Brazilian public system, constitute a particularly relevant analytical field. Far from being just a local issue, such realities also reveal tensions observed in other educational systems, especially regarding the integration of digital resources, pedagogical planning, and meeting students' diversity. Investigating these experiences contributes to the international debate by revealing how digital platforms are reinterpreted and adapted to the concrete conditions of teaching.

Given this scenario, this study seeks to contribute to the literature by offering initial empirical evidence of the use of the Matific platform in pedagogical practices, choosing teacher perceptions as the central axis of analysis and articulating dimensions often treated in isolation: technology, curriculum, and inclusion. The findings may provide analytical support for comparative studies and the implementation of digital technologies across different education systems.

Thus, this research is guided by the following question: How do mathematics teachers perceive and use the Matific platform in their practice, particularly regarding curriculum integration and student inclusion?

The objective of this study is to analyse mathematics teachers' perceptions and practices regarding the use of the Matific platform, with a focus on its integration into the curriculum and its implications for inclusive education. By focusing on the teaching perspective in real school contexts, we seek to understand tensions, challenges, and possibilities related to gamification, integration into the curriculum, and inclusion, with a view to contributing to the construction of more intentional, contextualised, and inclusive practices in mathematics teaching in public schools.

THEORETICAL FRAMEWORK

This framework is organised into three articulated axes: digital technologies and pedagogical mediation; teaching knowledge and curriculum integration; and inclusion and diversity in mathematics teaching. The concepts mobilised provide the interpretative basis for investigating teachers' perceptions of the use of the Matific platform, allowing us to understand the relationships among digital resources, teaching practices, curriculum, and support to students' diversity.

The presence of digital technologies in mathematics teaching implies reconfigurations of teaching and learning that go beyond a merely instrumental dimension. Engelbrecht et al. (2020) highlight that these resources tension

traditional forms of teaching, requiring new forms of organisation of pedagogical work. Selwyn (2017b) reinforces the idea that its effects are conditioned by pedagogical practices and the contexts in which they are situated, which helps explain why the same resource can be appropriated in different ways by different teachers. This perspective offers an analytical basis for interpreting the different ways Matific is used in the school context.

In the context of educational digital platforms, especially those structured in interactive and adaptive environments, such as online mathematical practice systems, the literature indicates that these resources tend to reorganise the learning experience by combining tasks, immediate feedback and personalised progression. However, its pedagogical effectiveness depends directly on teacher intentionality and integration into curriculum planning, rather than on uses restricted to the exercise or replacement of traditional activities.

In the field of mathematics education, Borba (2021, p. 387) synthesises this perspective by proposing that “the basic unit of knowledge production throughout history is human beings-with-media”, indicating that mathematical knowledge emerges from the interaction between individuals and technologies. In this understanding, the digital resource does not replace teacher mediation, but participates in the reorganisation of the ways of producing, representing, and communicating mathematical knowledge. Thus, the research of digital platforms requires considering not only their functionalities but also the pedagogical practices that guide their use.

The incorporation of technologies into teaching highlights the complexity of the teaching knowledge involved in this process. The TPACK model, an acronym for technological pedagogical content knowledge, proposed by Mishra and Koehler (2006), systematises the need for articulation between technological, pedagogical, and content knowledge as a condition for a qualified integration of technologies into teaching practice. The absence of this balance tends to limit the use of digital resources to reinforcement or exercise practices, without necessarily promoting deeper reconfigurations in how mathematics is taught and learned. Tardif (2011, p. 11) contributes to this debate by arguing that “teachers' knowledge is related to their experience and professional identity”, offering an interpretative basis for understanding how teachers' trajectories, experiences, and conceptions influence the appropriation of new resources.

From this perspective, teaching mediated by digital technologies shows that TPACK is not limited to a conceptual structure but is expressed in the

teacher's daily decisions when selecting, adapting, and articulating digital resources to learning objectives. In this sense, the use of educational platforms reveals different levels of teacher appropriation, ranging from instrumental use to more consistent pedagogical integration.

Teacher education is, in this context, a determining factor for the quality of technological integration. Imbernón (2022) argues that education should be linked to the real problems of practice, while Gatti (2016) points out that the availability of infrastructure does not, by itself, guarantee the quality of educational processes. Thus, the presence of digital platforms in schools needs to be accompanied by formative processes that favour the articulation of curriculum objectives, methodological choices, and students' needs. Without this formative intervention, there is a risk that resources will be used in a fragmented, disjointed way or reduced to a training logic.

