



An overview of the history, selection, and functions of Elementary Science and Biology textbooks

Um panorama sobre a história, a seleção e as funções dos livros didáticos de Ciências e de Biologia na Educação Básica¹

Una visión general de la historia, la selección y las funciones de los libros de texto de Ciencias y Biología de la Educación Primaria

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Abstract

This essay aims to reflect on the history, selection, main characteristics, and functions of Science and Biology textbooks in Basic Education, and to analyze their influence on teaching and learning processes in Brazilian classrooms. It delves into the evolution these works have undergone over the years as objects of school culture, primarily because they bring together political, social, and ideological approaches directly related to individuals' experiences and actions in society. The historical trajectory of the National Textbook and Teaching Material Program (PNLD) and its interaction with the National Common Curricular Base (BNCC) are addressed, along with the weaknesses, benefits, and investments this public policy has brought to date. It also highlights the focus of Science and Biology education on fostering greater student involvement in constructing new knowledge and in becoming active subjects.

Keywords: Science Teaching; Biology Teaching; Textbooks.

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Resumo

O presente ensaio tem como objetivo apresentar reflexões sobre a história, a seleção, as principais características e funções dos livros didáticos de Ciências e de Biologia na Educação Básica, analisando suas influências nos processos de ensino e de aprendizagem nas salas de aula brasileiras. Aprofunda-se na evolução que essas obras tiveram ao longo dos anos como objeto da cultura escolar, sobretudo por apresentarem abordagens de cunho político, social e ideológico, diretamente relacionadas às vivências dos indivíduos e às suas ações sociais. Aborda-se o percurso histórico do Programa Nacional do Livro e do Material Didático (PNLD) e sua interlocução com a Base Nacional Comum Curricular (BNCC), bem como as fragilidades, os benefícios e os investimentos que essa política pública trouxe até a atualidade. Destaca-se, ainda, o foco do ensino de Ciências e de Biologia em promover maior envolvimento do aluno na construção de novos conhecimentos e na formação de sujeitos ativos.

Palavras-chave: Ensino de Ciências; Ensino de Biologia; Livros Didáticos.

Resumen

El presente ensayo tiene como objetivo presentar reflexiones sobre la historia, la selección, las principales características y funciones de los libros de texto de Ciencias y de Biología en la Educación Básica y analizar sus influencias en los procesos de enseñanza y de aprendizaje en las aulas brasileñas. Se profundiza en la evolución que estas obras han tenido a lo largo de los años como objeto de la cultura escolar, principalmente por aportar enfoques de carácter político, social e ideológico que guardan una relación directa con las experiencias de los individuos y con sus acciones hacia la sociedad. Se aborda el recorrido histórico del Programa Nacional del Libro y del Material Didáctico (PNLD) y su interlocución con la Base Nacional Común Curricular (BNCC), así como las fragilidades, los beneficios y las inversiones que esta política pública ha generado hasta la fecha. Se destaca, además, el enfoque de las enseñanzas de Ciencias y de Biología en fomentar un mayor involucramiento del alumno en la construcción de nuevos conocimientos y en la formación de sujetos activos.

Palabras clave: Enseñanza de Ciencias; Enseñanza de Biología; Libros de Texto.

Introduction

The didactic textbook, traditionally conceived as a vehicle for content, has become a central artifact of the school's material culture in contemporary education. It is more than just a pedagogical resource; it is an instrument of power that defines what is recognized as legitimate science in basic education (Mainardes, 2006). However, the didactic textbook's hegemony is not without contradictions. It reflects the tension between the standardization sought by national policies, such as the National Textbook and Didactic Materials Program (Programa Nacional do Livro e do Material Didático - PNLD) and the National Common Core Curriculum (Base Nacional Comum Curricular - BNCC), and the plurality of knowledge demanded by holistic human education (Popkewitz, 2001).

Reflecting on the role of didactic textbooks in the Brazilian educational landscape and their social relevance is essential for building a more just and egalitarian society. Didactic textbooks undergo a rigorous evaluation process by the PNLD to ensure the technical, scientific, and pedagogical quality of the works distributed free of charge to public schools. The PNLD is a public policy that establishes a common foundation for the national curriculum and ensures that the content respects ethical principles, inclusion, and the country's cultural and regional diversity. Thus, didactic textbooks are indispensable tools for promoting quality, inclusive education that is committed to the holistic development of students and contributes to Brazil's scientific and social development (Krasilchik, 2008; Popkewitz, 2001).

This theoretical-critical essay, based on bibliographic and documentary sources, aimed to analyze the historical development and institutionalization of science and biology textbooks in Brazil. The study identified the discrepancies between public policy recommendations and teaching practices. It investigated how the PNLD shapes school culture as a device of symbolic regulation and the limits of this policy in light of the need for critical scientific literacy. It also addressed reflections on the history, selection, main characteristics, and functions of science and biology textbooks in basic education. A historical survey was conducted on the emergence and evolution of these textbooks, as well as public investments to ensure their use by Brazilian students and professors.

Methodologically, the textbooks were problematized as objects of school culture and devices of symbolic regulation, moving away from a purely linear narrative (Popkewitz, 2001). The analysis is grounded in Goodson's (1997) contributions, which view the curriculum as a social construction in which the discipline of biology strives for stability and legitimacy, and in Popkewitz's (2001) thesis on regulation and governmentality. From this perspective, the didactic textbook is not merely seen as a medium of content, but also as a technology of power that operates "systems of reasoning" regarding who the student is and which science should be validated.

Thus, the PNLD's trajectory is examined not as a succession of administrative milestones but as a genealogy of tensions that shape teachers' identities and students' subjectivities in the face of contemporary challenges to scientific literacy.

