

A theoretical and methodological possibility for research on teaching: organization through the logical and historical category¹

Uma possibilidade teórica e metodológica para pesquisas sobre
ensino: organização por meio da categoria lógico e histórico

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ABSTRACT

With reference to academic research on active methodologies in the teaching of mathematics in Brazilian basic education, a discussion is presented on the logical and historical category and its relationship with the unit of analysis of the research, the pedagogical activity, based on the activity theory. The approach to the object of research, the theoretical, methodological, and analytical deepening and the methodological actions are explained. We highlight the definition of analysis guidelines, as essential relations of pedagogical activity, and their role as logical organizers of the research. The way in which the study was developed, produced in the research process, is taken as one of its results and proposed as a contribution to the discussion of possibilities for research that aims to be guided by the logical and historical category, specifically in the teaching area.

Keywords: Logical and Historical; Unit of Analysis; Pedagogical Activity; Research

RESUMO

Com referência em uma pesquisa acadêmica sobre metodologias ativas no ensino da Matemática na Educação Básica brasileira, é apresentada uma discussão sobre a categoria lógico e histórico e sua relação com a unidade de análise da pesquisa, a Atividade Pedagógica com fundamentos na Teoria da Atividade. São explicitados e explicados os movimentos de aproximação ao objeto de pesquisa e de aprofundamento teórico, metodológico e analítico, e as suas ações metodológicas. Destacam-se a definição de orientadores de análise, como relações essenciais da Atividade Pedagógica, e sua atuação como organizadores lógicos da pesquisa. O modo de desenvolvimento do estudo empreendido, produzido no processo da pesquisa, é tomado como um de seus resultados e proposto como uma contribuição à discussão de possibilidades para a pesquisa que pretende ser orientada pela categoria lógico e histórico, especificamente, na área do Ensino.

Palavras-chave: Lógico e Histórico; Unidade de Análise; Atividade Pedagógica;

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1 Introduction

This text is based on the mode of theoretical and methodological organization of an academic study that analyzes the active methodologies in mathematics teaching in Brazilian primary and secondary education, producing an understanding of this object through the logical and historical category of historical-dialectic materialism and pedagogical activity, supported by activity theory. We aim to explain how the logical and historical categories were considered in the research organization process and the relationship established between them and the unit of analysis –the pedagogical activity with the indicated support.

This organization is taken as a result of the research since its constitution is an objectification of the moments of elaboration concerning the object or phenomenon proposed by Kosik (2002) for the investigation process. Thus, movements to approach the object and theoretical, methodological, and analytical deepening on the methodological actions that constituted them are indicated, including the explicitation of the logical and historical category and the concept of activity as a possibility for developing research on teaching.

2 Development

2.1 The object of the research and the need for its study

It starts from the premise presented by Netto (2011) that once the object of investigation is determined, the question of the method arises. Thus, the research that led to the writing of this text considered the possibility of promoting a more elaborate understanding of a special aspect of teaching methodologies within the scope of mathematics education, taken as an area of research and social practice (FIORENTINI; LORENZATO, 2006): the active methodologies, detailed in Brazilian basic education, more specifically, in the mathematics teaching. The need to develop a study that would produce an understanding of these methodologies is precisely due to their insertion in the pedagogical practice of mathematics teaching and the

proposition of research that puts forward practices and the study of practices with such methodologies in mathematics teaching in basic education in Brazil (GOSMATTI; PANOSSIAN, 2021).

A first approach to this object showed that under the name of active methodologies, different practices with a wide dispersion of foundations are brought together, as presented by Castellar (2016) and Mattar (2017). The same dispersion was found in an analytical and systematic study presented by Gosmatti and Panossian (2021) when the non-coincidence between the meaning of the term active –used to qualify a process, technique, or procedure as an active methodology– and the assertion of students’ active appropriation of knowledge in pedagogical activity based on activity theory was made explicit.

The dispersion of practices and fundamentals included in active methodologies within the scope of mathematics teaching makes successive approaches to the object difficult to understand (NETTO, 2011). In this sense, establishing a way to develop the study is a contribution to research in education and mathematics education.

