

## TWENTY YEARS OF LAW 10.639

HOW IS THIS LAW EFFECTIVE IN A COLLECTION OF MATHEMATICS TEXTBOOKS?

*VINTE ANOS DA LEI 10.639*

*Como essa lei se efetiva nas coleções de livros didáticos de matemática?*

*VEINTE AÑOS DE LA LEY 10.639*

*¿Cómo es efectiva esta ley en una colección de libros de texto de matemáticas?*

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Recibido: 12/07/2023

Aprobado: 12/07/2023

### ABSTRACT

This text presents an analysis of a collection of Mathematics textbooks, carried out for the discipline “Analysis of Mathematics Books and Teaching Materials”, taught in the Graduate Program in Mathematics Education at the Universidade Estadual Paulista “Júlio de Mesquita Filho”. Inspired by the methodology of vertical and horizontal analysis of textbooks, this work aims to understand in what ways the law 10.639/2003 is effective in textbooks that satisfy the demands of the New High School and the BNCC – Base Nacional Comum Curricular. Presenting the historical movements of black populations, mainly the Brazilian one, the text is inspired by the two decades of that law to conduct the analysis criteria and seek to understand in what ways the analyzed collection acts in the constitution of the mathematical identity of black students. At the end of the analysis, it is observed that the law is barely complied with, speaking through erasures and without delving into important points about racial discussions. It is concluded that changes are necessary for compliance with the law to produce positive effects on the constitution of mathematical identities of black subjects.

Keywords: ethnic-racial relations. mathematics textbooks. law 10.639/2003.

### RESUMO

O presente texto apresenta uma análise de uma coleção de livros didáticos de Matemática, realizada para a disciplina “Análise de Livros e Materiais Didáticos de Matemática”, ministrada no Programa de Pós-Graduação em Educação Matemática da Universidade Estadual Paulista “Júlio de Mesquita Filho”. Inspirada pela metodologia de análise vertical e horizontal de livros didáticos, este trabalho tem o objetivo de perceber de que formas a lei 10.639/2003 se efetiva em livros didáticos que satisfaçam as demandas do Novo Ensino

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Médio e da BNCC – Base Nacional Comum Curricular. Apresentando os movimentos históricos das populações negras, principalmente a brasileira, o texto se inspira nas duas décadas da referida lei para conduzir os critérios de análise e buscar perceber de que forma a coleção analisada atua na constituição da identidade matemática de estudantes negros. Ao fim da análise, se observa que a lei é cumprida de forma escassa, discursando através de apagamentos e sem se aprofundar em pontos importantes sobre discussões raciais. Conclui-se que mudanças são necessárias para que o cumprimento da lei produza efeitos positivos na constituição de identidades matemáticas dos sujeitos negros.

Palavras-chave: relações étnico-raciais. livros didáticos de matemática. lei 10.639/2003.

## RESUMEN

El texto actual presenta el análisis de una colección de libros didácticos de Matemáticas, realizado en el curso “Análisis de Libros e Materiais Didáticos de Matemáticas”, que es ofrecido en el Programa de Posgrado en Educación Matemáticas de la Universidad Estadual Paulista “Júlio de Mesquita Filho”. Inspirado en la metodología de análisis vertical y horizontal de libros didácticos, este trabajo tiene el objetivo de investigar de qué manera la ley 10.639/2003 es contemplada en libros didácticos de modo tal que satisfagan las demandas de la Nueva Educación Média y de la BNCC – Base Nacional Común Curricular. Presentando los movimientos históricos de las poblaciones negras, especialmente la brasileira, el texto se inspira en las dos décadas de la referida ley para conducir los criterios de análisis y buscar percibir de qué maneras la colección analizada actúa en la constitución de la identidad matemática de estudiantes negros. Al fin del análisis, se observa que la ley es cumplida de forma escasa, una vez que asume superficialmente las discusiones raciales. Se concluye que es necesario realizar cambios para que el cumplimiento de la ley produzca efectos positivos en la constitución de identidades matemáticas de los sujetos negros.

