

Platformization of Public Education in São Paulo, Brazil: Impacts on Teaching Practices and Technological Integration in Natural Sciences and Mathematics

Lívia Correia Chotolli, The State University of Campinas, Brazil
Renato Fernandes dos Santos, The State University of Campinas, Brazil
Gildo Giroto Júnior, The State University of Campinas, Brazil

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Abstract

The platformization of public education is characterized by the systematic incorporation of digital platforms, marketed by private companies, which come to mediate the school process. In Brazil, particularly in the State of São Paulo, this movement has reconfigured teaching work by guiding lesson planning and classroom practices, promoting the standardization of pedagogical approaches and restricting teachers' autonomy. This study analyzed how platformization and the use of digital materials, such as ready-made slides, impact teaching practice and the integration of technologies in Natural Sciences and Mathematics education, based on the Technological Pedagogical Content Knowledge (TPACK) model and James Wertsch's concepts of mastery and appropriation. A case study was conducted with teachers through non-participant observations, analyzed using Discursive Textual Analysis (DTA). Initial results indicate that the prescriptive use of these digital materials has become recurrent through imposition and naturalized in teachers' daily routines, no longer representing innovation and starting to reproduce what is already established in these resources. It was observed that other technologies are used mainly, in function of these materials, so that integration occurs as a response to external demands than as a teacher's choice. At certain moments, there were mobilizations of PCK, associated with this naturalization, and of TCK in the use of other technological resources; however, there is no evidence of effective TPACK integration or a critical stance toward these tools. Thus, an operational mastery of technologies predominates, without presenting an appropriation, showing that the analyzed policy doesn't promote innovation and reinforces the technological instrumentalization of teaching work.

Keywords: platformization of public education in São Paulo, digital materials, TPACK, mastery and appropriation

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Introduction

In recent decades, the incorporation of digital technologies into public educational policies has evolved beyond the mere introduction of new instructional resources to constitute a broader process of educational reorganization. This trend, known as the “platformization of education,” is characterized by the growing centrality of digital platforms in organizing school activities; these platforms integrate pedagogical practices, administrative processes, assessment systems, and monitoring mechanisms within digital infrastructures developed predominantly by private companies (Van Dijck et al., 2018). Rather than simply providing technological tools, these platforms shape specific ways of teaching, learning, and managing schools, thereby influencing the relationships among teachers, students, and educational systems.

This transformation aligns with a broader trend of expanding platform capitalism, in which data, algorithms, and monitoring processes play a strategic role in organizing various social sectors, including education (Zuboff, 2020). In this context, technologies cease to be neutral tools and instead embody political, economic, and pedagogical rationales that directly influence the organization of teaching work (Selwyn, 2017). Thus, understanding the integration of educational platforms requires moving beyond strictly technical analyses and recognizing that their implementation is linked to conflicts regarding curriculum organization, teacher autonomy, and the very social function of the school.

In the State of São Paulo, the platformization of education has become entrenched through a coordinated set of public policies that go beyond the mere incorporation of digital technologies into the school environment. An analysis of these policies reveals five movements characterizing this process. The first involves the adoption of digital instructional materials organized into pre-structured presentations that are mandatory for classroom use, which redefine pedagogical planning and curricular organization. The second consists of shifting the state school system's teacher professional development to digital platforms, structured primarily around video lessons and focused on the use of these materials. As Carvalho (2022), this dynamic promotes a centralizing pedagogical standardization that directly restricts the teacher's freedom of choice and local autonomy. The third movement concerns the acquisition and implementation of platforms designed to manage various dimensions of school life, encompassing pedagogical and administrative aspects as well as the monitoring of student learning. According to Maldonado and Jacomini (2024), this structural shift transforms the Secretaria Escolar Digital into a logic of total business intelligence, aligning public administration with market-driven metrics.

