PERSPECTIVAS DA EDUCAÇÃO MATEMÁTICA

REVISTA DO PROGRAMA DE PÓS-GRADUAÇÃO EM EDUCAÇÃO MATEMÁTICA DA UNIVERSIDADE FEDERAL DE MATO GROSSO DO SUL (UFMS)

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Historiographies of Mathematics in Undergraduate Mathematics Courses

Historiografias de Matemática nos cursos de Licenciatura em Matemática

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ABSTRACT

This article aims to present results of an ongoing qualitative, theoretical study grounded in historical-cultural theory. The objective is to study the historiographies of mathematics referenced in the History of Mathematics courses of undergraduate mathematics programs at Brazilian federal universities, focusing on the authors' understanding and understanding of mathematical concepts. It is assumed that the historiographical approaches to the History of Mathematics describe the logic of historical events that occurred in diverse contexts. In this sense, the logical-historical movement is understood as a didactic perspective for mathematics teaching because it explains the history of concepts from different perspectives. The results show that, by studying them, future teachers working in basic education can delineate conceptual connections between mathematical content and understand that one of the roles of historiographies of mathematics is to provide opportunities for reflection on Law n.º 10,639/03 in mathematics classes.

KEYWORDS: Conceptual Nexuses. Law n.º 10,639/03. Logical-historical Movement. Historical Cultural Theory. Discipline of Mathematics History.

RESUMO

Este artigo tem como objetivo apresentar resultados de uma pesquisa qualitativa em desenvolvimento, de cunho teórico, fundamentado na teoria histórico-cultural. Aqui, estudam-se historiografias de Matemática referenciadas nas disciplinas de História da Matemática dos cursos de Licenciatura em Matemática das universidades federais brasileiras, com foco nos modos que os autores veem e concebem os conceitos matemáticos. Pressupõe-se que as vertentes historiográficas da História da Matemática descrevem a lógica dos fatos históricos que ocorreram em diversos contextos. Nesse sentido, o movimento lógico-histórico é entendido enquanto perspectiva didática para o ensino de Matemática porque explica a história dos conceitos considerando-se diferentes pontos de vista. Os resultados mostram que, ao estudá-las, os futuros professores que atuarão na Educação Básica podem delinear nexos conceituais dos conteúdos matemáticos e compreender que um dos papéis das

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historiografias da Matemática é proporcionar momentos de reflexão sobre a Lei n.º 10.639/03 nas aulas de Matemática.
PALAVRAS-CHAVE: Nexos conceituais. Lei n.º 10.639/03. Movimento Lógico-Histórico. Teoria Histórico-Cultural. Disciplina História da Matemática.

Introduction

Future mathematics teachers in basic education should study the historiography of mathematics, as this perspective foregrounds the close relationship between the history of mathematics, historiography, and the logical-historical movement in mathematics education. Engaging with this relationship supports a deeper understanding of how mathematical concepts are formed and transformed over time, recognizing them as historical productions shaped by different social groups and cultures.

From this standpoint, when the logical-historical movement is conceived as a didactic perspective for teaching mathematics, we draw on Kopnin (1978). For Kopnin, history consists of the process through which an object changes across the stages of its emergence and development. The logical, in turn, is the means by which thought reflects upon this historical process, reproducing its main moments. Thus, to think about a given concept is to engage with “the confluence, the synthesis of the most diverse ideas, the result of a long process of knowledge” (Kopnin, 1978, p. 191, our translation[2]).

However, when analyzing the syllabi of the History of Mathematics courses offered in the Mathematics Degree programs at Brazilian federal universities, we find that there is a certain invisibility of both the contributions of African peoples and Latin American peoples regarding the creation of mathematical concepts. Ignoring the contributions of Africans and Latin Americans, including Brazilians, in the construction of mathematical concepts has distanced us from the objectives of Law No. 10,639/03, which emphasizes that the study of the history of Africa and Africans, the struggle of Black people in Brazil, Brazilian Black culture, and Black people in the formation of national society should be included in the basic education curricula of undergraduate, teacher training courses (Brasil, 2003, p. 1).

Teacher training courses and, consequently, schools should consider, in addition to ethnomathematics, the logical-historical movement as a didactic perspective and the possibility of implementing Law No. 10,639/03 in mathematics classes, contributing to the decolonization of mathematics curricula. This means

[2] This and all the following direct quotes are translated by the authors, unless otherwise stated.

promoting access to the histories of mathematical knowledge and concepts, developed by various civilizations and narrated in various versions in the historiographies of mathematics, since, according to report CNE/CP 003/2004, it is recommended that contributions of African origin, identified and described by Ethnomathematics (Brazil, 2004, p.14), should be included in the curricula.