Palabras clave: relaciones étnico-raciales. libros didácticos de matemáticas. ley 10.639/2003.

## Introducción

Januário Garcia, Brazilian photographer, black and anti-racist activist, once stated that “there is a history of blacks without Brazil, what does not exist is a history of Brazil without blacks” (Garcia & Neres, 2021). This message synthesizes the struggles of a people subjected to successive invisibilizations, casts new perspectives, and promotes new tensions to the constitution of history itself, both in Brazil and in other countries that were founded on the bases of slavery that still cause explicit and structural effects today.

Manoel and Coradetti (2019) work with Stuart Hall to present the concept of “black popular culture” as a way of representing the identities of the black population. The posture assumed by the authors on black popular culture configures it as a multiplicity, that is, unique as a set of experiences particular to the black population, but at the same time diverse in itself.

By adopting such a perspective on black identity itself, as uniqueness and difference, the struggles of black movements and their quests for valuing the equally diverse Afro-Brazilian roots are highlighted. As a result, in 2003, 20 years ago, one of the greatest achievements for Brazilian black peoples in the area of Education was achieved: Law 10.639/2003, which includes in the official curriculum of the Teaching Network the obligatoriness of the theme “History and Afro-Brazilian Culture” (Lei 10.639, 2003). L10.639 (as we will call it from now on) establishes the obligation to study the History of Africa and Africans, the struggle of blacks in Brazil, Brazilian black culture and blacks in the formation of

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national society, in addition to pointing out the contributions of these people in the social, economic and political areas of the history of Brazil (Lei 10.639, 2003).

It is the recognition of the importance of this law that motivates the analysis of this article. Recognizing the Mathematics textbooks as possibilities to realize L10.639 in schools, an analysis of the collection of textbooks in Mathematics for High School called “Matemática em contextos” (Dante & Viana, 2020), approved by the National Book and Didactic Material Program (PNLD) 2021, is carried out. This analysis aims to understand in what ways the L10.639 is effective in textbooks that satisfy the demands of the New High School (Lei 13.415, 2017) and of the BNCC — Base Nacional Comum Curricular, the Brazilian curricular standards (Ministério da Educação, 2018). It also points out the importance of analyzing Mathematics textbooks from an area that is mistakenly understood as neutral. In this movement of acknowledging Mathematics as a racialized discipline and trying to understand how this field of knowledge constitutes identities, we begin by presenting some theoretical operants.

### **Whitening and mathematical identity**

It is noteworthy, at this first moment, that the project of invisibilization of black people is articulated with the progressive weakening of knowledge. Thus, the alleged idea of a white hegemony is constituted not only in the constitution of a nation, but also in the very field of Mathematics knowledge.

We assume Mathematics as a white racialized discipline, since it is regarded as an area of knowledge, that is constituted with the aim of meeting the interests of domination of this race and that disqualifies other races in favor of maintaining a status of power. Simultaneously, Pinto et al. (2021, p. 8) alert to the discourse that affirms Mathematics as an epistemic field not linked to the physical body, but only one's mental capacity. They also point out that “Mathematics disqualifies the criterion of race as an agent of its production, even if it establishes a condition of existence and necessity to the knowledge of a certain cultural group, the white European, establishing its place in this criterion”. In this double movement, Mathematics is operated with a view to the subalternization of other ways of being (including the form as a black subject), while it presents itself as exempt, allegedly neutral and unrelated to the constitution of racialized identities.

In this way, how to think about the ways in which Mathematics is appropriated by black subjects? To do so, we work with Martin (2006) to try to understand the ways in which the work approaches in this discipline what the author calls mathematical identity. According to Martin

Mathematics identity refers to the dispositions and deeply held beliefs that individuals develop, within their overall self-concept, about their ability to participate and perform effectively in mathematical contexts and to use mathematics to change the conditions of their lives. A mathematics identity encompasses a person's self-understanding of himself or herself in the context of doing mathematics [...]. It also encompasses how others “construct” us in relation to mathematics. (p. 206)

