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The logical-historical movement in theses and dissertations: a content analysis[1]

O movimento lógico-histórico nas teses e dissertações: uma análise de conteúdo

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ABSTRACT
This article aims to present an exploratory investigation into the logical-historical movement in theses and dissertations. The adopted methodology is bibliographic in nature, supported by Content Analysis (CA), and encompasses both quantitative and qualitative treatments of the obtained results. The pre-analysis and material exploration phases result in 74 productions that discuss the logical-historical movement. The quantitative treatment stage organizes the data, considering the institution, the year of defense, the area of the postgraduate program, and the topic covered. The results reveal the composition of the data in 44 dissertations and 30 theses, 62 of which originate from public institutions. Of the 45 graduates from postgraduate education programs, 31 are involved in the logical-historical movement in mathematics teaching and learning. The predominant focus in Mathematics Education is on a qualitative analysis of the approach to the logical-historical movement, which originates from historical and dialectical materialism. The

RESUMO
O presente artigo tem como objetivo apresentar uma investigação exploratória acerca do movimento lógico-histórico em teses e dissertações. A metodologia adotada é de cunho bibliográfico, respaldada pela Análise de Conteúdo, e abrange tratamentos quantitativo e qualitativo dos resultados obtidos. As fases de pré-análise e exploração do material resultam em 74 produções que discorrem sobre o movimento lógico-histórico. A etapa de tratamento quantitativo organiza os dados considerando a instituição, o ano de defesa, a área do programa de pós-graduação e a temática abordada. Os resultados revelam a composição dos dados em 44 dissertações e 30 teses, sendo 62 pesquisas de origem em instituições públicas. Das 45 provenientes de programas de pós-graduação em educação, 31 envolvem o movimento lógico-histórico com o ensino-aprendizagem da matemática. A predominância na área de Educação Matemática direciona uma análise qualitativa sobre a abordagem do movimento lógico-histórico, oriunda do materialismo histórico e dialético. A exploração das 9 teses e 22 dissertações revela que 8 pesquisas tratam da

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exploration of the 9 theses and 22 dissertations reveals that 8 research projects deal with algebra, 5 with geometry, 5 with measurements, 3 with numbers, 1 with statistics, and 1 with analysis. The others refer to teaching non-specific mathematical concepts at different levels of education and teacher training. The logical-historical movement's most frequent function is the historicized approach to the mathematical concepts listed, in search of origins, changes, and influences. The analysis of historiographies highlights the interaction between logical and historical aspects in the development of concepts, recognizing that one cannot separate logic from history to understand the process of knowledge. The contribution made by this research lies in the enrichment of teaching and learning mathematics, in the relationship with the development of theoretical thinking and human development.

Keywords: Logical-historical; Content análisis; Mathematics Education.

Álgebra, 5 da Geometria, 5 de Medidas, 3 de números, 1 de Estatística e 1 de Análise. As demais referem-se ao ensino de conceitos matemáticos não específicos em diferentes níveis de escolaridade e formação de professores. A função mais frequente do movimento lógico-histórico é a abordagem historicizada do conceito matemático elencado na pesquisa em busca das origens, mudanças e influências. As análises das historiografias destacam a interação entre os aspectos lógicos e históricos no desenvolvimento dos conceitos, reconhecendo que não se pode separar a lógica da história para a compreensão do processo de conhecimento. A contribuição proferida por essas pesquisas reside no enriquecimento do ensino e da aprendizagem da matemática, na relação com o desenvolvimento do pensamento teórico e o desenvolvimento humano.

Palavras-chave: Lógico-histórico; Análise de Conteúdo; Educação Matemática.

1 Introduction

This study aims to delve into the knowledge surrounding the logical-historical movement. While many works have explored this perspective, there was a recognized need to organize and present the dissemination and approaches of this perspective in academic research in a more systematic manner.

The research, of a bibliographic type, is methodologically oriented into two phases according to Content Analysis (BARDIN, 2009). The first one focuses on quantitative data, while the second emphasizes the qualitative aspect. They utilize a sample of theses and dissertations from the Brazilian Digital Library of Theses and Dissertations (BDTD). The statistical variables of the first stage include university, graduate program, program area, type of production (thesis or dissertation), and year of defense.