A Brief History of the Didactic Textbook

First, to analyze the history of the didactic textbook in Brazil, it must be understood that the introduction of this subject of study into Brazilian education cannot be understood in isolation. It must be understood within a broader context that accounts for political, economic, and cultural landscapes. The history of education in Brazil begins with the arrival of the Jesuits in 1549 during the colonial period. Between 1599 and 1759, Jesuit education was organized and consolidated. However, in 1759, Marquês de Pombal, inspired by the modernizing reforms

of the 18th-century Enlightenment, issued a decree abolishing the Society of Jesus. This led to the prohibition of Jesuit activities and to an impact on Brazilian education (Saviani, 2007).

As Maciel and Shigunov Neto (2006) explain: "Minister Pombal intended to replace the traditional pedagogical methods instituted by the Society of Jesus with a new educational methodology." With the Jesuits' activities rendered unviable, the state assumed responsibility for public education, revealing the Portuguese Empire's intention to control the establishment of state-useful schools (Silva & Trivellato, 2000).

Following the arrival of the Portuguese court in Rio de Janeiro in 1808, concerns about education emerged, prompting the establishment of several schools, including institutions of higher education. Following the Additional Act of 1834, a new direction in education was taken with the abandonment of the national public school project and the delegation of responsibilities for Brazilian primary and secondary schools to the provinces. In other words, the Additional Act of 1834 delegated powers to municipal councils and the provinces. According to Castanha (2007), "Provincial legislative assemblies were created, which gained the power to legislate and organize various sectors of public administration, including primary and secondary education."

Thus, the Additional Act granted greater autonomy to the provinces, primarily contributing to the creation of lyceums and colleges, such as Colégio Pedro II, which became a benchmark throughout the country (Castanha, 2007). In the last third of the nineteenth century, Brazil underwent significant economic, political, and social transformations resulting from events that gradually influenced educational changes, including the Paraguayan War (1865–1870), the abolition of slavery (1888), and the end of the empire and emergence of the republic (1889) (Leme, 2005). From that point on, education began to receive greater attention from the federal government, which assumed responsibility for secondary and higher education with the codification of the 1891 Constitution. The aim was to train an elite capable of holding positions of public leadership.

As the century turned, concerns grew, particularly in the 1920s when the country was in the midst of a critical political and economic period. Global historical factors, such as the 1929 economic crisis in the United States, which affected the Brazilian coffee economy, and the consequences of World War I and the Russian Revolution, ultimately influenced the educational landscape of the time. These consequences included inflation and rising interest rates in subsequent years. During this period, Brazil was experiencing cultural effervescence, including the modernist movement and Modern Art Week in 1922. These factors contributed to political decisions that directly influenced the trajectory of Brazilian education, including a new perspective on school teaching methods.

The first ideas regarding didactic books in Brazil emerged in mid-1929, and the National Book Institute (Instituto Nacional do Livro - INL) was established in 1937 during President Getúlio Vargas's administration. The primary objective of the INL was to compile an encyclopedia that reflected national identity and memory. Investments in public libraries provided the population with greater access to books, facilitating the legitimization of this didactic material on the national stage.

In 1938, the Minister of Education and Health, Gustavo Capanema, established the National Didactic Textbook Commission (CNLD) through Decree-Law No. 1,006/1938 (Brazil, 1938). This decree set forth the conditions for the production, importation, and use of didactic textbooks in Brazil. This decree marked the beginning of the regulation of standards and state control over the dissemination of information in Brazilian schools.

However, the creation of the CNLD should be understood not merely as an administrative milestone, but also as a pedagogical facet of the Estado Novo's nationalist project. During the Vargas government, the didactic textbook became a tool for biopolitical regulation—the selection of scientific content aimed at promoting basic

literacy and shaping a productive and sanitized national identity. According to Rota (2014), science education was shaped to serve Brazil's modernization project during the Estado Novo. The focus was on sanitation and hygiene to create a healthy workforce capable of sustaining rapid industrialization. The human body was treated as a "machine" that needed to be fit for work (Rota, 2014). By centralizing the evaluation and authorization of educational materials, the state turned school materials into a domain of ideological surveillance, shaping what Apple (2006) defines as "official knowledge in the service of a centralizing national project."

Before 1938, book production was decentralized, and many textbooks were imported or written by foreigners, especially in immigrant schools in the South. Vargas's goal was to create a cohesive national identity. Decree-Law 1,006/1938 gave the state the power to dictate what was "truth" and "appropriate." It prohibited the promotion of foreign ideologies or anything that did not foster a sense of "Brazilianness." The state recognized that didactic textbooks could serve as government emissaries in Brazilian households (Rota, 2014).

Another important point is that the state used didactic textbooks to ensure that the content taught in rural and remote areas was the same as in the capital. As Rota (2014) explains, the Estado Novo regime used these textbooks strategically to consolidate national identity and control ideological discourse in schools. Since the country was vast and teacher training was inadequate, professors became mere executors of orders, a characteristic of the "school culture" of the time.

Ideas reflecting a desire for "unification" were evident even before the Estado Novo, just as they are today. However, in 1938, the push for curricular centralization was rooted in nationalist ideologies. Currently, this centralization is implemented through the National Common Core Curriculum (Base Nacional Comum Curricular - BNCC), which aims to promote equity based on global competencies.

Historically, this is how the conditions were determined for the CNLD to approve didactic materials for publication. If there were any impediments, the CNLD was required to suggest changes so that the material could be reevaluated and potentially approved (Brazil, 1938). Article 3 of Decree-Law No. 1,006/1938 clearly states the requirement of prior government authorization for using didactic books within the national territory.

Art. 3 As of January 1, 1940, didactic books that have not received prior authorization from the Ministry of Education, in accordance with this law, may not be used in pre-primary, primary, teacher-training, vocational, and secondary schools throughout the Republic (Brazil, 1938).

In 1945, Decree-Law No. 8,460 transferred the CNLD's functions to the Federal Government, which then assumed control of the textbook adoption process throughout Brazil. This process was gradually decentralized, and state didactic textbook commissions were created to assume responsibility for the functions previously delegated to the federal government. The distribution of didactic textbooks in mid-1945 undermined the Estado Novo regime's undemocratic nature in education. Years later, the Military Regime was established in 1964, resulting in the demobilization of the teaching profession, the privatization of education, and ideological repression. Consequently, school curricula emerged with doctrinal premises designed to allow greater intervention and control over the textbooks adopted by schools.

