Obutchénie
Revista de Didática e Psicologia Pedagógica

DOI: http://doi.org/10.14393/OBv8.e2024-36

The form and content relationship of the conceptual nexuses of counting in online classes for children in the 1st year of Elementary School[1]

A relação forma e conteúdo dos nexos conceituais de contagem em aulas online para crianças de 1º ano do Ensino Fundamental

Patrícia Pereira[2]

ABSTRACT

This article stems from a doctoral research based theoretically and methodologically on the historical-dialectical materialist paradigm, whose objective was to analyze the form and content relationship of the conceptual nexuses of counting (numerical sense, one-to-one correspondence, sequence/ordering, grouping). For the construction of the information, online math classes transmitted by the Early Childhood Education and Early Years Media Center (CMSPi), during the pandemic, for children enrolled in the initial grades, of Elementary School in the State network of São Paulo, were watched and analyzed, in order to understand how and which conceptual nexuses of counting are presented, identifying the relationship form and content of these connections. The results presented showed that the online classes prioritized the form through the use of manipulable concrete materials, such as bottle caps, chips and toothpicks, with emphasis on the perceptible elements of the concept that are manifested in the colors of objects and numerical representations. The concept of counting is restricted to the indication by the children of the objects from the correspondence one by one with the little fingers and immediately, they must represent the quantities by the numerical symbols that appear in the numerical base ten.

Keywords: Form and content; Conceptual nexuses of counting; Online classes.

RESUMO

Esse artigo é decorrente de uma pesquisa de doutorado fundamentada teórica e metodologicamente pelo paradigma materialista histórico-dialético, cujo objetivo foi analisar a relação forma e conteúdo dos nexos conceituais de contagem (senso numérico, correspondência um-a-um, sequência/ ordenação, agrupamento). Para a construção das informações foram assistidas e analisadas aulas online de matemática transmitidas pelo CMSPi, durante a pandemia, para crianças matriculadas nas séries iniciais, do Ensino Fundamental na rede Estadual de São Paulo, de forma a compreender como e quais nexos conceituais de contagem são apresentados, identificando a relação forma e conteúdo desses nexos. Os resultados apresentados mostraram que as aulas online priorizaram a forma por meio do uso de materiais concretos manipuláveis, como tampinhas, fichas e palitos, com destaque para os elementos perceptíveis do conceito que se manifestam nas cores dos objetos e representações numéricas. O conceito de contagem fica restrito à indicação pelas crianças dos objetos a partir da correspondência um a um com os dedinhos e imediatamente, elas devem representar as quantidades pelos símbolos numéricos que se apresentam na base numérica dez.

Palavras-chave: Forma e conteúdo; Nexos conceituais de contagem; Aulas online.

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DOI: http://doi.org/10.14393/OBv8.e2024-36

1 Introduction

This article presents as its theme the relationship between form and content of the conceptual links of counting in a period of pandemic, marked by the rupture of the teacher-student link, with classes transmitted by the Early Childhood Education and Early Years Media Center (CMSPi) for all students of 1st year of Elementary School in the São Paulo state network.

The choice of historical-dialectical materialism as a research method is due to the fact that the method is, according to Kopnin (1978, p.91), "a means of obtaining certain results in knowledge and practice". Thus, we seek to establish the dialectical relationship in a process of constant signification and resignification of the form and content of the conceptual nexuses of counting based on the analysis of CMSPi online classes.

It is noteworthy that research that has this theoretical and methodological perspective has as its central premise the need to seek to understand and explain the objects and phenomena investigated as they are in concrete reality, having as assumptions the epistemological dimension, which allows humanity to systematize a set of postulates about how it is possible to know natural and social reality, and the ontological dimension of scientific knowledge, which makes it possible to explain what it truly is, constituting itself historically and socially through the practical activity carried out by all men (NETTO, 2011).

Form and content are categories of materialist dialectics, in which, as in other categories, the essential aspects of the development of the objective world are reflected (ROSENTAL; STRACKS, 1960). As well as others (concrete and abstract, quantity and quality, logical and historical, cause and effect, essence and phenomenon, singular-particular-universal) reflect the universal laws of functioning and development of practical activity, serving as a process of knowledge of reality objective (ESTEVES, 2016).

