



The Brazilian mathematics textbook assessments

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Abstract

This paper briefly reviews Brazilian textbook policies during the twentieth century, and pays careful attention to its latest development, PNLD—*Programa Nacional do Livro Didático* (National Textbook Program) and its textbook assessments, which selects textbooks that are freely distributed by the Ministry of Education (MEC) to students of public elementary, middle and high schools. We focus on the mathematics textbook assessments, describing their evolution and commenting on some of their accomplishments and problems. The first assessment was carried out for the 1997 school year and retained basically its initial formulation, with changes and improvements, til the assessment for the 2018 school year. As of now, the program is undergoing substantial changes which are briefly discussed and which worry many educators. This assessment was responsible for a definite improvement of mathematics textbooks for elementary, middle and high schools in Brazil. It constitutes a good example of a successful program, coordinated by competent persons from mathematics education, schools of education and mathematics departments of good universities, at first without political interference, and strongly backed by powerful officials in MEC. In the last few years, pressures from publishers and conservative groups have undermined the assessments, with possibly serious consequences.

Keywords Mathematics textbooks · Textbooks assessment · National textbook policies · Mathematics education

1 Introduction

Ensino Básico, the formal mandatory school education in Brazil for children and youngsters from 6 to 17 years of age, is divided into *Ensino Fundamental* that lasts 9 years—1st through 9th grade—and *Ensino Médio*, which lasts 3 years. *Ensino Fundamental* corresponds to the elementary (first five grades) and middle (last four grades) schools of many countries, and *Ensino Médio* corresponds to high school. School years run from February through November, with a middle-year break in part of July. Since the 1997 school year, almost¹ all Brazilian children and young people in public elementary, middle and high schools receive, from MEC, free textbooks for all school subjects,² assessed by MEC. The approved books are bought by the federal government from privately owned publishing houses and distributed to public school in the whole country. The financial resources are provided

by FNDE, *Fundo Nacional de Desenvolvimento da Educação* (National Fund for Educational Development),³ which funds most national educational programs, with resources from many sources.

This textbook distribution program, called *Programa Nacional do Livro Didático* (PNLD, National Textbook Program) is, by far, the biggest, in financial investment, of all MEC programs. Table 1 shows the numbers of acquired books for all school disciplines, serviced schools, recipient students and the total costs for the last 4 years.

If we consider only mathematics textbooks, Table 2 shows the number of books distributed, in 2015, 2016 and 2017, for high, elementary and middle schools, respectively, and which show that PNLD is indeed a big program.

An invaluable source of information on the assessment program and PNLD in general is the page <http://www.FNDE.gov.br/programas/livrodidatico>. Also, MEC funds

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¹ In Brazil, elementary and middle schools are the responsibility of counties, while States are responsible for high schools. Both counties and states can decline receiving the books.

² The school grades and subjects covered have augmented through the years, until reaching their present state.

³ Instituted by laws no 5.537, of November 21, 1968 and no 872, of September 15, 1969.

Table 1 Data concerning books distributed in the last 4 years

PNLD	Books	Schools	Students	Investments (Very approximate values, due to the vagaries of the exchange rate during these years) (US\$)
2014	157,134,808	121,279	39,403,259	406,000,000.00
2015	144,291,373	123,947	306,013,441	454,200,000.00
2016	128,588,730	121,574	34,513,075	418,500,000.00
2017	152,351,763	117,053	29,416,511	370,260,220.00

FNDE Estatísticas do PNLD, organized by the author

Table 2 Data for mathematics textbooks

PNLD	Number of books
2015	8,592,307
2016	11,834,406
2017	8,592,307

FNDE Estatísticas do PNLD, organized by the author

a project, *Memorial do PNLD*,⁴ at the *Universidade Federal do Rio Grande do Norte*, in Natal, State of Rio Grande do Norte, to preserve the history of the assessments for all school disciplines.