When examined from the perspective of inclusive education, this discussion acquires additional dimensions. The presence of students with disabilities or different learning rhythms requires that pedagogical practices account for the diversity of conditions for participation and knowledge construction. The universal design for learning, identified by the acronym UDL, offers a relevant reference for this discussion by proposing multiple forms of representation, expression, and engagement as organising principles of inclusive teaching, allowing us to analyse to what extent digital resources, such as the Matific platform, favour or limit different forms of access, participation, and demonstration of mathematical learning.

According to Al-Azawei et al. (2016, p. 41), UDL seeks to offer “flexible approaches that can be customised and adjusted to individual needs”, as opposed to standardised models that disregard student heterogeneity. In this scenario, UDL also dialogues with the use of digital technologies by expanding possibilities for personalising learning, especially through multiple formats of representation and interaction. However, such potential depends on pedagogical intermediation and teacher planning, since technology alone does not guarantee inclusive practices.

Mantoan (2015, p. 11) reinforces this perspective by arguing that “every solution that disregards this specificity of human beings is doomed to failure”, highlighting the limits of proposals that attribute to technology alone the ability to promote inclusion. Thus, digital platforms can expand possibilities for participation and learning, but they can also reproduce barriers when they are not accompanied by pedagogical articulation, differentiated planning, and attention to students' concrete conditions. This limitation aligns with recent

studies indicating that digital platforms of this nature “still lack evidence to support inclusive education in the final years” (Heidmann & Guedes, 2025, p. 8).

These perspectives allow us to understand the use of digital platforms in mathematics teaching as a situated phenomenon, resulting from the interaction among teaching work, institutional conditions, curriculum integration, inclusion assumptions, and the specific characteristics of the digital environments used. Each theoretical axis presented fulfils a specific analytical function: the first guides the reading of the modes of technology appropriation; the second supports the analysis of teaching knowledge and training conditions; and the third grounds the discussion in the limits and possibilities of the platform in meeting diversity. The following section describes the methodological procedures adopted, the results of which will later be analysed in light of this framework.

METHODOLOGY

This study adopts a qualitative, interpretative approach aimed at understanding mathematics teachers' perceptions of the use of the Matific platform in their pedagogical practice. This perspective is justified by the need to analyse the meanings and interpretations attributed by the subjects to complex educational phenomena, which cannot be adequately apprehended through quantitative indicators, thereby proving particularly appropriate to the study's objective.

In line with Minayo (2014), qualitative research focuses on the universe of meanings, values, and practices that structure social actions. In a complementary way, teaching practice is seen as the "first personal source of production of their professional knowledge" (Tardif, 2012, p. 35), thus reinforcing the relevance of investigating practices located in real teaching contexts. In this sense, Gatti (2016, p. 163) points out that "it is not enough to provide infrastructures and technologies for changes in educational processes to occur", and it is necessary to consider the real conditions of professional practice.

Participants and context

The study participants were 10 mathematics teachers (P1 to P10) from the state public network in Mato Grosso, Brazil, all working in the final years of elementary school and using the Matific platform in their pedagogical practice.

Participants were selected through purposive sampling, guided by accessibility criteria, including teachers with direct experience using the platform in real classroom contexts. In addition, we sought to include teachers with varying lengths of professional practice to capture the diversity of pedagogical practices and perspectives.

The participants have a concentrated geographical distribution in the state of Mato Grosso, with a predominance of teachers working in the municipality of Tangará da Serra (n = 8), in addition to teachers from Sinop (n = 1) and Denise (n = 1). This configuration situates the data in a mostly local context while introducing variations across different school realities, an aspect considered in the analytical process.

Although the number of participants is small, it is consistent with qualitative designs that prioritise analytical depth over statistical representativeness. The adequacy of the number of participants was defined by the sufficiency of the corpus, understood as the point at which the information produced began to exhibit thematic recurrence and failed to add substantially new elements to the interpretations. This condition was observed through the repetition of patterns in the participants' speech, indicating that the set of interviews collected was sufficient to address the objectives of the investigation.

To ensure the ethical integrity of the research, information that could identify participants, such as school names or specific locations, was omitted. Teachers are identified through alphanumeric codes, from P1 to P10.