The current way of school organization, a product of a capitalist society, privileges individual competence, making questioning and reflection difficult, aiming to form individuals adaptable to the job market. It is necessary to

DOI: http://doi.org/10.14393/OBv8.e2024-36

understand the school form, therefore, as an obstacle that offers resistance to changing the content and form of the teacher's teaching activity.

In traditional schools, the individual's role in the learning process is passive, where knowledge is acquired cumulatively through memorization. Considering that this study is related to the form and content of the conceptual nexuses of counting, through online classes, and that these nexuses are the links that underlie concepts, being constituted by logic, history, abstractions, formalizations of human thinking in the process of knowledge construction (SOUSA, 2018), it is important to establish a relationship between formal logic and mathematical logic, as the way in which the contents are presented can affect the apprehension of concepts

Like this, we aimed to analyze the relationship between form and content of the conceptual counting links presented in online classes for children in the 1st year of Elementary School.

2 The formation of concepts: the construction of conceptual counting nexuses

The Mathematics we know today is the result of an ancient collective effort from several civilizations. Numbers represent the synthesis of a historical process marked by the development of man himself; a concept that passed through several civilizations until reaching the current organization, always reflecting the social needs of each time and in each specific context (MOURA et al, n.d.). In other words, numbers represent content because they indicate the idea of quantity. The numerals made up of numbers are also historical, since different civilizations created representations to indicate ideas of quantities.

It is no coincidence that children leave schools with the conviction that number is synonymous with numeral, as they are approached in the same way by teachers. This fact occurs because numbers contain aspects of formal logic (form, based on the numeral), mathematics (number) and dialectics (number and numeral are dialectical units) and, consequently, conceptual links (internal and external).

This relationship between number and numeral is practically inseparable and during the Modern Mathematics Movement, according to studies by Sousa (2018), number became practically synonymous with numeral. This means that,

DOI: http://doi.org/10.14393/OBv8.e2024-36

within the scope of formal logic, number is numeral, therefore, content and form are confused. It is worth highlighting that the organization of quantities by groupings arose from the need to overcome a problem: how to designate high numbers with as few symbols as possible? The solution was to use particular groupings such as the ten and organize the regular sequence (form) of numbers according to this base (content).

Regarding representation (shape), the hand was certainly the first concrete support for counting and calculation, as it well met the needs of visual representation of numbers, but the need for written, simple and unambiguous numbering led to the emergence of ten base digits (1, 2, 3, 4, 5, 6, 7, 8, 9, 0), allowing not only a simple and rational representation of any number, however large, but also a comfortable practice of operations arithmetic (content) (IFRAH, 1994).

From this perspective, it must be considered that humanity was creating logical counting forms that contained in their essence, conceptual links, that is, the process of building the history of a given concept (in this case, counting), as correspondence one-to-one, grouping, number sense, place value, comparison, among others (the nexuses being the content and mathematical representation, the way in which these contents are presented).

We can take as an example the form and content of these nexuses, respectively: numeral and number; regularity/pattern and concept of base 10; representation with “dots” and one-to-one correspondence, groupings.

Like this, conceptual nexuses “are made up of sociocultural, historical and philosophical aspects” (JESUS; SOUSA, 2011, p.115) and are presented in theoretical thought, that is, they represent links that help us construct concepts, continuously (GUILLEN; SOUSA, 2013).

We can say that these concepts are historical logic and formal logic because they are not dissociated. They are part of the logical-historical dialectical unity. But, for the formation of the concept to really happen, the use of the child's language with adults and adults with children is essential, as language expresses thought and also favors new modalities of attention, memory and imagination.

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For Vygotsky (1999, p.66-67), "a concept is not an isolated, fossilized and immutable formation, but rather an active part of the intellectual process, constantly at the service of communication, understanding and problem solving". To organize teaching in a way that considers the process of movement of thought, it is essential that the teacher considers the unity between the logical and the historical of the teaching objects to be worked on.

