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The digital technologies as mediation instruments in Teaching Guidance Activity[1]

As tecnologias digitais como instrumentos de mediação na Atividade Orientadora de Ensino

Elivelton Henrique Gonçalves[2]
Bruno Tizzo Borba[3]
Fabiana Fiorezi de Marco[4]

ABSTRACT

This article aims to discuss the organization of Mathematics teaching from the perspective of the Teaching Guidance Activity, considering digital technologies as mediation instruments. This is a theoretical essay, excerpt from two doctoral theses that used the Teaching Guidance Activity as a theoretical-methodological basis for the organization of Mathematics teaching integrated with the use of digital technologies. Anchored in the Historical-Cultural Theory and Leontiev's Activity Theory, the Teaching Guidance Activity proposes an intentional organization, in which the teacher develops situations that trigger learning based on problems that reveal the historical and logical movement of concepts, mobilizing students to appropriate historically elaborated mathematical knowledge. In this sense, digital technologies can be understood as mediation instruments, capable of enhancing pedagogical activity. As a result, the analysis indicates that it is not about using these resources by themselves, but the intentional way in which they are integrated and organized by the teacher,

RESUMO

Este artigo tem como objetivo tecer considerações sobre a organização do ensino de Matemática na perspectiva da Atividade Orientadora de Ensino considerando as tecnologias digitais como instrumentos de mediação. Trata-se de um ensaio teórico, recorte de duas teses de doutorado que utilizaram a Atividade Orientadora de Ensino como base teórico-metodológica para a organização do ensino de Matemática integrado ao uso de tecnologias digitais. Ancorada na Teoria Histórico-Cultural e na Teoria da Atividade de Leontiev, a Atividade Orientadora de Ensino propõe uma organização intencional, em que o professor elabora situações desencadeadoras de aprendizagem com base em problemas que revelam o movimento histórico e lógico dos conceitos, mobilizando os estudantes a apropriação do conhecimento matemático historicamente elaborado. Nesse sentido, as tecnologias digitais podem ser compreendidas como instrumentos de mediação, capazes de potencializar a atividade pedagógica. Como resultados, a análise indica que não se trata de utilizar esses recursos por si só, mas da forma intencional como são integrados e organizados

[1] English version by Silvia Iacovacci. E-mail: siacovacci@gmail.com.

[2] PhD in Education from the Postgraduate Program in Education at the Universidade Federal of Uberlândia. Adjunct Professor in the Department of Physical Sciences and Mathematics Education at the Universidade Federal of Lavras. Orcid: https://orcid.org/0000-0003-2969-9380. E-mail: elivelton.goncalves@ufla.br.

[3] PhD in Education from the Postgraduate Program in Education at the Universidade Federal of Uberlândia. Mathematics professor in the Uberlândia Municipal School System. Orcid: https://orcid.org/0000-0002-5718-6366. E-mail: brunotborba@ufu.br.

[4] Postdoctoral degree in Education from the Universidade de São Paulo. Professor at the Institute of Mathematics and Statistics at the Universidade Federal of Uberlândia. Permanent faculty member in the Postgraduate Program in Education. Orcid: https://orcid.org/0000-0002-7126-5626. E-mail: fabiana.marco@ufu.br.

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enabling interaction, cooperation and the development of theoretical thinking. Finally, the article reinforces that within the scope of the Teaching Guidance Activity, the use of digital technologies constitutes a possibility of mediation instrument in the process of teaching and learning Mathematics, favoring the appropriation of knowledge and boosting human development.

Keywords: Digital Technologies. Teaching Guidance Activity. Mediation instruments.

pelo professor, possibilitando a interação, a cooperação e o desenvolvimento do pensamento teórico. Por fim, o artigo reforça que no âmbito da Atividade Orientadora de Ensino o uso das tecnologias digitais constitui uma possibilidade de instrumento de mediação no processo de ensino e aprendizagem de Matemática, favorecendo a apropriação do conhecimento e impulsionando o desenvolvimento humano.

Palavras-chave: Tecnologias Digitais. Atividade Orientadora de Ensino. Instrumentos de mediação.

1 Introduction

Pedagogical activity, understood as the unity of teaching and learning (Gepape, 2023), is central to school education. It aims to promote the development of individuals' superior human capacities through learning historically developed knowledge (Moura et al., 2016; Moura, 2017; Moura, Sforni & Lopes, 2017; Moura, Araújo & Serrão, 2018; Almeida & Lopes, 2023).

Pedagogical activity involves professors and students who aim to study a concept and experience the macrostructure of human activity in the process of giving meaning to their joint activity. This requires awareness of the objective, planning of actions, operations with instruments, and evaluation of the previously idealized result (Gepape, 2023, p. 88). It is worth noting that the Teaching Guidance Activity mobilizes Pedagogical Activity and is understood as a theoretical-methodological basis for organizing teaching so that the educational process in school constitutes an activity for students and professors (Moura et al., 2016, p. 110).