The success of the mathematics assessments during the time span covered was in great part due to a very competent and dedicated group of persons from several institutions that have, in the last 20 years, continuously or not, given their time, knowledge and know-how, under often difficult conditions, to assure fair and reliable assessments of mathematics textbooks. Among them, I would like to mention Adriano Pedrosa de Almeida, Marilena Bittar, Bruno Alves Dassié, Iole Druck, Verônica Gitirana, Paulo Figueiredo Lima, Mônica Mandarin, Elisabeth Belfort da Silva Moren and Elvira Nadai. It has been a pleasure and privilege to share, each year, many weeks of productive work not only with them but with more than 250 persons, from all over the country, who have taken part in the assessments.

As of now, there have been few papers about PNLD and its assessments, along the lines of this one. Of course, there have been many papers and dissertations in Brazil about textbooks, looking into their structure, content coverage, methodologies, ideological biases and so on, but not focused on the assessment processes per se. I mention Mantovani (2009) and Botton (2014) who agree, as I do, that the program improved the quality of Brazilian textbooks. Romanini (2013) studied the administrative, bureaucratic entanglements and contradictions in the implementation of a big program such as PNLD, focusing on the State of São Paulo.

The author of this paper was actively involved with the mathematics textbooks assessments since 1993, when he coordinated a pilot assessment, which will be mentioned later, until 2017. During all these years, he kept extensive documentation about the program and its policies that he has constantly used while writing this paper concerning PNLD from 1997 through PNLD 2018.

A word of explanation: the numbering of PNLD—for example PNLD 1997, PNLD, 2011, PNLD 2017—refers always to the school year in which the books were distributed. Of course, they were assessed previously. This should always be kept in mind, to avoid confusion and misunderstandings.

2 The Programa Nacional do Livro Didático (PNLD)

PNLD, *Programa Nacional do Livro Didático* (National Textbook Program) was instituted in 1985,⁵ as part of Brazilian policies of school inclusiveness. It was preceded by similar programs, executed by several government agencies. This program was not created out of the blue. In Brazil, as in some other countries, there has been a long history of textbook control and assessment by the government. The “pre-history” (nineteenth century and until 1930) of these policies can be studied, for example, in the publication by Soares (2013); for more recent years (after 1930), one can read the record in several publications (Carvalho forthcoming; Dassié 2012; Ferreira 2008; Filgueiras 2011; Soares 2003; Soares and Rocha 2005); a comprehensive view of the period 1930–1984 is found in the publication by Filgueiras (2011).

In the years 1985–1997, differently from what had happened in the period 1937–1984, textbooks bought by PNLD were not assessed. Publishers presented lists of the books they were willing to sell and these lists were consolidated into a catalogue from which teachers had to select their textbooks. This was an excellent occasion to empty the publishing houses’ storage rooms of unsold books. Also, books

⁴ <http://www.cchla.ufrn.br/pnld/>.

⁵ Decreto Lei no 91,542.

were disposable, used for just one school year, since students could write answers to exercises in the textbooks.

Taking into account the many complaints of teachers and educators in general about the very poor quality of textbooks, in 1993 MEC instituted a commission with two tasks: firstly, to establish criteria for the assessment of textbooks bought by the Government, through PNLD.⁶ Secondly, to assess the 10 most purchased textbooks for mathematics, Portuguese language, sciences and social studies, for grades 1 through 4.

Initially, the mathematics group read and discussed books and papers related to textbook assessment in general, their role in school and society, and so on, particularly of mathematics textbooks. Specifically, the group coordinator selected, read and distributed or recommended, among others, for reading by the commission prior to the meeting, material by the following authors: Araújo (1986), Baquero and Ribeiro (1985), Bardin (1991), Freitag et al. (1987, 1989), Gérard and Roegiers (1993); Hariki (1994); Hariki (1992), INEP (1987, 1996), Keitel et al. (1980), Moysés (1985), Otte (1980, 1986), Pfromm Neto et al. (1974), Richaudeau (1979), Van Dormolen (1986), Venezky (1992) and Worthen et al. (1987). This gave the mathematics group a good grasp of mathematics textbooks before tackling the task of setting up the assessment criteria (MEC, FAE, PNLD 1994), which have been constantly refined and used in the mathematics assessments for PNLD 1997 through PNLD 2018.⁷