Next, there is a centralization of monitoring regarding access to and usage time of these platforms by teachers and students, enabling the continuous generation of data for educational management purposes. This movement operationalizes what Van Dijck, Poell and de Waal (2018) describe as datafication, where the continuous extraction of user data serves as infrastructure for accountability and managerial governance.

Finally, the institutional narrative is reinforced by linking the use of digital platforms to improved student performance in the São Paulo State School Performance Assessment System (SARESP), thereby strengthening the view that intensifying the use of these technologies is central to raising the quality of public education.

The expanded use of educational platforms has been accompanied by the adoption of mandatory digital instructional materials, the intensification of systems for monitoring

schoolwork, and the linking of platform usage to official educational performance indicators. As discussed by Barbosa and Alves (2023), the platformization of public education has contributed to reinforcing processes of curricular standardization and the centralization of pedagogical decision-making, progressively restricting the scope for teacher authorship and autonomy. Along similar lines, a technical note prepared by the Public School and Democracy Group (Gepud) and the Public School and University Network (Repu) argues that such policies extend mechanisms of control over teaching work by tying platform usage to management based on institutional indicators and targets (Gepud & Repu, 2025).

In this context, the adoption of digital materials within the São Paulo state school system warrants attention; these materials are organized into pre-structured presentations that guide the lesson sequence, the content covered, the proposed activities, and, in many instances, the pace of the teaching process itself. Although these resources are often touted as tools capable of fostering pedagogical innovation and facilitating technology integration, their use can take on a predominantly prescriptive nature, shifting the teacher from the role of architect of pedagogical practices to that of an executor of pre-defined sequences.

This discussion becomes particularly relevant when analyzed through the lens of the *Technological Pedagogical Content Knowledge* (TPACK) model, developed by Mishra and Koehler (2006) based on Shulman's (1986) proposal regarding *Pedagogical Content Knowledge* (PCK). The model posits that the meaningful integration of technologies relies on the interplay between technological, pedagogical, and content-specific knowledge, extending beyond mere instrumental mastery of digital tools. From this perspective, the educational use of technology entails planning and decision-making processes in which the teacher critically selects the resources best suited to learning objectives and the characteristics of the teaching context.

However, understanding merely which forms of teaching knowledge are mobilized is insufficient for analyzing the impacts of platformization on pedagogical work. To broaden this discussion, this study also draws upon Mediated Action Theory (MAT), proposed by James Wertsch (1998), specifically the concepts of mastery and appropriation.

Against this backdrop, this study analyzed how the use of digital materials provided by the São Paulo state school system influences teaching practice and the integration of technologies in the teaching of Natural Sciences and Mathematics. Specifically, the aim was to understand which forms of knowledge from the TPACK model are mobilized during the use of these resources and to what extent their usage demonstrates processes of mastering or appropriating digital technologies, based on preliminary results from a qualitative study involving the observation of a Chemistry teacher in the state public school system.

Technological Pedagogical Content Knowledge (TPACK)

The increasing presence of digital technologies in educational processes has expanded discussions regarding the knowledge teachers need to meaningfully integrate these resources into their teaching practices. However, the mere availability of technologies does not guarantee their pedagogical use, making it necessary to understand how different types of knowledge are combined in teaching practice. In this context, the Technological Pedagogical Content Knowledge (TPACK) model, proposed by Punya Mishra and Matthew J. Koehler (2006), extends Lee S. Shulman's (1986) framework by incorporating technological knowledge as a constitutive dimension of teaching practice.

Shulman's (1986) proposal marked a milestone by arguing that teaching relies neither solely on mastery of subject matter (*Content Knowledge* – CK) nor merely on knowledge of teaching methods (*Pedagogical Knowledge* – PK). The author introduced the concept of *Pedagogical Content Knowledge* (PCK), understood as the knowledge required to transform specific content into forms that are pedagogically accessible to students. PCK entails selecting examples, analogies, representations, and instructional strategies that foster learning, thereby constituting a distinct form of professional teaching knowledge.