Based on Historical-Cultural Theory and more specifically on Leontiev's Activity Theory (1978, 1985, 2001), Teaching Guidance Activity seeks to create conditions for the development of human potential to its fullest extent through pedagogical practices that encourage the understanding of concepts produced historically by humanity.

Within the scope of Teaching Guidance Activities, professors engaged in teaching activities are responsible for thinking, organizing, developing, guiding, and evaluating educational activities to stimulate student learning. Thus,

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professors are responsible for defining goals as common problems, organizing situations that respect students' different levels of knowledge, and establishing dynamics that allow interaction between those involved in teaching and learning, based on the concept of movement (Moura, 1996).

In contemporary society, we are increasingly immersed in a technological landscape that has had a progressive influence on all areas of life, including sociocultural interactions and education. Schools are no different. Digital technologies are entering the classroom, particularly through students' own use of them (Gonçalves & Marco, 2020a), creating a need for teachers in various fields to prepare themselves to deal with these constantly and rapidly evolving digital tools. They must also consider ways to integrate these technologies into the educational process.

In mathematics education, digital technologies can facilitate the teaching and learning of mathematical concepts. However, the use of these technologies should not be limited to making classes more 'interesting', 'playful' or breaking the routine of conventional teaching. Nor should it be a case of providing students with software that can perform countless calculations instantly and produce results (Gonçalves, 2018; Gonçalves & Marco, 2020b). Rather, it is about professors intentionally organizing teaching situations to explore the development and representation of mathematical knowledge with the help of these tools, and to encourage interaction between students and professors.

In this context, two doctoral theses were completed in 2023 (Borba, 2023; Gonçalves, 2023). Part of the investigation in both theses involved examining the use of digital technologies in mathematics teaching, based on the theoretical and methodological framework of Guided Teaching Activities in Youth and Adult Education and Distance Learning. The research was conducted within the Postgraduate Programme in Education at the Federal University of Uberlândia as part of the Study and Research Group on Mathematics Teaching and Pedagogical Activity (GEPEMAPe[5]).

[5] GEPEMAPe conducts studies on Historical-Cultural Theory, Mathematics Education, and teacher training at the undergraduate and graduate levels, under the coordination of Prof. Fabiana Fiorezi de Marco, PhD. For more information, visit: https://gepemapeufu.wixsite.com/gepemape. Accessed on: March 6, 2025.

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According to surveys by Araújo, Gonçalves, and Marco (2022) and Borba, Gonçalves, and Marco (2023), one of the unique aspects of both theses was their assumption that one of the theses' actions would be to use the Teaching Guidance Activity as a theoretical-methodological basis for organizing teaching (in this case, mathematics) in basic and higher education, addressing mathematical concepts with digital technology. The theses revealed the need to continue the investigative journey by focusing and deepening reflections on this theme.

Following this logic, this article aims to offer considerations on the organization of mathematics teaching from the perspective of Guided Teaching Activity, considering digital technologies as mediation tools.

This theoretical essay takes a qualitative approach and presents an interpretive and argumentative reflection based on the two aforementioned theses, problematizing, questioning, deepening, and articulating knowledge (Meneghetti, 2011). These assertions align with the objective of this article.

First, we reflect on some theoretical assumptions of Historical-Cultural Theory in relation to digital technologies. Next, we discuss Guided Teaching Activity as a theoretical and methodological basis for organizing teaching and consider digital technologies as mediation tools. Finally, we conclude with some considerations.

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2 Historical-Cultural Theory and Digital Technologies

The Historical-Cultural Theory, proposed by Lev Semyonovich Vigotsky (1896-1934) and his collaborators, is anchored in historical materialism and dialectical Marxism as philosophical methods. It broadly indicates that individual changes in human beings throughout their development process are rooted in their society and culture and the interpersonal relationships established therein. In other words, these changes are based on the social context in which the individual is immersed.

Within this theory, activity theory, referencing the Russian psychologist Leontiev (1978, 1985, 2001), posits that needs direct the subject's actions during activity. According to this author, "We do not call all processes activity. By this term, we designate only those processes that realize man's relations with the world and satisfy a special need corresponding to him" (Leontiev, 2001, p. 68).

According to Leontiev, activities are "[...] processes psychologically characterized by what the process as a whole is directed toward (its object), always coinciding with the goal that stimulates the subject to perform this activity, that is, the motive" (Leontiev, 2001, p. 68). Activity originates from a need, which is determined by the object; thus, the object becomes the motive for the activity and stimulates it.

Action can be considered one of the fundamental components of activity or a means of carrying it out. According to Leontiev (1985, p. 83, our translation), "action is [...] the process that is subordinate to the representation of the result to be achieved, that is, the process subordinate to a conscious goal." Notably, action expresses an intentional aspect (what must be accomplished) and an operational aspect (how it can be accomplished), the

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latter of which is determined by the objective conditions for its accomplishment. According to Leontiev (1985), actions are related to conscious goals, while operations are related to the conditions of actions. Thus, operations constitute the means by which an action is accomplished.