In this context, we maintain that if the historiographies of mathematics address the history of mathematical knowledge and therefore explain the logical-historical movement of concepts when learning about them, we are able to understand the conceptual nexuses (internal and external) that each historian, mathematician, or mathematics educator prioritizes. There is a direct relationship here between historiographies, the history of mathematics, and logical-historical movement.

The common link between these three concepts lies in the way of conceiving the history of human knowledge about certain objects. In this case, we are dealing with mathematical objects that materialize from various languages, including arithmetic, algebra, and geometry. In this sense, we agree with Todão (2024, p. 37) when they state that

> the history of mathematics becomes lighter when we show that mathematics is a human construction, created and developed by the power of our ancestors. That our black children, adolescents, and adults know that they are descendants of queens, kings, and people who developed mathematics. May non-Black people recognize the enormous African contribution to the development of humanity, demystifying what they have always learned through structural racism and scientific racism. Different forms of racism dehumanize, while true history and representation humanize.

For this reason, we argue that future mathematics teachers have access to the various narratives written by mathematicians and historians about the history of mathematics. We demand that these professionals be familiar with the different historiographies of mathematics so that they can conduct historical research, according to the studies by Radford (2011), and outline what we call the conceptual nexuses (internal and external). Thus, the future educators will be able to contribute, didactically, to the organization of mathematics teaching in basic education classrooms.

Here, conceptual nexuses, historically constructed in various social practices and in various political, cultural, and social contexts, represent links between concepts, which are formed in multiple contexts. When treated didactically, they can guide the development of Learning Triggering Situations (LTS), considering that

> Considering the logical-historical dialectically in the process of knowledge of a given object has implications for teaching. For the teaching of mathematics, it is essential that the history of the concept permeates the organization of the teacher's actions, so that they can propose to their students triggering problems that embody the essence of the concept. Factual history, which is impregnated in the concept, considering that this concept aims at a historically established human need (...). The teacher's intention in using it as a teaching resource is that the concept to be taught becomes a cognitive or material need for their students, so that the actions they develop in seeking to solve the problem are in line with the reason that leads them to act, and that, in this way, they can, in fact, be active. (Moretti e Moura, 2011, p. 442-443).

It should also be considered that, when understood by teacher training students, conceptual nexuses become didactic elements that guide students and teachers to better understand part of the process of constructing mathematical ideas, developed based on the needs of each community in their cultural practices. Based on these assumptions, we defined the general objective of the research under development is to study the historiographies of mathematics referenced in the History of Mathematics courses of the Mathematics teacher training programs in Brazilian federal universities.

The focus is on how the authors conceive and interpret mathematical concepts, considering that, according to Stamato (2003), these subjects have incorporated into curricula over the past twenty years. We seek to understand which conceptual nexuses (internal and external) are prioritized by the authors who wrote the historiographies. We start from the hypothesis that these nexuses permeate Basic Education classes, as they are integrated into the training activities of both mathematics teachers working in Basic Education and students enrolled in mathematics courses when studying History of Mathematics.

Thus, the question that guides the research is: *what are the ways of seeing and conceiving the mathematical concepts explained in mathematics historiographies written by Brazilian, African, and European authors, referenced in the History of Mathematics courses at Brazilian federal universities?*

In the following sections, we will present the theoretical and methodological foundations, as well as the study of historiography by Eves (1997), with emphasis on the concept of function. Finally, we will present our concluding remarks.

Theoretical foundations

Considering the main research question, there is no doubt that it is necessary to consult studies by authors who help us to understand the concept of history in

greater depth. For Cardoso (2011), the definition of History is structured by two paradigms: the Enlightenment one and the postmodern one, which underpin the main theoretical strands currently studied. The common points between the Marxist and the Annales conceptions related to the concept of History are part of the Enlightenment paradigm. In the postmodern paradigm, on the other hand, the conception of history (of histories) must be considered. However, how can we relate the concepts of history and the history of mathematics?

D'Ambrosio (1999, p. 1), one of the first mathematics educators to concern himself with relating the two concepts, states that "at all times in history and in all civilizations, mathematical ideas are present in all forms of doing and knowing." It is worth noting that the same author also stated that we had virtually no in-depth knowledge of the historiographies produced by Brazilian authors. Thus, we agree with the author when he draws attention to "Brazilian priorities in the history of mathematics," as he points out that the works of researchers such as Father Bartolomeu Lourenço de Gusmão; José Bonifácio de Andrada e Silva; José Fernandez Pinto Alpoym; Alberto Santos Dumont, Joaquim Gomes de Souza (Souzinha), among many others, are practically ignored.