To assess the level of use of the Matific platform, frequency of use was categorised as frequent (weekly) and sporadic (monthly). Table 1 shows participants' profiles.

Table 1

Profile of the research participants

Participant	Municipality	Teaching time (years)	Education	Experience in digital technologies	Use of Matific
P1	Tangará da Serra	17	M	Int	E
P2	Tangará da Serra	18	Esp	Bas	E

Participant	Municipality	Teaching time (years)	Education	Experience in digital technologies	Use of Matific
P3	Tangará da Serra	26	L	Int	F
P4	Tangará da Serra	20	M	Int	F
P5	Tangará da Serra	27	M	Bas	E
P6	Tangará da Serra	18	M	Adv	F
P7	Tangará da Serra	2	L	Bas	E
P8	Sinop	8	M	Adv	F
P9	Tangará da Serra	11	L	Int	F
P10	Denise	21	M	Int	F

Note. Academic background: L = Teaching degree; Esp = Specialisation; M = Master's degree. Experience in digital technologies: Bas = Basic; Int = Intermediate; Adv = Advanced. Use of Matific: E = Sporadic; F = Frequent.

Instrument of data collection

Data production took place between November and December 2025 through semi-structured interviews conducted remotely via Google Meet. The choice of this modality is justified by the geographical dispersion of participants across different municipalities, making a non-face-to-face interview a methodologically viable strategy and appropriate to the context of the investigation. As Antunes et al. (2023) point out, videoconference interviews have established themselves as a legitimate alternative in qualitative research, preserving the dialogical interaction between researcher and participant and allowing flexibility in exploring the narrated experiences, without compromising the consistency of the instrument.

The script was organised into three thematic axes: (1) professional trajectory and experience with the Matific platform; (2) perceptions about the teaching and learning process in articulation with the structured material; and (3) practices related to inclusion, accessibility, and support to diversity.

All interviews were recorded with the participants' consent and fully transcribed, ensuring analytical rigour. The use of semi-structured interviews facilitated the emergence of themes not initially foreseen, contributing to a more comprehensive understanding of the phenomenon under investigation.

Data analysis procedures

Data analysis was carried out based on the assumptions of content analysis, in the thematic category, as proposed by Bardin (2016). This approach proved adequate for the systematic identification of patterns, meanings, and thematic structures found in the qualitative data.

The analytical process was developed in three stages: (1) pre-analysis, with floating reading of the transcripts and organisation of the corpus; (2) exploration of the material, involving coding procedures and identification of units of meaning; and (3) treatment and interpretation, in which the codes were grouped into broader thematic categories.

Coding occurred iteratively, allowing for the progressive refinement of analytical categories as interpretative patterns emerged from the corpus. The analysis was guided by a dialogical relationship between empirical data and theoretical references to ensure that the interpretations remained anchored in the participants' narratives and supported by consistent analytical reasoning.

In order to strengthen the validity of the analysis, the following strategies were adopted: (a) prolonged immersion in the data, allowing in-depth familiarisation with the participants' narratives; (b) identification of recurrences and thematic convergences, contributing to the robustness of the findings; and (c) analytical transparency, through the explanation of the coding and categorisation stages. Although the study does not aim at statistical generalisation, it is guided by the notion of analytical generalisation, offering transferable interpretative elements for similar educational contexts.

Ethical considerations

The research was conducted in accordance with Resolution n. 510/2016 of the National Health Council and Resolution n. 466/2012, ensuring respect for the dignity, autonomy, and voluntariness of the participants, as well as the minimisation of risks and maximisation of benefits. The project was approved by the Research Ethics Committee of a Brazilian public institution (Opinion n. 6.309.206).

All participants signed the Term of Free and Informed Consent (TFIC), ensuring voluntary participation, confidentiality, and anonymity. Identifying

information was suppressed throughout the process of analysis and dissemination of results.

RESULTS AND DISCUSSION

The analysis of interviews with the ten mathematics teachers, identified as P1 to P10, enabled the construction of analytical categories indicating that the integration of the Matific platform occurs predominantly adaptively, configuring itself as a complementary resource to the pedagogical practices already established. Considering the participants' profile, characterised by heterogeneous professional trajectories and varying levels of familiarity with digital technologies, the appropriation of the platform did not occur uniformly, being shaped by prior experiences, institutional conditions, and the specific demands of the school context.