In 1966, the Commission for Technical and Didactic Books (Comissão do Livro Técnico e Livro Didático - COLTED) was formed. To secure government funding, the Ministry of Education (MEC) reached an agreement with the United States Agency for

International Development (USAID) (Freitag, Motta, & Costa, 1987). According to Bezerra and De Luca (2006, p. 30), "The injection of public funds ensured the continuity of the didactic textbook, which, from then on, occupied a prominent place among the concerns of the Brazilian state, which once again sought to control what and how it was taught."

In light of this, it is worth noting that didactic texts underwent major adaptations to include politically and ideologically charged content that glorified militarism, encouraged civic duty, and led individuals to adopt standardized behavior in accordance with the military regime's perspectives. Didactic textbooks became instruments of state repression and control, and their distribution expanded on a massive scale to achieve these ends (Miranda & De Luca, 2004).

The National Foundation for School Materials (Fundação Nacional de Material Escolar - FENAME) was created in 1967 to take over the production and distribution of didactic textbooks to schools. In 1970, Ministerial Ordinance No. 35 (Brazil, 1970) established a co-publishing system with national publishers to support FENAME. Under Decree-Law 77.107/1976 (Brazil, 1976), FENAME assumed its assigned tasks and began creating more secure market conditions for publishers. The Federal Government expressed interest in purchasing a significant portion of the produced books to distribute them to public schools nationwide.

The Student Assistance Foundation (Fundação de Assistência ao Estudante - FAE) was created in 1983 and incorporated the Didactic Textbook Program. In 1985, Decree-Law No. 91,542 (Brazil, 1985) established the National Textbook Program (PNLD), formerly known as the Textbook Program. Since 2017, it has been known as the National Program for Textbooks and Educational Materials, though it retains the same acronym, PNLD. With the establishment of the PNLD, publishers began submitting their works for evaluation and subsequent publication. Initially, the goal was to provide textbooks to all students in grades 1 through 8 of the former Primary Level in public schools, including federal, state, territorial, municipal, and community schools. The program prioritized textbooks for the core subjects of Communication and Expression and Mathematics (Höfling, 2006).

Following the dissolution of the FAE in 1997, the PNLD became the responsibility of the National Fund for Educational Development (Fundo Nacional de Desenvolvimento da Educação - FNDE), which was established in 1968 by Law No. 5,537 (Brazil, 1968). The FNDE is thus responsible for raising and managing funds to finance programs for Brazilian public elementary education effectively. To this end, the FNDE relies on two main sources of funding: the National Treasury and the Education Salary Fund.

Moving beyond the linear narrative of Brazilian educational policy, we analyze the didactic textbook as a focal point of tension between pedagogical tradition and modernity. According to Goodson (1997), the development of science and biology textbooks reveals an ongoing pursuit of stability and academic status. In this process, disciplines adapt to remain relevant in the curriculum, often sacrificing pure naturalistic knowledge in favor of a more practical science. Simultaneously, this transformation is permeated by what Popkewitz (2001) defines as technologies of regulation and governmentality. The textbook ceases to be merely a repository of content and becomes a device that operates "systems of reasoning."

Thus, the transition of the textbook from an instrument of national unification in the Vargas era to a manager of competencies in the contemporary BNCC does not represent neutral progress but rather a shift in regimes of truth that govern students and define permissible school science.

The National Book and Didactic Materials Program (PNLD)

Beginning in the 1990s, the influence of international agencies, notably the World Bank (IBRD), on the design of the PNLD extended beyond technical financing (Rota, 2014). This influence led to the adoption of an efficiency- and standardization-based approach to align the Brazilian curriculum with global educational productivity metrics. This approach often prioritized textbooks as "instructional packages" (Krawczyk, 2011), thereby neglecting direct investments in teacher training and infrastructure. The PNLD aims to distribute didactic textbooks free of charge to public school students in developing countries to contribute to the universalization and improvement of education quality (Höfling, 2006).

For this study, Zambon and Terrazzan (2012) divide the PNLD's history into three phases. Concerns about the evaluation of didactic textbooks mark the first phase. The expansion of the PNLD characterizes the second phase. The authors note that two additional government programs were established in 2004: the National Book Program for Secondary Education (Programa Nacional do Livro para o Ensino Médio - PNLEM) and the National Didactic Textbook Program for Youth and Adult Literacy Programa Nacional do Livro Didático para Alfabetização - (PNLA). These programs were created through Resolution No. 38 of the National Fund for Educational Development (Fundo Nacional de Desenvolvimento da Educação - FNDE). The final phase began with the creation of the Didactic Materials Programs through Decree No. 7,084 of 2010 (Brazil, 2010). These programs comprise the PNLD, which focuses on basic education, and the National School Library Program (Programa Nacional da Biblioteca na Escola - PNBE).

To better understand the aforementioned phases, the main changes that have occurred in the PNLD over the years are detailed below. In 1985, Decree-Law No. 91,542 was enacted in Brazil. This law replaced the Book Program for Elementary Education (Programa do Livro para o Ensino Fundamental - PLIDEF), which was previously managed by the National Book Institute, with the PNLD. The creation of the PNLD brought changes to the management, selection, and distribution of didactic textbooks. These changes included the reuse of textbooks, which eliminated disposable books. There were also improvements to the technical specifications that guide the production of these works.

This measure promoted the durability of the books, enabling the implementation of book banks. Additionally, the PNLD increased the availability of books for students in the first and second grades of public and community schools. It also ended state financial participation and transferred decision-making authority to the Student Assistance Fund (FAE). Furthermore, it ensured that professors had the final say in selecting didactic textbooks (Brazil, 1985).

In 1993, FNDE Resolution No. 6 was published to guarantee funds for acquiring didactic textbooks for public school students, representing a significant step toward ensuring and regulating the flow of funds for purchasing and distributing books.