2.2 The logical and historical category as an instrument of thought

According to Kosik (2002), the moments of elaboration of the object or phenomenon are the detailed appropriation of the subject, the analysis of the forms of development of the material, and the investigation of its internal coherence. This general statement requires an organization of methodological actions that configure the movement of appropriation, analysis, and investigation of the internal coherence of the specific object, such that there is an orientation of thought that provides knowledge through abstraction and generalization, which is characterized by the discovery of laws that govern the objective world and the “[...] internal, essential nexus and relationships that exist between things” (ROSENTAL; STRAKS, 1960, p. 2, our translation). This process of knowledge starts from active perception, based on practical activity, which involves observing reality for its deep understanding beyond the superficial or external aspects and nexus (relations) of the phenomenon or

object (ROSENTAL; STRALS, 1960), which, in Kosik's terms (2002), is the process of overcoming the pseudo-concreteness of the object's most spontaneous expression.

We must consider that elaborated scientific knowledge, through abstraction and generalization, is constituted by categories: condensations of humanity's theoretical and practical activities that manifest the essential traits and aspects of the phenomenon or object (ROSENTAL; STRAKS, 1960). Therefore, they are not just the fruits of pure thought but instruments of thought constituted in the interdependence between theory and practice.

Among the various categories typical of historical-dialectical materialism indicated by Rosental and Straks (1960) as philosophical categories –theory and practice, content and form, phenomenon and essence, necessity and chance, among others– the methodological orientation of the research was the logical and historical category, with implications for the structuring and explanation of its movements.

With this option, the approach to the research object, active methodologies, was done through its logical and historical development within the scope of teaching, internal and external conceptual nexus, as explained by Sousa and Moura (2019), for which, based on Kopnin and Davydov, the totality of the object is in the dialectical pairs, in the internal and external nexus of the concept and in the confluence between the logical and the historical, in which the singular is connected to the universal (totality), or, in Rosental and Straks' (1960) terms, the essential and non-essential relationships of the investigated object.

There is great potential in this category to explain the most general and universal structural conditions of the object or phenomenon studied, as well as its singularities, with the mediation of its particular historical transformations since “The logical reflects not only the history of the object itself but also the history of its knowledge” (KOPNIN, 1978, p. 186). It is worth noting that, according to Kopnin (1978), the logical aspect is how the historical process is reproduced in thought in an abstract and theoretical way, configuring itself as a theoretical

reflection of the historical. This, in turn, is the process of changing the object and is therefore primary to the logical, presenting itself as content or object of thought (ROSENTAL; STRAKS, 1960).

Rosental and Straks (1960, p. 325, our translation) state that “[...] the historical is the objective reality, which exists independently of consciousness, of the knowing subject [...]”, reflecting the historical and changeable character of reality. The logical, as a form of knowledge, is “[...] the reflection of reality, the intellectual copy or image of it [... being] a certain form of movement of thought towards the object” (ROSENTAL; STRAKS, 1960, p. 325, our translation). In other words, this category allows research to deal with the object or phenomenon, its knowledge, and the process of its knowledge by man, providing understanding.

However, we must be careful not to make history logical, approaching the facts not as they occurred but as they should have occurred, or just uncritically narrating the events. We must consider the conditions of emergence, production, and reproduction of the object or phenomenon (KOSIK, 2002). The historical and the logical constitute a unity that reflects the movement of reality, overcoming “logicization” and the superficial and empirical description of reality (ROSENTAL; STRAKS, 1960), so that taking it as a research guide aims to address “ [...] the problem of accurately reflecting reality, that is, that of the agreement of the form (of the logical) with the content (with life, with what is eternally subject to change, with life in eternal development, with practice)” (ROSENTAL; STRAKS, 1960, p. 328, our translation).

If research is a process of knowledge, of producing an understanding about an object, like active methodologies, it is necessary to explain the relationships between the logical and the historical since “knowledge based on overcoming appearance towards the essence requires the discovery of the tensions inherent in the interlinkage and interdependence between form and content” (MARTINS, 2006, p. 10). This methodological path must make it possible to understand how the phenomenon or object investigated appears and develops. However, according to Rosental and Straks (1960), this is not the development of a historical investigation, with many casual elements and

secondary facts.

Without disregarding the unity between the historical and the logical, the elaborated organization does not coincide with the description of facts but with the establishment of a thought process to understand reality, capturing what governs the development of the phenomenon (ROSENTAL; STRAKS, 1960) through concepts, that is, in a generalized way.

Rosental and Straks (1960, p. 350, our translation) state that “there is no pure logical method, just as there is no pure historical method, free from elements of the logical method”, i.e., the facts of the process of historical development of the object or phenomenon are intrinsically linked to the internal nexus or relationships of its logical constitutional movement. In this direction, we consider Ilienkov’s statement that “[...] the discovery of the authentic ‘historical’ order of the development of some forms of the object’s existence from others of its forms can only be achieved through the ‘logical’ analysis of the object at the highest level of its maturity” (1960, p. 26, our translation).