The content of the teaching activity is, therefore, quite complex, which requires the development of the teacher's own theoretical thinking (Esteves, 2016). In this way, form and content are always in movement. Content can be converted into form and form into content according to the mutual relationships established between the phenomena.

Considering that a concept is not formed by chance, as it is the result of a mental operation in the service of a practical activity, we emphasize that one of the main objectives of solving problems in mathematics is to provide conditions for the child to think and seek possible ways to solve a problem. problem posed to you.

Reflecting on the relationship between form and content, for changes to occur in the organization of teaching, it is necessary to provoke, firstly, changes in the content of the teaching activity, as it is only "as a result of the accumulation of quantitative changes in the content, [that] there will be, sooner or later, a change of form, which is accompanied by the passage of material formation to a new qualitative state" (CHEPTULIN, 1982, p.348).

For this to happen, we consider that the proposed situations must be engaging, challenging and motivating, in order to generate thought processes of a productive nature, leading to the construction of conceptual counting nexuses (number sense, one-to-one correspondence, sequence/ ordering, grouping), especially based on communication and understanding of the proposed activities, as for Vigotsky (2009, p.156),

> [...] the formation of concepts is a process of a productive and not reproductive nature, in which a concept emerges and is configured in the course of a complex operation aimed at solving some problem,

DOI: http://doi.org/10.14393/OBv8.e2024-36

> and that only the presence of external and the mechanical establishment of a link between the word and the object are not sufficient to create a concept.

But what would these conceptual nexuses of counting be? They were built and developed historically due to man's need to count quantities.

Numerical sense can be defined as the innate and biological ability of human beings to perceive quantities without counting, that is, simply "glancing" to perceive quantities. One-to-one or one-to-one correspondence makes it possible to compare two collections of the same nature or not, through equivalence. The sequence/ordering allows the child to understand that it is necessary to follow an order to count (content), as there are predecessors and successors of numbers (form). Finally, grouping allows the basic intuitive idea to be developed (content), in a process of thought abstraction, making it possible to use fewer objects to count through one object representing several, that is, there is the possibility of creating numerical systems. For example: systems that have a base of 2, systems that have a base of 10. When we write 113, 131, 311 we use the same digits (form – numerical representation) with the content being the understanding of groupings and positional value.

Thus, corroborating with Vigotsky (2009), Padovan, Guerra and Milan (2000), they state that children need more than memorized information; They need to learn information search and interpretation procedures, know how to communicate their ideas, as well as know techniques and master problem-solving strategies, and thus form mathematical concepts. When children are faced with situations in which they are encouraged to think about different problems, seeking solution strategies or raising hypotheses on how to solve them, they increase confidence in their own way of thinking and, as a consequence, begin to understand why they are doing such a thing; that is, it ceases to be a mechanical action, becoming an action that favors the appropriation of the concept, as presented in the previous examples.

DOI: http://doi.org/10.14393/OBv8.e2024-36

2.1 The form and content relationship of conceptual counting nexuses in CMSPi online classes

Shortly after the beginning of the 2020 school year, a global pandemic caused by a highly contagious virus, responsible for many deaths, COVID-19, had its first cases confirmed in Brazil, causing state and municipal authorities to suspend classes from 03/19/2020 and subsequently decreed quarantine[3], for an indefinite period, closing all services considered non-essential.

With the unpredictability of returning to classes, the São Paulo State Department of Education (SEDUC) opted to restart classes remotely, remotely, using the "Centro de Mídias SP" (CMSP) applications, aimed at the final years of elementary school. and secondary education, and "Center for Early Childhood Education and Early Years Media" (CMSPi), for the initial years of primary education and early childhood education.

CMSP and CMSPi classes were broadcast live, operated in two studios of the Escola de Formação e Aperfeiçoamento dos Professores da Ensino do Estado de São Paulo (EFAPE), linked to SEDUC, and were normally taught by one or two teachers from the network selected by notices (one that actually taught and coordinated the class and another responsible for monitoring and reporting participation via chat), allowing students to interact via chat. The live schedule through the app had fixed times for each year/grade throughout the day, and for the 1st years the online class hours were from 7:30 am to 9 am, Monday to Friday.