In 1994, the MEC promoted measures to ensure continuous and systematic evaluations of didactic textbooks since the PNLD only guaranteed that schools would receive books chosen by teachers; the selected books were not always suitable for learning, nor were they always made available at the correct time (Bizzo, 2000).

Zambon and Terrazzan (2012) report that the document "Definition of Criteria for the Evaluation of Textbooks" was published in 1994. It presented analyses of didactic textbooks for grades one through four of elementary school that were acquired by FAE and distributed to schools.

The following year, the MEC began efforts to address these shortcomings and improve pedagogical practices in Brazilian schools (Bizzo, 2000), marking the beginning of the didactic book evaluation process.

The MEC officially instituted this process in 1996 with the publication of the first Didactic Guide (*Guia de Livros Didáticos - GLD*) for grades one through four. The GLD synthesized a preliminary analysis of the didactic textbook collections, highlighting pedagogical and methodological aspects, as well as curriculum content (Zambon & Terrazzan, 2013). The MEC evaluated the books according to previously discussed criteria. This procedure has been refined and continues to be used today. Thus, books containing conceptual errors, misleading content, outdated information, or any form of prejudice or discrimination are excluded from the GLD (Brazil, 2024). In 1996, the process of pedagogical evaluation of books submitted for the following year began (Brazil, 1997).

In 1997, the program expanded to include the continuous acquisition of didactic textbooks on literacy, Portuguese language, mathematics, science, social studies, history, and geography for all public elementary school students in grades 1 through 8. In 2000, Portuguese-language dictionaries for students in grades 1 through 4 were incorporated into the PNLD. In 2001, didactic textbooks began being delivered the year before they were to be used. That same year, the PNLD expanded to include students with visual impairments in the regular public school system by providing Braille books (Zambon & Terrazzan, 2013). Currently, books in Libras are also distributed to students with hearing impairments. Since then, the federal government has reaffirmed its commitment to ensuring the availability of funds to acquire and distribute these materials.

The steps for the centralized operation of the PNLD by the FNDE are specified below:

- a. First, a public call for submissions is published in the Federal Official Gazette for the registration of didactic works in the PNLD;
- b. Next, the works are registered by the companies holding the copyrights;
- c. Then, the MEC conducts a pedagogical analysis of the works, resulting in the Didactic Guide;
- d. The FNDE publishes the Guide, which contains reviews of all previously selected books, along with forms for selecting titles, in accordance with the Program's established criteria;
- e. Professors at schools registered in the School Census have access to the Guide and can therefore select the didactic material to be adopted by the school;
- f. After the textbook is selected, the FNDE processes the data from the form and begins negotiations with publishers to purchase the books;
- g. Finally, the books are distributed to schools in advance so that enrolled students receive them in time for use. In addition to this centralized operational method, the PNLD can be managed in a simpler, more decentralized manner. In this case, FNDE funds are transferred directly to the states through an agreement. The states then organize and process all stages until the books reach their users (Höfling, 2006).

The PNLD's relevance in the Brazilian educational landscape lies in its role in democratizing access and fostering pedagogical autonomy. By ensuring the free distribution of instructional materials to public schools, the program enables teachers to select materials aligned with their students' needs and is supported by continuous public investment. With the update cycle transitioning from three to four years, starting with the 2021 edition, the mechanism ensures the physical integrity of the copies and the constant renewal of content. This guarantees that the scientific knowledge conveyed in the classroom aligns with contemporary advances.

For example, the table below shows the amounts invested in acquiring and using books in the 2026 school year, as well as the number of schools and students who benefited from the distributed copies. The consolidated data includes the acquisition of replacement books and didactic materials for the early and final years of elementary school (PNLD 2023 and 2024, respectively, and items 1 and 3), as well as acquisitions for youth and adult education (Educação de Jovens e Adultos - EJA, categories 1 and 2) and high school (PNLD 2026, category 1). These serve students and professors in Brazil's public basic education system (Brazil, 2024).

Table 1 – Public investment for the purchase of didactic textbooks (PNLD) (Purchased in 2025 for use in 2026)

Educational level	Object	Schools benefiting	Students benefiting	Print	Digital	Total (Print + Digital)
				Value	Value	Value
Elementary School – Early Grades	PNLD 2023 Item 1	78.831	12.459.648	R\$ 764.883.814,60	–	R\$ 764.883.814,60
Elementary School – Early Grades (Literature)	PNLD 2023 Item 3	78.623	10.451.144	R\$ 213.235.032,79	R\$ 21.344.075,83	R\$ 234.579.108,62
Elementary School – Later Grades	PNLD 2024–2027 Item 1	46.021	9.576.513	R\$ 66.858.718,62	–	R\$ 66.858.718,62
High School	PNLD 2026–2029 High School	20.675	7.273.526	R\$ 1.430.497.330,34	–	R\$ 1.430.497.330,34
Youth and Adult Education	PNLD 2026–2029 Adult Education	20.269	1.434.684	R\$ 141.065.562,91	R\$ 9.045.291,30	R\$ 150.110.854,21
TOTAL		105.744	30.744.371	R\$ 2.616.540.459,26	R\$ 30.389.367,13	R\$ 2.646.929.826,39

Source: Adapted from statistical data from the National Fund for Educational Development, 2024.

As shown in Table 1, one of the federal government's missions is to invest in the procurement of didactic textbooks for all levels of basic education. This highlights the scale of a program that has steadily reached an ever-growing audience. Initially, the PNLD was intended for the free distribution of textbooks only for Portuguese and mathematics in elementary school. Currently, the program covers all levels of education, including youth and adult education. Furthermore, the program has evolved over the years to benefit students with special needs through the National Program for Accessible Textbooks. Students with visual and hearing impairments in elementary and secondary school can receive Braille materials, primers, and books in Brazilian Sign Language (Libras), as well as CD-ROMs to support teaching and learning.

These advances demonstrate the PNLD's commitment to inclusion and broad access to books in basic education, reflecting its dedication to combating illiteracy, poverty, and social inequality.