As summarized by Oliveira and Panossian (2021, p. 4), activity is a mental process consisting of a complex structure. To satisfy a need, the individual's motives must coincide with the object to which they are directed. Thus, in activity, the individual performs actions and operations using different instruments based on the available material conditions to achieve a goal that meets this individual and/or collective need.

According to Leontiev (1978, 1985, 2001), human development occurs through the activities performed. "The subject in activity transforms objects and, at the same time, transforms themselves in doing so" (Almeida & Lopes, 2023, p. 3). As discussed in Borba, Gonçalves, and Marco (2023), when human beings appropriate what humanity has produced culturally, they internalize culture. When acting in a given context, they objectify themselves culturally in reality. This process of appropriation-objectification takes place in a dialectical movement.

Considering that, systematic education acts as a driving force in this process and that the social experience accumulated in cultural objects and phenomena is not immediately given to human beings (Leontiev, 1978), educational institutions become a privileged space for the appropriation of knowledge developed by humanity. Understanding the school/university as the privileged social place for the appropriation of historically produced knowledge “[...] necessarily assumes that the professor’s action must be intentionally organized for this purpose” (Moura et al., 2016, p. 102), to purposefully favor these processes with professors and students/undergraduates in action. In this sense,

> [...] meeting their needs, such as technological ones, and appropriating what has already been culturally produced by humans, is part of the process of becoming human. Thus, it is believed that schools also have a role to play in contributing to digital literacy and inclusion, using technology as a possible tool for the human development of their students (Borba; Gonçalves; Marco, 2023, p. 67).

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Society is changing every day due to the current growth and expansion of digital technologies. The internet has eliminated space-time boundaries (Lopes, 2010; Borba & Penteado, 2017; Gonçalves & Marco, 2020b), significantly changing the way education is delivered. Kenski (2012, p. 30) states that the "rapid technological transformations of today are imposing new rhythms and dimensions on the task of teaching and learning." For example, distance-learning courses now offer the opportunity for synchronous online sessions, where people can engage in real-time dialogue and idea sharing via audio and video.

However, despite this scenario of digital technological advancement and diffusion in contemporary society, a significant portion of the Brazilian population still lacks access to digital resources and devices. According to the most recent TIC Domicílios[6] report, more than 12.1 million Brazilian households (16%) did not have internet access in 2023, leaving 16% of Brazilians, or 29.7 million people, disconnected from the global computer network (CETIC.BR, 2024). This information shows that the digital reality, which many experience, does not reach the entire Brazilian population.

Bridging the gap between the connected and the unconnected requires the mobilization of schools, universities, communities, and government officials to raise awareness and encourage their participation in this movement.

As instruments of human activity, digital technologies can enable and aid human actions. To explore this concept further, it is important to first highlight the term "mediation.[7] "In one of his works, Vygotsky (2007) explains that in an individual's relationship with a given situation, there may be an intermediary that assists and/or facilitates the completion of an operation. "[...] the simple stimulus-response process is replaced by a complex, mediated

[6] TIC Domicílios is a survey conducted annually in Brazil since 2005 by the Regional Center for Studies on the Development of the Information Society (CETIC.BR), with the aim of mapping access to ICT (Information and Communication Technology) infrastructure in urban and rural households by individuals aged 10 and over. More information at: https://cetic.br/pesquisa/domicilios/. Accessed on: April 1, 2025.

[7] The concept of mediation is understood as a fundamental element in the constitution of human beings, since it allows them to appropriate the historical and social production of humanity by acting on reality in a way that is mediated by culturally produced instruments and signs (Moretti, Moura, 2011, p. 436).

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act" (p. 33). This intermediary link "gives the psychological operation qualitatively new and superior forms, allowing human beings, with the help of extrinsic stimuli, to control their behavior" via psychological processes rooted in culture (Vygotsky, 2007, p. 34).

The relationship between humans and the environment is fundamentally indirect and occurs through mediated actions—the emergence of an intervening element that aids human activity. These mediating elements are instruments and signs[8], which enable humans to transform and understand the world by appropriating the material and symbolic universe and their humanity. Mediation interconnects humans and the world, transforming them (Sousa, 2019, p. 26).

Another aspect worth mentioning is the term "technology." Due to the rise of technology in contemporary society, in the social imagination, the term technology "[...] seems to take on the meaning of 'something modern,' in the sense of new, current, advanced, as if technology had not existed for a long time, throughout history" (Lopes, 2010, p. 26). As reflected in Gonçalves (2018), technologies are human creations that emerge and change over time, according to the social, cultural, economic, and professional context in which they are inserted, to facilitate, assist, and improve human actions. For Guimarães and Ribeiro (2011), technologies arise from the need to do things, to transform, and to achieve goals.