With the advancement of digital technologies, Mishra and Koehler (2006) argue that integrating these resources requires knowledge that goes beyond the mere use of technological tools. Thus, the TPACK model proposes that teaching practice results from the dynamic interaction among three fundamental types of knowledge: CK, PK, and *Technological Knowledge* (TK). The interplay between these forms of knowledge gives rise to new domains, such as *Technological Content Knowledge* (TCK), *Technological Pedagogical Knowledge* (TPK), PCK itself, and, finally, TPACK, considered the knowledge necessary to integrate technologies in a way that is coherent with pedagogical needs and specific content.

Unlike approaches that view technologies merely as supplementary resources for instructional planning, TPACK is based on the premise that their integration into teaching arises from the interplay among technological, pedagogical, and content knowledge. Consequently, teachers are expected to mobilize this knowledge in an integrated manner to select and use technologies that align with learning objectives, content specifics, pedagogical strategies, and the context in which the practice takes place. As highlighted by Graham (2011) and Koehler et al. (2012), TPACK should not be understood as a set of independent competencies or a linear sequence of knowledge, but rather as an analytical framework capable of capturing the complexity of this interplay across diverse educational contexts.

From this perspective, context plays a central role in the formation of TPACK. Koehler and Mishra (2008) argue that the incorporation of technologies into teaching should stem from a planning process that integrates learning objectives, content, pedagogical strategies, and the characteristics of the educational context, rather than from the prior selection of digital tools. Thus, the selection of technologies is a consequence of this integrated planning, enabling the teacher to intentionally choose the most suitable resources to enhance learning experiences.

However, the literature also acknowledges that the relationship between technology and teaching practice undergoes changes as certain resources become widely incorporated into daily school life. Cox and Graham (2009) argue that when a technology is used continuously, it tends to lose its novelty and comes to be perceived as a natural part of the teaching environment. This process of naturalization means that technological knowledge is no longer easily distinguished as a specific component of teaching practice, becoming instead transparent within pedagogical action. In other words, TK does not disappear, but it ceases to be perceived as knowledge consciously mobilized, as the technology becomes integrated into professional routines much like other resources traditionally used in schools.

Although this discussion was developed within contexts of established technological integration, it holds significant implications for understanding the processes of the platformization of education (Barbosa & Alves, 2023). Consequently, this discussion is particularly relevant to the present research, as it highlights that technological integration depends on more than just the presence of digital tools in the classroom. Instead, it is necessary to analyze how these technologies are incorporated into pedagogical planning and which

professional forms of knowledge are actually mobilized during their use. Thus, in this study, the TPACK model serves as an analytical framework to investigate whether the digital materials prescribed by educational policy foster a meaningful integration of technology, pedagogy, and content, or whether they tend to limit this connection to the operational use of pre-defined resources.

Mediated Action Theory: Mastery and Appropriation

Given that digital technologies not only expand teaching possibilities but can also alter the ways teachers understand and organize their practices, a framework is needed to analyze not only the knowledge mobilized during technology integration but also the relationship established between teachers and these tools within their specific sociocultural contexts. In this regard, the TPACK model is complemented by the Mediated Action Theory (MAT), proposed by Wertsch (1998), which enables an understanding of how cultural tools play a role in shaping human actions and the processes of meaning-making constructed by individuals.

Drawing on the contributions of Vygotsky, Bakhtin, and Burke, TAM shifts the analytical focus from isolated individuals to the relationship established between subjects and mediating instruments, termed cultural tools. From this perspective, these tools do not function as elements external to action but rather participate in its constitution, shaping and transforming the ways in which subjects act in the world. Thus, the central object of investigation is neither the subject nor the tool analyzed in isolation, but rather mediated action, understood as an inseparable unity comprising the agent and the cultural means that make their action possible (Wertsch, 1998). Consequently, while cultural tools expand the possibilities for human action, they simultaneously guide, condition, and delimit the ways in which that action is carried out.