Conversely, data on FNDE's actual financial execution (2024) enable a more precise analysis of public investment in light of the digitization of the curriculum and the new demands of the BNCC. The figures in Table 1 are not just statistics; they represent the tangible reality of educational policy in Brazil and have deeper implications. The substantial investment, exceeding 2 billion reais and covering over 30 million students, confirms the PNLD's status as the primary policy for the large-scale provision of didactic materials. This level of investment creates a common base of materials across the country, ensuring equitable access and centralized knowledge. As the major purchaser of didactic textbooks, the State determines which publishers will be selected and which topics may receive commercial priority, attracting large publishing groups. This transforms the didactic textbook into a "standardized commodity," often focused on approval by the Ministry of Education (MEC) rather than pedagogical innovation.

In terms of pedagogical impact, the substantial investment ensures the stability of certain disciplines, such as biology. It provides teachers with a sense of "comfort" by materializing the curriculum, which serves as an anchor for teachers in schools lacking laboratories or libraries. Table 1 also reveals that the state is investing in student governance through technology. The focus is not only on reading the content but also on managing students' interactions with the digital platform (Popkewitz, 2001).

The shift from printed to digital books introduces a duality that impacts teaching methods. Investment in digital media forces professors to adopt a hybrid teaching model, but schools' physical structures are often unprepared for this change. Although the government provides the Textbook Guide (GLD) to help professors choose the most appropriate didactic textbooks for their students, material constraints limit this choice to pre-approved catalogs. This generates what Ball (2005) calls "managed autonomy," meaning professors can choose within defined financial and bureaucratic parameters.

The institutionalization of the didactic textbook via the PNLD has established a school culture in Brazilian science and biology marked by tension between state prescriptions and pedagogical autonomy. According to Apple (2006), the PNLD serves to legitimize "official knowledge," whereby the selection and mass distribution of textbooks determine what constitutes legitimate school science, often silencing local knowledge in favor of global competencies. However, as Libâneo (2013) warns, the curriculum is not merely an imposed program, but rather an instrumental synthesis that depends on teachers to implement it. This policy's limitation lies in its superficiality and the risk of excessive "didactization." By making the textbook the primary—and sometimes the only—guiding framework for practice, the PNLD may reduce holistic human development to training functional skills (Frigotto, 2010; Saviani, 2007). This approach neglects the theoretical depth necessary for students to understand science as a historical and social heritage, rather than merely using it (Libâneo, 2013).

At this point, the discrepancy between the official and actual curricula becomes evident (Libâneo, 2013). The discrepancy between the scientific literacy project outlined in the BNCC and the available school materials exemplifies "the tensions of the policy cycle" (Ball, 2005). The official document advocates autonomy and inquiry, while classroom reality is marked by dependence on the PNLD didactic textbook, which serves as "official knowledge" (Apple, 2006). This dependence creates a dialectical tension because the textbook must serve as a vehicle for innovation aligned with the BNCC while also remaining a reliable resource for teachers amid the system's precariousness. Therefore, it can be concluded that the institutionalization of biological knowledge in Brazil is not merely achieved by government decree. Rather, as suggested by Ball (2005) and Chervel (1990), it arises from the complex appropriation and recontextualization that professors perform on material often detached from their everyday reality.

In light of this, Brazilian school culture has become "textbook-dependent," meaning that didactic materials have ceased to serve as support and have, in practice, taken on the role of the curriculum (Silva, Krawczyk, & Calçada, 2023). This centrality operates as a mechanism for curricular simplification. Using the textbook as the sole source risks transforming the teaching of science and biology into mere textbook reading. This distances students from empirical experience and the critical thinking necessary to address contemporary challenges. Overcoming this scenario requires the textbook to resume its role as an auxiliary resource, and for professors to reclaim their role as curators and mediators of knowledge in the classroom. (Medeiros et al., 2025).

Thus, the Federal Government's substantial financial investment, as illustrated in Table 1, does not guarantee the overcoming of ideological distortions or the achievement of pedagogical effectiveness.

Selection of Didactic Science and Biology Textbooks

The Textbook Guides (GLD) serve as resources to assist teachers in selecting textbooks by providing information on the principles and evaluation criteria used by a team of evaluators for didactic series. They also include reviews that briefly describe the analysis of the work, the pedagogical and content approaches, the focus and contributions of the professor's manual, the concepts of the editorial project, and the scientific, experimental, and research-oriented nature of the practical activities (Brazil, 2012).

However, Núñez et al. (2003) clarify that choosing the best didactic textbook is not simple. It requires teachers to possess specific knowledge, skills, and sensitivity so they do not select textbooks randomly or adopt selection criteria that prioritize the type of paper used, the layout of figures, or the sharpness of images. According to Núñez et al. (2003), "the choice of a didactic book should never exclude the professor, as the professor must play an active role in deciding which book best suits the profile of their students" (p. 4).

According to Vasconcellos (1993), a science textbook should foster reflection on various aspects of reality and encourage students to adopt an investigative approach, enabling them to construct their own knowledge actively. When science and biology textbooks lack these characteristics, the teaching and learning processes can contribute to academic failure and the formation of distorted conceptions of scientific knowledge and activity.

If adopted textbooks present science in a decontextualized manner, disconnected from society and daily life, and portray the scientific method as a rigid set of rules designed to uncover absolute truths, then professors must adopt strategies that supplement teaching, research, and learning. However, this does not always occur, and the didactic textbook often becomes the sole reference for teaching practice (Frison et al., 2009).