For Ilienkov (1960), although it is the object itself that develops and then knowledge about it can be developed, it is necessary to understand, firstly, the connection between the theory and the history of the object and then the connection between the theory and the history of knowledge human on such objects. It follows that to understand the present historically, “[...] it is not necessary to delve into the depths of centuries and study in detail the empirical history that precedes the present” (ILIENKOV, 1960, p. 11, our translation). The logical study itself provides the historical understanding of facts, even without the study of history since, in the results of the historical process, in some way or under some modified aspect, in Ilienkov’s terms (1960), history is found and preserved of its origin, as long as the logical is a reflection of the historical aspect.

Kopnin (1978) also expresses the unity between the logical and the historical elements in studying the phenomenon or object. However, he states that

[...] The reproduction of the essence of this or that phenomenon in

thought constitutes at the same time the discovery of its history so that the theory of any object cannot but also be its history. Therefore, the primary definitions of the object, the logic of the concepts that express it, constitute the starting point for the study of the process of formation and development of a given object (KOPNIN, 1978, p. 185, emphasis added).

Thus, the research process, which is a reference for writing this article, was organized by movements of studying the object of active methodologies and their expression in mathematics teaching: approximation, theoretical or methodological deepening, or analysis. They aim to explain the logic of concepts, their essential relationships and connections between historical processes – previous elements, their genesis, their forms of development, and their current conformation– and the logic of such methodologies, using bibliographic sources that register knowledge about the researched object. However, what will be the reference for the analysis of the object? The social practice to which teaching methodologies refer is the didactic work as a human activity, and the analysis must take this activity as a reference.

2.3 The unit of analysis and its relationship with the logical and historical study of active methodologies

To meet the demand of establishing a critical study of the researched object through the logical and historical category, there is a need to establish its unit of analysis, a methodological proposition supported by Vigotski (2000, p. 8), which takes “unit as a product of analysis that, unlike the elements, has all the properties that are inherent to the whole and, concomitantly, are living and indecomposable parts of this unit,” using the unit of analysis “word meaning” to understand the development of higher psychic functions in his investigations into the historical constitution of the relationship between thought and language.

In a very similar way, considering its specificities, Leontiev (2021, p. 103), investigating the development of the psyche, concludes that “activity is a molar, non-additive unit of the life of the corporeal and material subject.” Specifically, Leontiev (2021, p. 104) analyzes the activity to understand the development of the human psyche, considering that “whatever the conditions and forms under

which human activity occurs, whatever the structure assumes, it cannot be examined separately from social relations, from life in society,” precisely because all the activity of a singular subject, therefore, a singular activity, is inserted in a system of relations in society.

These two examples of determining the unit of analysis of the researched object reflect the relationship between the singular, the particular and the universal in terms of what is researched, in which singularity is constructed in universality, which is realized in singularity, such that in these processes, there is the mediation of particularity, as explained by Oliveira (2001, p. 1) when discussing the dialectical relationship between the universal, the particular, and the singular as philosophical support for the psychologist’s work. This ontological relationship has implications for the movement towards the object of active methodologies, as this refers to teaching and education processes, with room for the specification of their singular and universal, as well as the particular that mediates them for the presentation of the research unit of analysis.

Oliveira (2001, p. 3-4) addresses the “individual-genericity” relationship, that is, the relationship between the singular individual and human objectifications they must appropriate

[...] to master the system of references of the context in which they live and, thus, objectify themselves as active subjects and participants in its transformations. However, for this to be understood in its multiple relationships, we must consider that this entire process between the individual (the singular) and humans (the universal) takes place in the individual’s relationship with society (the particular).

And here, school education has a place in the realization of relations between human objectifications and their appropriation by the singular individual, as a response to a social need, originating in production relations; that is, education is a social form of human activity, which, as highlighted by Oliveira (2001, p. 5), based on Marx, has the following structural relationships, like any other human activity: “[...] 1) the individual’s relationship with production, that is, with the execution of activity; 2) the relationship between the

individual and the product of the activity performed; 3) the relationship between the individual and humans”, the latter of which includes the concrete relationship between a human being with other human beings, as this relationship operates in life in society (Oliveira, 2001).

As the author indicates, the singular-universal relationship occurs between the individuals and humans, although some analysis mistakenly consider it a relationship between the individual and the society, as this is more immediate. This is the understanding we have of Duarte’s (2013, p. 104) statement that: “since the formation of the individual is a part of the historical process of objectifying human beings, the fundamental relationship is not between the singular organism and the species but between the social singularity of the individual and humans”.