The findings indicate that, although technology is present in the school routine, its articulation with the structured material and the demands of inclusion remains strongly dependent on the pedagogical organisation and the strategies mobilised by the teachers. In this process, the relationship between the platform and the structured material does not occur automatically, requiring teachers to make choices, including about excerpts and adaptations, to bring digital activities closer to the content provided for in the pedagogical planning. Thus, in the investigated group, teachers with longer experience and less technological familiarity tend to mobilise the platform more instrumentally, while those with greater digital mastery report more frequent use, although not necessarily more integrated into the curriculum.

Given the corpus of ten interviews, the interpretations presented below are situated and do not propose extrapolating to broader contexts; rather, they offer an in-depth understanding of the phenomenon investigated in this specific group. Table 2 summarises the analytical categories derived from content analysis (Bardin, 2016) and presents a representative excerpt from each category. Subsequently, the discussion deepens the interpretation of the results in dialogue with the literature, delimiting the inferences to the investigated corpus.

Table 2*Analytical categories and empirical evidence*

Analytical category	Summary	Representative excerpt
Technology as complementary resource	The platform is predominantly used as a complement to the pedagogical practices already in place, especially for reviewing, reinforcing, and consolidating content.	<i>"It complements what you're already working on in class."</i> (P1)
Weaknesses in teacher education	Training for the pedagogical use of the platform occurs predominantly through self-study or through the exchange of experiences among colleagues, without systematic institutional support.	<i>"Most of the things I learned from Matific were by myself."</i> (P4)
Pedagogical mismatch and heterogeneity	Teachers identify an incompatibility between the level of platform activities and the real learning conditions of some students.	<i>"The students are not at the proper level of the platform."</i> (P1)
Tensioned inclusion	The participation of students with disabilities or learning delays depends largely on adaptations made manually by teachers.	<i>"I have to deselect his activities because he will not be able to follow; I do it manually."</i> (P9)
Student autonomy and limits of gamification	The interaction with the platform does not always lead to effective autonomy, remaining dependent on teacher mediation.	<i>"They do not reach autonomy to do it alone."</i> (P1)
Engagement and limits of conceptual deepening	Playfulness favours students' interest but does not, by itself, guarantee the construction of deeper mathematical knowledge.	<i>"The focus is on winning the coins and not understanding the fraction."</i> (P10)

Next, the analytical categories are discussed in relation to the empirical data and theoretical references, highlighting tensions among the pedagogical use of the platform, its articulation with the structured material, institutional conditions, teacher education, and the demands for inclusion.

Technology as complementary resource

As summarised in Table 2, the reports indicate that the Matific platform is predominantly used as a complementary resource to established pedagogical practices, particularly for reviewing, reinforcing, and consolidating content. The analysis of the interviews allows us to understand how this form of appropriation materialises in teaching practices and what implications it produces for the integration of technologies into mathematics teaching.

P10 illustrates this movement by stating that, *"after we do all that work in the classroom, we solve activities, then look for those that match the content on the platform"*. In the same vein, P9 describes the use of the platform *"as a reinforcement for students to add the knowledge taken from the room"*, which highlights the secondary role attributed to the resource relative to central pedagogical practices. In this process, articulation with the structured material depended on the teachers' selection, who sought platform activities considered compatible with the content already worked on in the classroom, rather than assuming Matific as an integrated axis for curriculum planning.

Such dynamics suggest that the platform is incorporated within the limits of the already established structures, without changing the organisational logic of the class. According to Selwyn (2017a), digital technologies "tend to be incorporated in a way that supports existing educational practices, rather than transforming them" (p. 10), a pattern that aligns with that identified in this group of participants. Kenski (2015) reinforces this perspective by arguing that the mere availability of digital resources is not enough to cause substantive changes in teaching practices, which helps to situate the data of the present study in a broader framework, without implying generalisations about other contexts.

Teachers reinterpret institutional proposals based on the conditions of school daily life and the need to manage the heterogeneity of classes. This movement demonstrates that "teachers' knowledge is plural and heterogeneous" (Tardif, 2011, p. 18), comprising diverse experiences that guide pedagogical decisions and, in the context investigated, shape how the platform is used. Teacher education appears, in this context, as an element that interferes with the quality of technological integration, especially when there are no systematic guidelines to articulate how digital resources align with curriculum objectives and structured materials. This interpretation aligns with Mishra and Koehler (2006), for whom the effective integration of technologies into teaching requires articulation among technological, pedagogical, and school subject knowledge.