In addition to Brazilian authors, African mathematics educators, African and Latin American mathematicians also remain absent from the history of mathematics taught in undergraduate courses and, consequently, in basic education classrooms. "Black people and everyone else need to know that these women and men of African origin participated in some inventions that changed the course of modern history" (Machado, 2014, p. 1), since the mathematical concepts developed in the Nile Valley show that

> the ancient Egyptians possessed sophisticated mathematical skills that formed the basis of Western science, which was still in its infancy. The concepts of distance, area, weight, volume, and time were used by the Egyptians. Egypt also invented standards, units, and methods of measurement. Egyptians invented geometry, trigonometry, and many other mathematical techniques such as algebra (Machado, 2014, p. 23).

We understand that this way of seeing and conceiving mathematical concepts, as proposed by Machado (2014), which takes African knowledge into account, should be part of mathematics classes, both in basic education because "science and technology in Africa have been developing since the dawn of human history, the first

evidence of the use of tools by our hominid ancestors is buried in the valleys throughout sub-Saharan Africa" (Machado, 2014, p. 9).

It is also necessary to consider that when the contemporary formulation of concepts becomes a restriction for teachers, they are left with few options for organizing their teaching. Thus, they are left to resort to exercises and problems that prioritize the memorization of rules and algorithms whose origin they do not know. In this way of conceiving mathematics and its teaching, knowledge of the historical movement of concepts is practically nonexistent. Formal logic enters the scene, prioritizing only the perceptible elements of concepts.

In this context, these elements are associated with mathematical symbolism, reducing the teaching of mathematics exclusively to the manipulation of symbols, without the need to understand the ideas underlying the concepts taught. In this sense, we agree with Radford (2011, p. 44) when he states that

> the history of mathematics can give us a new perspective on teaching. Obviously, we are not saying that our students must follow the same path as those of ancient mathematicians. Rather, it is a matter of better understanding the nature of mathematical knowledge and finding, within its historical structure, new possibilities for teaching.

In the specific case of this research, the new perspective is related to the development of LTS, which can be done by future teachers, preferably in a shared manner. We can cite as an example of LTS the concept of function that had conceptual nexuses outlined when we studied some historical moments that explain the history of thought of various groups, described in the historiographies of Karlson (1961), Ríbnikov (1987), Eves (1997), and Caraça (1998), which led to the development of the concept of function, and we list the conceptual nexuses (internal and external) that can be used by future teachers when teaching content related to the concept of function in high school.

In advocating that the logical-historical movement be included in teacher training courses, we suggest that LTS consider: a) the historical movement of the concept, that is, the logical-historical aspect of the concept being studied; b) the dialectical moments of its formation; and c) the experience of the subjects' participation linked to a reflective-active explanatory process, measured by the individual-group-class relational dynamics, considering that,

> in the Teaching Guidance Activity, the needs, motives, objectives, actions, and operations of the teacher and students are initially mobilized through the learning triggering situation. This is organized by the teacher based on their teaching objectives which, as we said,

> translate into content to be appropriated by students in the learning space. The teacher's actions will be initially organized with a view to setting in motion the construction of the solution to the learning triggering situation [...]. The learning triggering situation must contemplate the genesis of the concept, that is, its essence; it must explain the need that led humanity to construct the concept in question, how problems and human needs arose in a given activity, and how humans developed solutions or syntheses in their logical-historical movement (Moura, 2010, pp. 222-223).

In this sense, the role of teaching activity (TA) is initially related to the autonomy that teachers can achieve in organizing the teaching they will deliver, as they rethink and break with educational practices that prioritize the memorization of mathematical concepts in basic education, since they can take the risk of inviting students, young people, and adults to participate in the organization of their classes.

Research methodology

The research is qualitative, theoretical in nature, based on historical-cultural theory, and linked to the productivity grant project of the National Council for Scientific and Technological Development (CNPq). The methodology for developing the study consists of the following stages and strategies: 1) Performing a logical content analysis. This consists of a theoretical study of the historiographies of mathematics presented in the syllabi of the History of Mathematics courses in 117 mathematics degree programs at Brazilian federal universities, in the classroom format, and 31 in the distance learning format, totaling 148. 2) Studies on the conceptual nexuses (internal and external) that appear in mathematical concepts proposed in the syllabi of History of Mathematics courses from the 148 courses taught at Brazilian federal universities.