As stated by the author, mathematical identity refers to how students can come to see themselves as agents in Mathematics and perceptions of their ability to participate in actions involving this knowledge. Throughout history, Afro-descendants have been seen as less than human and having their image constructed as opposed to mathematically literate (van Belle, 2011), or as mathematicians. Martin (2006) analyzes the North American context to indicate that, currently, there is numerous data that point to the narrative that black people perform worse than white and Asian students, to whom the image of the “mathematician” is often associated. This is a factor that continues the notion that black people are awkward with math and whose knowledge is viewed as inferior to whites. Another factor is analyzed by van Belle (2011, p.132), who states that mathematical literacy deficiencies have consequences for students beyond K-12 and affect access to higher education. According to van Belle:

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There exist racist discourses related to print based literacy [...] these texts present mathematical literacy as a form of school-based capital that is accrued by Whites and used to reproduce White, middle-class privilege. (p. 133)

Consequently, black students have the possibility to develop mathematically with less confidence and disbelief in their abilities. This lack of assurance, associated with low performance data and esoteric style of communicating mathematics, result in lower participation both in classes that demand and develop more advanced knowledge of Mathematics, and in Higher Education itself, since Mathematics is part of assessment and selection processes to access these possibilities.

Thus, the international scenario presents even more indications that justify the need to support affirmative action policies, since it is still common for black students to demand more time in complementary studies, such as Brazilian pre-university or pre-Enem courses, or students who need to repeat remedial courses in community college in the United States. This need for additional efforts, a constant alternative for low-performing students, such as Afro-descendants, discourages them from seeking to participate or even from believing that it is possible to achieve through Mathematics.

Added to this point, there is little to no representation of black people in books or areas of Mathematics (Silva, 2020), as well as the absence of activities that align with the more common lifestyle of such people. There was, in the USA, the period of desegregation of schools, in which the presence of Afro-descendants was recent, not only among students in segregated schools, but also among teachers and staff. The faculty of these schools were predominantly, if not completely, white. Their concerns were not the improvement of education for black students, but the preservation of the quality of learning for white students, while educational success was only a by-product of the case that students understood.

## **Textbooks in Brazil**

The Brazilian educational system is organized in three stages. The first, called Early Childhood Education, serves children from 0 to 5 years old. Then comes Elementary School (EF), subdivided into EF 1, from 1st to 5th grade, and EF 2, from 6th to 9th grade. The last stage is called High School and lasts for three years. Throughout the entire school period, the school must follow the curriculum set out by the BNCC.

In 2017, law 13.415/2017 (Lei 13.415, 2017), known as the High School Reform, was enacted, which changed the general structure of this educational stage. With the so-called New High School, the BNCC gained more strength, the workload was expanded and even the textbooks were affected, since the organization of the curriculum became freer and, therefore, the books could not be sequential. Therefore, each book in a collection must be self-contained, that is, it must not depend on skills and abilities presented in another book in the collection.

In Brazil, textbooks are frequent allies of teachers, being one of the main pedagogical tools used by them. For this reason, over the years, various policies have dealt with these materials, seeking to expand access, develop quality or standardize contents and principles. Today, the PNLD is in force, which conducts the process of selection and distribution of books and other didactic materials for the public schools. It is worth mentioning that in the process of evaluating candidate collections for participation in the PNLD, the BNCC appears as one of the main drivers and its non-compliance may result in the elimination of a collection in the program. Likewise, the PNLD public notice points out that non-compliance with legislation related to Education (L10.639 is included in this) is also an eliminatory criterion. Once approved in the PNLD selection process, a collection of textbooks is available for purchase by all public schools that attend the grades for which such collection is intended.

## **Methods**

The analysis methodology adopted here is inspired by Charalambous et al. (2010). For that, a horizontal analysis was initially carried out in order to understand the organization of the book and the resources made available by it in the presentation of the contents. At this stage, we looked at the formats of the sections, the different texts, such as subtitles, content texts, presentation topics, exercise statements and even the images.