Soares (2001) points out that the didactic textbook emerged alongside educational institutions and has historically accompanied them across different societies and periods. For this reason, professors must adopt rigorous criteria when selecting textbooks. Studies such as those by Vasconcelos and Souto (2003), El-Hani, Roque, and Rocha (2011), Batista, Cunha, and Cândido (2010), and Bandeira, Stange, and Santos (2012) present relevant parameters for analyzing and selecting didactic textbooks. Vasconcelos and Souto (2003) suggest that science professors analyze content, visual, and supplementary resources, as well as activities, when selecting a didactic textbook. Batista, Cunha, and Cândido (2010) consider substantial aspects to be the analysis of content and basic concepts, figures, contextualization, critical thinking, activities, supplementary readings, language, and references. El-Hani, Roque, and Rocha (2011) take it a step further by considering conceptual, methodological, graphic, editorial, activity, and professor manual

aspects. These authors also emphasize the importance of teachers critically analyzing the ethical principles of citizenship-oriented education, the texts, and the explanations to promote the development of scientific knowledge and ascertain if a historical approach with parameters directed toward science, technology, and society (STS) exists.

Therefore, there are various types of didactic textbook analysis, and science and biology professors must choose one, either individually or jointly. This selection is an important task for effective student learning (Núñez et al., 2003). Specific criteria must be developed according to students' needs and life contexts to ensure effective learning (Martins, Sales, & Souza, 2009). However, when professors select a didactic text using the Textbook Guide (GLD), they face a "preselection" of materials that can complicate their choice. One can observe a certain standardization of content, activities, and concepts in the textbooks approved by the Ministry of Education (MEC), resulting in a rigidly established curriculum (Souza, 2015).

The "pre-selection" of these materials leads to a valid and necessary discussion. The Science and Biology didactic textbook has evolved from an instrument of indoctrination conceived during the Estado Novo, a period characterized by a dictatorship that controlled all disseminated knowledge, to a skills-building tool guided by the BNCC and consolidated through the PNLD. Nevertheless, it remains an object of ideological dispute that shapes scientific literacy. In other words, the trajectory of the didactic textbook in Brazil reveals a project of state control over public education that is reconfigured in each historical period (Libâneo, 2013).

Bandeira, Stange, and Santos (2012) proposed categories and criteria for theoretical-methodological, pedagogical-methodological, and visual aspects, based on the GLD/PNLD, the Paraná State Science Curriculum Guidelines, and books and articles on this topic. Chart 1 below presents the categories and criteria established by these authors. The retention of these categories is justified by their anticipation of the methodological transition to inquiry-based learning, serving as a reference framework that, although derived from conference proceedings. These consolidated criteria still permeate current assessment guides.

Chart 1 – Categories and analysis criteria

Categories	Criteria	
Content – Theoretical and Methodological Aspects	1) Conceptual clarity 2) Comprehensibility 3) Appropriateness to students' level of maturity 4) Consideration of students' prior knowledge 5) Interdisciplinary connections 6) Contextualization 7) Content presented appropriately 8) Sequential organization 9) Conceptual language 10) Current scientific developments 11) Supplementary readings 12) Encouraging respect for the environment 13) Anthropocentric perspective 14) A coherent conceptual approach	Readability, interest, and difficulty
Visual Resources	15) Appropriate Visual Analogies 16) Presentation of figures and tables 17) Accuracy of illustrations 18) Appropriate layout 19) Graphic quality 20) Scientific consistency 21) Inclusion of biases	Clarity, conciseness, and visual appropriateness...Ethnic, cultural, and gender-related
Activities – Pedagogical and Methodological Aspects	22) Practice Questions 23) Research 24) Practical Exercises	Presenting problems for discussion, demonstrating connections to everyday life, organizing knowledge through a variety of exercises, and presenting mathematical problems without placing undue emphasis on them. Provision of reference materials, encouragement of group research, and individual research. Encouragement of the sharing of diverse practices, proposal of experiments for each topic, conducting experiments that stimulate inquiry, and proposal of experiments using alternative and low-cost materials
Evaluation	25) Proposal for a variety of assessment resources and tools	

Source: Adapted from Bandeira, Stange, and Santos, 2012, pp. 4–5.

Chart 1 shows that the PNLD evaluation emphasizes the pedagogical-methodological dimension. This suggests that the effectiveness of a didactic textbook is more dependent on its ease of instructional use than on the depth of its critical scientific discussion.

In this context, selecting the best didactic textbook is considered a form of social participation because the materials address social issues. It is also important to investigate the presence of ideologies that promote disrespect for different cultures and religions, personal genders, racial and ethnic prejudices, sexism, and disregard for anything that differs from students' daily lives (Martins, Sales, & Souza, 2009).

Arroyo (2013) reports that educators have become bolder in recognizing and denouncing diversity issues, including sexism, racism, and denigration, in some didactic and literary materials reaching schools. This demonstrates the importance of teacher engagement in textbook selection.

Therefore, teachers must perform their duties democratically, taking students' profiles into account. If science and biology textbooks serve as representatives of the scientific community in a school setting, the importance of selecting quality material becomes clear. Such

material must engage with other forms of knowledge and function as open works that question reality and foster creative thinking (Núñez et al., 2003).

According to Amaral (2006, p. 86), teachers often complain about the selection of didactic books, claiming that they are "always made in a rush, at the last minute, preventing an in-depth examination of the new collections arriving as novelties at educational institutions." This type of conduct may lead to shortcomings, as it neglects an important stage in the teaching-learning process.

Additionally, the pre-selection process conducted by the PNLD severely limits teacher autonomy, constituting what curriculum theory refers to as a "prescribed curriculum." Although the program promotes "freedom of choice," professors select from a catalog filtered by the state and the publishing market. Ball (2005) discusses this mediation, which transforms autonomy into monitored choice. In this system, professors' preferences are shaped by publishers' marketing strategies and the need to adhere to the official curriculum. This highlights the paradox between the investigative proposal and bureaucratic practice.

Features and Functions of the Didactic Science and Biology Textbook

As science and technology came to be regarded as essential to societal change (Krasilchik, 2000), didactic textbooks also changed to update and align them with current policy. Consequently, it is necessary to examine the historical context of the policies that influenced science education to describe changes in didactic textbooks (Souza, 2015). Fracalanza (1993), in his doctoral dissertation, examined changes in science education over time.

