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The concept of *object of teaching* in Pedagogical Activity

O conceito de objeto de ensino na Atividade Pedagógica

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ABSTRACT

The problematic about what to teach in pedagogical activity often appears directly associated with the debate on the definition of a list or sequence of contents, subjects or topics. Based on the foundations of Cultural-Historical Theory, it is discussed three general issues: the relationship between teaching content and the systematized knowledge from disciplinary areas; the expression of the relationship between content and knowledge in curricular proposals, notably, in the current National Curricular Common Base; the specificity of the teacher's role in the organization of knowledge to be taught and learned at school. It is argued that the organization of pedagogical activity aimed at promoting the development of theoretical thinking in students involves the systematization of the *objects of teaching* in each area of knowledge. It is assumed that the term *object of teaching* expresses the conceptual bonds of an area, synthesizing the unity between the historically emerged needs and the answers that were developed to such needs in a certain sphere of life. In this way, it is argued that the *object of teaching* can be a potential instrument for teaching activity in relation to the analysis of the different prescribed contents.

Keywords: Object of teaching. Pedagogical Activity. Conceptual bond.

RESUMO

A problemática sobre o que ensinar na atividade pedagógica aparece, muitas vezes, associada diretamente ao debate sobre a definição de uma lista ou sequência de conteúdos, assuntos ou tópicos de ensino. A partir dos fundamentos da Teoria Histórico-Cultural discutem-se três questões gerais: a relação entre os conteúdos de ensino e os conhecimentos sistematizados das áreas disciplinares; a expressão da relação entre conteúdo e conhecimento em propostas curriculares, notadamente, na atual Base Nacional Comum Curricular; a especificidade do papel do professor na organização dos conhecimentos a serem ensinados e aprendidos na escola. Argumenta-se que a organização da atividade pedagógica direcionada a promover o desenvolvimento do pensamento teórico dos estudantes passa pela sistematização dos *objetos de ensino* em cada área de conhecimento. Assume-se que o termo *objeto de ensino* expressa os nexos conceituais de uma área, sintetizando a unidade entre as necessidades historicamente surgidas e as respostas que foram sendo desenvolvidas a tais necessidades em uma determinada esfera da vida. Nesse sentido, argumenta-se que o objeto de ensino possa se colocar como um potencial instrumento para a atividade docente em relação à análise dos diversos conteúdos prescritos.

Palavras-chave: Objeto de ensino. Atividade Pedagógica. Nexos conceituais.

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1 Teaching content and subject knowledge: general problems and hypotheses for proposing the concept of *object of teaching*

The pedagogical discussion about "what to teach" in the different areas of knowledge is often directed towards the definition and curricular organization of "content". These, in turn, end up taking the form of topics, subjects, or objectives, constituting a kind of "list" of the knowledge to be taught and learned. However, these "lists" do not always explain the *conceptual relationships* between the knowledge present in the different topics, subjects, and objectives that appear in school programs and curricula.

In academic literature, this debate about "what to teach" in school often appears through a separation between what would be the *scientific knowledge* of an academic area and what would be t*he knowledge to be taught and learned in school*. This discussion is expressed in formulations such as "content knowledge" and "pedagogical content knowledge", the latter being constituted and engendered directly in school practice (SHULMAN, 1987), or in "didactic transposition", understood as "The 'work' that transforms the knowledge to be taught into the *object of teaching* [...]" (CHEVALLARD, 1991, p.45, emphasis added).

In this sense, on the one hand there would be the system of knowledge or concepts of an academic discipline and, on the other, the "use" of this knowledge in pedagogical activity. The emphasis on this distinction between the "two types" of knowledge seems to express a general understanding that the scientific knowledge of an area is not "ready" to be taught in school and therefore needs to be—somehow—"transformed" into "school knowledge".

On the one hand, differentiating between the scientific knowledge of an area and the knowledge to be worked on in school, recognizing that they are not the same thing, can be considered unquestionable when one seeks—through this distinction—to make it explicit that the concepts of an area are not "ready" to be "used" in the teaching and learning processes. However, this

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recognition (in itself correct) seems to indicate much more the need to consider the specificity of teaching and learning activities (or the specificity of pedagogical activity) rather than the existence of "two" types of knowledge: on the one hand, "scientific," and on the other, "school."

It turns out that both an academic discipline and a school discipline, dealing with the same sphere of life, with the same phenomenon (that is, with the same relationship between human needs and the responses that have been constructed to those needs), should deal with this phenomenon based on the *same conceptual relationships* that have been possible to produce. If this is the case, then one could ask, "Where" does the distinction lie between the "knowledge" to be worked on in science and in school. The answer is *that this distinction lies in the relationship or activity that is established with this knowledge when one is engaged in research or pedagogical activity* , and not in the knowledge itself.