We must note that Oliveira (2001) draws attention to how the relationship between the particular (society) and the singular (the individual) is taken in place of the individual-genericity relationship, such that humans lose their universal function and cease to be “[...] the element in which the maximum goal of the individual’s development is found, but rather the narrow limits of society. Within these limits, the adaptation of the individual to the mold of existing society is the fundamental principle” (OLIVEIRA, 2001, p. 18). The mediation of the individual-society relationship is also lost.

Regarding the approach to active methodologies, the universal-particular-singular relationship intervenes in the definition of the unit of analysis, that which effectively conducts the analysis of the object, considering: its singular expressions through examples of teaching situations; the particular mediation of statements about what such methodologies are, and their defining characteristics, which provide forms of their clusters under the designation of active methodologies; education as a social practice, as a universal element. From the perspective of Leontiev’s (1988, 2004, 2021) activity theory, the unit that contains the universality of education is the pedagogical activity, as proposed and explained by Asbahr (2005), Bernardes (2009), Moura, Sforini, and Lopes (2017) and Moura (2017b), for example.

As Leontiev (1988, p. 68) explains, an activity is constituted as “[...] processes psychologically characterized by where the process as a whole is directed towards (its object), always coinciding with the objective that stimulates the subject to perform this activity, that is, the motive”. According to this author, these processes, when carrying out a human being’s relationships with the world, do so by satisfying a corresponding need (LEONTIEV, 1988), always having a collective character (DUARTE, 2004). According to Moura (2017a), based on Leontiev, the activity involves the combination of interdependent actions agreed upon between the subjects to satisfy a group need, which, to be a collective, must have a common objective. This characteristic is due to the objective relationships between the individual and the rest of the community of which they are part, relationships that are, therefore, social and that give meaning to the individual action, connecting it to the reason for the activity (DUARTE, 2004). The collective activity itself results in a product in which the activity process is contained and creates new human needs, including the appropriation of what was objectified in the product of human activity.

Not every process is an activity, as it may not have an objective directly linked to the reason, although it is developed to satisfy the need for the activity. In this case, there is an action whose motive lies in the activity of which it is part (LEONTIEV, 1988). The objective of an action, in isolation, does not encourage the subject to act, making it necessary for the subject to establish the relationship between the objective of the action and the reason for the activity of which the action is part. The different ways of carrying out the action are operations, which are technifications (LEONTIEV, 1988). If the need, the object, and the reason guide the activity, its achievement occurs through actions, with their objectives and operations. These are the structuring elements of the activity, also appearing in the pedagogical activity.

Being “[...] the pedagogical activity one that synthesizes teaching and learning actions as a unit” (BERNARDES, 2009, p. 237), both teachers and students are subjects in this activity. The objective of the teacher’s activity, the

final result that they envision, is to produce the psychic development of students through the students' appropriation of the elaborated knowledge. In pedagogical activity, the student is the subject of learning, as they actively and intentionally participate in the appropriation of knowledge through which they develop. To this end, students must also engage in a learning activity, that is, have the need to appropriate the teaching object (scientific, artistic, philosophical knowledge), which is thus taken by them as an object of learning.

The pedagogical activity, assumed as a unit of analysis, is a process directed towards an object (students' development through learning or appropriation of content historically produced by humanity), which coincides with the objective (studying and theoretically apprehending reality) that stimulates subjects (teachers and students) to carry out the activity. This consideration arises from Leontiev's (2004) propositions regarding the appropriation of human objectifications, a process of appropriation that is always active, in the sense that the subject must carry out an activity that reproduces the essential traits of what was objectified by the human activity accumulated in the object, which is corroborated by Duarte (2004; 2013), something that does not occur individually or spontaneously.

Organizing teaching and learning is a social need aimed at pedagogical activity. Such an organization must consider that "[...] There must be an interaction between subjects or between subjects and objects for the establishment of the need for new knowledge" (MOURA, 2017a, p. 155), which must be a need of the group of subjects', the collective of the classroom, specifically.

It also follows from Leontiev's (2004) proposition that form and content must mutually determine each other in pedagogical activity since the appropriation of a human objectification requires reproducing the essential traits of what in it was objectified. For example, the appropriation of mathematical knowledge requires reproducing the essential traits of human activity accumulated in mathematical knowledge. This means that the teaching organization, in pedagogical activity, must consider the relationship between content and form and how it implies in the teaching and learning processes so

that the characteristics of mathematical content are determinants of this organization in the scope of mathematics teaching, for example.