Although it was an initiative to try to minimize the distance between students and schools and ensure the continuity of the teaching and learning process, this initiative interfered with the autonomy of teachers, since the classes were the same for all students that year throughout the entire school. state of São Paulo, without considering the differences and specificities of each school and students with more or less difficulties.

Considering data from the 2018 School Census/INEP, there are 5667 basic education schools in the São Paulo state network, with 122,774 students enrolled

[3] Type of seclusion applied to a certain group of healthy people, but who may have been contaminated by the agent causing a disease, in order to prevent that disease from spreading and causing an epidemic.

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in the 1st year of Elementary Education. However, CMSPi had around 2000 to 3000 accesses to its live online classes via the application every day, which represents only 1.62% to 2.44% of attendance/participation.

A pouca quantidade de acessos pode ter ocorrido pelo fato de algumas famílias apresentarem dificuldades para acompanhar as crianças nas aulas online ao vivo, visto que muitas estavam trabalhando no horário em que eram transmitidas e não tinham experiência em ensinar. Salientamos também que existiam alunos sem acesso à internet ou a TV que não conseguiam acompanhar as aulas.

According to CadÚnico (2020 information), around 500 thousand students were in this situation. The challenges would be immense, but this was the solution found to minimize the impossibility of returning to in-person classes (CORDEIRO, 2020). This solution helped to maintain inequalities in access and maintenance of students enrolled in schools, especially in a pandemic situation.

When we attended online classes from 04/27/2020 to 10/29/2020, we found that in several CMSPi classes the areas of counting one-to-one correspondence, grouping, sequence/ordering were addressed, through challenges and use of concrete material such as caps and toothpicks.

However, in relation to numerical representation, “the use of the numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, 0 generally seems so obvious to us that we almost consider it as an innate ability of the human being, as something that would happen to him in the same way as walking or talking” (IFRAH, 1994, p.9).

The history of numbers, as well as other mathematical concepts, was not a linear and abstract history, a succession of concepts linked together. It was and continues to be a history of the practical and utilitarian needs and concerns of social groups, which used empirical means to record quantities. The principle of counting would have emerged from one-to-one correspondence, making it easy to compare two collections of beings or objects, whether of the same nature or not, without resorting to abstract counting.

DOI: http://doi.org/10.14393/OBv8.e2024-36

Videos can be an important and flexible instrument for collecting oral and visual information, as they allow valuable behaviors and complex interactions to be re-examined.

Analyzing the organization of content and presentation dynamics of these online classes, at the beginning there was a large turnover of teachers and there was not always a sequence in the content covered, due to the structuring of CMSPi. Little by little this turnover began to decrease and from 06/22/2020 classes began to be taught by the same pair of teachers, or by at least one of them until the end of October, with the exception of 07/13, 23/ 07, 07/24, 08/13 when they were taught by other teachers, for reasons not stated.

It is important to highlight that always (or most of the time) having the same pair of teachers made it possible for the content to have a sequence, without sudden changes in subject matter. As pointed out by Bauer, Cassettari and Oliveira (2017, p.957) "turnover compromises the continuity of pedagogical work and the possibility of teamwork, which, in turn, interferes with student learning". Regarding the content covered, there was a focus on counting, as 37 of the 103 online classes (35.92%) were on this topic through counting objects and collections, comparing quantities, estimation, representation, strategies, reading and identification of quantities (Table 1).

Table 1 – Number of classes by themes

CLASS CONTENT WATCHED	NUMBER OF CLASSES WITH THE THEME	PERCENTAGE OF TOTAL CLASSES
Geometric figures	8	7,76
Operations	5	4,85
Calendar	9	8,73
Space orientation	5	4,85
Counting	37	35,92
Problem situations	14	13,59
Graphs and tables	5	4,85
Patterns and sequences	8	7,76
Standardized and non-standardized measurements	2	1,94
Monetary system	3	2,91
Random Events	5	4,85
AAPs	2	1,94
TOTAL	103	100

Source: Prepared by the author based on analysis of CMSPi online classes

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Given the data presented and initially analyzed in table 1, we were able to conclude that there is a prevalence (35.92%) in situations and challenges that involve counting itself, using as a reference the skills of the São Paulo Curriculum for the concept of number, specific to counting. (EF01MA02, EF01MA03, EF01MA04 and EF01MA05). We present below the counting skills expected for students in the 1st year of Elementary School, as described in the São Paulo Curriculum (Table 2).