This way of thinking, proposing, and elaborating the problem of "what to teach" at school can help to overcome a common understanding: that the teaching *activity* has the function of 'simplifying' knowledge for learning processes and, consequently, that the teacher is the one who "facilitates" student learning. It is therefore important to discuss what "complex knowledge" is and what the 'nature' of the teaching and learning activity is at school to assess "what" and how the process of appropriating knowledge takes place through pedagogical activity.

Based on the foundations of Historical-Cultural Theory, particularly the concept of activity (KOPNIN, 1978; LEONTIEV, 1978; MARX; ENGELS, 2007), this article argues that the organization of pedagogical activity aimed at promoting the development of students' theoretical thinking (DAVIDOV, 1988) involves the systematization of *objects of teaching* in each area of knowledge. It is assumed that the term *object of teaching* expresses the conceptual links of an area, synthesizing the unity between historically arisen needs and the responses that have been developed to these needs in a given sphere of life. Thus, while the term " *object of teaching "* seeks to highlight the more general aspects of a piece of *knowledge* - or its essential relationships, understood from the study of the historical and logical movement of

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KOPNIN (1978) - the term "teaching content" seeks to express the *particular form*s in which a given piece of knowledge appears and is realized in pedagogical activity.

The question then arises: how can this *object of teaching* be made explicit in the different areas of knowledge to guide teaching activity towards promoting the best possible conditions for students in learning activities? How do the current Brazilian curricular proposals contemplate the conceptual system to be taught and learned in the different areas of knowledge? These questions guide and organize this article, which is based on bibliographical sources and in dialogue with the foundations of Historical-Cultural Theory, Activity Theory and Teaching Guiding Activity. Three general problems in the debate on "what to teach" in pedagogical activity are highlighted for discussion in this article.

The first problem refers to the relationship that is established between the "teaching content" and the "systematized knowledge of the subject areas." A second problem refers to the analysis of how the relationship between "content" and "knowledge" has appeared in curricular proposals, notably in the current Common National Curriculum Base (BNCC, Brazil, 2017). Finally, a third problem refers to the discussion and positioning on the specificity of the teacher's role in the process of organizing teaching.

To analyze these problems, the historical and logical movement of knowledge (KOPNIN, 1978) is taken as a category, insofar as it makes it possible to identify and explain the genesis and conceptual links of a given phenomenon in human activity. Considering, furthermore, that the *object of teaching* expresses a relationship between form and content, contemplating the unity between the historically produced syntheses of knowledge (the essential relationships or conceptual links) and the thought process triggered by this knowledge (DAVÍDOV, 1988), it is argued that the appropriation of the *object of teaching* is presented as an instrument in the pedagogical activity, necessary for the organization of the different "contents", 'topics' or "subjects". The central criterion for this organization is the possibility of guiding the students' learning activity, helping them to develop a theoretical relationship with the contents of each area.

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2. Theoretical knowledge and the specificity of the teaching activity

An academic discipline systematizes certain human relationships, historically established with a given phenomenon. More specifically, it systematizes answers to a set of problems that arise in social practice and are identified by the subjects as necessary to be answered in a *theoretical* way. This process, which can be called the logical and historical movement of the concept (KOPNIN, 1978), expresses the very *object* of scientific activity, what scientific activity is aimed at, and, consequently, the criteria for producing and evaluating knowledge in the various academic areas.

The *object* of human activity (LEONTIEV, 1983) is thus not a "thing" that exists independently or "before" human action in the world but is constituted as an object as a result of this action, which is always aimed at satisfying one need or another. However, for each individual subject, this same object appears as a premise for their action in the world, mediating the effective possibilities of their activity (LEONTIEV, 1983). It is for this reason that science can be understood, as Caraça (1951, p. XIII) puts it, "as a living organism, impregnated with the human condition, with its strengths and weaknesses, and subordinated to the great needs of man in his struggle for understanding and liberation; it appears to us, in short, as a great chapter in human and social life".

Scientific knowledge, the object and product of human scientific activity, is consolidated and systematized in the search for solutions to various human problems, including those posed internally to science itself and aimed at its development. This knowledge derived from scientific activity differs from the knowledge produced in other activities or spheres of life (which could be called empirical knowledge). Scientific activity is not satisfied with immediate answers but intentionally seeks to explain the causes of the emergence and development of a given phenomenon. It is this characteristic that allows this human activity to approach an understanding of the relationships between the general, particular, and singular aspects that make up such a phenomenon (DAVÍDOV, 1988; KOPNIN, 1978).

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During scientific activity, in the search for explanations of a given object or phenomenon, we can consider that there are oscillations between empirical and theoretical forms of thought. However, as scientific knowledge reaches greater degrees of systematization, there is a possibility of overcoming empirical relationships with phenomena, aiming for *theoretical thought* processes (DAVÍDOV, 1988).