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The second stage, based on the first, aims to comprehend the function of the logical-historical movement in research, under the historical and dialectical materialism associated to mathematics episteme.

Without the pretension of promoting a theoretical discussion, a synthesis about the logical-historical movement is presented next, followed by the sections: the mapping of the logical-historical movement in theses and dissertations and the role of the logical-historical movement in Mathematics Education with quantitative and qualitative methodological approaches, respectively.

2 The Logical-Historical Movement: A Synthesis

This item does not aim to extensively discuss the logical-historical movement. Instead, it aims to provide a concise overview of elements that will assist the reader understand the results of the presented research.

Kopnin (1978) defines the logical-historical movement as a category in understanding dialectics as logic and theory of knowledge. In this epistemic perspective, the logic of the *historical* part extends beyond formal logic. This is because formal logic focuses on the internalist synthesis of the object being studied, while dialectical logic looks for all the parts that can be used to understand it, based on how it relates to objective reality while learning it. Kopnin describes the logical-historical movement as follows:

> By historical, we understand the process of change of the object, the stages of its emergence and development. The historical acts as the object of thought, the reflection of history, as content. Thought aims at reproducing the real historical process in all its objectivity, complexity, and contradiction. The logical is the means through which thought accomplishes this task, but it is the reflection of the historical in theoretical form, that is to say, it is the reproduction of the essence of the object and the history of its development in the system of abstractions. The historical is primary in relation to the logical, logic reflects the main periods of history (KOPNIN, 1978, p. 183-184, translated text).

Imbued with the same episteme, Rosental and Straks (1960) argue that the dialectical categories of the historical and the logical are the foundation for

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understanding the essence of knowledge in the Marxist method of investigation, that is, the inseparable unity between theory and practice in the production and understanding of knowledge.

While the main emphasis is on the logical-historical movement within the universe that involves historical and dialectical materialism, it is important to recognize that this focus is not meant to separate it from the framework that defines it. This study does not aim to engage in theoretical debate, but instead provides an overview of scientific publications that shed light on the various directions that this field has taken in the production of knowledge in Brazil.

3 Mapping of the Logical-Historical Movement in Theses and Dissertations

In the initial phase of the research, the aim is to analyze Brazilian theses and dissertations that focus on the logical-historical movement. This analysis will be conducted using the Content Analysis methodology developed by Bardin (2009). Research in this field typically involves three key phases: pre-analysis, material exploration, and interpretation of results. Each phase requires specific criteria and actions to be taken.

During the pre-analysis phase, 79 documents were found in the Digital Bank of Theses and Dissertations (BDTD). These documents, which included theses and dissertations, contained the keyword "logical-historical" in the text. This phase is crucial for the initial organization of the material.

Five duplicate records were found during the data analysis process, which was conducted in accordance with the methodological rule of exhaustiveness. This rule states that all elements of the set must be considered and should not be excluded unless there is a compelling reason to do otherwise. Therefore, it is important to acknowledge this gap in the data entry control of the BDTD.

Seventy-four documents were found to be valid based on the rules of representativeness (forming a significant sample in relation to the original universe of data), homogeneity (having the same parameters for analysis), and

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relevance (meeting the objective of data composition). Consistency in results is evident, regardless of the formatting of the keywords, unlike the CAPES' Catalog of Theses and Dissertations database.

Every record has identical indices. The document should include the title, author(s), advisor(s), institution, and a link to access the complete document. It should also mention the graduate program, type of document (thesis or dissertation), language, and subject in both Portuguese and English. Additionally, there should be an abstract in Portuguese and English, along with the field of knowledge as registered in CNPq, year of defense, country, and the names of the researchers who composed the defense board. Not all fields require filling out.

Since scientific publications often originate from theses and dissertations, the 74 documents are regarded as a representative sample of scientific production. It is important to note that there is no intention to draw statistical conclusions from the sample. Instead, the corpus, which is a set of data that follows specific rules, will be used for further quantitative analysis.