Table 2 – Description of counting skills from de São Paulo Curriculum Source: Paulista Curriculum

ABILITY	DESCRIPTION
EF01MA02	Count accurately or approximately, using different strategies such as pairing and other groupings.
EF01MA03	Estimate and compare quantities of objects from two sets (at least 20 elements) by estimation and/or by correspondence (one to one, two to two) to indicate "there is more", "there is less" or "there is the same quantity".
EF01MA04	Count the number of objects in collections of at least 20 units and present the result using verbal and symbolic records, or situations of interest to you, such as games, classroom materials, among others.
EF01MA05	Compare natural numbers of up to two orders in everyday situations, with and without support from the number line.

Source: Paulista Curriculum (2019)

Observing these skills, we observe a proposal for gradual development in the counting process, starting with the concrete through one-to-one correspondence, reaching numerical registration and number comparisons. The counting content is expressed in the form of pairings, groupings, estimates, verbal and symbolic records, in addition to the use of concrete materials.

For Cheptulin (1982, p.263)

> The content cannot be the simple set of elements or aspects that constitute the thing, it is a process in which all these elements and aspects are constantly in interaction, in movement, changing one another and sometimes manifesting one, sometimes another of its properties.

There needs to be a dialectical unity between teaching and learning, between form and content, considering the logical-historical movement of concepts

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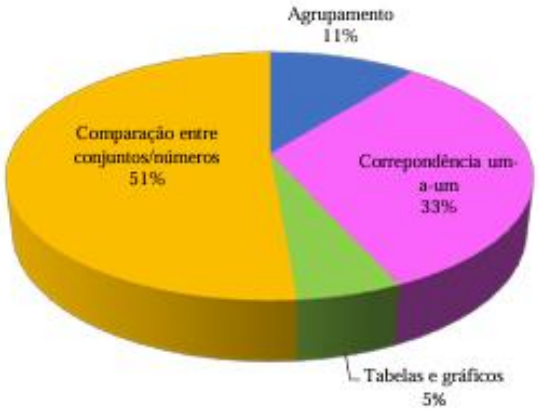
and that these are not treated in a mechanical way, even more so in the context in which these skills were proposed to be developed (online).

Analyzing the online classes that presented the concept of counting and the classification made into groups based on the prevalence of the topics covered, we found that the majority of them (51%) involved counting through the comparison between sets and numbers (19 classes), according to the Graphic 1:

Graph 1 – The counting approacha in CMSPi online classes

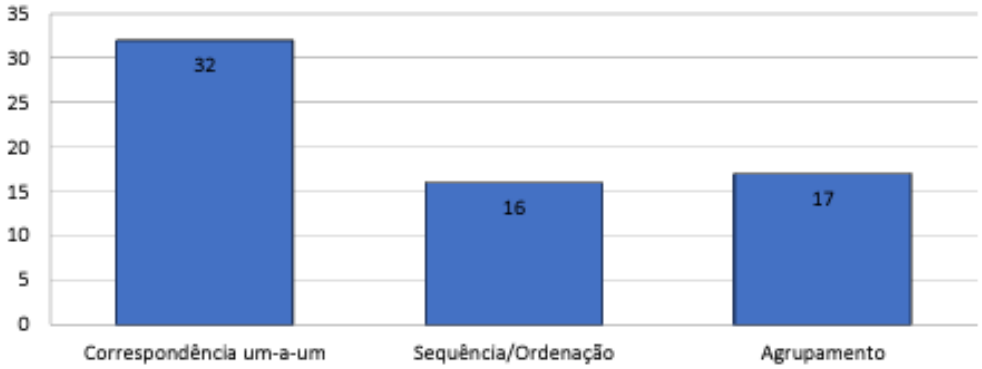


Source: Pereira, 2022, p.57

It is important to highlight that in none of the 37 classes analyzed did we find the conceptual nexus of counting numerical sense, defined by Ifrah (1994) as the direct perception of quantities without counting. In all classes there were counts of concrete materials such as caps, letters, toothpicks and pencils or counts of representations through figures, even in situations where children were asked to estimate quantities. We emphasize that the focus of the analysis was the relationship between form and content, considering the conceptual links of counting: number sense, one-to-one correspondence, sequence/ordering and grouping. We present below, in Graph 2, the number of occurrences of these connections in classes, highlighting that in most of them we identified a combination of two or three of these connections.