This movement, recognized in the cultural experience of humanity and systematized by scientific activity in the form of theoretical concepts, is both historical and logical. Historical, in the sense that it accompanies the movement of objective reality, "which exists independently of consciousness, of the subject who knows; reality which develops historically and is in a stage of constant transformation" (ROSENTAL; STRAKS, 1960, p.325). Logical, in the dialectical sense that it reflects this reality in the process of thought and, therefore, cannot be considered separately from the historical, from which it emerges, because concepts are not born arbitrarily in the process of thought.

The study of this *historical and logical movement* in different scientific areas makes it possible to identify and systematize the essential and necessary relationships for a given phenomenon to become what it is today, which can be recognized and synthesized in the conceptual links established in a given area, in other words, in explanations of the object or the processes that led to its emergence and development.

In particular, in relation to mathematical knowledge, we believe that this movement allows us to understand, for example, the main r*elationships between human needs to count and control quantities* and the responses that have been created to satisfy these needs, notably those related to the constitution of numbering systems. As Caraça (1951, p.4) states, "The idea of natural numbers is not a pure product of thought, independent of experience; men did not first acquire natural numbers to count them later; on the contrary, natural numbers were slowly formed through the daily practice of counting."

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The fact is that today, this field of mathematics is highly systematized, considering its organization of numerical sets and properties, including notions about zero, infinity, numerical base, positional value, etc. However, when the process of teaching and learning these various concepts does not make explicit the links (or the logical-historical movement) between human needs and the responses created to them, the concepts tend to be appropriated only in their empirical dimension, as "items", 'topics' and, in the words of Ilyenkov (2007), as "dead truths". Thus, we believe that it is from this recognition of conceptual links, revealed in the analysis of the historical and logical movement of knowledge through scientific activity, that the criteria and means for recognizing and systematizing the *object of teaching* in the different areas are located.

In this sense, it is understood that the *object of teaching* also includes the synthesis of the general and essential conceptual links of the scientific area to which it refers, but it is not the same as the *object of science* because it occupies a different role in pedagogical activity from the role that this same knowledge occupies in research activity. Considering that the *object of teaching* expresses, in the form of theoretical thinking, the conceptual links of a phenomenon that are necessary for students to grasp, and also considering that "the essence of theoretical thinking is that it is a special procedure in which man focuses on understanding things and events by analyzing the conditions of their *origin and development*" (DAVÍDOV, 1988, p. 6, emphasis added). 6, emphasis added), the question arises: how is the *object of teaching*, understood as the synthesis of the most general and essential conceptual links of an area of knowledge, expressed, and/or could it be expressed in curricular proposals that refer to teaching and learning activities at school?

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3. The relationship between knowledge, content, and *objects of teaching* in curriculum proposals

A curriculum document, such as the current Common National Curriculum Base (BNCC) (BRASIL, 2017) or even proposals drawn up at the municipal or state level, expresses not only a curriculum proposal but also an educational policy. In the case of the BNCC, and as the document itself recognizes, it is indicated that it should

> [...] contribute to the alignment of other policies and actions, at the federal, state, and municipal level, regarding teacher training, evaluation, the development of educational content, and the criteria for providing adequate infrastructure for the full development of education" (BRASIL, 2017, p. 8).

This announcement seems to be materializing, for example, in the New High School Education[3], in the 2019 Teacher Training Guidelines[4], in the bill to regulate home education,[5] and in the many speeches that have accompanied the construction and dissemination of the BNCC.

One of these speeches refers to the statement that the BNCC is a "[...] plural, contemporary document that clearly establishes the *set of essential and indispensable learning that all students, children, young people, and adults,* are entitled to" (BRASIL, 2017, p. 5, our emphasis). Since "[...] the right to learn depends on other rights that are not available to most students: the right to housing, food, culture, health, etc." (FREITAS, 2014, p. 1. 109), when an official document presents school learning in isolation from a solid analysis of the economic and social scenario from which the teaching and learning processes take place in Brazil (for example, the living conditions of the 80% of students who attend public school in Brazil[6]; the conditions of state investment in basic education; the

[3] See law 13.415, of February 16, 2017.
[4] CNE/CP Opinion No. 22/2019, Common National Basis for the Initial Training of Basic Education Teachers - known as BNC-Formação.
[5] Bill of Law (PL) 3.179 of 2012, approved by the Chamber of Deputies on May 19, 2022.
[6] Data according to the Basic Education Census (INEP, 2019).

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working conditions of teachers, etc.), there is an indication of why the BNCC is an educational policy and not simply a curriculum proposal.