During the 1950s, the curriculum proposals for Brazilian schools were highly centralized and rigid. Official curricula prescribed content that organized scientific knowledge in a way designed to facilitate the "cultural transmission" of scientific findings and illustrate the practical application of that knowledge. Didactic teaching methods were based on oral presentations, student note-taking, review exercises, and occasional practical demonstrations of what had been taught (Fracalanza, 1993, p. 121).

In contrast, the influence of the United States on science education in Brazil was prominent in the 1960s. From this perspective, the author states that:

This influence emerged through the adoption of key educational reform ideas from American projects, which were translated, adapted, and disseminated in Brazil during the 1960s. Based on Yager's (1981) premises that "if science is presented in the form in which scientists know it, it will be inherently interesting to all students" and "any content can be taught in an intellectually honest manner to any student at any stage of development," a revolutionary wave of changes in science education took shape. This primarily took the form of developing curriculum projects and training professors to use the new materials (Fracalanza, 1993, pp. 118–119) and was underpinned by strong political will and considerable government funding.

Clearly, the political, economic, and social contexts of a given era influence teaching and, consequently, didactic materials. In the 1950s, for example, students adopted a passive stance toward professors, who were seen as central figures in "cultural transmission." Amaral (2006, p. 107) notes that: "So-called traditional teaching, with its focus on transmitting universal knowledge and its teaching method centered on expository and demonstrative techniques, is the classic expression of technical rationality in education."

In the following decade, a shift in the objectives of science and biology education became evident. While the focus had previously been solely on demonstrating the benefits of science and its impact on society, by the 1960s, the goal was for students to engage in "scientific inquiry" to spark their interest. From this perspective, there was an emphasis on school laboratories and practical activities. This shift was driven by an understanding of the significant scientific and technological advances achieved through the experimental sciences (Fracalanza, 1993). Amaral describes how the technicist movement took traditional teaching to extremes.

The technicist movement that followed in the late 1960s and throughout the following decade radicalized this conception. It sought to subject the teaching-learning process to absolute control through teaching techniques and didactic materials guided by behavioral psychology. This approach rigorously molded students according to its own designs, ignoring the socio-psycho-cultural factors that influence school learning. The didactic textbook shifted from a model based on theoretical expository texts, supplemented by demonstrative, illustrative, and reinforcement activities, to guided studies and programmed instruction. This new model was grounded in rigorous planning and meticulous, strictly defined instructional objectives (Amaral, 2006, p. 107).

Krasilchik (2000) describes changes in science education within their historical context beginning in the 1950s. The author identifies shifts in educational objectives and the didactic materials used during a given period. These changes resulted from political, economic, and social factors that led to transformations in Brazilian educational policies in response to the global situation. Thus, didactic textbooks generally exhibit characteristics associated with their historical context. If traditional, essentialist methods once governed schools, it was only natural that didactic textbooks would resemble the compendiums of the time, treating science as irrefutable with an "unproblematic" and "ahistorical" perspective. According to these paradigms, textbooks presented a conception of science that was individualistic and elitist, accessible only to a few geniuses, and governed by infallible methods (Cachapuz et al., 2005).

However, with the influence of progressive thought and positivism, education began to value not only the transmission of information but also the recognition of students as autonomous individuals capable of producing their own knowledge. Thus, there was a need to allow students to experience science through school laboratories. Sperb (1979) discusses the significant influence of John Dewey's philosophical theories on science education in the United States in the late 20th century.

Much of the progressive education movement emphasizes the role of education in society, highlighting the development of the creative individual. Thus, there are efforts to focus education on developing the individual's full potential, particularly their creative imagination, freedom, independence, right to self-discovery, and physical and emotional abilities (Sperb, 1979, p. 9).

According to Dewey (as cited in Andrade, 2011, p. 123), scientific knowledge consists of processes through which "past experiences are refined and transformed into tools for discovery and progress," aligning with the conception of the scientific method as a set of steps that characterize scientific inquiry. Thus, Dewey seeks to explore the possibility of addressing social and moral issues through the scientific method (Andrade, 2011). This line of thought is considered the main influence behind didactic science textbooks that include experiments for students to conduct in laboratories (Fracalanza, 1993).

In the Brazilian context, didactic science and biology textbooks have undergone various changes, shaped by their historical, social, economic, and cultural contexts. Over the past seventy years, the primary emphasis in science and biology education has been on increasing student involvement in constructing new knowledge. For this reason, experimental teaching has been proposed to achieve different objectives, such as developing skills, providing hands-on experience with scientific methods and their applications, and creating conditions that allow students to find solutions to problems (Borges, 2012). These changes all had a single purpose: to bring scientists' science closer to school science.

Krasilchik (2000) further emphasizes that with the creation of the Program for the Expansion and Improvement of Education (Programa de Expansão e Melhoria do Ensino - PREMEN) — an agency of the Ministry of Education (MEC) — funding was provided for various projects. One such project was the Integrated Science Project, which fostered discussion on the relationship between scientific procedures and common sense, as well as issues related to energy, population growth, food, and hunger (Fracalanza, 1993). (Fracalanza, 1993). Thus, we observe the evolution of didactic materials, which began to address concerns prevalent at the time.

A New Book in the Digital Age

The transition of the PNLD into the digital age, driven by the 2018 BNCC, is more than just a format change; it is a reconfiguration of the nature of school materials themselves. With the introduction of digital educational resources, videos, and simulators, biology textbooks have become part of teaching platforms aimed at standardizing real-time learning. According to Popkewitz (2001), this digitization functions as a new form of governmentality. By monitoring student progress through data and metrics, the state and technology companies now manage individuals' content, rhythms, and behaviors in the virtual environment.

In this context, new hybrid teaching formats, accelerated by the post-pandemic landscape, combine online digital tools with in-person sessions and have transformed the didactic textbook into a gateway to digital ecosystems, which are often controlled by large private conglomerates (EdTechs). This shift alters the dynamics of "teacher appropriation" discussed by Chervel (1990) because recommendation algorithms and predefined learning paths now mediate professors' autonomy. As contemporary critical literature points out, the risk is that the digital textbook will cease to be a support tool and instead become a classroom manager, reducing the professor's role to that of a platform tutor (Silva, Krawczyk, & Calçada, 2023).