Among the central concepts of this approach, mastery and appropriation stand out. Mastery refers to the ability to use a given instrument operationally, understanding its functioning and properly executing the actions required for its use. However, mastering a tool does not necessarily imply incorporating it into one's own ways of thinking and acting (Wertsch, 1998).

Appropriation, in turn, represents a more complex process of internalization in which the subject not only uses the instrument competently but also assigns personal meanings to it, critically reinterpreting it and integrating it into their own purposes and practices. In this process, the tool ceases to be merely reproduced according to its originally established functions and comes to be imbued with new meaning by the subject; it can be adapted to different contexts and even mobilized as a form of resistance against intended conditions or uses. As Wertsch (1998) highlights, an individual may use a tool with technical competence without necessarily establishing a relationship of identification or incorporation with it, situations characterized by mastery but not appropriation.

In the educational context, this distinction becomes particularly relevant for understanding the use of digital technologies. Giordan (2005) argues that the introduction of technologies into schools does not, in itself, guarantee qualitative changes in pedagogical practices. This is because learning to use these tools can be limited to operational mastery when their use is prescriptive, failing to foster processes of re-signification by teachers, as can happen with platformization.

In this study, the digital platforms and instructional materials provided by the São Paulo state school system are understood as cultural tools that mediate the organization of teaching work.

However, the premise is adopted that their use may occur at varying levels of internalization. While some contexts foster processes of appropriation, in which teachers adapt, reinterpret, and transform technological resources to meet instructional needs, others tend to restrict this possibility, predominantly favoring an operational mastery driven by adherence to institutional mandates.

Linking TAM with the TPACK model thus enables a more comprehensive analysis of the integration of these technologies. While TPACK allows for the identification of the professional knowledge mobilized during teaching practice, the concepts of mastery and appropriation make it possible to understand the quality of this relationship, revealing whether the use of technologies stems from autonomous pedagogical choices or from adaptation to, or resistance against, the demands imposed by the mediating tools present in the school context.

Methodology

This research is qualitative in nature and was conducted as a case study (Yin, 2001), as this approach enables an in-depth investigation of contemporary phenomena within their real-world contexts. The study is part of broader research seeking to understand the impacts of the platformization of public education in São Paulo on the work of teachers and the mobilization of professional knowledge among Natural Sciences and Mathematics teachers.

The study was conducted with four teachers from the São Paulo (SP) state public school system, working in public schools in the municipality of Campinas (SP). However, as the research is still ongoing, this article presents preliminary results obtained from the observation of a chemistry teacher who uses exclusively the digital materials provided by SEDUC-SP to conduct her classes.

Data generation was carried out through non-participant observations (Lakatos & Marconi, 2003), aimed at understanding how digital materials influence the organization of teaching practice, the conduct of classes, the integration of technologies into instruction, and the professional knowledge mobilized by the teacher during the teaching process. This technique was chosen because it enables the analysis of teaching practice in its natural context, allowing for the identification of how platformization policies materialize in the daily life of the school.

The records produced during the observations were subjected to Discursive Textual Analysis (DTA), as proposed by Moraes and Galiuzzi (2016). This analytical method unfolded in three complementary movements: (i) unitarization, a stage in which the records were broken down into units of meaning related to the research objectives; (ii) categorization, a phase in which these units were grouped based on theoretical and interpretive affinities; and (iii) production of metatexts, aimed at constructing broader understandings of the phenomenon under investigation by linking empirical data with the adopted theoretical framework.

The categorization phase was guided by *a priori* categories derived from the two theoretical frameworks underpinning the research. The first is the TPACK model proposed by Mishra and Koehler (2006), used to analyze the professional knowledge mobilized during the integration of digital technologies into teaching. The seven categories comprising the model (CK, PK, TK, PCK, TCK, TPK, and TPACK) were taken into account. Using these categories made it possible to identify the knowledge mobilized during teaching practice and the manner in which technology integration occurred within the observed context.