Selecting the statistical variables and applying a quantitative treatment that facilitated the ensuing phase of interpretation and analysis comprised the exploration and material treatment phases of the methodology.

Thus, the research corpus consists of a total of 74 documents, which are considered the statistical population. These documents contain the keyword and are subjected to quantitative frequency analysis based on variables such as the university of the graduate program, program area, type of production (thesis or dissertation), and year of defense. Graph 1 displays the frequency distribution of research conducted in Brazilian universities.

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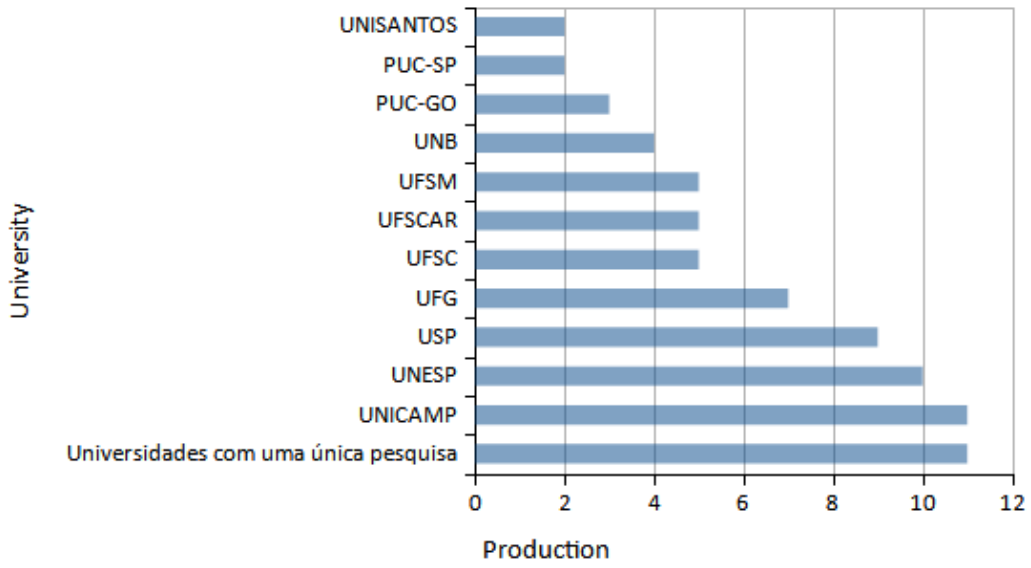
Graph 1 – Production of theses and dissertations with an approach to the logical-historical movement in universities



Source: authors' own elaboration.

There are 22 universities, with 11 of them having produced more than one work, namely: UNICAMP (State University of Campinas); UNESP (Paulista State University); USP (University of São Paulo); UFG (Federal University of Goiás); UFSCAR (Federal University of São Carlos); UFSC (Federal University of Santa Catarina); UFSM (Federal University of Santa Maria); UNB (University of Brasilia); PUC Goiás (Pontifical Catholic University of Goiás); PUC-SP (Pontifical Catholic University of São Paulo), and Unisantos (Catholic University of Santos).

The database contains a single research entry for the remaining, namely FGV (Getúlio Vargas Foundation); Mackenzie (Mackenzie Presbyterian University); PUC Minas (Pontifical Catholic University of Minas Gerais); UERJ (State University of Rio de Janeiro); UFC (Federal University of Ceará); UFMG (Federal University of Minas Gerais); UFN (Franciscan University); UFPel (Federal University of Pelotas); UFRGS (Federal University of Rio Grande do Sul); UNIFESP (Federal University of São Paulo), and Unioeste (State University of Western Paraná).