The report of this commission (MEC, FAE, PNLD 1994) showed that the textbooks bought for PNLD were really very bad. In mathematics for example, 54 books were examined, of which only seven (13%) passed the established criteria. Summing up its findings, the mathematics group wrote (MEC, FAE, PNLD 1994):

[T]he mathematics group was surprised by the poor quality of the texts, the repetition of the same errors in almost all collections, the very poor illustrations, wrong language and disrespect of the child intelligence, due to ridiculous or senseless contextualization. (...) There is imprecise or obscure language, which makes its understanding by the student difficult ... (p. 61)

The media had a field day and quoted extensively from the report. Publishers protested forcefully. A high MEC official said that the report was very pessimistic, like all

academic studies, and it was better to have a bad book than no book at all. He did not stop at words and halted distribution of the report. It seemed that the case was closed, that things would go on as always. It came as a surprise to many that the government decided to institute assessments as a mandatory part of PNLD, starting with the 1997 school year.

There were several reasons for doing so, besides justified concern about the quality of textbooks. At the time, Brazil negotiated substantial loans for educational programs with international agencies, such as the World Bank. This institution stressed the importance of good textbooks to compensate for poorly trained teachers, mentioning that in many countries these books impose de facto curricula and are very cheap (Torres 2000, p. 135). The bank also recommended that textbook production be left to privately owned publishing houses and that the government should publish guides (catalogues with comments) to help teachers in selecting their textbooks. Besides, several international organizations had begun to insist on accountability and program evaluation; also, the assessments would generate very positive media coverage for the government, because of widespread criticism of textbooks quality.

According to Worthen et al. (1987, p. 53), any assessment should satisfy the following conditions:

1. A valid reason to assess.
2. The organization that contracts or executes the assessment must be legitimate.
3. The results of the assessment should be transparent.
4. The results should be used to policy formulation and decision making.

Let's see how PNLD's assessment program fares if we take into account the above requirements:

- First, the legal basis for the assessments is provided by the Brazilian Constitution of 1988 (Brasil 1988, Capítulo III, § 205, § 206-VII) and by the National Education Act (Lei de Diretrizes e Bases da Educação Nacional), of 1996. The Constitution declares that public education of good quality has to be provided by the State and the National Education Act states that it is a State duty to provide assistance to students, with didactic materials, transportation, food and health services.
- Second, MEC is, by law, in charge of supervising the country's educational system, including watching over its quality.
- Third, the assessment criteria and the list of approved books is made public.
- Last, the assessment results are used by teachers and school districts to choose the textbooks for the public school system.

⁶ The mathematics commission had five members, representing various scientific and educational associations: Anna Franchi, Iara Augusta da Silva, João Bosco Pitombeira de Carvalho (coordinator), Martha Maria de Souza Dantas and Tânia Maria Mendonça Campos.

⁷ They are all available in the *Guias do livro didático* for these years, at <http://www.fnde.gov.br/livrodidatico/PNLD/guias>.

There are several compelling reasons to study PNLD's assessments, until now the most lasting nationwide assessments for elementary, middle and high school textbooks in Brazil.

First, textbooks in Brazil, as in many countries, define the real curriculum, that is, what is really taught (Venezky 1992, p. 436). Therefore, any improvement in textbooks, in their contents or methodologies, opens the way for improvements in teaching, and possibly in learning. Moreover, the assessment has weeded out the really bad textbooks and helped improve many others. This is specifically shown for some collections of mathematics textbooks in the publication by Zúñiga (2007). As examples of this, we can mention, in the early years of the assessment program, the many errors in the study of fractions which were slowly eliminated. Next, we have the case of plane symmetries, whose presentation improved slowly but surely. On the other hand, financial mathematics, statistics and probability are still undergoing an improvement process, maybe because their inclusion in the curriculum is recent.⁸