The part of the “Teacher's Manual” was also explored, a section destined to present to the teacher what is intended with the work. This section is divided into two parts: general guidelines and specific guidelines. In general guidelines, the manual seeks to expose the precepts that guide the work with the collection as a whole, presenting theoretical-methodological approaches, norms that regulate the textbook (such as the BNCC and the New High School), skills and competences that are expected to be developed, in addition to other guidelines. As it is a section that talks about the collection as a whole, this section is the same in all books. In the specific guidelines, it is pointed out in detail what is expected with the didactic resources available in each book. To this end, this section makes suggestions on how certain texts, exercises and subjects can be developed and worked on in the classroom.

On the other hand, vertical analysis is understood here as the study of the ways in which a subject is treated in the textbook. For our analysis, this subject is ethnic-racial relations and African and Afro-Brazilian history and culture. Therefore, criteria were defined to conduct the analysis. As previously presented, the L10.639 was the main trigger for the movement proposed here. Therefore, in this analysis, criteria that depart directly from the law are adopted and, inspired by works such as Silva (2020), criteria for representation (whether written citation or imagery) of black people were added, a criterion called “Representation of black people”, and objects and places that refer to Africa or Afro-Brazilian and African peoples, a criterion called “Representation of black cultures without human body presence”. This choice was based on the understanding that these representations play an active role in identifying black subjects who may use these books, that is, these representations point to how black students can identify themselves in that book. From this point of view, these representations add to the objective of L10.639 to positively compose the Brazilian black identity.

In addition to the representation criteria, mentions were made throughout the analysis of contributions that were not rigidly framed in the social, economic and political areas. Thus, the subject “Contributions of black peoples in other areas not mentioned above” was added. The subject frame looks like this:

Code	Subject Matter
A1	History of Africa and Africans
A2	The struggles of blacks in Brazil
A3	Brazilian black culture
A4	The black in formation of the national society
B1	Representation of black people

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B2	Representation of black cultures without human body presence
C1	Contributions of black people in the social area
C2	Contributions of black people in the economic area
C3	Contributions of black people in the political area
C4	Contributions of black people in other areas not mentioned above

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**Table 1:** Final criteria inspired by L10.639

The “Matemática em contextos” collection, by Luiz Roberto Dante and Fernando Viana, comprises six books. As guided by the PNLD 2021 notice (Ministério da Educação, 2020), each textbook in a collection must be self-contained, that is, all concepts and content necessary for learning must be presented in the book itself, without making references to other volumes. In this way, six volumes make up this collection, they are: “Exponential, logarithmic function and sequences”; “Trigonometry and linear systems”; “Affine function of quadratic functions”; “Statistics and financial mathematics”; “Combinatorial analysis, probability and computation” and; “Plane geometry and spatial geometry”. Once this collection was approved by the analysis of the PNLD, it is understood that it satisfies the demands of content and organization imposed by the BNCC and by the New High School.

All volumes in the collection have a part that is the student's book and another part that is the Teacher's Manual, the latter, as previously mentioned, being divided into general guidelines and specific guidelines. Through the full reading of each of the volumes, both the student's book and the teacher's manual, incidences were identified that satisfied the analysis criteria presented. Throughout this exploration phase, a table was filled in in order to organize the occurrences and specific comments were also produced for each occurrence. The aforementioned table appears below:

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Volume	A1	A2	A3	A4	B1	B2	C1	C2	C3	C4
Exponential, logarithmic and sequence functions	2	0	0	0	7	1	0	0	0	1
Trigonometry and linear systems	0	0	0	0	2	0	0	0	0	0

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Affine function and quadratic function	0	0	0	0	3	0	0	0	0	0
Financial statistics and mathematics	0	0	0	1	7	0	0	0	0	0
Combinatorial analysis, probability and computation	0	0	1	0	13	0	0	0	0	1
Plane geometry and spatial geometry	1	0	0	0	3	4	0	0	0	0
Total	3	0	1	1	35	5	0	0	0	2