At the same time, this Educational Policy is materialized in the BNCC document in the very logic of the organization of the curricular components, for example, in the concept that they should present "[...] a set of skills [...] related to different *objects of knowledge* - here understood as content, concepts, and processes - which, in turn, are organized into *thematic units"* (BRASIL, 2017, p. 28, our emphasis). It so happens that these "skills" - specific to each curricular component and mandatory for all education networks - are explicitly identified by "codes", which makes them potential *descriptors* for large-scale assessments (FREITAS, 2017a, 2017b). In this sense, the BNCC stands as one of the instruments of an Educational Policy that seeks to intensify and expand control over pedagogical processes in schools, both through the implementation of these large-scale assessments and through the "supposedly necessary" processes to achieve the 'skills' proposed in the document, which includes the production and dissemination of "ready-made" and standardized teaching materials, guidelines, and content for initial and continuing teacher training, etc.

Understanding this mutual relationship between being a curricular proposal and being an Educational Policy is also in line with the understanding that we are facing an educational project, present since the 1990s and aimed at maintaining capital (FREITAS, 2014). This project intends to build a discourse and practice of "flexible learning" (KUENZER, 2016) so that schooling better expresses or adapts to an increasingly "flexible" labor market, i.e., uncertain as to the existence of fixed labor relations or even any paid labor relations (KUENZER, 2016).

In this sense, it is important to recognize the possibilities of disputes and transformations in relation to teaching actions with the current BNCC. Among them is the debate about how the knowledge to be taught and learned appears in the document, using the concept of *objects of teaching* as a mediation for this analysis. For this reason, we will present an analysis of the logic of the organization of knowledge in this document.

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Primary education is structured in the BNCC into five areas of knowledge, including mathematics. To present the area and the understanding adopted of mathematical science, the document assumes that it is a "hypothetical-deductive science" (BRASIL, 2018, p.265), which creates abstract systems to organize and relate phenomena through the construction of arguments and representations. To relate it to the teaching process, it is considered that,

> through the articulation of its various fields - Arithmetic, Algebra, Geometry, Statistics and Probability - needs to ensure that students relate empirical observations from the real world to representations (tables, figures, and diagrams) and associate these representations with a "mathematical activity" (concepts and properties), making inductions and conjectures (BRASIL, 2017, p. 265).

It also highlights the importance of "mathematical literacy," understood as the "competencies" and 'skills' of "reasoning, representing, communicating, and arguing mathematically" (BRASIL, 2017, p.266), considering that the development of such "skills" is related to the analysis of everyday situations, involving other areas of knowledge besides mathematics. The document also indicates the processes of solving problems, investigating, modeling, etc., as privileged forms of mathematical activity.

Based on these considerations, it lists eight specific "competences" that it expects to be guaranteed in the teaching process, including "Recognizing that mathematics is a human science, the result of the needs and concerns of different cultures at different historical moments [...]" and "Developing logical reasoning, a spirit of investigation, and the ability to produce convincing arguments, using mathematical knowledge to understand and act in the world" (BRASIL, 2017, p.267).

It also presents what it calls "fundamental ideas", which are considered relevant to the development of mathematical thinking and "should become objects of knowledge at school" (BRASIL, 2017, p.268), including equivalence, order, proportionality, interdependence, representation, variation, and approximation. The document does not, however, explain what these "objects of knowledge" or "fundamental ideas" are, but

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instead proposes and structures the presentation of the area based on so-called "thematic units": Numbers, Algebra; Quantities and Measures; Geometry; Probability and Statistics. For each "thematic unit" and for each 'cycle' of schooling, the corresponding "knowledge objects" and "skills" are broken down.

For the analysis proposed here, we will focus specifically on the "numbers" unit. For the BNCC, this thematic unit "aims to develop numerical thinking, which implies knowledge of ways to quantify attributes of objects and to judge and interpret arguments based on quantities" (BRASIL, 2017, p. 268). It is also considered that the "fundamental ideas" of approximation, proportionality, equivalence, and order would be present in it. The expectation is that students will solve problems with natural and rational numbers, develop different strategies by estimation and mental calculation, and consider it important to put students in front of situations that involve measurements in which natural numbers are not enough to solve (BRASIL, 2017).

However, there is no explicit indication of how this thematic unit relates to the others, nor is there any explanation of the meaning of the "fundamental ideas/objects of knowledge" presented above or how these "ideas" relate to or can be developed from the "competences" and "skills" proposed in the document. However, it is noted that the criteria for organizing the skills in the BNCC are "one possible arrangement among others" (BRASIL, 2017, p. 275) and that it is necessary to emphasize the articulation of the skills with each other.