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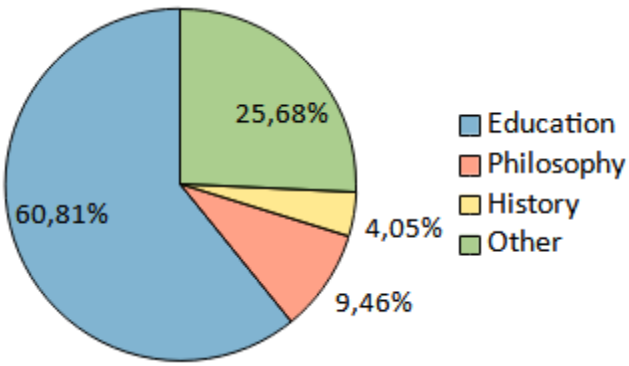
Of the universities, 15 are public institutions while 7 are privately funded. Public universities have made a significant contribution to research, with 62 published works, accounting for approximately 83.78% of all of them. When examining the universities whose graduate programs produced only one research, it is worth noting that public universities make up the majority, with a total of 7 (UERJ, UFC, UFMG, UFPel, UFRGS, UNIFESP, and Unioeste).

The state of São Paulo concentrates 56.76% of the productions, distributed across 9 universities, followed by the states of Goiás and Rio Grande do Sul with 13.51% and 10.81%, respectively, while the others are dispersed throughout Brazil.

Graph 2 presents the distribution of data regarding graduate programs. Out of 74 records, 45 mention the graduate program, as filling in this field is not mandatory; however, to gather all the data, verification was done in the remaining texts.

Graph 2 - Production of theses and dissertations with an approach to the logical-historical movement in Graduate Programs



Source: authors' own elaboration.

Postgraduate Programs in Education, Mathematics Education, Science and Mathematics Teaching, and Teaching in Basic Education are all considered for research in the Education field. There is a noticeable disparity

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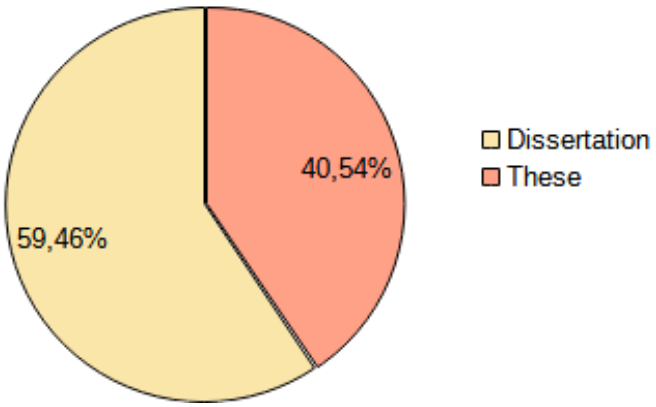
in the number of productions between this area and Philosophy. Other programs, such as Medicine, Social Sciences, Linguistics, Agronomy, Religious Science, Engineering, and so on, vary significantly in terms of their areas of operation. It is worth mentioning that the logical-historical movement is not solely a theoretical contribution from the humanities field. This suggests the need for further research to explore these data. Graph 3 displays the quantity of theses and dissertations published on the platform, indicating a greater number of dissertations.

Graph 3 - Theses and dissertations with an approach to the logical-historical movement



Source: authors' own elaboration.

Although dissertations account for 59% of the productions, the difference is not significant when considering the length of thesis and dissertation productions.

The following data analysis pertains to the temporal scale of productions, as depicted in Graph 4. There is currently no available data regarding the specific year in which Graduate Programs submit their documents to the BDTD in a systematic manner. Before the digital production of theses and dissertations, the process of inserting them was more laborious as the documents had to be digitized. Therefore, it is possible that not all of them were included. For instance, there are productions from 1985 and 1993 before the year 2000, but these two are not necessarily the only ones from that period.