Secondly, since the assessments have always been coordinated by persons in universities and the assessors have always been chosen from Brazil's five great geographic regions, the program helped to awaken or increase interest in the study of textbooks in many Brazilian universities, particularly in the case of mathematics textbooks. While in other areas research on the respective textbooks was already active in Brazil, in mathematics not much was done before 1997 (UNICAMP 1989). The assessments fostered the development in the country as a whole of a mathematics textbook assessment culture and made research on mathematics textbooks a serious subject in several mathematics education departments, schools of education and mathematics departments. Many doctoral and MSc dissertations were written on this subject from 2000 on, after PNLD had grown deep roots and many researchers had already taken part in the assessment program. It would be unfair to them and to their graduate students to name just a few of the excellent dissertations and papers of the last 20 years and not to mention the others, and a full list would be too long.⁹

Third, since the assessors have always been chosen from Brazil's five great geographic regions, the assessments have fostered the development of a textbook evaluation culture in Brazil and the awareness that textbook quality matters, and that something can be done about it. So far, in mathematics,

more than 250 persons, from all over Brazil, have been assessors. They have been graduate students in education, mathematics or mathematics education or worked in universities and their laboratory schools (*colégios de aplicação*), elementary, middle or high schools state and county boards of education.

Through the years, slowly, a methodology for assessing mathematics textbooks was developed. This was helped because, from PNLD 2002 through PNLD 2018, the mathematics assessments were carried out by the same institution, UFPe (*Universidade Federal de Pernambuco*), with basically the same coordinating group; this continuity allowed the above mentioned development.

In addition this paper discusses how a government policy for textbooks was effective for improving their quality and the political and administrative conditions that allowed it to last and continuously improve.

Last, PNLD has had a profound impact on book publishers in Brazil, because the large number of government acquisitions fostered the strengthening of publishing houses, attracted foreign publishers, and at the same time made the textbook publishing market very dependent on government acquisitions (Cassiano 2005).

The assessments for PNLD 1997–2000 were carried out directly MEC. In 2000, it decided to delegate the execution to public federal or state learning institutions. In mathematics, UFPe (Universidade Federal de Pernambuco) was chosen and carried out all the mathematics assessments for PNLD 2002 through PNLD 2018. In 2000, MEC created an advisory board, the *Comissão Técnica do Livro Didático*, CT (Textbook Technical Committee), to help in supervising the carrying out of the assessments by the universities and to advise MEC on matters concerning textbooks.

In the first assessments—for PNLD 1997, 1998, 1999—books were evaluated individually. Starting with PNLD 2000, publishing houses could present only complete collections for assessment, even though the exclusion of one of their volumes did not disqualify the whole collection. Since PNLD 2002, each collection is assessed as a whole: if one of its books is disqualified, the whole collection is *ipso facto* excluded.

In 2010, a law¹⁰ gave publishers the right to question the assessments results and allowed them to correct small mistakes in assessed books, to avoid their exclusion. In 2011, the Free Information Law¹¹ guaranteed that anyone could have information on all the assessments results.¹²

⁸ These statements are based on the personal files of the author, which include all the assessments' reports from all mathematics books, from PNLD 2002 through PNLD 2018.

⁹ An ongoing project undertaken by this author and other persons involved with the mathematics assessments has already listed almost 130 MSc or PhD dissertations dealing with mathematics textbooks or PNLD policies, and there are many more to locate.

¹⁰ Law 7084 of January 27, 2010.

¹¹ Law 12,527 of November 18, 2011.

¹² Since PNLD 1997, publishers had successfully prevented MEC from issuing the lists of excluded books, but now anyone can have access to this information.