The coexistence of different modes of use indicates that this integration is not homogeneous and is conditioned by pedagogical, institutional, and formative factors. This finding is in line with Engelbrecht et al.'s (2020, p. 822) remarks that “different phases of digital technologies coexist in educational contexts”, without necessarily producing a synthesis that consistently incorporates them into pedagogical planning. In the investigated group, regardless of the reported level of technological familiarity, it was not possible to identify uses of the platform that reconfigured the pedagogical logic of the class, reinforcing the predominantly complementary character of the resource in this specific context.

Weaknesses in teacher education

As shown in Table 2, training for the pedagogical use of the platform occurred predominantly autonomously or through the exchange of experiences among colleagues. The interview interpretations help us understand the impact of this formative gap on the modes of technology appropriation and on its incorporation into pedagogical planning.

The qualified pedagogical conduct of the use of the platform, in the analysed reports, runs into the insufficiency of specific teacher education. The data indicate that the appropriation of the resource occurred autonomously and unassisted: P10 states that “*we learn by ourselves*”, P2 reports the absence of “*specific education*”, P4 states that “*most of what I learned was explored by myself*” and P8 mentions having received only a “*basic course, without pedagogical focus*”. These reports reveal a gap between the technical implementation of the platform and the pedagogical support necessary for its qualified use, configuring a self-taught appropriation process resulting from the absence of structured formative actions.

This gap is not limited to the operational domain of technology but also impacts how the resource is integrated into planning and pedagogical practices. The investigation of the participants' profile indicates that teaching time does not automatically translate into competence for the pedagogical use of digital technologies, and that professional experience by itself does not guarantee the qualified incorporation of these resources. There is also a predominance of teachers with basic and intermediate levels of technological familiarity, with only two classified at an advanced level. Mishra and Koehler (2006) warn of the need to distinguish between the technical domain of technology and the technological-pedagogical knowledge of content, a central dimension of the TPACK framework, showing that familiarity with digital resources in personal

use is not equivalent to the competence to intentionally integrate them into teaching, an often neglected distinction in teacher education programs.

Even among teachers with greater technological familiarity, more consistent didactic integration was not observed, indicating that technical mastery is not a sufficient condition for pedagogical innovation. In the absence of specific education, teachers mobilise knowings built on experience to guide the use of the platform, which, although legitimate, can result in fragmented practices that are poorly aligned with learning objectives. This scenario dialogues with Gatti (2016, p. 164), who states that inputs and infrastructure "are not sufficient for the implementation of more humanly effective educational processes", and with Imbernón (2022, p. 51), for whom teacher education needs to be "linked to the real problems of practice". Without an education that links the use of the platform to curriculum planning and pedagogical adaptation needs, its potential tends to be reduced to its more operational dimension.

This formative fragility also has repercussions for the articulation between the platform and the structured material, since, without specific pedagogical guidelines, the selection of digital activities tends to depend on individual teacher initiative rather than on institutionally oriented planning.

Pedagogical mismatch and heterogeneity

The results summarised in Table 2 indicate that the participants identify a mismatch between the level of complexity of the activities proposed by the Matific platform, the contents provided for in the structured material and the real learning conditions of some students. In the analysed reports, the requirements of reading, interpretation, and logical reasoning often exceed the capacity of some students to execute them autonomously, directly impacting the pedagogical strategies adopted by teachers. This scenario highlights the heterogeneity of the classes and the need for teaching mediations to adjust the use of the platform to the different learning conditions present in the investigated context.

P1 states that "*students are not at the proper level of the platform*" and reports that, when working on "*activities from the seventh grade in the eighth grade, there is improvement*". P5 summarises this distance by stating that "*the student knows X; the content is in Z*". In the same vein, P9 notes that "*several exercises are too advanced*". These reports, limited to the participating group, indicate a discrepancy between the student profile inferred from certain platform activities and the concrete learning conditions teachers observe.