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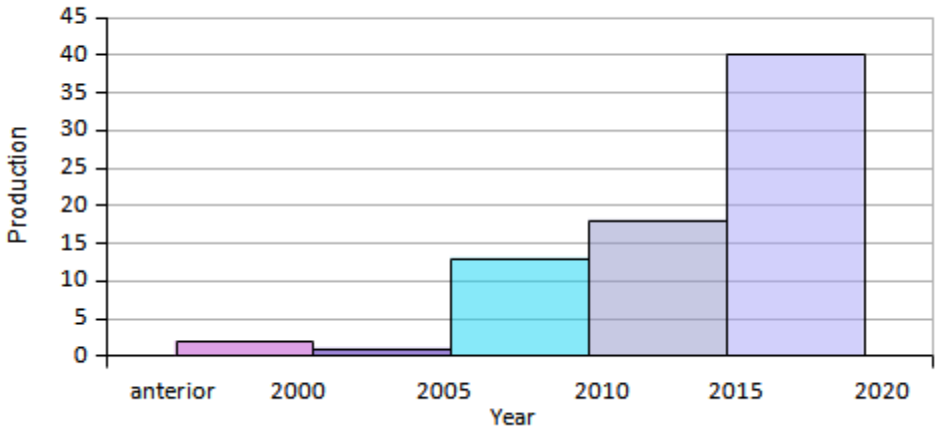
Graph 4 - Production of theses and dissertations with an approach to the logical-historical until 2020



Source: authors' own elaboration.

Graph 4 depicts a notable surge in research utilizing the logical-historical approach starting from the year 2000, particularly intensifying after 2015. Prior to the period between 2005 and 2010, there was no notable disparity in the quantity of productions. Additionally, following the period from 2010 to 2015, specifically in the five-year span from 2015 to 2020, over half of the research, specifically 53.42%, was successfully defended. It is important to note that these data were collected in 2021.

Out of the 74 productions, 32, equivalent to 43%, contain the word "mathematics" or some concept from this area in their title, indicating the beginning of a possible trend of the logical-historical movement in the Mathematics Education area.

4 The role of the logical-historical movement in Mathematics Education

With a qualitative focus, the ongoing research will use Content Analysis to delve further into the methods of the logical-historical tradition of thought within the historical and dialectical materialist epistemology, with a special emphasis on mathematics.

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The new corpus was created by the methodological process of floating reading, which selects document sections for a more thorough examination with the aim of confirming signals that are consistent with the study goals.

Therefore, the system initially selected four theses: one on the history of logic in Brazil (MORAES, 2007), another on the cultural impacts of Gödel's Theorem (LANNES, 2009), a third on the history of logic in Ducrot's semantics (CASTRO, 2018), and a fourth on the logic of deductive thought of Boole (JANGUAS, 2019). However, these theses did not include any references to historical and dialectical materialism. Thus, the new corpus is made up of 31 research works, including 9 theses and 22 dissertations (see appendix).

Methodologically supported in the study, the unit of registration (UR) is used as a content representation that gives the analyst information about the features of the text, emphasizing the word logical-historical and its variants in the quantitative and qualitative phases. The unit of context (UC), the part of the message that offers the background information required to comprehend the UR, is taken into consideration for a more complete analysis. When considering UC dimensions, it is important to strike a balance between the cost of analysis and the relevance of the provided context.

Therefore, the process of handling the productions involves organizing data into three distinct units: the identification unit of the work, the logical-historical and mathematical unit, and the research subjects unit. The identification unit includes the type of production, year of defense, title, authorship, graduate program, and university. The mathematical unit focuses on identifying mathematical concepts that are connected to the logical-historical and bibliographic references, which provide a historical account of mathematics. It also considers the presence of the term logical-historical and its different forms in the texts. The research subjects unit involves examining the participants present in the investigations or the type of document being analyzed.

The phase of interpretation and analysis, articulated with the described methodological units, guides the understanding of the role of the

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logical-historical movement in the research, resulting in the intended qualitative analysis.

The interpretative and analytical synthesis of the role of the logical-historical movement that follows is based on the texts of the theses and dissertations that make up the research corpus. When examining the scope of the productions, it is interesting to note that there have been a few changes. Out of the 31 productions, there are 8 that focus on Algebra, with 5 of them discussing the general concept, one focusing on functions, and two specifically addressing Linear Algebra. Additionally, there are 5 productions that pertain to Geometry, with two covering general aspects, one exploring the concept of angles in relation to location, one studying polyhedra, and one focusing on concepts of plane geometry. Furthermore, there are 5 productions that relate to Measurement, each involving the concepts of fraction, area, time, and angle, along with one production that addresses the general concept of measurement. In terms of Number, there are 3 productions that cover the decimal numbering system, whole numbers, and real numbers. Additionally, there is one production that addresses Statistics and another that focuses on the concept of continuity, contributing to the field of Analysis. Lastly, the remaining 8 productions center around the teaching and learning of non-specific mathematical concepts.