But what are the essential relationships, in the terms of Rosental and Straks (1960), of the pedagogical activity to be taken as guiding the analytical process? As an activity aimed at the formation of new generations (LEONTIEV, 2004; SAVIANI, 2010), in addition to the relationships between the subjects – teacher and student – and the relations of these subjects with knowledge – taken as an object to be taught and learned, therefore, objectification of the activity of humanity –, the direction of the educational process is also a relationship that makes it possible to guide the research process of active methodologies, within the scope of mathematics teaching in basic education.

Note that all these relationships constitute the humanization process, in which each subject develops their individuality by appropriating the culture developed by humans in the constant being and becoming humans. In Duarte's terms (2004, p. 4), the “[...] appropriation of culture is the mediating process between the historical process of formation of the human race and the process of formation of each individual as a human being.”

Thus, the look at the logical and historical movement of active methodologies was guided by these essential relationships of pedagogical activity. As knowledge of didactic work, the essential relationships of this activity logically organize and, therefore, direct what will be considered and how in the study of this movement. That is why they were designated and assumed as analysis guidelines, and, in the specific research process that references this text, they were described as follows:

- a. The *direction of the formation* provided by active methodologies –presented or that can be inferred regarding the active methodologies– in those authors' writings. It refers, as a possibility, to the meaning of the purpose of the school educational process –elements pointed out about the conception of the world, human beings (and students and teachers), society, and education that can be considered.
- b. The *relationships between teachers and students*, contemplating their interaction and role in the school educational process, which, historically,

occur in different ways, with different emphases on the subjects of the pedagogical activity.

- c. The *relationship between content and form* (between the object of teaching and learning and how they are proposed) in active methodologies. This guideline includes statements about the process that characterizes learning (how the student learns) and teaching (how the teacher teaches).

In the research taken as a reference for this text, mathematics teaching situations with active methodologies such as the singular are seen as individual phenomena that carry all the richness of their casual elements and connections with the universal, in this case, the didactic work as a human activity. However, these connections occur through the mediation, in principle, of active methodologies, as a particularity of education, which act as a link between the singular and the universal.

Beforehand, it is worth clarifying that, as particular, active methodologies in a specific relationship are “[...] universal, and in another, they are individual or singular” (ROSENTAL; STRAKS, 1960, p. 258, our translation). Its mediation must take place in a critical way, explaining what the particular is and what it is not in the relationships between the singular and the universal. Therefore, in addition to understanding the singular, the analytical process can and should also provide an understanding of the particular and its mediation.

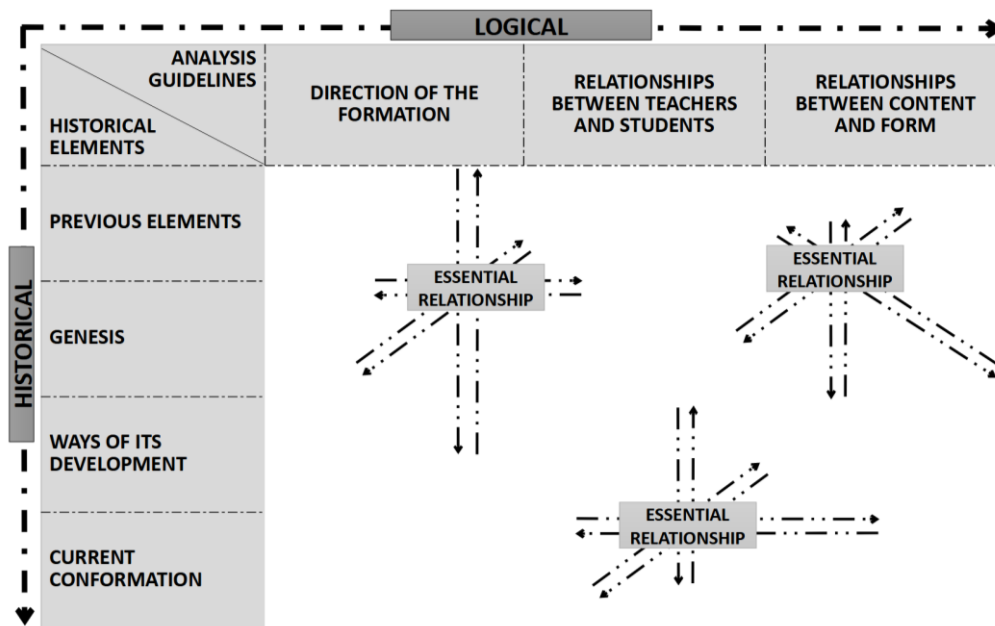
Therefore, in addition to defining the analysis guidelines as constituent elements of the unit of analysis, the process begins by explaining how, specifically, researchers and authors define or conceptualize the object.