The data analysis follows an interpretative approach characterized by particularization rather than the generalization of results. The search is not for abstract universals, which, according to Moreira (1990), are reached through statistical generalizations, but for concrete universals, which are achieved through the detailed study of a specific, culturally localized case. In this sense, during the development of the research, we are deducing and organizing categories that represent the different ways of seeing and conceiving mathematical concepts of authors who attend undergraduate mathematics courses at Brazilian federal universities, based on the historiographies indicated and studied in mathematics history courses. These different ways of seeing and conceiving mathematical concepts can help us to configure possible logical and historical conceptual nexuses (internal and external), as well as to

study Brazilian, Latin American, and African historiographies so that we can contribute to the implementation of Law No. 10,639/03, based on LTS in classrooms.

Results and discussion

We began our research by consulting the Pedagogical Political Project of the bachelor's degree (teacher training) course at the Federal University of São Carlos (UFSCar). We found that History of Mathematics was first included in the course as a subject in 2004. It is worth four credits (each credit being 15 class hours), and to take it, students must have completed prerequisites totaling 84 credits. It is taught in the eighth semester of the course by professors from the Department of Mathematics, and its objectives are:

> To study the development of mathematics in different civilizations and its connection with social and scientific facts. To study the nature of mathematics through its genesis and development. To study the evolution of mathematical thought and the processes of constructing mathematics. To recognize the contemporary theoretical and methodological challenges of mathematics. To study the role of mathematics in the development of societies and sciences throughout history. To understand the use of the history of mathematics as a methodology for teaching mathematics. Program content: Pre-Hellenic civilization; origins of geometry and the concept of numbers. The Classical Age. Genesis of deductive mathematics in Ancient Greece. The birth of integral calculus. The Renaissance and the roots of modern mathematics. Genesis of differential calculus. The age of Euler. The 19th and 20th centuries and the development of mathematics. The axiomatization of mathematics. Our era and topics in the history of contemporary mathematics. History of Mathematics in Brazil (UFSCar, 2017, p. 36).

In other words, the mathematical concepts studied are related to geometry, numbers, integral and differential calculus, as well as the history of mathematics in Brazil. Thus, during the period of this research, we are analyzing historiographies of mathematics, among them the three that appear in the basic bibliography referenced in the History of Mathematics courses taught in the undergraduate teacher training programs at UFSCar (Sousa, 2021, p. 42):

> 1) BOYER, C. História da Matemática, Translated by Elza Gomide, S. Paulo: Edgard Blucher, 1974. 2) EVES, H. Introdução à História da Matemática. Translated by Hygino H. Domingues, Campinas: Ed. Unicamp, 1999. 3) ROQUE, T. História da Matemática: uma visão crítica, desfazendo mitos e lendas. Rio de Janeiro: Zahar, 2012.

In this specific case, we find that, among the three historiographies, there is one written by the Brazilian Roque (2012) and another written by the American Boyer (1974), which we are currently analyzing in 2025.

In 2021, we conducted a literature review on the subject in the Capes (Brazilian Federal Agency for Support and Evaluation of Graduate Education) repository. We used the keyword: Mathematics History Course. We found two studies: Stamato (2023) and Fragoso (2011), and nine articles: Oliveira and Fragoso (2011); Junqueira and Manrique (2012); Pereira and Guedes (2016); Brandemberg (2017); Soares and Bisognin (2019); Moraes and Cavalari (2019); Rosa and Santos (2020); Carmo and Queiroz (2020); and Machado and Trivizoli (2020). Thirdly, we consulted the pedagogical plans in order to analyze the names of the subjects, their respective codes, workloads, and syllabi, available on the Ministry of Education (MEC) website, distributed across the 26 states and the Federal District, in both face-to-face and distance learning (EaD) formats. We organized the data for analysis by Brazilian state and in alphabetical order in Table 1, with information on the 148 undergraduate courses in Mathematics.

State	Name of the Institution	Acronym	Municipality/ State	Subjects	
				Codes	Names
Acre	(549) Federal University of Acre	UFAC	Rio Branco/AC	CCET 352 (60 hours)	History and Philosophy of Mathematics
Alagoas	(577) Federal University of Alagoas	UFAL	Maceió/AL	No code (60 hours)	History of Mathematics
Amazon	(4) Federal University of Amazonas	UFAM	Manaus/AM	ITM080 (60 hours)	History of Mathematics
Amapá	(830) Federal University of Amapá	UNIFAP	Macapá/AP	No code (90 hours)	History of Mathematics
Bahia	(578) Federal University of Bahia	UFBA	Salvador/BA	MAT216 (68 hours)	Topics in the History of Mathematics
	(18506) Federal University of Western Bahia	UFOB	Barreiras/BA	CET0161 (60 hours) CET0455 (60 hours)	History of Mathematics