Technologies have been present since the beginning of civilization, accompanying humanity and social groups throughout history. "From the bone used as a tool by early humanoids to our everyday environment, the human trajectory has been linked to the use of technologies" (Kenski, 2003, p. 91). The term "Information and Communication Technologies" (ICT) became popular in the 1990s and is used to refer to technologies that "involve the acquisition,

[8] According to Vigotski (2007), instruments are elements that guide processes external to humans, developed by individuals to modify, control, and expand the possibilities for transforming objects and nature. Signs, according to the same author, guide the psychological activity of the individual, that is, they are focused on internal processes, on the control of the individual themselves. Signs and instruments are creations of societies throughout human history and alter the social form and level of cultural development. It is worth noting that language stands out among signs, since, in addition to functioning as a system of communication between individuals of all human groups, it carries within itself generalized concepts, developed by human culture and socialized among human generations (Oliveira, 1997; Vigotski, 2007).

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storage, processing, and distribution of information by electronic and digital means, such as radio, television, telephone, and computers, among others" (Miskulin et al., 2006, p. 3). In this research, we use the term "digital technologies" to refer to computers, the internet, and other related devices and applications (Gonçalves, 2018).

We also agree with Pereira (2017) that the various uses of digital technologies in the last decade extend beyond communication and information through radio and television. They are used in various situations, such as learning, leisure, gaming, work, mobility, tourism, and gastronomy, among others, in any social space.

As humanity develops socially and scientifically, people expand their knowledge of natural resources in the quest to ensure better living conditions and satisfy their individual and social needs. Throughout history, this has led to an ongoing process of improving and creating increasingly sophisticated technologies (Kenski, 2012, p. 20) that change not only the way people use certain devices but also their behavior.

Machines and technologies are the result of human thought, social practice, and scientific and technological progress. "The more perfect the thought itself, the more complex the machine" (Kopnin, 1978, p. 139). The more complex human needs are the more complex the machines and technologies will be.

From this perspective, technologies constitute a cultural phenomenon (Sousa, 2019), carrying the practices and knowledge produced by humans to satisfy their needs and achieve their goals. Digital technologies are an element of this historical and cultural moment. Throughout the different eras of human history, as Kenski (2012, p. 21) points out, humans are culturally mediated by contemporary technologies. These technologies transform their ways of thinking, feeling, and acting. They also change the ways humans communicate and acquire knowledge."

We understand that when human beings act on external nature, they modify it by imprinting their intentions on it. In this process, they also change themselves. By integrating technology into this process and considering it a cultural element produced by humans, people will have tools with which to interact with the world, transforming it and, at the same time, transforming

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themselves. Sousa (2019, p. 32) identifies technology as the result of the inseparability of instrument and sign. "As an instrument, technology modifies and controls external nature. As a sign, it affects psychological nature and objectifies the experiences of previous generations, making them susceptible to appropriation by other generations."

Digital machines and technologies can constitute elements of mediation through which humans act and interact with the world, their environment, and/or other people to achieve individual and/or collective goals. At the same time, digital machines and technologies can assist humans in thinking and reorganizing their thoughts. They can support humans in making abstractions and reflections and expand their understanding according to their needs and goals. In this process, humans and their environment are both transformed, and the need to improve the machine may arise. As mediating elements between humans and their environment, digital technologies become auxiliary tools for human activity.

Therefore, we understand that digital technologies can be considered mediation tools. In other words, they are tools that facilitate human interaction with the world to meet and satisfy goals and needs. These external instruments support and complement natural human abilities, building a more efficient system that can lead to higher achievements (Kaptelinin, 1996, p. 50, our translation). They influence mental processes through internalization. By using machines and technologies to transform nature, humans also transform themselves.

According to Kopnin (1978), there is a temporal distance between the stone axe used by primitive humans and a sophisticated computer. However, there is also an affinity between them. "Both are instruments of human labor. In either case, humans use the physical and mechanical properties of objects as instruments of their activity" (Kopnin, 1978, p. 137). The primitive axe reinforces the human hand, and the computer reinforces the human brain in intellectual activity by offering elements that help one think and reflect on a given object. Both could function as instruments that mediate human activity.

In this sense, we agree with Nardi (1996), who states that all human experience is conditioned by the instruments and sign systems we use to connect

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to the world. However, they are not merely filters or channels through which experience is transported (Nardi, 1996, p. 10, our translation). Mediation through instruments and signs is a fundamental process for developing higher psychological functions.

In the teaching and learning process, we understand that computers, the Internet, and other associated devices and resources can serve as tools that mediate how students explore content and objects of study. At the same time, students broaden their understanding of the object being studied through spoken and/or written language, which acts as a symbolic mediation system. However, "the relationships established through the use of tools and signs can strengthen or distance the subject from the object" (Witt, 2019, p. 74), revealing the importance of careful organization of teaching and selection of digital technologies and resources according to teaching objectives, as well as careful consideration of language and presentation of teaching proposals.