From Vygotsky's (1978) perspective, learning occurs in the zone of proximal development (ZDP), defined as the distance between the level of actual development and the level of potential development. The speeches suggest that, in some of the situations described, the proposed activities exceeded this interval, especially when the students lacked the necessary conditions to carry them out autonomously or with sufficient mediation. This interpretation, restricted to the analysed corpus, points to the need to attend to the alignment between the level of activities, curriculum planning, and students' learning conditions.

This concern also aligns with the discussions of Al-Azawei et al. (2016) within the scope of universal design for learning (UDL), whose principles emphasise the importance of adapting activity design to the different profiles and conditions of learners. In this sense, the existence of playful and digitised activities by itself does not guarantee effective access to mathematical knowledge, especially when the cognitive, linguistic, or operational demands of the task do not correspond to the students' capabilities.

Although some teachers recognise potential in the engagement promoted by the platform, such benefits were conditioned, in the analysed reports, to the pedagogical strategies that support the use of the resource. When there is no path of adaptation sufficiently articulated to the teacher's planning, the structured material and the students' needs, the resource can, in certain situations, make it difficult to access the content instead of favouring it, which reinforces the importance of active pedagogical monitoring for the platform to fulfil its educational function.

This finding, exploratory given the scope of the study, is supported by Mishra and Koehler (2006), for whom the possibilities of using any technological resource depend not only on its intrinsic characteristics but also on the interaction among technology, content, and pedagogical context. Thus, Matific's educational potential does not arise automatically from its insertion into the school routine, but from the intentional intervention of the teacher, who is capable of selecting, adapting, and articulating digital activities to the concrete needs of the class.

The study of the reports indicates, therefore, that the absence of specific guidelines for the use of the platform contributes to a mismatch between the proposed activities, the structured material, and the students' conditions, leaving the students without a systematic pedagogical response. The effectiveness of the resource is contingent on a reorganisation of practices that

brings curriculum planning, digital activities, and classroom realities closer together, so that playfulness does not become a barrier to student participation.

Tensioned inclusion

As summarised in Table 2, the participation of students with disabilities or learning lags depends largely on adaptations made by teachers themselves. The reports allow us to understand how these interventions occur in everyday school life and show limits in the context investigated regarding the ability of the Matific platform to meet the diversity present in classrooms.

While P2 reports the need to “*hunt first-year activities for the seventh-grade student*”, P9 describes that she “*manually makes*” the adaptations and needs to “*deselect the activities that the student cannot follow*”. These practices constitute a process of pedagogical adequacy not systematically foreseen by the resource, which tends to expand the teaching work and indicates the absence, in the reported experiences, of structured mechanisms capable of accommodating different rhythms and learning conditions.

In light of Mantoan (2015), inclusion is not achieved by the mere availability of resources; instead, it requires fostering significant participation in the educational process. In this sense, the need for manual adaptation reported by the participants shows limits in incorporating the principles of Universal Design for Learning (UDL), as discussed by Al-Azawei et al. (2016) and CAST (2018). DUA recommends that educational environments be planned with multiple means of representation, engagement, and expression, so that accessibility does not depend solely on later adaptations but is incorporated into the structure of the resource from its conception.

In the analysed reports, such principles do not seem to be sufficiently operationalised in the conditions of use of the platform described by the teachers. This imposes on teachers an adaptive mediator role, requiring them to select, replace, deselect, or reorganise activities to enable the participation of students who do not follow the originally proposed activities. This teaching practice is central to inclusion, but the data suggest that it occurs without sufficiently structured support from the platform, structured material, or specific institutional guidelines.

This absence of structured support has repercussions not only in teaching practice but also in students' own experiences. According to Ryan and Deci (2000), motivation and engagement depend on contexts that support the psychological needs of competence, autonomy, and relationships, conditions that, in the analysed reports, are weakened by the unpredictability of the

required adaptations. When access to content depends on reorganisations not foreseen by the platform design, there is a risk that some students experience the digital activity as a barrier rather than an effective opportunity for learning and participation.

The interpretations of inclusion refer exclusively to the experiences reported by the ten participants and do not allow conclusions about the suitability of the platform for broader contexts. What the data indicate, in this specific group, is that the absence of structured inclusive support concentrates on the teacher an adaptive responsibility that, ideally, should be shared among the platform, the structured material, the teacher education, and the institutional support.