Figure 1 shows the proposed and developed analytical process considering that the essential relationships of active methodologies are constituted as a confluence between the logical and the historical. The analysis guidelines as conceptual guides (thought instruments) are arranged in the columns, emphasizing the logical. Historical elements are arranged along the lines. The unity between the logical and the historical is represented by a double arrow line, in the outermost part, top and left. It is not continuous to indicate that there are casual historical elements “[...] that do not have fundamental importance for knowing an object [or phenomenon]

[...]” (ROSENTHAL; STRAKS, 1960, p. 2, our translation). As for the logical, the non-continuity refers to the stipulation of analysis guidelines chosen based on the theoretical-methodological foundation of the research, whose unit of analysis is the pedagogical activity.

The essential relationships of the studied object are represented in Figure 1 by arrows that indicate the various possibilities of relationships between the guidelines and historical elements, between the guidelines themselves, and between the historical elements themselves, considering the possibilities of various intersections that can be essential relationships of the object (in this specific case, of the active methodologies in mathematics teaching in basic education in Brazil).

Figure 1- Organization of the Analytical Process



Source: Prepared by the authors (2023).

2.4 Research movements

The previous theoretical organization and the establishment of its relationship with the research object provided the gathering of methodological actions in movements toward active methodologies of theoretical, methodological, and analytical depth. Such movements, as already mentioned, correspond to the moments of investigation, being their objectification. We should note that the research movements intertwine and interfere, such that Chart 1 expresses its

logic of organization and concatenation. However, except for some specific actions, there is no linear temporal correspondence between them and the order of their presentation. The concomitant development of several movements and actions occurred as a response to the needs of the very research process.

Chart 1 – Summary of Movements and Methodological Actions

Movement	Objectives	Methodological Actions
Initial approach to the object	Define the research object, problem, and objective.	<ol style="list-style-type: none"> 1. Presentation of the contingencies that led to the research proposition. 2. Definition of the research object. 3. Organization of initial understandings about the object. 4. Definition of the research question and objective, justifying its proposition. 5. Organization of the research hypothesis and its premises.
Theoretical-methodological deepening	Present the methodological organization of the research and the principles that guide it.	<ol style="list-style-type: none"> 1. Methodological organization of the research. 2. Explicitation of the research’s methodological movements and actions. 3. Study of the logical and historical as a category of dialectical and historical materialism. 4. Explanation of the research analysis unit. 5. Study of the relationship between the singular, the particular, and the universal.
Theoretical deepening	Present pedagogical activity from authors who understand that pedagogical actions can constitute an activity, in Leontiev’s sense.	<ol style="list-style-type: none"> 1. Study and presentation of the foundations of pedagogical activity from the perspective of the activity theory. 2. Indication of essential relationships of the pedagogical activity. 3. Discussion of the object of the teacher’s activity. 4. Presentation of the Teaching-Orienteering Activity (AOE⁴) 5. Exemplification of a school mathematics teaching situation through the AOE.
Second approach to the object	Analyze active methodologies through research within the scope of mathematics teaching in Brazilian basic education.	<ol style="list-style-type: none"> 1. Survey of theses and dissertations on active methodologies within the scope of mathematics teaching in Brazilian basic education. 2. Explanation of the analytical study guidelines of the work resulting from the surveys. 3. Analytical study of the of the surveyed works. 4. Explanation by reference authors regarding the active methodologies of the surveyed works. 5. Recognition of historical elements of active methodologies. 6. Analysis of an example of a mathematics teaching situation with active methodology. 7. Synthesis of relationships between active methodologies by an analytical study guideline.
Deepening of the object understanding	Deepen the understanding of the research object by studying its logical and historical movement.	<ol style="list-style-type: none"> 1. Explicitation and explanation of the analysis guidelines for the study of the historical logical movement of active methodologies. 2. Study of the logical and historical movement of active methodologies, directed by analysis guidelines, in the productions of reference authors on these methodologies. 3. Explanation of essential relationships and contradictions of active methodologies. 4. Preparation of study summaries by an analysis guideline. 5. Explicitation of the logical elements of the current configuration of active methodologies in two unique mathematics teaching situations.

⁴ From portuguese “Atividade Orientadora de Ensino”.