As a proposal presented nationally and as a driver for the development of teaching materials and large-scale assessments, there is no denying the strong influence of the BNCC as a prescriber of teachers' actions in the classroom. In this sense, it is important to note that the "list of skills" that are presented for each grade or school cycle are linked to what the document now calls "objects of knowledge", which are no longer the "fundamental ideas" (initially presented) and are once again materialized as a list of content "topics". The explanation of the relationship between the "skills" is not recorded in the document. Furthermore, these "skills" are characterized as minimum learning expectations , indicating a

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fundamentally pragmatic nature. Table 1 shows an example of how this logic that structures the BNCC materializes for the thematic unit "Numbers", in the first year of elementary school.

Chart 1: An example of the logic behind the organization of knowledge in the BNCC- "Thematic Unit-Numbers", 1st grade

Object of Knowledge	Skills
Routine counting; Counting up and down; Recognizing numbers in everyday contexts: indicating quantities, indicating order or indicating a code for organizing information	(EF01MA01) Use natural numbers as an indicator of quantity or order in different everyday situations and recognize situations in which the numbers do not indicate counting or order, but rather an identification code.
Quantifying elements of a collection: estimates, counting one by one, pairing or other groupings and comparison	(EF01MA02) Count accurately or approximately, using different strategies such as pairing and other groupings. (EF01MA03) Estimate and compare quantities of objects from two sets (around 20 elements) by estimation and/or correspondence (one to one, two to two) to indicate "there is more", "there is less" or "there is the same amount".
Reading, writing, and comparing natural numbers (up to 100); number line	EF01MA04) Count the number of objects in collections up to 100 units and present the result using verbal and symbolic records in situations that interest them, such as games, play, classroom materials, etc. (EF01MA05) Compare natural numbers of up to two orders in everyday situations, with and without the support of the number line.

Source: prepared by the authors based on Brazil (2017)

From the first year, counting procedures are presented as "objects of knowledge," for example: "Routine counting; Ascending and descending counting"; or "Recognition, writing, and reading numbers," etc. (Table 1). These "objects" are repeated mainly in the first three years of elementary school, with some variations in relation to the types of problem solving involving addition, subtraction, multiplication, or division, or even more than one operation. Starting in the fourth grade, some properties of operations are introduced, as well as working with rational numbers. Each year, for each of these "objects of knowledge," which are no longer linked to what was previously considered "fundamental ideas" for teaching

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mathematics, there are associated "skills," expressed by verbs such as *solve, compare, identify, use, and count* (Chart 1).

In summary, it can be said that the *knowledge* to be taught and learned in basic education appears in the BNCC in four general forms: i) as a "thematic unit" (which expresses the main axes or blocks of "content" in an area, in the case of mathematics Numbers, Algebra; Quantities and Measurements; Geometry; Probability and Statistics); ii) as "objects of knowledge" (as a list of "topics" or 'subjects' for each Thematic Unit (e.g., "Routine counting; Counting up and down; Recognizing numbers in everyday contexts"); iii) as "skills," comprising a list of learning expectations expressed through actions or procedures (e.g., "*solve; compare; identify; use, count"*; iv) as "general competencies" for each area (e.g., "Develop logical reasoning, a spirit of inquiry, and the ability to produce convincing arguments, using mathematical knowledge to understand and act in the world" (BRAZIL, 2017, p.267)).

It should be noted, then, that what is referred to as "objects of knowledge" in the BNCC represents a list of topics, items, and subjects that potentially synthesize the knowledge and "fundamental ideas" of the area in relation to a given "thematic unit," but does not directly provide any explanation of this articulation. At the same time, what are called "skills" propose a second list of minimum objectives to be taught and learned that, as a rule, express a pragmatic, utilitarian, and procedural character with knowledge, for example "Counting the number of objects in collections up to 100 units and presenting the result through verbal and symbolic records, in situations of interest, such as games, play, classroom materials, among others" (BRAZIL, 2017, p. 279).

Assuming that concepts, ideas, etc., are relationships that can be synthesized in words and phrases, but that to be appropriated by the teacher, they need to appear precisely as relationships (not just as "items"), the question arises as to how much this logic of organizing knowledge in the BNCC, without explicitly stating the relationships between the various skills, or even the relationships between these and the "objects of knowledge" and what was previously named as

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"fundamental ideas," leads to ways of organizing teaching that reinforce the proposition of specific and singular tasks, oriented to directly and pragmatically address each of the listed skills.

Organized under this logic, how can the curriculum proposal help teachers understand, for example, how a particular "competence" is developed, such as "Recognizing that mathematics is a human science, the result of the needs and concerns of different cultures at different moments in history [...]" (BRAZIL, 2017, p. 267)? At what point, between "calculations," "procedures, and problem solving" – which resemble exercises – can a student establish such relationships? How can we revisit and discuss the "fundamental ideas" initially presented and then not articulated in the thematic unit "numbers"?