Student autonomy and limits of gamification

Table 2 shows that interaction with the platform, although it favours students' participation in certain situations, does not automatically translate into effective autonomy. The analysis of the interviews shows that the use of gamified resources remains strongly dependent on teachers' pedagogical intervention, especially in reading the commands, understanding the tasks, and the relationship between the proposed activity and the mathematical content addressed.

P1 reports *"a lot of dependence"* and states that *"there is no autonomy to do it alone"*, while P4 notes that *"if the teacher does not read the command, the student just keeps clicking"*. P5 deepens this interpretation by indicating that students tend to be *"right by trial, without production"*, which suggests that interaction with the resource does not necessarily translate into conceptual understanding. This set of reports, restricted to the investigated group, points to the need to distinguish between interaction and effective autonomy in the context of the use of gamified platforms.

Although the gamified interface favours initial engagement, it does not, by itself, guarantee the construction of mathematical meanings. According to Papert and Caperton (1999), educational digital environments should enable students to take an active role in the production of knowledge, a potentiality that depends on clear didactic intentionality. In this sense, Kenski (2015, p. 430) highlights the need for a *"reflective and constant teaching mediation"*, without which the use of technology tends to be reduced to a mechanical activity. Deterding et al. (2011) also warn that transferring game elements to learning environments does not guarantee the development of complex cognitive

competencies, requiring careful articulation between game mechanisms and learning objectives.

The analysed reports indicate that perceptions of student autonomy are related to the teaching strategies adopted and the frequency of platform use. Teachers who use the resource more regularly tend to recognise more clearly the limits of autonomy promoted by gamification, highlighting the need for constant monitoring. This scenario suggests that autonomy is not a property of technology, but a pedagogical construction that depends on the teacher's intention and the conditions of use of the resource.

For students with disabilities or educational lags, the limits of autonomy become even more apparent, as mere access to the platform does not guarantee meaningful participation. In these cases, teaching practice and the adequacy of activities are central conditions for interaction with the resource to lead to conceptual elaboration, rather than merely the mechanical execution of tasks.

Thus, the data indicate that, in the context investigated, gamification can favour student involvement but does not ensure learning autonomy without pedagogical planning, teacher intermediation, and adaptation of activities to students' needs.

Engagement and limits of conceptual deepening

As shown in Table 2, the reports recognise the potential of the platform to favour student engagement, but also point out limits on the conceptual deepening of learning. Interpreting the interviews suggests that the interest aroused by the playful elements does not always translate into a consistent construction of mathematical knowledge.

Participants widely acknowledge the motivational dimension of the platform. While P10 reports that students spontaneously request "*TIA, Matific*", and P1 notes that "*they like it because it is a little game, passing through phases*", P3 associates the resource with increased interest in classes. However, the data indicate that this engagement does not automatically translate into conceptual elaboration. The playful character favours the initial access to activities; however, it can produce an involvement centred on external stimuli, limiting the depth of the cognitive processes mobilised, as suggested by the reports of this specific group.

The distinction between motivation and effective learning is precisely highlighted by P10's speech: "*the focus is on winning the coins and not*

understanding the fraction". This tension is supported by the self-determination theory: Deci and Ryan (2000, p. 68) argue that learning tends to be less effective when motivation stems predominantly from extrinsic factors to the detriment of autonomous regulation processes. When the resource design privileges rewards and visual stimuli over the development of reasoning, the pedagogical potential of the platform may be limited, especially for students who already have difficulty with conceptual elaboration. It is important to note, however, that this finding reflects the specific conditions of the investigated group and does not permit conclusions about the behaviour of the platform in other contexts.

The reports also indicate that engagement varies with students' years of schooling. P7 notes that *"in the sixth grade, they learn, in the ninth, they do not find it funny"*, and P8 reinforces that the *"platform is good for previous grades, but does not add up for the eighth and ninth"*, suggesting that the gamified interface finds greater receptivity among younger students. P9 summarises this issue by stating that *"engagement does not guarantee learning"*, indicating that, even in contexts where the platform promotes interest and participation, conceptual elaboration requires pedagogical conditions that transcend interaction with the resource. This set of reports points to the need to evaluate the adequacy of the platform not only regarding the content, but also regarding students' age and cognitive profile.