The second corresponds to James Wertsch's (1998) TAM framework, specifically the concepts of *mastery* and *appropriation*, used to understand the process of internalizing these cultural tools. Based on this framework, three analytical categories were defined: Mastery and Appropriation, characterized by operational mastery coupled with critical, autonomous, and transformative use of the technology; Mastery and Non-Appropriation, where the teacher possesses technical mastery of the resources but their use remains restricted to fulfilling institutional mandates, without pedagogical adaptation; and Non-Mastery and Non-Appropriation, characterized by an absence of both technical mastery and meaningful integration of the technology into pedagogical practice, as well as resistance or adaptation to other contexts.

Integrating the TPACK model with the concepts of mastery and appropriation made it possible to simultaneously analyze which forms of teacher knowledge were mobilized during classes and the extent to which the use of digital technologies represented a process of pedagogical appropriation, or merely operational mastery resulting from the demands of the São Paulo state school system's platformization policy.

Results and Discussion

The results presented correspond to the initial stage of ongoing research and focus exclusively on the observation of a Chemistry teacher in the São Paulo state public school system who conducts her classes using only the digital materials provided by the São Paulo State Department of Education (SEDUC-SP). Although this is a single case study, its analysis offers insight into how platformization policies shape daily school life and influence the mobilization of teachers' professional knowledge.

The interpretation was constructed based on *a priori* categories grounded in the TPACK model (Mishra & Koehler, 2006) and the concepts of mastery and appropriation proposed by Wertsch (1998), seeking to understand both the knowledge mobilized and the way digital technologies are internalized during pedagogical practice.

Digital Materials as an Organizing Structure for the Lesson

The observations indicate that digital materials play a central role in organizing teaching practice, serving as the primary structuring element of the observed lessons. Throughout the observation period, the slides provided by SEDUC-SP shifted from a merely complementary role in the teacher's planning to guiding the sequence of content, the lesson's timing, the examples presented, the proposed activities, and the moments of interaction with students.

In this context, the teacher conducted her classes by following the structure previously established by the material, making interventions primarily when questions arose or when she identified a need to tailor the explanation to the class's characteristics. These interventions demonstrate the presence of her own pedagogical decisions; however, they remained focused on the manner of content presentation, without significantly altering the previously defined didactic organization.

Thus, although the teacher makes adjustments while conducting the lessons, the general structure of the practice remains conditioned by the Digital Material. The selection of content, the sequence of presentation, and the proposed activities are already embedded in the resource,

shifting part of the decision-making traditionally associated with lesson planning to the technological artifact itself.

This configuration alters the relationship between the teacher and the instructional material. Instead of serving as a support resource developed based on the teacher's pedagogical choices, the Digital Material acts as an organizing reference for teaching practice, pre-establishing aspects that historically constitute the exercise of professional autonomy.

Another recurring aspect observed was the process by which the use of digital materials became normalized. At no point was their presence treated as a specific methodological strategy or as an innovation incorporated into teaching; rather, their use appeared as part of the school routine, understood as the expected way of conducting classes.

This naturalization allows us to understand that platformization goes beyond the mere introduction of technologies into education. It involves a reorganization of school practices in which technology comes to establish parameters for the conduct of teaching work.

From this perspective, the teacher does not use Digital Materials because she considers them the best strategy for specific content, but rather because they have become the central reference point for the development of school activities. Technology, therefore, ceases to be merely one possibility among various methodological alternatives and assumes a normative position within pedagogical practice.

This movement aligns with discussions regarding the platformization of education, in which platforms cease to function merely as digital tools and begin to organize pedagogical, curricular, and administrative processes (Vieira & Ferraro, 2025). The result is a progressively standardized practice, the logic of which is defined externally to the teacher.

The prevalence of digital materials also influences how other technologies are incorporated into lessons. Although there were instances where the teacher used supplementary resources, such as images, quick internet searches, and digital simulators, these elements primarily served to support the content already structured by the official slides.

In other words, these resources did not constitute new methodological approaches or reorganize the class dynamics; rather, they were used to supplement explanations, clarify questions, or facilitate the visualization of specific chemical concepts. The additional technology, therefore, did not displace the logic established by the Digital Material; on the contrary, it was incorporated to reinforce it.