**Table 2:** Afro-Brazilian representations perceived in the collection.

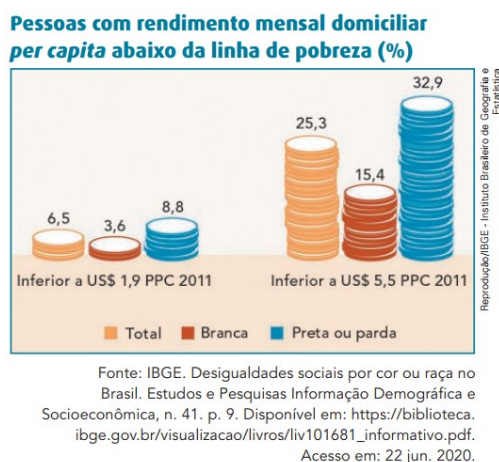
Through the analysis of the numbers in Table 2 and the comments produced, some general trends present in this collection were perceived and which will be presented in more depth below: “How are the stories of black people told?”; “Is the presence of the black person enough?” and; “What are the contributions of African and Afro-descendant peoples?”.

### How are the stories of black people told?

In the content of the analyzed books, the history of black people is scarcely presented, and it can be said that it is basically non-existent, which is inconsistent with L10.639 itself. The representations that appear in the texts maintain the ideology that blacks are the underclass in society, or that their cultures and practices do not align with mathematical concepts.

In the book “Statistics and Financial Mathematics”, the only presentation of the position of blacks in society is that they constitute the majority of subjects living below the poverty line.

A4 = An infographic presents the percentages of people with per capita monthly household income below the poverty line, differentiating by race between whites and blacks. It can be seen that most of the population living on less than \$1.90 is black, as is the share of the population living on less than \$5.50. Those data are about 2018. The text accompanying this data does not delve into the subject, using it only to represent what "pictograms" are, without proposing further discussion. (Comment taken from the authors' notes)



**Figure 1:** Pictogram presented in one of the textbooks.

It may be important to ask what motivated the choice to present these data in this way, determining differences in poverty by race. This may serve as an under-representation of black people living in the most varied locations in Brazil and who may have higher incomes. That is, it presents a single portrait of the black population in Brazil, that of the poor person.

The combination of marginalization and the lack of representation of black people in Mathematics can influence how a subject thinks about their abilities and their performance in this field of knowledge. This continues a racial imagination and a society at large that blacks are poor and removed from mathematical production, maintaining the dominant view of whites as mathematicians and prioritizing European styles of education.

### Is the presence of the black person enough?

Those who analyze the data presented in Table 2 may have indications that, through image representations and textual citations, black people are more present in the collection. In fact, it is common to see black people appearing in the most diverse situations, such as in the use of technology, in the daily interaction between young people and even in the position of teacher. However, two main points focus on necessary tensions: in general, black people are a minority in representations; and there are few representations of personalities relevant to a context greater than the representation itself.

Silva (2020) already points out in her thesis that there are, in the textbooks analyzed by her, asymmetries in the imagery representations between whites and blacks. This finding is repeated in the analysis of this collection, since the comments produced during data collection indicate that, in the images where black people appear, there is a predominance of white people. It is common to see one black person among two, three, four or more white people, or two black people among four white people. In the book “Exponential Function, Logarithmic Function and Sequences”, was perceived that

B1 = In a illustration, there is several people in a town. None of them that clearly appear is black, however, it is possible to identify 3 of 4 people with darker skin than the others 14 or 13 ones. (Comment taken from the authors' notes)





**Figure 2: Illustration showing noise pollution's effects.**

The Brazilian black population represented, in 2018, about 56% of the total Brazilian population (IBGE, 2019), so it is necessary to question such disparities in the sense of the majority becoming a minority. Erasure is articulated by compliance with the law, accompanied by omissions, by unexplored tensions and by the imposition of a narrative that diminishes a strength of the black population, the strength of the great mass.

At the same time, among the black people who appear visually or who are quoted textually, few are relevant to the flow of the book. By that, we mean that most of the images are committed to a representation that has an end in itself, that is, they are images that do not converse with the supporting text or with the content worked on at that moment in the book, but only show an existence.