Mediation as merely a "channel," or simply making various materials and resources available, may not produce effects in terms of knowledge acquisition. Sanchez (2018, p. 67) states, "[...] mediation would be possible if the interaction between the subject, the object, the symbols, and the medium were established. For the development of mediation, interaction between professor-student, student-student, and available means is crucial." Exploring spaces and digital tools and resources in the teaching and learning process in relation to others and the object being studied through written, spoken, and symbolic language (e.g., emotions and GIFs) can facilitate the mediation of studies.

In Borba (2023), we argue that digital technology can be an ally in the process of acquiring knowledge, provided that teaching is intentionally organized and that teaching situations are proposed and conducted in the classroom in a way that favors the acquisition of humanly elaborated mathematical knowledge.

With these tools, students can explore the object of knowledge and, based on their external activity, appropriate, transform, and reorganize it in their internal activity. They do so using signs with which human beings "begin to control or dominate their internal nature or behavior" (Cedro & Nascimento, 2017, p. 36).

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Considering the relationship, individuals establish with digital technologies, Rubtsov (2014) notes that the primary component in the human-machine relationship is human activity, while the machine component serves as a means for its effective realization (Rubtsov, 2014, p. 11, our translation). In the teaching and learning process, this assertion takes on greater significance: what stands out in the relationships that subjects establish using digital technologies is human activity, including interactions, dialogue, and multidirectional communication between those involved and the environment in relation to a concept. Digital technologies can thus act as instruments that facilitate these human relationships.

In an educational context, these relationships can be leveraged in the teaching and learning process. Based on their instructional needs, professors develop specific actions[9] to direct their activities toward achieving their goal of organizing instruction to promote student learning (Moretti, 2007; Cedro & Nascimento, 2017). To this end, professors will choose the tools that can be used based on their working conditions (software, texts, videos, printed material, etc.) and define the necessary operations to use them, i.e., how to carry out and objectify the action.

According to Rubtsov (2014), when a machine or digital technology is involved in an action,

> [...] humans set goals and delegate the operational implementation to the machine. [...] In the human-machine relationship, which corresponds to a specific type of activity, humans follow specific needs and motives to set tasks and perform the operational part of the action aimed at solving that task with the help of the machine. In other words, when the human-machine relationship works, the objective of the activity is defined by humans, while executing the objective, that is, obtaining some real product is performed by the machine (Rubtsov, 2014, p. 11-12, translation and emphasis added).

[9] It is worth remembering that human actions are related to the objectives of a given activity and that operations are related to the conditions for carrying out those actions. In a given activity, "[...] the objectives of a certain action remain the same, but the conditions under which the action is performed will vary; therefore, only the operational aspect of the action will vary" (Leontiev, 1985, p. 87, our translation). Operations are also related to the instruments that will be used in the operationalization of a given action. The instrument "[...] is a material object in which the methods and operations are precisely crystallized [...]" (Leontiev, 1985, p. 87, our translation and emphasis).

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Digital machines/technologies can therefore be understood as tools that help humans achieve their goals and satisfy their needs. The elaboration and definition of goals are always carried out intentionally by the subject, and digital machines/technologies help in the operationalization of actions, either because it is impossible for subjects to perform some operational part of their actions or because they offer elements with greater precision and/or speed. This fact allows humans to critically read, interpret, compare, hypothesize, reflect, and make inferences to achieve their desired goals.

Corroborating these considerations, Kaptelinin (1996) states that

> People generally use computers not because they want to interact with them, but because they want to achieve goals beyond the scope of a "dialogue" with the computer. According to Bødker (1991), users act "through the interface." Thus, human-computer interaction should not be confined to a "computer-user" system, but rather, it should encompass the user's meaningful context, including their goals, the environment, available tools, and interactions with others (Kaptelinin, 1996, p. 49, our translation).

Humans always interact with machines and digital technologies based on objectives and with the purpose of achieving goals they have set for themselves that go beyond mere interaction with such technologies. Kaptelinin (1996) points out that people use computational tools to achieve objectives that exist beyond the human-computer interaction situation. Moreover, these tools often serve as intermediate steps to achieve higher-level objectives that may be more remotely related to simply using the computer. Thus, human interactions with machines and digital technologies are based on established goals and are "included in logically structured sequences of interaction with other objects and people" (Kaptelinin, 1996, p. 48, our translation). This does not mean that such sequences cannot change, but rather that a logical organization of the intended actions is necessary first.

Therefore, contrary to the idea that digital technology use is associated with an absence of professors, we understand that distance learning reinforces the need for professors to be involved and have contact with students.

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Professors must also be intentional in organizing, monitoring, evaluating, and conducting the subjects in a course.

As Rubtsov (2014) points out, computers and digital technologies are not professors themselves. They require intentionality from professors in organizing proposals and interactions in teaching and learning. After all, as Kopnin (1978, p. 135) argues; "only man, or rather, humanity, can think." According to this author, what machines do is not thinking because "the machine cannot create an ideal image of reality through abstractions; this is a function exclusive to the human brain" (Kopnin, 1978, p. 135). Without this function, thought does not exist, not even in its most basic form (Kopnin, 1978). Machines can only help humans think by assisting in their mental work.