This characteristic is important for understanding the mobilization of teacher knowledge, which is subsequently analyzed using the TPACK model. Although various technologies are present in the observed practice, their use occurs predominantly within a pre-established pedagogical framework; this may limit the possibilities for a broader integration of technological, pedagogical, and content knowledge (Koehler & Mishra, 2008).

Mobilization of Teacher Knowledge Based on the TPACK Model

The analysis based on the TPACK model categories revealed that the teacher draws upon various forms of professional knowledge while conducting lessons. However, initial results suggest that this mobilization occurs predominantly in isolation or through partial connections

between certain domains of the model, with no evidence of a consistent integration of the seven knowledge components that characterize TPACK.

CK is evident in the confidence with which the teacher addresses the chemical concepts found in the digital materials, answering students' questions and supplementing explanations when necessary. At the same time, PK is observed in the management of the class, the organization of the lesson, and the mediation of student interactions; TK is seen in the use of software integrated into the digital materials, such as PhET Colorado, during lessons. The use of slides is treated as a standard practice, given that they are employed in every class (Cox & Graham, 2009).

The primary form of knowledge mobilization identified during the observations relates to PCK. This mobilization occurs, above all, when the teacher modifies the way she explains specific concepts, uses additional examples drawn from the students' daily lives, or expands upon information found in the official slides. These interventions demonstrate that the teacher does not simply read the material mechanically, but rather mobilizes pedagogical knowledge to facilitate the understanding of the content.

However, these adaptations remain sporadic and localized. At no point was a significant reorganization of the instructional sequence, lesson objectives, or activities proposed by the digital materials observed. The changes focus primarily on expanding explanations and inserting supplementary examples, while preserving the pedagogical structure originally defined by the material. Thus, although PCK is being mobilized, it occurs within the limits established by the prescribed logic of the slides themselves.

Another connection observed relates to TCK. At times, the teacher employs complementary technological resources, such as simulators from the PhET Colorado platform, animations, and other digital resources linked to or integrated with the Digital Materials themselves, to facilitate the understanding of specific chemical concepts. In these instances, technology is used to represent scientific phenomena more dynamically, establishing a link between the technological resource and the specific subject matter.

However, even this mobilization of TCK remains tied to the logic of Digital Materials. The additional technological resources neither reorganize the lesson's pedagogical approach nor foster new teaching strategies; instead, they are primarily used to complement planned activities or to delve deeper into content already presented in the official slides.

On the other hand, few situations were found that allowed for characterizing the mobilization of TPK, since the technologies were not employed to transform teaching methodology, promote different forms of interaction, or foster inquiry-based processes led by the students. Their use remained predominantly associated with the implementation of the instructional sequence pre-organized by the digital materials.

In this context, initial results suggest that the integration of technology, pedagogy, and content occurs in a limited manner. Although various forms of teacher knowledge are constantly mobilized, they tend to appear relatively independently or through partial connections, particularly between PCK and TCK, without constituting a broad, dynamic integration of the seven domains proposed by the TPACK model.

This configuration may be linked to the specific model of platformization under analysis. By providing a pre-structured instructional sequence, complete with defined content, activities, and technological resources, these digital materials reduce the scope for teachers to engage in autonomous lesson planning. Consequently, technology tends to serve primarily as a means of executing a prescribed pedagogical approach, thereby limiting opportunities for teachers to independently integrate their technological, pedagogical, and content-specific knowledge into the process of shaping instruction.

Between the Mastery and the Appropriation of Digital Platforms

An analysis of the professional knowledge integrated by the teacher reveals that her relationship with Digital Materials aligns predominantly with the category of “Mastery without Appropriation” (Wertsch, 1998). Observations indicate that the teacher possesses technical mastery of the resources provided by the state school system. She uses the Digital Materials confidently and fluidly, demonstrating familiarity with their controls, organization, and functionality.