The works stress the need of the logical-historical movement in the development of conceptual systems and the comprehension of mathematical concepts. These productions mostly arrange chapters to address the theoretical foundations of this methodology as well as the historical and logical aspects of the mathematical concept that is being studied.

Mathematical concepts are influenced by various historical, political, economic, and cultural factors, which shape their evolution alongside societal norms and practices. This study is closely aligned with the teaching and learning process, focusing on the aspect of human knowledge production. The authors utilized various historiographies to compose their texts, aiming to

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present mathematical concepts in their essence by exploring their origins and evolutions.

The logical-historical movement also plays a role in didactic activities, involving students from Basic Education and higher education. It contributes to the understanding of conceptual movement and helps develop theoretical thinking, ultimately improving the quality of the teaching-learning process beyond mathematics.

Within the realm of education, Historical-Cultural Theory has been extensively studied in 23 research works. These studies highlight its strong connection to the logical-historical movement, which provides valuable insights into the psychological aspects of human development during the learning process. Remaining in this framework, it is expressed through Activity Theory, emphasizing Teaching Guiding Activity. This approach is understood in educational institutions as mediating the growth of theoretical thinking, connected to various historical periods, and grounded in logical-historical analyses of concepts and the teaching-learning process.

Historical-critical pedagogy has been presented in 4 research works as a pedagogical theory that emphasizes the importance of understanding the history and development of mathematical concepts. It is regarded as an ally for teaching classical content.

The connection between the logical and the historical is seen as a crucial aspect in the development of mathematical concepts. In the process of comparing the past with the present, in the cultural, social, economic, and political dimensions in which mathematical concepts are immersed, the histories of mathematics are a tool that can be utilized to provide students with a sense of the content that is being covered.

In the realm of education, it is worth noting that a significant number of academic productions, specifically 26 out of 31, incorporated pedagogical interventions when working with research subjects. Out of these, 21 included some form of Teaching Guiding Activity, while the remaining 5 focused on bibliographic research. To advance the approach of statistical contents in

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high school, Cunha (2014) conducted a literature review in scientific journals in the fields of education and mathematics education with the goal of analyzing the historical development of concepts related to statistics.

The National Meeting of Mathematics Education (ENEM) proceedings from 1987 to 2013 that deal with the idea of function are examined by Vasconcelos (2015). The researcher examines the conceptual debates, epistemological discussions, and methodological and theoretical conceptions that permeate the field of study with the purpose of identifying the main themes, problems, and inquiries that are addressed. By analyzing research, the logical-historical movement covered in the dissertation seeks to comprehend the concept's growth and development.

In Porto's (2017) theoretical analysis, the focus is on the relationship between the subject and object in the construction of knowledge. It explores how the subject shapes and transforms the object of reality through the logical-historical process of knowledge production, using concepts. This analysis draws on the contributions of Historical-Cultural Psychology and Historical-Critical Pedagogy.

The dissertation, authored by Ribeiro in 2018, is a bibliographic analysis that explores the connection between the historical context of syllabi for Linear Algebra in undergraduate Mathematics programs at federal universities and the evolution of the concepts within the discipline. Assis' thesis (2018) also touches upon this discipline, but her research focuses on a didactic intervention that explores the historical processes of the fundamental concepts. Both highlight the historical development of Linear Algebra, discussing the contributions of different mathematicians like Leibniz, Euler, Cramer, Frobenius, and emphasizing the impact of culture and geography on the evolution of this concept.

In Silva's research from 2019, the goal is to explore the conceptual connections of the continuity concept in mathematics through an analysis of scientific productions using a documentary and historical-epistemological approach. Higher education instructors of Differential and Integral Calculus

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and Mathematical Analysis can benefit from the research's logical-historical analysis, which aims to reveal the fundamental relationships of mathematical knowledge throughout its evolution.