Added to this, it is also worth mentioning that some black personalities from the international scene are represented. Few are directly related to mathematics. However, the presence of white personalities that appear throughout the collection is considerably higher, especially in the moments that articulate Mathematics and the history of Mathematics. This finding reinforces the findings of Manoel and Coradetti (2019, p. 275), who point out that most Mathematics textbooks analyzed by them are based on historical characters belonging to Western civilization. This strategy reinforces what we have already pointed out as a movement to "whiten Mathematics", since a kind of mathematician phenotype is constructed: the white man.

It is even worth mentioning that non-human representations of African cultures and black peoples in general are mostly associated with Egypt, without any mention of the African continent. This movement fulfills the role of detaching Egypt, a place recognized as a producer of knowledge, from the rest of the continent and corroborating the idea that there is no mathematics.

Finally, this topic ends by raising the question: the high recurrence of data in this category means which representation of black people?

### **What are the contributions of African and Afro-descendant peoples?**

It is possible to observe in Table 2 that the contributions of African and Afro-descendant people in Mathematics are almost nil. At least, this is the discourse that the book tells through the silencing of black movements.

In the analyzed collection, both identified contributions relate to the development of science. One of them concerns Fibonacci's experience in Egypt, where he developed his studies in a more advanced way than would be possible only by the knowledge that circulated in Europe at the time. The proposal to carry out historical research on this character appears in the Teacher's Manual, in the Specific Orientations section, and opens up the possibility of envisioning Egypt as a knowledge-producing region and of explaining the way in which an African civilization influenced European studies in math. However, such possibilities are not explicitly indicated by the book, leaving room for countless other possibilities to work on the history of this mathematician, including those in which the European subject

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is placed at the center of the discourse on the development of Mathematics, Egypt is seen as a supporting actor and the African continent itself is relegated to invisibility due to disconnection.

The other identified contribution is about the story of the American Katherine Johnson, Dorothy Vaughan and Mary Jackson, as well as the team of “human computers” who worked at NASA (National Aeronautics and Space Administration) during the space race period. In the “Reading and understanding” section of this book, stories and situations are told that, in some way, are related to the mathematical content worked on, and discussions are proposed that go beyond the content itself. Telling the story of these three black women, the text deepens in discussions about the aforementioned racial segregation that happened in the United States, it also indicates discussions about racial prejudices today and how such racist practices may have influenced the pace of technological development in the world.

Unfortunately, such a rich discussion is lost in the solitude of uniqueness. The authors could bring more discussions in order to emphasize substantial contributions of black people in mathematics and in science in general. Although the Teacher's Manual – Specific Guidelines points out how various skills, competences and topics requested by the BNCC are satisfied by this contribution, the non-repetition of sections, texts or activities that present the aforementioned contributions summarizes the participation of black people in mathematics and science to few exceptions. With this, the narrative of a supporting people in their own history is told and again leads to the formation of a mathematical identity: the identity of the supporting black subject in the performance with Mathematics.

## Conclusion

Although the law requires that texts, including Mathematics, include Afro-Brazilian history and culture, there is little or no evidence, in the analyzed textbooks, that this obligation is being fulfilled. In general, the African and Afro-Brazilian population is underrepresented or misrepresented. The perpetuation of black people as minorities and as poor and non-contributors to science and mathematics are communicated to students through the lack of knowledge produced by black people and the exclusion of their histories, current implications and the importance of being.

Greater actions and initiatives need to be taken to influence more active changes in the materials used in Mathematics Education. There should be greater inclusion of different aspects of black culture and practices. Black students should not only depend on their imaginations to see themselves in textbooks and, consequently, in the Mathematics curriculum itself. They should have opportunities to participate and have positive reinforcements and representations to assist them in their learning.

Finally, the alert is made that, even though the analysis was made of a single collection, such discussions should not be particularized to this work. Our analysis serves as an indication that larger discussions are needed to ensure the construction of a positive black mathematical identity, going beyond simply fulfilling requirements stated by normative documents.

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