However, this mastery remains confined to the operational level. The Digital Materials are used in their original form, undergoing minimal modification and guiding virtually all decisions regarding lesson organization. The teacher makes specific adjustments during her explanations, yet these changes do not alter the pedagogical approach embedded in the technological resource.

Thus, the use of technology remains strongly tied to institutional mandates. The resource is incorporated into daily school life without undergoing a process of re-signification that would transform it into a tool for pedagogical authorship (Barbosa & Alves). Although the teacher demonstrates knowledge and use of the tool, her practice continues to be structured around possibilities pre-defined by educational policy.

No characteristics consistent with the “Mastery and Appropriation” category were identified, as there were no observed instances of systematic processes involving the reconstruction of material, the development of original strategies, or the critical use of technologies capable of significantly altering class organization, nor was there any resistance to their use. Likewise, the “Lack of Mastery and Appropriation” category does not apply to the case analyzed, given that technical mastery of the resources was evident throughout the observed period.

These initial results suggest that the platformization policy under analysis primarily fosters processes of operational mastery while offering limited opportunities for teachers to develop a critical appropriation of digital technologies. In this context, technology integration tends to occur in response to institutional demands and the pedagogical model pre-established by the digital materials, shifting a portion of teacher autonomy to the technological resources and reinforcing the standardization of pedagogical work (Barbosa & Alves, 2023; Vieira & Ferraro, 2025). This dynamic helps explain why the integrated mobilization of knowledge envisioned by the TPACK framework remains limited: when lesson organization is pre-defined by the materials, there is less scope for teachers to articulate their technological, pedagogical, and content knowledge in an original, self-directed manner (Koehler & Mishra, 2008, Mishra & Koehler, 2006).

Conclusion

The preliminary results of this research demonstrate that the use of the digital materials provided by SEDUC-SP goes beyond merely introducing a new tool into the school routine; instead, it reorganizes the very dynamics of teaching practice. In the case analyzed, these resources were observed to play a structuring role in lesson organization, guiding the sequence of content, proposed activities, and pedagogical approaches. Although the teacher intervenes and draws upon her professional knowledge to adapt explanations and foster student understanding, these actions remain constrained by the structure pre-established by the material, indicating a process of incorporation characterized by the centrality of technological prescription.

Analysis based on the TPACK model revealed the mobilization of various forms of teacher knowledge, specifically CK, PK, TK, PCK, and TCK. However, this mobilization was only partial, failing to demonstrate the comprehensive integration of technology, pedagogy, and content that characterizes TPACK. This result suggests that the mere presence of digital technologies does not guarantee meaningful pedagogical integration, as such integration depends on the possibilities afforded by the planning context and on teacher autonomy regarding the selection, adaptation, and recontextualization of technological resources. When technologies arrive accompanied by pre-defined instructional sequences, content, and activities, the scope for teachers to construct their own practice may be diminished.

Integrating the TPACK framework with Mediated Action Theory revealed that, in the observed context, the relationship the teacher established with digital materials aligns more closely with the category of *mastery* rather than *appropriation*. In other words, while there is technical mastery of the resources and the ability to use the tools, the processes of transforming these instruments to meet specific pedagogical needs remain limited. These initial findings suggest that the platformization policy under analysis tends to foster a predominantly operational relationship with digital technologies, reinforcing the standardization of teaching work. However, as this research is ongoing, further investigation is required to deepen our understanding of how different teachers, school contexts, and training conditions influence the processes of technology appropriation in the teaching of Natural Sciences and Mathematics.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The author declares that Grammarly, an AI-assisted writing software, was used in proofreading and refining the language used in the manuscript. The usage was limited to correcting grammatical and spelling errors and rephrasing statements for accuracy and clarity. The author further declares that, apart from Grammarly, no other AI or AI-assisted technologies have been used to generate content in writing the manuscript. The ideas, design, procedures, findings, analyses, and discussion are originally written and derived from careful and systematic conduct of the research.

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