Similarly, Rubtsov (2014) argues that computers enhance and assist a person's intellectual abilities, affecting their memory, emotions, and motives. They also modify a person's way of thinking and productive activity. Computers enable humans to perform actions and interactions, plan, reflect, and process results. Thus, "any action or impact of the user can be indexed, represented as a scheme or model, saved, returned, and fixed for analysis, evaluation, and control" (Rubtsov, 2014, p. 17, our translation). Therefore, the machine needs human thought to become an agent of transformation in the educational context (Ribeiro, 2005, p. 94).

According to Moura et al. (2016), teaching is a social process mediated by instruments and signs that is structured based on a need. This requires intentional organization.

3 Teaching Guidance Activity as a theoretical and methodological basis for the organization of teaching and digital technologies

The Study and Research Group on Pedagogical Activity (Gepape[10]) and its members, particularly Moura (1996, 2000, 2001) and Moura et al. (2016), which

[10] Gepape, created in 2002 and based at the Faculty of Education of the Universidade de São Paulo, is a study and research group coordinated by Prof. Dr. Manoel Oriosvaldo de Moura, which conducts studies and research on pedagogical activity in accordance with the theoretical and methodological principles of the historical-cultural approach. More information at: https://sites.google.com/usp.br/gepape-usp. Accessed on: March 6, 2025.

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focuses on school education and is based on Leontiev's (1978, 1985, 2001) psychological concept of activity, proposed the concept of guiding teaching activity.

In the context of teaching guidance activity, the teacher can organize a situation that triggers learning by taking the teaching objectives, which are revealed in the content to be appropriated by students (Moura et al., 2016). This constitutes one of the professor's actions in teaching activity, with the aim of achieving teaching objectives and materializing their activity.

Teaching Guidance Activity is understood as the professor intentionally performing actions that respond to their need to teach and their reason for organizing teaching to promote students' learning of historically developed content (Moretti, 2007; Moura et al., 2016).

> [...] It is structured in a way that allows subjects to interact with each other and with the content, negotiate meanings, and solve a problem collectively (MOURA, 1996). This activity serves as a guide because it defines the essential elements of educational action and respects the dynamics of interactions that may not produce the expected results. The teacher establishes objectives, defines actions, and selects auxiliary teaching tools. However, the teacher does not control the entire process because they accept that subjects in interaction share meanings that change in relation to the object of knowledge discussed (Moura, 2001, p. 155, emphasis added).

The Teaching Guidance Activity is a general method of organizing teaching. Its main content is the knowledge to be acquired and put into practice in the learning space. Its objective is to transform the individual in the process of acquiring this knowledge. When organizing the teaching process, professors also qualify their knowledge. This is why the AOE becomes the unit of training for professors and students alike" (Cedro, Moraes, & Rosa, 2010, p. 438).

Teaching organization based on the Guiding Teaching Activity presupposes an essential aspect: a problem within a situation that triggers learning (Moura et al., 2016; Moura, Sforni, & Lopes, 2017). In these situations, the professor presents problems that emphasize the logical-historical movement of the concept under study for the students to reflect upon as a group. The purpose is to enable mobilizations, especially psychological

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ones, through actions and operations directed toward an end (Moura et al., 2016; Sanchez, 2018). (Sanchez, 2018).

By defining their teaching objectives and choosing the concept to be implemented in the learning space, professors can organize a learning-triggering situation.

> [...] Bring the essence of the need that led humanity to create the concept to be taught and the core of the concept to be understood. The solution must address the need that led to the concept's creation and how people organized themselves to satisfy that need. The situation that triggers learning must also have the potential to motivate learning and trigger the creative tension of learning processes in subjects who organize themselves to grasp a relevant concept. This is the essence of the situation that triggers learning (Moura, Sforni, & Lopes, 2017, p. 91, emphasis added).

In this sense, concepts have historical and logical aspects. The historical aspect reflects humanity's needs for the production, change, and development of an object over time, revealing core elements necessary for understanding it (Kopnin, 1978, p. 183). The logical aspect is the systematization carried out by human thought in theoretical form based on the object's historical process. It is a reflection of history through abstractions, a synthesis or "summarized" form of the object's social and historical development process (Kopnin, 1978, p. 183).

Understanding the origin of concepts allows us to explain the need that led humanity to construct the concept in question, how human problems and needs arose in a given activity, and how humans developed solutions or syntheses in their logical-historical movement (Moura et al., 2010, p. 104).

According to this logic, studying the logical-historical development of mathematical knowledge can provide insight into how various civilizations contributed to the formation of the mathematical concepts addressed by the professor and the conceptual links that underpin them.

> Taking the historical and logical movement of concepts as a point of analysis, we understand that this allows us to identify essential elements inherent to a particular form of knowledge, thus constituting a “teaching object.” This “teaching object,” in turn, can and should be present in various “teaching contents” or “teaching topics” in the school curriculum (Panossian; Moretti; Souza, 2017, p. 139).