Summary of the analysis developed	Present the conclusions and final considerations on understanding active methodologies through pedagogical activity and its logical and historical movement.	<ol style="list-style-type: none"> 1. Presentation of analytical process results- understanding active methodologies through pedagogical activity in the scope researched. 2. Resumption of the research question, objective, and hypothesis. 3. Indications of research contributions to the field of mathematics education.
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Source: The authors (2023).

In Chart 1, these movements are arranged along with their objectives in the reference research for this text and their methodological actions to assist the understanding of the study of the logical and historical movement of the active methodologies object was developed.

However, we must ponder that this is not a step-by-step prescription for other research but the expression of a way of developing research whose conformation took place in approaching the object, guided by the unit of analysis (the activity pedagogical, based on the activity theory).

The first movement consists of initial approaches to the phenomenon, considering the research proposition. It expresses the researcher’s initial knowledge about the investigated object, that is, a level of elaboration that represents the results of non-systematic studies of this object, typical of practice, which includes the process that leads to the creation of the research project and the indication of its object, problem, objective, hypothesis, methodology, and theoretical support.

It is worth mentioning that this first movement occurs through the external presentation of the object to enable the unveiling of what lies behind “[...] the external appearance of things, their internal essence, the law that governs them” (ROSENTAL; STRAKS, 1960, p. 354, our translation), that is, to unveil what their internal relationships are, since it is a methodological principle “[...] moving from primary representations and consensual meanings in their sensitive immediacy toward the discovery of multiples ontological determinations of reality” (MARTINS, 2006, p. 10-11).

From this, there is a need, in the set of research movements and in each of the approaches, to start from what is the apparently real and proceed to its analysis with abstract mediations, to then return to the concrete, to the complexity of the real that can only be captured and understood through the

process of abstraction of thought (MARTINS, 2006). Without this initial approach, we cannot define the research object and proceed. In this sense, in the specific research on active methodologies, the hypothesis was presented with its premises in this movement, indicating the need for its confirmation or refutation with the development of the study.

Overcoming the primary definitions of the essence of the object, in terms of Kopnin (1978), or overcoming its pseudo-concreteness (KOSIK, 2002), requires taking steps beyond the first approach to active methodologies, with the use of theoretical instruments that guide the thought, the explicitation and explanation of the essential relationships of this object (ROSENTAL; STRAKS, 1960). To meet this requirement, two theoretical and methodological deepening movements were developed: a) the study of the logical and historical dialectical pair and its methodological implications, and the explicitation of the unit of analysis based on the relations between the universal and the particular, and the singular, which enables the analysis of the object (active methodologies); b) the study of pedagogical activity, supported by activity theory, the explicitation of its foundations and structure and its essential relationships, from which analysis guides are created for the study of the logical and historical movement of active methodologies.

The study starts from the need to express the object or phenomenon through the logic of concepts or the reproduction of its essence, in Kopnin's terms (1978), requiring the indication and explanation of essential relationships of the pedagogical activity regarding the subjects and the mathematical knowledge, including discussion of the object of the teacher's activity. This discussion was presented to clarify the relationship between the object of teaching and learning and what teaching actions are aimed at in the school process from the perspective of the pedagogical activity. As a possible theoretical-methodological basis for this activity, the Teaching-Orienteering Activity (AOE) is presented, in terms of Moura *et al.* (2010), and an example of a mathematics teaching situation organized and developed with the AOE structure as an approach to practice.

The fourth movement of the research is a new approach to active

methodologies systematically for the detailed appropriation of the content of the object (KOSIK, 2002), considering the need to “[...] know what others have already done [...]” (CASTRO, 2006, p. 78). To meet this need, we surveyed master’s or doctoral works in Capes⁵ and IBICT Theses and Dissertations Banks⁶. The survey was developed as a form of review to establish relationships with productions in previous research on active methodologies within the scope of basic education mathematics teaching, with the definition of a specific data source. This survey is analytical-documentary in nature, focusing on “[...] examination and [n] reflection on the connection between these data” (CASTRO, 2006, p. 78).

Guidelines for the analytical study of the works resulting from the survey were defined to meet needs that arose during the study itself, including the explicitation of reference authors regarding the active methodologies, an indication of historical elements of these methodologies, and an indication of their possible essential relationships. Furthermore, an exemplification of a school mathematics teaching situation with active methodology is presented as a singularity of these methodologies and analyzed regarding the relationships between teacher and student and the implications of mathematical knowledge in using active methodologies.