Table 3 Details of assessments through the years

	Assessments carried out for PNLD, by year and school level		
	Elementary school	Middle school	High school
1997	x		
1998	x		
1999		x	
2000	x		
2001			
2002		x	
2003			
2004	x		
2005		x	
2006			
2007	x		
2008		x	
2009			
2010	x		
2011		x	
2012			x
2013	x		
2014		x	
2015			x
2016	x		
2017		x	
2018			x

Until 2004, PNLD bought books only for elementary and middle school. MEC started buying books for high school in 2005, as a different program, which in 2012 was incorporated into PNLD that since then covers elementary, middle and high schools. Until PNLD 2018, the textbooks were supposed to last 3 years, excepting the ones for first grade that last just 1 year. Table 3 shows how many assessments were done until now for PNLD.

3 How is the mathematics assessment carried out?

The assessment program is part of a long chain of steps designed to deliver the textbooks to (almost) all public schools in the country before the first school day of each year (First workday in February).

I now present the main steps in this long and complex chain. I describe its state as of PNLD 2018, with remarks about its evolution. The situation changed considerably starting with PNLD 2019, outside the period we are dealing with.

The sketched timetable may vary, with delays of a few months, usually because of bureaucratic problems; its only

unchangeable part is the requirement that the books must reach schools the first workday in February.

3.1 The assessment preparation

The chain is set in motion roughly 2 years before the deadline, when MEC issues a public call (*Edital*) for publishing houses interested in selling textbooks for PNLD. It is a legally binding document, which, among many things, deals with the technical characteristics the books must have, like size, paperweight, etc.; it also stipulates the legal framework, such as copyright rights, the deadline for books' submission, and so on. The part of the *Edital* that interests us is the one that specifies the assessments' criteria. They are divided into two groups, the first one for all school subjects, and the second one specifically for mathematics. Both have varied slightly through the years, and we summarize them, freely, as follows.

General criteria:

- The collection must comply with the laws and other legal documents related to Brazilian education.
- The collection must obey the ethical and democratic principles that underlie a republican and just society.
- The collection methodology should be in accordance with the methodological principles propounded in the teacher's manual.
- The collection must present correctly concepts, information and procedures.
- The collection's editorial project must be in line with its didactical, scientific and pedagogical goals.

The laws and legal documents mentioned in (a) define the goals of elementary, middle and high school; besides, (a) and (b), jointly, forbid any kind of discrimination whatsoever. In addition, the collections must also show the variety and the richness of the several cultures that make up Brazilian society, in particular the contribution of African-Brazilians. There is also the *Estatuto da Criança e do Adolescente* (Children and Adolescents) Act¹³ that specifies their rights and need of protection and the Senior citizens act (*Estatuto do Idoso*)¹⁴.

The specific criteria for mathematics, presented freely, are as follows:

- The collection must present all fields of school mathematics; for elementary and middle school, numbers and operations, geometry, algebra, measurements and data

¹³ Law 8069 of 1990.

¹⁴ Law 10,741 of October 1st 2003.

analysis; for high school, numbers, algebra, geometry, statistics and probability.

- (b) The collection must foster the development of basic cognitive abilities by the student, such as observation, comprehension, argumentation, analysis, synthesis, communication of mathematical ideas, memorization.
- (c) The collection must stress concept development and the power of mathematics for solving problems.
- (d) The teacher's manual must show the didactical choices available to the teacher, present detailed answers to all problems and exercises and guide the teacher on how to make the best use of them.
- (e) The collection cannot advertise goods, commercial services or brands of any kind.

Starting with PNLD 2016 and until PNLD 2018, shortly after this public call for publishing houses, MEC issued a call for institutions interested in carrying out the assessment. Before, PNLD 2016, MEC chose the institutions.¹⁵ Only public federal teaching institutions could compete. Each candidate institution had to submit a detailed proposal, which had to show the institution's competence for carrying out the assessment and specified the group that would coordinate the assessment. Then, MEC convened a special committee to select the institution for each school subject.