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We understand that knowledge of an object is possible through the unity of the logical and the historical (Moretti & Moura, 2011). This understanding encompasses the human needs that led to the development and systematization of concepts[11], as well as their conceptual links, which goes beyond external characteristics.

To this end, Moretti and Moura (2011) assert that it is essential for professors to understand the history of the concept and to incorporate it into their teaching. This involves seeking information about the history[12] of the concept creating and recreating problems that allow students to recognize the needs humanity has faced throughout history and the ways in which these needs have been addressed. These elements provide professors with support for elaborating and developing the situation and problem that will trigger learning.

The materialization of situations that could potentially trigger learning can occur based on different references, among which the following stand out: games; emerging everyday situations, and virtual history of the concept[13]. Depending on how they are organized and proposed—and in each case the problem is presented in a certain way and requires specific actions—these references have the potential to set the concept in motion in the learning space and mobilize individuals to share actions to solve a situation in the process of resolving a problem.

In this sense, when we use technology, digital or otherwise, as a

[11] Conceptual nexus is the link between ways of thinking about a concept (Sousa, 2018), that is, the elements that guide, structure, and underpin a concept. According to Sousa (2018, p. 50), "[...] external nexuses are limited to the perceptible elements of the concept, while internal nexuses comprise the logical-historical movement of the concept."

[12] An important aspect of situations that trigger learning is that we are not advocating the idea that it is necessary to "tell"/narrate the history of concepts to students. Furthermore, by understanding the origin of concepts, professors can develop teaching situations steeped in history in which the student involved can: "[...] understand the human need to produce this knowledge [...]" and develop a "[...] mental activity mediated by the concept" (Moura; Sforni; Lopes, 2017, p. 94).

[13] We have: the *game* with an educational purpose that preserves the nature of the problem; the problematization of *situations arising in everyday life* that enables students to experience the need to solve problems that are significant to them; and the *virtual history of the concept*, which confronts students with a problem similar to one that may have been experienced by humans at some point in history, i.e., it is not necessarily factual history, but rather history that is imbued in the concept (Moretti, 2007).

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mediation tool in the teaching and learning process, it can have the desired effect of mobilizing the appropriation of knowledge if it is intentionally organized in a way that promotes the development of theoretical thinking[14] using the tool's potential.

The elaboration and definition of teaching objectives help in the intentional organization of actions, directing their actions towards teaching a particular concept. Thus, by being clear about the starting point and the objective to be achieved, the professor can consciously resort to the technologies that best meet their human need to teach a particular concept and that are agreeing with the purpose of their pedagogical action. Given the concept that one wishes to develop in the classroom, one plans to use the best instrument for the operationalization of actions, considering the objective and material conditions available to the teacher for the objectification of their teaching activity.

"Teaching activity does not exist a priori to the material conditions in which it will be developed" (Moura, Sforni, & Lopes, 2017, p. 71). The professor's actions will consider the objective conditions for developing their activity because these conditions allow the choice of methodological resources (Moura et al., 2016, p. 118). In this sense,

> It is not a question of planning teaching based on ideal representations of the educational phenomenon in an impersonal, timeless way, independent of the real conditions in which it will be carried out, as traditional didactic prescriptions sometimes lead us to do. Nor is it a question of allowing the material conditions present in everyday school life to be the only drivers of teaching. The dialectical interaction between the ideal and the material in the teaching process puts the professor in a constant state of learning and, therefore, of development (Moura; Sforni; Lopes, 2017, p.71-72).

[14] Theoretical thinking can be understood as a form of thinking that allows the subject to grasp the essence of phenomena, their internal relationships, and general principles of organization. Unlike empirical thinking, which is based on the generalization of superficial characteristics and the repetition of procedures, theoretical thinking seeks to reveal the underlying laws that structure the concepts and phenomena studied (Rosa; Moraes; Cedro, 2010). In the context of mathematics education, this means that the learning of a concept must be organized in such a way that students understand its genesis and structural relationships, promoting the formation of thinking that goes beyond the reproduction of definitions and algorithms, allowing for the conscious and meaningful appropriation of mathematical knowledge.

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Thus, the material conditions of the environment in which the action is carried out determine the instruments used and guide the operations developed (Leontiev, 1985). Considering the procedures to achieve the objectives, the object of study, and the intentionality involved, understanding the peculiarities, instruments, and approaches and procedures.

In this context, regarding digital technologies in the classroom as instruments of mediation, we do not view them as "pedagogical saviors" (Borba & Penteado, 2017) or a fad (Borba, 2023). In other words, digital technology itself is "dead" and static. It only makes sense when used as a tool to implement strategies and dynamics that promote dialogue, interaction, sharing, and socialization with a specific purpose. In this way, it can contribute to knowledge acquisition. Therefore, it is important to note that simply using digital technology does not guarantee learning. We understand digital technology as another tool that can enable mental work in mathematics teaching and learning, depending on how it is used and integrated into the classroom. "We expect a methodological use that can contribute to human development in the teaching and learning process" (Borba, Gonçalves, & Marco, 2023, p. 68).