The differences in understanding of competencies[7] present in the document, the way in which the "fundamental ideas" of mathematics were adopted in the National Common Core Curriculum, and, above all, their

existence not only as a "minimum curriculum," but as an expression of an Educational Project oriented toward the maintenance of Capital, are also expressed in the divergence regarding the very logic of organizing the knowledge to be taught and learned: an orientation that allows (or even induces) a direct, pragmatic, and utilitarian relationship with knowledge.

The ramifications of this trend can be seen in calls for proposals inviting interested parties to submit didactic, literary, and pedagogical works for students and teachers in the early years of elementary school in the country's schools. The National Program for Books and Teaching Materials (PNLD 2023) states:

> Educational and pedagogical works shall comply with the criteria of consistency and adequacy of the theoretical-methodological approach and shall: [...]
> 2.4.3. Comply with the provisions of the National Common Core Curriculum (BNCC) and:
> 2.4.3.1. Consider and apply the specific principles and precepts present in the BNCC to each component—Portuguese Language,

[7] On the fundamentals of the discussion on "skills" in education, see Moretti and Moura (2010) – Teacher Training from a Historical-Cultural Perspective: in search of overcoming individual competence.

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> Art, Physical Education, Mathematics, Science, Geography, and History; and
> 2.4.3.2. Address, for each component—Portuguese Language, Art, Physical Education, Mathematics, Science, Geography, and History—all of their respective language practices or thematic units, objects of knowledge, and skills, according to the child's school year.
> (PNLD NOTICE, p. 41).

4 The *object of teaching* as a teaching tool in pedagogical activity

It is expected that teaching activities will identify "which" knowledge is relevant and core to a given area of science, based on which scientific concepts are recognized as syntheses of conceptual links derived from historically constituted human activity. The identification of this socially relevant knowledge—including the needs and motives that generated it—characterizes a first step in determining and explaining the *object of teaching*. A second step is understanding how to organize teaching activities so that this knowledge and its relationships become the *object* of the teacher's teaching activities and the students' learning activities.

The general pedagogical question guiding the teacher's activity would be: how to organize teaching to make explicit the knowledge systematized through theoretical thinking and thus contribute to promoting student learning and development. In particular, this question leads to others, for example, what allows a given content, present in curricular proposals, to be presented and appropriated as a concept in pedagogical activity, that is, to express a synthesis of the conceptual links of the phenomenon in question? If we consider the "content" *number*, given the multiple *knowledge* that expresses or can express this content, how can we see the relationships between them? And, above all, how can we see which of these relationships are essential for students' appropriation to contribute to the formation of theoretical thinking?

Considering the fundamentals presented here and Davidov's perspective on school education, that each curricular component should be oriented so that "[...] in a concise, abbreviated form, it reproduces the real historical process of the genesis and development of knowledge" (DAVIDOV, 1988, p.174, our translation),

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we can say that the *object of teaching*, as a *unit* of connection between the historical process of knowledge production and the general responses that were produced to solve this problem, constitutes the fundamental criterion for the organization of a curriculum proposal that is oriented towards the development of the theoretical thinking of the subjects of pedagogical activity.

It so happens that the needs or problems that required the creation of certain knowledge continue to be necessary and permanent problems for social practice, giving meaning to the very responses or instruments created to solve them. This unity between the process of producing knowledge and its product can be called a theoretical concept (DAVIDOV, 1988), derived from the *logical-historical* movement of the concept (KOPNIN, 1978). For this very reason, it constitutes the general material from which the teacher's teaching activity can be guided to create situations that allow each individual subject to reconstruct this concept for themselves.

Taking the BNCC as an example again, when it indicates as one of the "objects of knowledge" for the first year of elementary school "reading, writing, and comparing natural numbers (up to 100)" (BRAZIL, 2017, p.278) and for the fifth year "the decimal number system: reading, writing, and ordering natural numbers (up to six orders) (BRAZIL, 2017, p.294), it can be admitted that the concept of number is present in *some way* in such propositions, however, the conceptual links that make "number content" a *concept* do not appear explicitly at any point in the document. Several aspects that make up the concept of number appear and are described in the form of "skills" or "objects of knowledge" (e.g., numerical symbols; counting and grouping actions/procedures; one-to-one correspondence; grouping; number line; numbering system). However, the way they are presented does not make it clear to what extent these notions or aspects allow the *concept* of number to be expressed. One wonders, for example, how "reading, writing, and comparing natural numbers (up to 100)" expresses the *concept* of number and not just a procedure.

In this sense, it is considered that a curriculum document needs to express in its "contents" and "objectives" the *core concepts* of the specific area of knowledge,

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which potentially helps teachers to recognize and mobilize the *conceptual links* of the area in their teaching activities. If we do not start from a vision and systematization of the content to be taught and learned based on (essential) theoretical relationships, any "transposition," "transformation," "pedagogization," etc. of the content to be taught will be based on fragments of "concepts" or, rather, notions about the concepts, which limit students' recognition of historically constituted meanings.