					History of Mathematics and its Teaching
	(4503) Federal University of Recôncavo da Bahia	UFRB	Cruz das Almas/BA	No code (51 hours)	History of Mathematics
	(18812) Federal University of Southern Bahia	UFSB	Itabuna/BA	No code (60 hours)	Infinite and Infinitesimal
Ceará	(15497) University of International Integration of the Afro-Brazilian Lusophony	UNILAB	Redenção/CE	No code (60 hours)	History of Mathematics
	(18759) Federal University of Cariri	UFCA	Juazeiro do Norte/CE	No code (64 hours)	History and Philosophy of Mathematics
	(583) Federal University of Ceará	UFC	Fortaleza/CE	CB0611 (64 hours)	History of Mathematics
Federal District	(2) University of Brasília	UNB	Brasília/DF	MAT 113603 (60 hours)	History of Mathematics
Espírito Santo	(573) Federal University of Espírito Santo	UFES	Vitória/ES	MAT13706 (60 hours)	History of Mathematics
Goiás	(25274) Federal University of Catalão	UFCAT	Catalão/GO	No code (64 hours)	History of Mathematics and Mathematics Education
	(584) Federal University of Goiás	UFG	Goiânia/GO	IME0174 (64 hours)	History of Mathematics
	(25282) Federal University of Jataí	UFJ	Jataí/GO	ICE0397 (60 hours)	Topics in the History of Mathematics

Maranhão	(548) Federal University of Maranhão	UFMA	São Luís/MA	Md (COMA0065) (60 hours)	History of Mathematics
Minas Gerais	(595) Federal University of Alfenas	UNIFAL	Alfenas/MG	DCE 570 (90 hours)	History of Mathematics
	(598) Federal University of Itajubá	UNIFEI	Itajubá/MG	MAT072 (96 hours)	History of Mathematics
	(576) Federal University of Juiz de Fora	UFJF	Juiz de Fora/MG	MAT-025 (60 hours)	History of Mathematics
	(592) Federal University of Lavras	UFLA	Lavras/MG	GFM200 (34 hours)	History of Mathematics
	(575) Federal University of Minas Gerais	UFMG	Belo Horizonte/MG	MAT025 (60 hours)	History of Mathematics
	(6) Federal University of Ouro Preto	UFOP	Ouro Preto/MG	MTM261 (60 hours)	History of Mathematics
	(107) Federal University of São João Del Rei	UFSJ	São João Del Rei/MG	No code (72 hours)	History of Mathematics
	(17) Federal University of Uberlândia	UFU	Uberlândia/MG	No code (60 hours)	History of Mathematics
	(8) Federal University of Viçosa	UFV	Viçosa/MG	MAT305 (30 hours)	History of Mathematics
	(596) Federal University of the Jequitinhonha and Mucuri	UFVJM	Diamantina/MG	No code (60 hours)	History of Mathematics

	(597) Federal University of Triângulo Mineiro	UFTM	Uberaba/MG	No code (60 hours)	History of Mathematics
Mato Grosso	(4504) Federal University of Grande Dourados	UFGD	Dourados/MS	No code (36 hours)	History of Mathematics for Mathematics Education
	(694) Federal University of Mato Grosso do Sul	UFMS	Campo Grande/MS	07090011369 (68 hours) 07090021015 (68 hours)	History and Philosophy of Mathematics History of Mathematics
Mato Grosso	(1) Federal University of Mato Grosso	UFMT	Cuiabá/MT	No code (64 hours)	History and Philosophy of Mathematics and Mathematics Education
	(25352) Federal University of Rondonópolis	UFR	Rondonópolis/MT	No code (60 hours)	History of Mathematics
Pará	(15059) Federal University of Western Pará	UFOPA	Santarém/PA	Educational Project not available	Pedagogical Project not available
	(569) Federal University of Pará	UFPA	Belém/PA	No code (68 hours) No code (34 hours)	Topics in the History of Mathematics Laboratory on Topics in the History of Mathematics
	(18440) Federal University of Southern and Southeastern Pará	UNIFESSPA	Marabá/PA	MT07040 (85 hours)	History and Philosophy of Mathematics
Paraíba	(579) Federal University of Paraíba	UFPB	João Pessoa/PB	8103186 (60 hours)	History of Mathematics