In this sense, the learning trigger situation is a teaching and learning proposal that can stimulate and improve mental work for both professors organizing it and students solving it. Combining it with digital technologies as mediation tools in the teaching and learning process creates challenging spaces and situations for these subjects. Depending on how they are used, digital technologies stimulate explorations that are difficult to carry out and/or visualize with only pencil and paper or charts (Borba, 2023; Gonçalves, 2023; Marco, 2009). These explorations allow students to formulate conjectures, test hypotheses, and reach their own conclusions with their peers, thereby developing their imagination and creativity. Thus, combining digital technologies with learning trigger situations enhances educational experiences.

Borba (2023) viewed digital technologies combined with learning trigger situations (LTS) as distinct instruments.

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> *Mobilization tool*, acting in the interest/motivation of students for the class and for mathematics; social tool, not only because it is indisputable that digital technologies are part of people's daily lives in various areas of society, but also because digital inclusion can go beyond access to these resources; and an effective tool in the activity, for the development of SDA by students, which can assist in construction and visualization by virtually representing the real object studied (Borba, 2023, p. 171).

Therefore, we understand that digital technologies can assist in the organization of teaching within the scope of Teaching Guidance Activities when integrated with pedagogical intent. These technologies serve as instruments of mediation, enhance, and aid pedagogical activity. They offer subsidies that mobilize internal processes that can drive human development and encourage abstract thinking.

4 Some considerations

This text discusses the organization of mathematics teaching from the perspective of Guided Teaching Activity, considering digital technologies as tools for mediation. In light of what has been discussed so far, we will now make some observations.

In this work, we consider digital technologies to be mediation tools and begin with an understanding of the concepts of tools and signs, primarily based on Vigotski's (2007) contributions. We understand that when subjects use tools to satisfy their motives and needs, they can act on the world, which may also transform their ways of thinking and acting.

Considering digital technologies in this context, we understand that they have a dual function: as instruments that can enhance subjects' actions in teaching and learning contexts, and as signs that can mobilize mental actions and ways of thinking to assist students' thinking when used.

This understanding is reinforced by Rubtsov's (2014) contributions, which problematize the relationship between technology and activity, as well as Leontiev's (1978, 1985, 2001) elaborations, which highlight that different

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instruments imply different actions depending on the objective conditions in which the activity takes place.

In this sense, we emphasize that the Guiding Teaching Activity is an alternative approach to organizing mathematics education. This approach enables professors to create situations that stimulate learning by studying the logical-historical development of concepts. This approach motivates students to understand historically developed mathematical knowledge.

Finally, we reaffirm that mathematics teaching organized from the perspective of the Guiding Teaching Activity finds possibilities for mediation in the teaching and learning process in digital technologies when they are understood and used as instruments for developing actions that aim to facilitate the appropriation of historically accumulated knowledge. This understanding guided the two theses from which this article is an excerpt and can serve as a guide for future research seeking to deepen the relationship between Guiding Teaching Activity and digital technologies in the context of mathematics education.

Las tecnologías digitales como instrumentos de mediación en la Actividad de Orientación Docente

RESUMEN
Este artículo tiene como objetivo realizar consideraciones sobre la organización de la enseñanza de las Matemáticas desde la perspectiva de la Actividad de Orientación Docente, considerando las tecnologías digitales como instrumentos de mediación. Trata-se de un ensayo teórico, extracto de dos tesis doctorales que utilizaron la Actividad de Orientación Docente como base teórico-metodológica para la organización de la enseñanza de las Matemáticas integrada con el uso de tecnologías digitales. Anclada en la Teoría Histórico-Cultural y en la Teoría de la Actividad de Leóntiev, la Actividad Guía de Enseñanza propone una organización intencional, en la que el docente desarrolla situaciones desencadenantes de aprendizaje a partir de problemas que revelan el movimiento histórico y lógico de los conceptos, movilizando a los estudiantes a apropiarse de conocimientos matemáticos históricamente elaborados. En este sentido, las tecnologías digitales pueden entenderse como instrumentos de mediación, capaces de potenciar la actividad pedagógica. Como resultado, el análisis indica que no se trata solo de utilizar estos recursos, sino de la forma intencional en que son integrados y organizados por el docente, posibilitando la interacción, la cooperación y el desarrollo del pensamiento teórico. Finalmente, el artículo refuerza que en el ámbito de la Actividad de Orientación Docente, el uso de las tecnologías digitales constituye una posibilidad de instrumento de mediación en el proceso de enseñanza y aprendizaje de las Matemáticas, favoreciendo la apropiación del conocimiento y potenciando el desarrollo humano.

Palabras clave: Tecnologías digitales. Actividad de Orientación Docente. Instrumentos de mediación.

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