The coordinating group is composed of

- (a) An academic coordinator, who must be a professor at the proposing institution; he/she is responsible for all academic, professional assessment matters.
- (b) An institutional coordinator, who is responsible for all the operational and administrative side of the assessment. He also must be a professor at the proposing institution.
- (c) Adjunct coordinators, whose number varies depending on the number of collections to be assessed; they are chosen from Brazilian geographic regions other than the one of the proposing institution.
- (d) Pedagogical advisors, whose number depends on the amount of collections to be assessed. They advise on special topics, like statistics and probability, incorporated into the curriculum only recently, and in which authors have difficulties. They may also help in the assessment of particularly problematic books, for which the designated assessors cannot reach an agreement.
- (e) Critical readers, who teach in the school grades covered by the assessment. Their job is to read the final assessment reports sent to all schools to check if they will be easily understood by their readers.

Roughly 18 months before the deadline, publishing houses submit their books for assessment. After MEC has established how many collections will be assessed, it defines how many assessors will be needed, taking into account that each collection is examined by two experts.

Until PNLD 2017, the institution selected to carry out the mathematics assessment chose this group, taking care that they came from all five great Brazilian geographic regions. Besides, these experts had to have different backgrounds: persons with strong mathematical knowledge, experts in mathematics education, teachers actually in classrooms. In addition, there were experts in some particularly difficult subjects in elementary, middle and high school education, such as probability and statistics, which had been introduced into the curriculum only recently. Care was taken that new members were paired with more experienced partners and that in each pair the partners did not have similar backgrounds. For PNLD 2018 MEC set up a bank of experts, from which half of the assessors were chosen by lot, and the selected institution chose the other half, also from the bank. Starting with PNLD 2019, all the assessors will be chosen by lot, from the bank. The selected institution, jointly with the area representative in *Comissão Técnica*, could refuse a person drawn by lot, to achieve a group with more balanced backgrounds, but they had to have a valid reason for doing so, for example, if the drawn person had connections as author or advisor with publishing houses.

3.2 The assessment Kickoff¹⁶

Approximately 12 months before the deadline, all these preparations bear fruit with the effective beginning of the assessment. The mathematics coordination convenes a general meeting of all the persons involved in the assessment: the coordination, with its adjunct coordinators and advisors; the mathematics representative in the *Comissão Técnica*; and all the assessors. The purposes of the meeting are as follows:

- (a) To present the assessment program as part of PNLD.
- (b) To present and discuss the assessment criteria.
- (c) To present and discuss the assessment documents the assessors must write.
- (d) To promote the uniform application of the assessment criteria by means of workshops for the assessors.
- (e) To make the assessors feel they are part of a group actively committed to improving mathematics textbooks quality.

¹⁵ From PNLD 2019 on, MEC will carry out the assessment directly.

¹⁶ This part deals with the assessment structure until PNLD 2018. Things have changed substantially starting with PNLD 2019, which is already under way.

The meeting lasts a few days and it usually opens with a talk about the history of the mathematics assessments and their place in the general framework of PNLD. After this, there is a detailed presentation of the assessment criteria, which is followed by a discussion of the documents they will produce, which are as follows:

- (a) A detailed checklist which covers the contents and methodology of both the student book and the teacher's manual and proposes that the book be accepted, dismissed or should be corrected before being accepted. For most items, it is required that the expert write an argumentative text, and not just recommend a decision of yes or no.
- (b) A detailed report on the collection, stating why it should be excluded, accepted or conditionally accepted.¹⁷
- (c) If the collection is either approved or conditionally approved, a small report, called *resenha*, to be included in the catalogue sent to all schools to help teachers select the textbooks they will use. These *resenhas* have a common structure, and are divided into sections that deal with specific features of the book so that the teacher can have an idea of how the author deals with the mathematics content and of what the collection's methodological characteristics are. There are also a discussion of the teacher's manual and suggestions on how to use it in the classroom.

In the workshops, particular care is taken to discuss the checklist thoroughly, in order to minimize different interpretations of its items. All examples used in the workshop are taken from collections assessed in previous years. Also, the assessors try their hand at writing the reports they will have to hand in. Besides, they are given two *resenhas* and are asked to decide which book they would choose, and why.