	(2564) Federal University of Campina Grande	UFCG	Campina Grande/PB	No code (60 hours) No code (60 hours)	Introduction to the History of Mathematics Topics in the History of Mathematics
	(580) Federal University of Pernambuco	UFPE	Recife/PE	06499 (60 hours)	History of Mathematics
	(587) Rural Federal University of Pernambuco	UFRPE	Recife/PE	06008 (60 hours)	Evolution of Mathematical Ideas
Piauí	(25277) Federal University of the Parnaíba Delta	UFDPAR	Parnaíba/PI	DCE0177 (60 hours)	History of Mathematics
	(5) Federal University of Piauí	UFPI	Teresina/PI	No code (60 hours)	History of Mathematics
Paraná	(15001) Federal University for Latin American Integration	UNILA	Foz do Iguaçu/PR	No code (60 hours)	History of Mathematics
	(571) Federal University of Paraná	UFPR	Curitiba/PR	CMMM 116, CMMM 117, and CMMM118	Topics in History and Philosophy of Mathematics I, II, and III
	(588) Federal University of Technology – Paraná	UTFPR	Curitiba/PR	No code (60 hours)	History of Mathematics
Rio de Janeiro	(693) Federal University of the State of Rio de Janeiro	UNIRIO	Rio de Janeiro/RJ	HDI0161 (30 hours)	History of School Mathematics
	(586) Federal University of Rio de Janeiro	UFRJ	Rio de Janeiro/RJ	No code (60 hours)	History and Philosophy of Mathematics

	(572) Federal Fluminense University	UFF	Niterói/RJ	VMA00039 (60 hours)	History of Mathematics
	(574) Rural Federal University of Rio de Janeiro	UFRRJ	Seropédica/ RJ	IC 579 (4-0) (60 hours)	Fundamentals of Mathematics
Rio Grande do Norte	(570) Federal University of Rio Grande do Norte	UFRN	Natal/RN	MAT1521 (60 hours)	Topics in the History of Mathematics
	(589) Federal Rural University of the Semi-arid Region	UFERSA	Mossoró/RN	No code (60 hours)	History of Mathematics
Rondônia	(699) Federal University of Rondônia	UNIR	Porto Velho/RO	MAT31016	History of Mathematics
Roraima	(789) Federal University of Roraima	UFRR	Boa Vista/RR	EaDMAT 023 (60 hours)	History of Mathematics through Problems
Rio Grande do Sul	(5322) Federal University of Pampa	UNIPAMPA	Bagé/RS	BA000795 (60 hours)	History of Mathematics
	(634) Federal University of Pelotas	UFPEL	Pelotas/RS	11260034 (68 hours)	History of Mathematics
	(582) Federal University of Santa Maria	UFSM	Santa Maria/RS	MTM 1125 (60 hours)	History of Mathematics
	(12) Federal University of Rio Grande	FURG	Rio Grande/RS	01390 (60 hours)	History of Mathematics I
	(581) Federal University of Rio Grande do Sul	UFRGS	Porto Alegre/RS	MAT01351 (60 hours)	History of Mathematics

Santa Catarina	(15121) Federal University of Fronteira Sul	UFFS	Chapecó/SC	GEX994 (60 hours)	History of Mathematics
	(585) Federal University of Santa Catarina	UFSC	Florianópolis/ SC	No code (72 hours)	History and Philosophy of Mathematics
Sergipe	(3) Federal University of Sergipe	UFS	São Cristóvão/SE	105118 (60 hours)	History of Mathematics
São Paulo	(4925) Federal University of ABC	UFABC	Santo André/SP	MCTD010-18 (48 hours)	History of Mathematics
	(7) Federal University of São Carlos	UFSCar	São Carlos/SP	No code (60 hours)	History of Mathematics
Tocantins	(3849) Federal University of Tocantins	UFT	Palmas/TO	MAT-28 60 hours	History of Mathematics

Source: Pedagogical Projects for Mathematics Teaching Training Degree Courses - MEC (2021).

When we examined the syllabi for the subjects listed in Table 1, we found that almost all of them refer to the historiography by Eves (1997). To contextualize this reference, we analyzed this work, which consists of 15 chapters. Its second edition was published in Brazil in the late 1990s and is intended for undergraduate students in higher education mathematics programs. According to Eves (1997, p. 17)

> This book differs from many existing histories of mathematics in that it is not primarily a reference work, but rather an attempt to introduce the history of mathematics to undergraduate students in higher education mathematics courses. Therefore, in addition to the historical narrative, there are many pedagogical devices aimed at assisting, motivating, and engaging students.