DOI: http://doi.org/10.14393/OBv8.e2024-36

Graph 2 – Occurrence of conceptual countig links in online classes



Source: Pereira, 2022, p.58

Observing the data in Graph 2, the conceptual nexus of counting one-to-one correspondence appeared in almost all classes (32 of 37), while the sequence/ordering and grouping nexuses had this occurrence reduced to just under half of the classes (16 of 37 and 17 of 37, respectively).

We also highlight that although in several classes the concept of base 10 (content) was implied, where understanding positional value is of paramount importance, there was no mention of the use of the abacus (shape), which constructed with children would greatly help on this issue. There was a constant concern in reading the numerical table in its entirety (as occurred a few times) and/or in its lines and columns, hoping that the regularity and pattern (shape) would be understood, but without the movement of constructing the concept.

3 Final considerations

Our object of study was the form and content of the conceptual connections of counting in CMSPi online classes transmitted to children in the 1st year of Elementary School.

With the implementation of this mediating instrument (online classes), the teacher-student link was broken, as there was no longer the possibility of direct contact. Furthermore, online classes standardized the transmission of content for all students in the state network, disregarding the cultural, social and economic differences present, attended by a minority of students, as previously presented in our discussions.

DOI: http://doi.org/10.14393/OBv8.e2024-36

Online classes highlighted social inequality above all, as the economic condition of many students prevented access to remote teaching due to the difficulty in accessing the instruments and resources necessary for this type of teaching (computers, cell phones, tablets and internet) perceived by the low number of accesses.Com a análise das aulas online verificamos uma preocupação com a forma, retratada pelo excesso do uso de elementos perceptíveis do conceito (como cores) e de representações numéricas.

The conceptual links were explained in these online classes completely disconnected, the form of the concepts was prioritized, however form and content were not related. The external links were limited to the perceptible elements of the concept, while the internal ones make up the logical-historical movement of the concept. The external links are formal and in the formal logic, matching constitutes the content, as was possible to verify.

La relación, forma y contenido de los nexos conceptuales del conteo en las clases en línea para niños y niñas de 1er año de Educación Básica

RESUMEN
Este artículo es el resultado de una investigación doctoral basada teórica y metodológicamente en el paradigma materialista histórico-dialéctico, cuyo objetivo fue analizar la forma de relación y el contenido de los vínculos conceptuales del conteo (sentido numérico, correspondencia uno a uno, secuencia/ordenamiento, agrupamiento). Para la construcción de la información, se atendieron y analizaron clases de matemática en línea transmitidas por el CMSPi, durante la pandemia, para niños matriculados en los grados iniciales de la Escuela Básica de la Red Estatal de São Paulo, con el objetivo de comprender cómo y qué vínculos conceptuales del conteo se presentan, identificando la forma de relación y el contenido de esos vínculos. Los resultados presentados mostraron que las clases en línea priorizaron la forma a través del uso de materiales concretos manipulables, como gorras, fichas y palillos de dientes, con énfasis en los elementos perceptibles del concepto que se manifiestan en los colores de los objetos y representaciones numéricas. El concepto de contar se restringe a la indicación por parte de los hijos de los objetos de la correspondencia uno a uno con los deditos e inmediatamente, deben representar las cantidades mediante los símbolos numéricos que se presentan en la base numérica diez.

Palabras clave: Forma y contenido; Nexos conceptuales del conteo; Clases online.

DOI: http://doi.org/10.14393/OBv8.e2024-36

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Received in February 2024
Approved in April 2024