The relationship between the BNCC and digital culture further highlights the contrast between promised innovation and actual precariousness. Although digital textbooks in science and biology offer sophisticated, three-dimensional simulations of cells and ecosystems, Brazilian schools still face a connectivity gap. This gap shows that the PNLD's digitization policy can further exacerbate educational exclusion if not accompanied by infrastructure. In official discourse, the digital book is presented as an instrument of equity. However, in practice, it can reinforce the stratification of official knowledge identified by Apple (2006), in which access to technology becomes a new marker of social distinction.

Furthermore, introducing digital platforms into science and biology education raises ethical concerns about the privatization of the curriculum (Mainardes, 2006). With the adoption of educational systems integrated into the PNLD, data on the performance and study habits of millions of Brazilian students become valuable assets for the publishing market. This collection of educational data reveals that contemporary didactic textbooks operate at the center of an economic dispute where biological knowledge is fragmented into small "content pills" optimized for digital consumption. This process often causes the loss of the systemic and critical perspective necessary for scientific literacy (Silva, Krawczyk, & Calçada, 2023).

Finally, one must question how digital textbook resources tend to prioritize universal and generic biology models that are more easily marketable on a global scale. Digital culture in the PNLD risks masking chronic problems in science and biology within technological modernity. Therefore, it is important to reaffirm that technology alone does not overcome the analytical gaps and ideological choices that shape the school curriculum (Silva, Krawczyk, & Calçada, 2023).

Final Considerations

The first ideas regarding didactic textbooks in Brazil emerged in mid-1929. In 1937, the National Book Institute (INL) was established with the primary objective of compiling an encyclopedia that would reflect the nation's identity and collective memory. Since then, several legislative changes have occurred, including the enactment of government regulations aimed at achieving the same goal: establishing control and regulatory mechanisms for the dissemination of textbooks in Brazil. This signaled a significant cultural shift in the educational landscape.

As didactic textbooks evolved and were introduced into classrooms, the federal government adopted an important public policy to regulate the acquisition of books for basic education nationwide: the National Textbook Program (PNLD), which remains in effect today. Throughout history, the PNLD's institutionalization not only organized access to knowledge but also operated what Popkewitz (2001) calls "systems of reasoning," defining standards of identity and citizenship that served different national projects, ranging from Vargas-style nationalism to contemporary neoliberal governmentality. Thus, the science and biology didactic textbook in Brazil transcends its technical function as a pedagogical aid, establishing itself as a powerful device of symbolic regulation.

A historical analysis revealed that the instrumental synthesis of the curriculum, in Libâneo's (2013) terms, was often influenced by external factors, such as MEC-USAID agreements and the technical involvement of organizations like the World Bank. These partnerships were not merely administrative; they introduced a logic of efficiency and standardization that aimed to align biology education with global productivity metrics, often at the expense of the theoretical depth necessary for a well-rounded education.

In this scenario, the PNLD emerges as a terrain of tension between official knowledge, as analyzed by Apple (2006), and schools' needs. While the policy of evaluating and distributing textbooks democratizes access to materials, it ultimately imposes a "preselection" that limits professors' options. Thus, professors' freedom of choice proves to be monitored autonomy, conditioned by a catalog that prioritizes curricular homogenization over regional specificities and local biodiversity.

Implementing the National Common Core Curriculum has widened the gap between the prescribed curriculum and what is actually taught. Although official documents advocate for teacher autonomy, research, and critical scientific literacy, the daily reality of Brazilian schools reveals a dependence on didactic textbooks. Due to resource scarcity, a lack of incentives for continuing education, and limited availability of instructional technologies, textbooks cease to

serve a supporting role. Instead, they become reliable references for teaching that seek not to be reduced to merely instructional practices.

Therefore, the originality of this analysis lies in highlighting that strengthening the National Textbook and Didactic Materials Program, when not linked to continuing training policies and investments in school infrastructure, can paradoxically contribute to curricular rigidity. In this context, the didactic textbook serves as a "silent teacher" and ultimately inhibits the investigative stance that the National Common Core Curriculum claims to encourage. The discrepancy between the sophistication of official guidelines and school culture underscores the need to redefine textbooks as resources requiring constant critical mediation rather than as the end goal of teaching.

Furthermore, the transition from the PNLD to digital culture raises concerns about the proper role of didactic textbooks in the lives of students and teachers. There are indications that textbooks are becoming sophisticated devices of algorithmic governance rather than content carriers. The intertwining of the historical, political, and pedagogical dimensions reveals that the BNCC-driven digitization is not neutral but a new chapter in the struggle for control over official knowledge (Mainardes, 2006). Thus, the transition to a digital environment, under a technological guise, recreates the former function of books as "state emissaries," as described by Rota (2014).

While control was exercised through censorship and the pursuit of a sanitized "Brazilianness" during the Vargas Era, it occurs today through standardization via metrics and algorithms. "Book dependence" has taken the form of "platform dependence," in which professors' autonomy—their role as reinterpreters in Mainardes's (2006) framework—is at risk of being stifled by preconfigured learning paths and the logic of the "instructional package." Thus, the new format of the PNLD may exacerbate educational inequality. As Silva, Krawczyk, and Calçada (2023) point out, technological innovation without real infrastructure—i.e., governance policies—transforms scientific literacy into a privilege for the connected, reinforcing educational exclusion.

In short, for science and biology textbooks to fulfill their role in critical education, we must move beyond viewing them as an "instructional package." School science should be understood as a social and historical construct, not a dogmatic truth handed down by the state. Only by challenging official regulations and valuing teachers' autonomy can we transform didactic textbooks from instruments of governmentality into spaces of resistance and effective scientific literacy. We must always remember that technology is a support tool, not a manager of teaching practice. The cultural authority of the classroom and the professor's central role as a mediator are indispensable in bridging the gap between scientific knowledge and Basic Education students.

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