Thus, a curriculum proposal guided by the explicitation of *objects of teaching* in different areas of knowledge would imply presenting and systematizing the *unity between the central problems to be perceived and analyzed by students in relation to a given object and/or phenomenon and the syntheses that have allowed (and continue to allow) the construction of creative responses by subjects to such problems.*

Considering the "content" number, one of the core problems that marked its systematization refers to the need to control the variation in quantity of objects of a discrete and continuous nature (CARAÇA, 1951; IFRAH, 1994). From this general problem, others unfold, composing a system of needs that effectively guided human activity in its historical process of elaborating the concept of "number." One possibility for expressing the relationship between the core problems in relation to the "content" of number and the syntheses that were constructed to respond to it is summarized in Chart 2.

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Chart 2: One way of expressing the relationship between core problems and responses to such problems for the concept of Number

The central issues to be understood and analyzed by students in relation to Number	**Syntheses/elements for constructing creative responses to these problems**
How can we control the variation in quantity of discrete and continuous objects?	Things (objects, phenomena) have certain characteristics that can be quantified (**magnitudes**), and in certain situations, due to their variation, they need to be controlled**. Controlling the variation of this quantity** is therefore the first problem for subjects, who need to compare one magnitude with another magnitude of the same nature. In this process, it is necessary to recognize that there are types of quantities that are discrete in nature and others that are continuous in nature. For example, when proposing a task to control the number of animals in a corral, the first synthesis that is expected to be produced in the pedagogical activity is the recognition of the need to establish a set that counts (e.g., pebbles, sticks, etc.) the set that one wants to count (e.g., animals). This need is linked to the concept of **one-to-one correspondence.** On the other hand, when proposing a task such as "counting the distances achieved by the jumps of each child in the classroom," the first synthesis that is sought is to recognize the need to establish a quantity that can serve as a **unit of measurement** for what is to be measured, allowing us to approach the concept of qualitative comparison between quantities (greater, smaller, and equal).
How can we compare the variation in quantity of continuous quantities?	To control the variation of continuous quantities, it is necessary to **establish a unit of measurement** that serves as an equivalent of what is to be measured (length with length, area with area, etc.), *resulting in a relationship of being equal, greater, or smaller*. A second synthesis that we seek to produce is the need to know how much *greater or smaller* a given quantity is in relation to the chosen unit of measurement. To do this, the comparison between quantities must be expressed as a number (for example: the distance of the jump was four straws, because the length of this straw fits four times into the length of the jump). From the beginning of the appropriation of the concept of number, the child needs to be confronted with the *quality of the quantities* expressed in the numerals they are using: two what? four what?, approaching the understanding that these *quantities result from the comparison of two quantities with each other*. In this movement of "measuring," it is necessary to recognize a second need, regarding when it is possible for this "measurement" to be expressed in a certain number of whole times or if it is necessary to fractionate the unit of measurement to more adequately express the measurement of continuous quantities, which allows us to approach the concepts of **whole numbers and rational numbers**.

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How to control the variation in the quantity of discrete objects using the smallest number of signs and symbols	To control the quantity of discrete objects, it may be necessary to recognize the need to count faster and/or record the quantity of the counted group in a "more economical" way. To count faster, **groupings** are used as a means of organizing the quantity of the counted group (on a table full of beans, you can make groupings of "two by two" or three by three and, from these, control the total quantity). This action presents the basis of the *operations of* addition and multiplication. At the same time, groupings allow us to highlight a second conceptual link between numbers and discrete quantities: the **one-to-many** correspondence. In this case, the value represented by a single object can be more than one (for example: the blue stick is worth one, but the red stick is worth five). In addition, it is necessary to recognize situations in which it is necessary to reduce the number of *object-signs* to count the group (one-to-many correspondence or one that is worth many) and *one that is worth many in position*, which introduces the concept of **positional value.**

Source: prepared by the authors.

Chart 2 seeks to express some of the central relationships that make up the concept of number, relating them to the *needs* that gave rise to them and which continue to present themselves as permanent problems to be taught and learned when "number" is indicated as teaching content. One may question here whether these are really the core and central problems in relation to the concept of number, and it is important that this question be asked constantly, not only in relation to this "content," but in relation to all others that are proposed in pedagogical activity. This questioning places us precisely in the movement of appropriation and systematization of the *objects of teaching* in the areas of knowledge.

Furthermore, considering that scientific knowledge advances as it becomes more complex and more relationships are established that explain the causes and consequences of certain objects and phenomena, it is important that these other relationships are constantly apprehended in teaching activities so that their incorporation as *objects of teaching* can be evaluated. Geometry presents itself as an expression of this last consideration. The geometric relationships that underpin teaching are based on Euclid's postulates, from which various concepts of geometry are explained. However,

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these have been continuously studied by so-called "non-Euclidean geometries." At what point will the relevance of such relationships be evaluated to determine whether they should be incorporated as *objects of teaching*?