Considering the scope of the research (mathematics teaching in Brazilian basic education), the fifth movement of the research analyzes the forms of development of the phenomenon (active methodologies), as proposed by Kosik (2002), making explicit its internal or essential contradictions and relationships through the study of its logical and historical movement. In this movement, we began the organized methodological actions from the explicitation and explanation of the analysis guidelines to study the logical and historical movement of these methodologies, considering the essential relationships of the pedagogical activity as a reference.

We established criteria and used them to determine which reference authors on active methodologies would be analyzed. The analysis was carried out

⁵ Coordenação de Aperfeiçoamento de Pessoal de Nível Superior: <https://catalogodeteses.capes.gov.br/catalogo-teses/#/>

⁶ Instituto Brasileiro de Informação em Ciência e Tecnologia - www.gov.br/ibict/pt-br.

with the analysis guidelines. As a result of this study, the essential relationships and contradictions of active methodologies were made explicit, and summaries of those relationships were prepared per analysis guideline. As a return to practice, the logical elements of the current configuration of active methodologies were explicitly expressed in two unique mathematics teaching situations. Studying the logical and historical movement of active methodologies through the production of reference authors created a frame of reference for understanding this phenomenon beyond its appearance. It is worth considering that the choice of analysis guidelines as a path toward this approach means it is *a* study of the logical and historical movement of methodologies.

In developing this fifth movement of research, we chose reference authors who use the term active methodologies (or active methodology) in parts of their texts cited in the works resulting from the survey or the designation of a specific active methodology, such as *peer instruction*. Their written productions on active methodologies were collected and read. We cut out the excerpts or statements that expressed ideas about the definition of active methodologies, the guidelines for training through these methodologies, the relationship between subjects, and the relationship between content and form. The terms that designated the authors' ideas and characterization were organized into summary tables.

The analysis was continued by the explicitation and explanation of the essential relationships of active methodologies. Its result was compiled in figures organized by the previous elements of these methodologies, elements of their genesis, their forms of development, and their current conformation. These last elements were used to explore the movement of explicitation in two teaching situations with active methodologies, present in two survey works, to test the results of the analysis undertaken.

The last movement of the research is summarizing, expressing the analytical process results as an understanding of the object –the active methodologies– through pedagogical activity in the scope researched. In this movement, the research hypothesis is configured as a thesis, and is reformulated from the investigation results. We are aware that these results are configured as

summaries that take on concrete characteristics in the thought process. Thus, they can be investigated and studied again, serving as a basis for new formulations or reformulations.

3 Final remarks

The objective of this text was not to present all the results from the research that supported it but to make explicit how the logical and historical category was taken in the theoretical organization of the moments of the investigation, in its relationship with the unit of analysis. This mode of organization, a theoretical-methodological construction developed during the research, is taken as one of its results, suggesting a possible path for new research.

In this sense, we emphasized the process of objectifying research in movements closer to the object, with the description of its various methodological actions. The processes of definition and explanation of analysis guidelines stand out as essential relationships of the unit of analysis that direct the gaze to the researched object. Those guidelines constitute, therefore, the logical organization (the logical) of a study of the logical and historical movement of the object, whose intertwining with the historical provides the explicitation of the essential relationships of the object and the production of an understanding of it, in addition to its primary definitions.

We, therefore, expect that this will contribute to the discussion about the possibilities for research that intends to be guided by the logical and historical category, despite the consideration that the prescription of closed and sequenced procedures is not considered a possibility *a priori*, beyond the researched object, when this category is intended as an instrument of thought.

Una posibilidad teórica y metodológica para la investigación sobre la enseñanza: la organización a través de la categoría lógico e histórico

RESUMEN

Con referencia a un estudio académico sobre metodologías activas en la enseñanza de las matemáticas en la educación primaria brasileña, se presenta una discusión sobre la categoría lógica e histórica y su relación con la unidad de análisis de la investigación, la Actividad Pedagógica, basada en la Teoría de la Actividad. Se explica el abordaje del objeto de investigación, la profundización teórica, metodológica y analítica y las acciones metodológicas. Se destaca la definición de las pautas de análisis, como relaciones esenciales de la Actividad Pedagógica, y su papel como organizadoras lógicas de la investigación. La forma en que se desarrolló el estudio, producida en el proceso de investigación, se toma como uno de sus resultados y se propone como contribución a la discusión de las posibilidades de investigación que pretende orientarse por la categoría lógica e histórica, específicamente en el área de la Enseñanza.

Palabras clave: Lógico e Histórico; Unidad de Análisis; Actividad Pedagógica; Organización de Investigación.

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Received in February 2024

Approved in April 2024