When the meeting is over, the assessors take home the collections assigned to them. Usually, they have 1 month to fill in their individual checklists. After this, there is another meeting of the assessors. The pair¹⁸ of experts assigned to each collection works together to fill in a joint checklist. Using this checklist, they write, together, their final report. If they do not agree on a decision about the collection, the coordinator asks someone else to examine it.

After the assessors turn in their reports, the coordinating group begins to organize all the material they wrote. Three difficulties are always present:

- (a) What is the boundary between a serious error which will, ipso facto, exclude the whole collection and a minor mistake?
- (b) How can one be sure that problems which excluded a collection are not present in other, approved ones?
- (c) For approved collections, does the *resenha* match the detailed report? Is there any disagreement between them? Does it faithfully present the book to teachers looking for the textbook they will use?

These difficulties are tackled by intensive work of the coordinating group during several months, reading over and over all checklists, reports, *resenhas*, cross-checking them with the actual textbooks.

The fruit of all this, a catalogue sent to all schools and called *Guia de Livros Didáticos*,¹⁹ consists of an introductory message to teachers, stressing the importance of choosing a good textbook; a text on the assessment criteria, a description of the *resenhas*' structure and how to use them efficiently to help to select a textbook; and also a text about the characteristics of the approved collections. And, of course, the *resenhas* for all the approved collections.

A *resenha* was, at first, a simple text describing the textbook and pointing out its strong and weak points and it evolved slowly to become a very structured text, with several parts. First, it has a small presentation of the collection, stressing its good points and its eventual weaknesses, followed by a list of the collection's contents, grade by grade. After this, we find several sections, as follows:

1. *Content organization* In which is discussed the distribution, for each grade, of the big areas of school mathematics (numbers, geometry, measurements and data handling, for elementary and middle school; numbers, algebra, geometry, statistic and probability, for high school)
2. *Content presentation* In which is discussed how the collection presents each big area of school mathematics.
3. *Didactical methodology* In which are discussed the didactical choices made by the collection's authors.
4. *Contextualization and interdisciplinarity* Which discusses if they are genuine or artificial, just a pretext to satisfy the requirements set by the *Edital*.
5. *Contributions to the student citizenship* In which is discussed whether the collection contributes to a critical consciousness of society's problems and promotes the principles of a just, democratic society, without prejudices of any kind.

¹⁷ A conditionally accepted collection has small mistakes that must be corrected before it is approved.

¹⁸ Until this meeting, they were a "blind pair": each one of them did not know who the other one was.

¹⁹ All the catalogues, from the very first one, can be downloaded from <http://www.fnde.gov.br/programas/livro-didatico/guias-do-pnld>.

6. *Editorial project and language correction* In which are discussed whether the editorial project promotes readability, the contents are easily identified, the illustrations are useful or just ornaments, graphs and maps are accurate and follow the prescribed norms for their presentation, and whether the language is correct and there is a variety of textual types.
7. *Teacher's Manual* In which are discussed the authors' conception of school mathematics, its role in society, the pedagogical and didactical choices made, and whether it is really helpful to the teacher, both in content and for planning his course and whether it has the answers to all proposed exercises, has extra projects and activities and bibliographical references for further study by the teacher.
8. *In the classroom* In which it is discussed the care the teacher must take
9. + to make good use of the book.

Since PNLD 2015 the *Guia de Livros Didáticos*, has both printed and digital versions. When it is released by FNDE to schools, some 8 months before the deadline, the assessment program closes all its activities, and FNDE takes charge of the final steps, until books reach the schools. This is no easy task. First, FNDE has to process and consolidate the choices of all public schools in the country—1 year elementary schools, the following year middle schools, the third year high schools. Second, it has to negotiate with publishers the acquisition of the required number of books. Third, it has to distribute, using the mail service, all these books to their respective schools, all over the country.