Ultimately, the teaching and learning methods of the logical-historical movement can vary in numerous ways depending on the specific context and research goals. Nevertheless, its focus is on comprehending and placing in historical context the origin and evolution of concepts, with the aim of effectively teaching them through a dynamic process that encourages the development of theoretical thinking among those involved, including students in both basic and higher education, as well as teachers. Examining the conceptual links that pervade knowledge throughout its development, the logical-historical movement employs a dialectical approach as a method of historical-bibliographic research.

5 Considerations

In the quest to understand how the logical-historical movement is addressed in scientific research, a bibliographic investigation was developed, considering data from theses and dissertations. The initial phase of the investigation yields quantitative findings, with particular emphasis on the domain of education. The second phase, qualitative in nature, focuses on research in the field of mathematics education from the standpoints of dialectical materialism and historical materialism. In short, these perspectives emphasize the significance of the logical-historical movement in academic productions as the agent that contextualizes mathematics historically, assigns meaning to mathematical concepts by highlighting their meanings, and directs didactic activities. Every study highlights the importance of challenging one-sided interpretations of the history of mathematics and acknowledges the impact of diverse viewpoints, encompassing mathematicians, philosophers, sociologists, and historians.

The primary purpose of the logical-historical movement as described in the texts is to investigate the historical origins, transformations, and

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influences of the mathematical concepts mentioned in the research. By examining historiographies, research emphasizes the interconnectedness of logical and historical elements in the evolution of concepts. It acknowledges that the comprehension of mathematical knowledge requires an understanding of both logic and history, from the standpoint of historical and dialectical materialism.

These points emphasize the importance of recognizing the interdependence between mathematical concepts and the histories of mathematics. This approach seeks to go beyond traditional teaching methods and enrich both the teaching of mathematics and the discussion on educational issues. They also emphasize the dynamic nature of mathematics, as it continuously evolves to meet the changing needs of society and adapt to increasingly complex concepts and practices.

El movimiento lógico-histórico en tesis y disertaciones: un análisis de contenido

RESUMEN
El presente artículo tiene como objetivo presentar una investigación exploratoria acerca del movimiento lógico-histórico en tesis y disertaciones. La metodología adoptada es de carácter bibliográfico, respaldada por el Análisis de Contenido, y abarca tratamientos cuantitativo y cualitativo de los resultados obtenidos. Las fases de pre-análisis y exploración del material resultan en 74 producciones que discurren sobre el movimiento lógico-histórico. La etapa de tratamiento cuantitativo organiza los datos considerando la institución, el año de defensa, el área del programa de posgrado y la temática abordada. Los resultados revelan la composición de los datos en 44 disertaciones y 30 tesis, siendo 62 investigaciones de origen en instituciones públicas. De las 45 provenientes de programas de posgrado en educación, 31 involucran el movimiento lógico-histórico con la enseñanza-aprendizaje de la matemática. La predominancia en el área de Educación Matemática direcciona un análisis cualitativo sobre el enfoque del movimiento lógico-histórico, proveniente del materialismo histórico y dialéctico. La exploración de las 9 tesis y 22 disertaciones revela que 8 investigaciones tratan de Álgebra, 5 de Geometría, 5 de Medidas, 3 de Números, 1 de Estadística y 1 de Análisis. Las demás se refieren a la enseñanza de conceptos matemáticos no específicos en diferentes niveles de escolaridad y formación de profesores. La función más frecuente del movimiento lógico-histórico es el enfoque historicizado del concepto matemático elegido en la investigación en busca de los orígenes, cambios e influencias. Los análisis de las historiografías destacan la interacción entre los aspectos lógicos e históricos en el desarrollo de los conceptos, reconociendo que no se puede separar la lógica de la historia para la comprensión del proceso de conocimiento. La contribución proferida por estas investigaciones reside en el enriquecimiento de la enseñanza y del aprendizaje de la matemática, en relación con el desarrollo del pensamiento teórico y el desarrollo humano.

Palabras clave: Lógico-histórico; Análisis de Contenido; Educación Matemática.

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