Thus, we return to the general problem of the relationship between knowledge of a subject area and the knowledge to be taught and learned in school. We can affirm that the pedagogical effort is not to find ways to "facilitate" or "adapt" scientific knowledge so that it can be 'transformed' or presented as "*teaching content*." On the contrary, pedagogical activity seeks to recognize this conceptual complexity to create learning situations that allow students to relate to such conceptual links. The idea that, since the concept of "number" is "complex," it could be "simplified" in teaching by, for example, first teaching the numerals from 1 to 10, then from 11 to 100, then measuring, etc., not only prevents rigorous work with number content (because it tends to reduce it to procedures), but also generates *other difficulties* for the learning process, related to the very meaning of learning what is learned.

Recognizing the essential relationships and conceptual links between objects and phenomena in their *historical and logical movement* is thus one of the permanent actions of teaching in relation to the areas of science that are taught. In this direction, we have found some possibilities for studies and research that deal with the process of organizing teaching, focused on explaining the relationships between concepts, considering them essential in pedagogical activity.

The studies by Davydov (1982, 1988), for example, clearly express criticism of the school teaching model based on empirical thought processes, presenting the possibility of understanding real numbers as the *general* concept to be taught and learned. The author considers that

> [...] the ultimate goal of this school subject [mathematics] today [...] is to give students a detailed and valid understanding of real numbers, which is based on the concept of magnitude. Numbers (natural and real) are a particular aspect of this more general mathematical object. Well, would it not be possible to first familiarize children with this general

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> object, and only then deduce the particular cases of its manifestation? Would it be possible to do so, and what would this mean for the subsequent assimilation of mathematics? (DAVYDOV, 1982, p.431)

Based on this understanding, and guided by the concept of *study activity*, Davydov organizes *specific tasks* from the first year of schooling that seek to explain the *relationship between quantities* in a way that is linked to arithmetic, but also algebraic and geometric meanings. Thus, the tasks are articulated and highlight what would be the conceptual links of numbers.

Another possibility for overcoming the presentation of the concept of numbers in a pragmatic, empirical, and segmented way is presented in studies based on the Guiding Teaching Activity (GTA) (MOURA, 1996a; MOURA et al., 2010). Theoretically supported by the concept of activity, AOE is the link between teaching and learning activities, constituting a general way of organizing teaching aimed at reconstructing the specific content of each human activity (its objectives and *motives*). This content, which potentially *mobilizes* the subject to act in the world, materializes in what has been called the *learning trigger situation* (MOURA et al, 2010), as one of the actions that seeks to objectify, in teaching, the relationship between the human problem that generated a particular concept, the collective way of generating hypotheses for its solution, and the collective synthesis that allows for the mobilization of joint activity among subjects.

This *triggering problem p*otentially explains the historical and logical movement of the concept, that is, the human needs that generated the concept and the search for solutions that were synthesized. Thus, situations regarding the teaching of numbers explained in works such as Moura (1996), Moura, Lopes, Araujo, and Cedro (2018); Lopes, Golin, Giacomelli, and Klein (2019) aim to establish relationships between what would be the *conceptual links* recognized in their historical and logical movement for different "subjects" or "topics": one-to-one correspondence; ordering; grouping; numbering systems; numeral recording; operations, etc.

The intention here is not to scrutinize these studies, but only to present the possibility of taking, as an *object of teaching,* not the simplification of

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scientific knowledge or one or another "notion" related to it, but its essence, so that this is the *motive* for pedagogical activity, directing the training of students through theoretical thinking.

5 Final considerations

In this article, we present the following question to guide the discussion: How can we recognize the *object of teaching* that guides teaching activities toward promoting the best conditions for student learning? We start from the understanding that what pedagogical activity does, considering the nature of the process of human appropriation of knowledge, is to create specific ways for the subject, in different stages, to approach knowledge in its *complex* character (as a totality) and from its essential relationships.

In this sense, we also assume that scientific knowledge and the knowledge presented in pedagogical activity are not, or should not be, "different" types of knowledge, but rather knowledge that takes on different roles due to the objects and instruments of the activities that organize them: research and teaching.

It was discussed that, often, what is called "school content" ends up being reduced to a list of topics, on which conceptual relationships are not always found. It was argued that these "contents" express, in a particular way, the *object of teaching,* understood as a synthesis of the links and relationships between concepts. In this sense, it is understood that one of the permanent actions of a teacher's teaching activity is the analysis of the content to be taught and learned. In order for this action to take place in an increasingly conscious, voluntary, and autonomous manner, it was argued that the concept of *object of teaching* can be used as a potential tool for teaching activity.

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