The historiographical narratives are based on seven mathematical periods, namely:

> 1st) Egyptian and Babylonian (3,000 BC – 260 AD); 2nd) Greek (600 BC – 450 AD); 3rd) Chinese (1030 BC – 1644 AD); 4th) Hindu (200 BC

> – 1250 AD); 5th) Early Middle Ages (450-1120 AD); 6th) Modern (First half, 1450 to 1700 AD) and 7th) Modern (Second half, 1700 AD to the present (Eves, 1997, pp. 2-3).

The first period is related to an African country. At the same time, the author informs readers of the changes that the book has undergone in relation to the previous edition. For him, these changes:

> Constitute very significant additions to the book Cultural Panoramas, written by Jamie Eves. In fact, they respond to requests from users of previous editions of the book, for whom a deeper understanding of the cultural context of the various eras and periods in the history of mathematics would be of great benefit to students. An informed student should read each Cultural Panorama carefully before delving into the historical material of the associated chapter (Eves, 1997, p. 13).

In other words, Eves (1997) is concerned with undergraduate students and the cultural overview of the mathematical concepts he will be addressing. He writes for future teachers. It is no coincidence that, at the end of each chapter, he presents what he calls “teaching aids”: exercises, topics, and bibliographies, considering that

> Traditionally, courses on the history of mathematics in university curricula tend to emphasize the more picturesque and entertaining side – he biographies and little “stories” surrounding the characters in history – leaving aside the more substantial part, linked to the development of ideas over the centuries. Howard Eves' book helps greatly to alleviate these difficulties, as one of its characteristics is precisely that it is a true course in "Mathematics" – focusing on the examination of important works – not limiting itself to short stories, biographical notes, and pleasantries (Ávila, 1997, cover).

Eves (1997) emphasizes the development of mathematical ideas that have been elaborated over the centuries. In this sense, it is necessary to understand the cultural landscape of each group that contributed to the development of mathematical concepts. When it comes to the historiography of the concept of function, Eves (1997) is emphatic in stating that

> The concept of function, like the notions of space and geometry, has undergone marked changes. Mathematics students will clearly see this fact when they consider the various refinements of this evolutionary process that accompany their academic progress, from the most elementary courses in secondary school to the most advanced and sophisticated at the postgraduate level. The history of the term function provides another interesting example of mathematicians' tendency to generalize and expand concepts (Eves, 1997, p. 660).

In the case of Eves' historiography (1997), the focus of the concept of function is on the development of the term by European mathematicians. This means that the author is concerned with making students aware of the logical-historical movement of the word function. By analyzing the logical-historical movement of a word from a dialectical perspective, we can understand its content through its form, as shown in Table 2, in which the author describes the logical-historical movement of the concept, taking the word function as a starting point (Eves, 1997, pp. 660-661).

Table 2: Logical-historical movement of the word function

Leibniz (1694)	He introduced the word function in its equivalent Latin form. It expressed any quantity associated with a curve, such as the coordinates of a point on the curve, the slope of a curve, and the radius of curvature of a curve.
Johann Bernoulli (1718)	He had come to consider a function as any expression formed from a variable and some constants.
Euler (following)	He considered a function to be any equation or formula involving variables and constants. This is the concept that our elementary mathematics students have.
Fourier (1768-1830)	In his research on heat propagation, he considered the so-called trigonometric series. These series involve a more general form of relationship between variables than those that had been studied previously.
Lejeune Dirichlet (1805-1859)	He arrived at the following formulation: A variable is a symbol that represents any of the elements of a set of numbers; if two variables x and y are related in such a way that, whenever a value is assigned to x, a value corresponds automatically to y by some law or rule, then y is said to be a (single-valued) function of x. The variable x, to which values may be freely assigned, is called the independent variable, and the variable y, whose values depend on the values of x, is called the dependent variable. The possible values that x may take constitute the domain of the function, and the values taken by y constitute its range.
Set theory (20th century)	A function is, by definition, any set of ordered pairs of elements, subject to the following condition: if $(a_1, b_1) \in f$ and $(a_2, b_2) \in f$ and $a_1 = a_2$, then $b_1 = b_2$. The set A of the first elements of the ordered pairs is called the domain of the function, and the set B of all the second elements of the ordered pairs is called the image of the function. Thus, a function is simply a particular type of subset of the Cartesian product $A \times B$. A function f is said to be injective if, from $(a_1, b_1) \in f$ and $(a_2, b_2) \in f$ and $b_1 = b_2$, it follows that $a_1 = a_2$. If f is a function and $(a, b) \in f$, one writes $b = f(a)$

Source: Eves (1997)

When analyzing Table 2 from a didactic perspective, we can see that, for Eves (1997), the conceptual nexuses of the function were systematized by European mathematicians over approximately three centuries (late 17th to 20th) and are directly related to: variation, the field of variation, dependence, interdependence, relation, representation, and set theory. The author also emphasizes that

> The concept of function permeates much of mathematics, and since the early decades of the present century [20th], many mathematicians have advocated its use as a central and unifying principle in the organization of elementary mathematics courses. (...). In short, it is unquestionable that the sooner a student becomes familiar with the concept of function, the better for their mathematical education (Eves, 1997, p. 661).