The engagement promoted by the platform should therefore be understood as a relevant starting point, but insufficient when disconnected from intentional pedagogical practices. Ausubel (2003) points out that meaningful learning requires anchoring new concepts to pre-existing cognitive structures, which presupposes pedagogical monitoring capable of identifying students' prior knowledge and connecting it to the platform's proposals and structured material. Without this orientation, the use of the resource tends to favour mechanical learning, without guaranteeing the internalisation of mathematical concepts.

In summary, the results indicate that the use of the Matific platform, in the context investigated, is characterised by tensions between potentialities and limits. Although it contributes to engagement and diversification of pedagogical strategies, its effectiveness was conditioned, in the analysed reports, by qualified teacher monitoring, adequate education, alignment with curriculum objectives, articulation with structured material, and inclusion demands.

From this perspective, technology proved insufficient to realise its pedagogical potential when unaccompanied by adequate formative and institutional support, and in some situations reported, may reproduce or intensify difficulties already present in the school context. Thus, we emphasise the need to build guiding material that offers teachers concrete support for planning more intentional, equitable, and meaningful practices, leading, therefore, to the final considerations of this study.

CONCLUSION

The present study analysed the perceptions and practices of mathematics teachers in the use of the Matific platform, with emphasis on its curriculum articulation and the implications for inclusive education. The results show that the integration of digital technologies into teaching practices occurs in a situated way, conditioned by pedagogical articulation, the concrete conditions of the school context, and class heterogeneity.

In general, the platform is appropriate as a complementary resource, aimed at consolidating and reviewing content, rarely assuming a structuring role in the curriculum. This finding reinforces that the simple insertion of digital technologies does not, by itself, imply pedagogical innovation, since its effectiveness depends on the forms of use, the conditions of implementation, and the strategies mobilised by teachers.

In the field of inclusion, although the platform has the potential to expand engagement and diversify access to knowledge, its effectiveness remains conditioned on teaching action and intentional processes of pedagogical adaptation. Similarly, student autonomy depended on structured mediation and support, showing that interactivity alone does not guarantee significant learning.

The study also indicates that the forms of platform appropriation are related to participants' profiles, characterised by different professional trajectories and varying levels of familiarity with digital technologies. The predominance of basic and intermediate levels, associated with the absence of systematised institutional education, contributes to more instrumental and fragmented uses, reinforcing the centrality of continuing education for a more qualified pedagogical integration.

Although student engagement has emerged as a relevant aspect, we found that this engagement does not always translate into conceptual deepening. Such evidence reinforces the need to articulate motivational

dimensions to pedagogical strategies that favour the consistent construction of mathematical knowledge.

By offering empirical evidence on the use of the platform in real-world public school contexts, this study contributes to advancing discussions on digital technologies in education, especially regarding the articulation among curriculum, pedagogical practices, and inclusion. In this sense, Matific is a situated case that contributes to reflecting on the use of gamified platforms in similar educational contexts.

The results must be understood in light of the principle of transferability, since they arise from a small number of participants and a predominant geographic concentration within the same state, which limits the possibilities for statistical generalisation. Still, the findings offer relevant interpretative elements for analogous realities, especially regarding the tensions among digital technologies, curriculum, and inclusion.

As an unfolding, the need for the development and validation of guiding materials that support the teacher in articulating technology, curriculum, and inclusion stands out.

In summary, the integration of digital technologies in mathematics teaching is configured as a situated practice, whose effectiveness depends on teaching, curriculum articulation, and consideration of student diversity. In this context, policies focused exclusively on providing platforms tend to produce superficial and fragmented uses, underscoring the need for investments in teacher education and the development of guiding materials that support intentional, critical, and inclusive pedagogical integration.

AUTHORSHIP CONTRIBUTION STATEMENT

MKH and SFG designed the study. MKH was responsible for the methodological development, conduct of the investigation, data curation, formal analysis, and writing of the original version of the manuscript. SFG was responsible for supervision, validation of the results, and critical review of the content. Both authors participated in the discussion of the results, the revision and editing of the text, and approved the final version for publication.

DATA AVAILABILITY STATEMENT

The data supporting the results of this study are not publicly available due to ethical constraints related to participant confidentiality. The data were produced through interviews with human participants, who signed the Informed Consent Form (ICF), and are duly anonymised. The data may be made available

upon reasonable request to the corresponding author MKH, subject to ethical approval and a formal commitment to preserve participants' confidentiality and anonymity.

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