As the logical-historical movement of the concept of function underwent new meanings by European mathematicians, one of the internal conceptual nexuses responsible for the existence of this concept, movement, became implicit. The other conceptual nexuses that prioritize the form of the concept take precedence. That is why we venture to say that, at this point, it seems that form has taken the place of content. It is as if, when hearing the word function, young people from all social classes who attend school, as well as mathematicians, already know that they are dealing with an instrument created historically over at least three centuries by Europeans to help us describe movements in life, provided they are regular.

Here, priority is given to the external links of the concept, which have materialized in classrooms from conceptual nexuses: relation, variable, field of variation, and representation (analytical and graphical). It is no wonder that few educated young people can relate the concept of function to the movements of their own lives.

Most mathematics textbooks that address the concept of function present it to students on the basis of set theory. It should be noted that Eves (1997) is unable to indicate the theorists who made the definition, because there are so many. The author in question prefers to indicate that, in the 20th century, the definition of the concept of function took Set Theory into account. In this context, Eves' (1997) way of seeing and conceiving the concept of function among European peoples does not take into account the knowledge of African peoples, such as the word "ahá," the first term used to designate numerical variation, as pointed out in the studies by Lima and Moisés

(2000), considering that they used this expression to control unknown quantitative movements. Today's variable was already expressed using a word, since

> One of the first peoples to feel the need to overcome the "manual number" was the Egyptians. Great builders, living in a complex society with large urban centers, the Egyptians dealt with countless movements and, therefore, with multiple forms of quantitative variation (Lima and Moisés, 2000, p. 15).

In other words, the Egyptian peoples understood fluidity, and therefore the movements of life. This way of seeing and conceiving the concept of variable is present in Hogben's historiography (1970), since the author reveals to us, as do Lima and Moisés (2000), that Egyptian civilization, at some point in its history, experienced the need to represent an unknown quantity, that is, a quantity that varied and, therefore, could not be expressed. The Egyptians then created the expression "ahá" to refer to an undefined value. The conceptual genesis of the variable was undeniably first expressed by African peoples, by black people. Our children, young people, future teachers, and elementary school math teachers have a right to this knowledge.

The inclusion of this knowledge in school curricula and mathematics degree programs contributes to compliance with Law No. 10,639/03 and creates opportunities to decolonize mathematics curricula, insofar as the logical-historical movement is understood as a didactic perspective for teaching mathematics.

Final considerations

In this research, the logical-historical movement in the classroom developed from the assumptions of the formal teaching activity, has as its main function, through conceptual nexuses (internal and external), to assist the thinking of both the teacher and the learner in moving towards finding relative truths because they are continuously defined and redefined based on the definability of the concept itself. In other words, conceptual nexuses play a key role in drawing attention to the historical moments that led to a type of thinking being considered theoretical, thus breaking with a teaching of mathematics whose starting point is empirical-discursive thinking and whose end point is theoretical thinking advocated by formal logic.

Here, history, through its various historiographical perspectives, serves as a link between the causality of facts and the possibility of creating new conceptual definitions. These definitions help to understand a studied reality that is fluid and interdependent, while also enabling the implementation of Law No. 10,639/03 in mathematics classrooms.

By framing the logical-historical movement as a didactic perspective for mathematics teaching, attention is drawn to the idea that the history of mathematics can invite critical questioning of mathematical truths. Yet is this not the very essence of teaching and learning mathematics? That is, providing opportunities to reflect on the multiple interpretations that underpin mathematical concepts, and to recognize the contributions of all peoples, especially African peoples, to the construction of the mathematical knowledge addressed in basic education.

Thus, teaching mathematics means learning about the different ways of seeing and conceiving the mathematical concepts present in historiographies. After all, there is no denying that Africa is the cradle of humanity. Therefore, the genesis of mathematical concepts has always been part of the lives of black people. Such knowledge has been systematically rendered invisible since we chose to teach mathematics from the perspective of Eurocentric peoples. In other words, it is high time we began to decolonize our mathematics curricula, whether in basic education or in mathematics degree courses, as we appropriate the logical-historical movement of mathematical concepts.

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