4 Accomplishments and problems of the assessment program

Since the aim of the assessment program is to provide good books to students of the public school system, let us start with a direct question: has the assessment program guaranteed that schools receive “perfect books”? No. The process is regulated by a legally binding document (*Edital*) which has explicit criteria for the exclusion of a collection. If it does not clearly violate one or more of these criteria, it cannot be excluded, even if the assessment group thinks it should not be used in schools. Many mathematicians or mathematics teachers do not understand this distinction, and claim that the assessment program approves books with errors, and that it is inconceivable that MEC put in the hand of children or teachers books that have such and such mistakes. Nevertheless, let us remember that mathematical rigor is contextualized: it depends on to whom and when you are speaking or writing. What must be kept in mind is that there should be no assertions that hinder or contradict later learning.

Table 4 An example of early assessment results

	Results of the mathematics assessment for PNLD 1997	
	Number of books	(%)
Recommended (REC)	25	27.5
Recommended with restrictions (RR)	16	17.6
Not recommended (NR)	37	40.7
Excluded (EXC)	13	14.3
Totals	91	100

(MEC/FNDE 2000, results organized by the author)

Table 5 An example of more recent assessment results

	PNLD 2000—assessment of mathematics textbooks for grades 1 through 4	
	Number of books	%
RD	16	13.1
REC	24	19.7
RR	38	31.1
EXC	44	36.1
Totals	122	100

(MEC/FNDE 2000, results organized by the author)

Table 6 The results for PNLD 1999

Total number of books	PNLD 1999 middle school books assessment		
	Approved books	Excluded books	% of excluded books
72	38	34	47.2%

Personal files of the author

If one compares the quality of books around 1997 with their present quality we can see a real improvement (Mantovani 2009). In the first assessments, there were books which stated, for example, that the zero is the successor of the “nothing”, a quadrilateral is a figure formed by four angles or that presented situations in which the total of percentage shares exceeded 100%. These extreme cases do not occur anymore.²⁰

The percentage of approved books for elementary school increased steadily during the first assessments. For example, in PNLD 1997, we had the situation shown in Table 4.

²⁰ Personal files of the author.

Table 7 The results for PNLD 2017

Total number of collections	PNLD 2017 middle school books assessment		
	Approved collection	Excluded collections	% Excluded collections
23	11	12	52%

Personal files of the author

Table 8 Comparison of results for high school assessments

PNLD	Comparison of the high school textbooks assessments			
	Approved collections	Excluded collections	Totals	Percentages of excluded collections (%)
2012	7	13	20	65
2015	6	14	20	70
2018	8	7	15	47

Personal files of the author

In this assessment, books could be excluded (EXC), not recommended (NR), recommended with restrictions (RR) or recommended (REC). Teachers could choose books from the three last categories (NR, RR, REC). The compromise to allow teachers to choose non-recommended books was made to give teachers time to adapt themselves to the new standards of quality. As shown in Table 4, the excluded and not recommended books represented 55% of the total.

For PNLD 2000, which assessed books for the same grades as PNLD 1997, we have the results shown in Table 5.

This time, we do not see any more the category of not recommended (NR) books. Comparing the results of these two assessments, we see that the percentage of “bad” (EXC, NR) books decreased from 55 to 36.1%, which is considerable progress. The situation was similar for the other school grades. But what is the current situation compared to the early assessments?

We present below, in Tables 6 and 7, the results, respectively, of PNLD 1999 and 2017, for grades 6 through 9.²¹

Differently to what we saw for elementary school books, for which there was a clear improvement of quality, measured by the percentage of excluded books, the situation for middle school books does not show such an improvement. If one compares the exclusion reports for the two assessments,²² we notice that in 2017 the causes for exclusion were

²¹ It was necessary to separate the two assessments, because for PNLD 1999 publishers presented books for some or all of the grades, fifth through eight, not collections, and these books were assessed individually, not as part of a collection.

²² Personal files of the author.

PERCENTAGES OF EXCLUDED COLLECTIONS FOR PNLD 2012, 2015 AND 2018

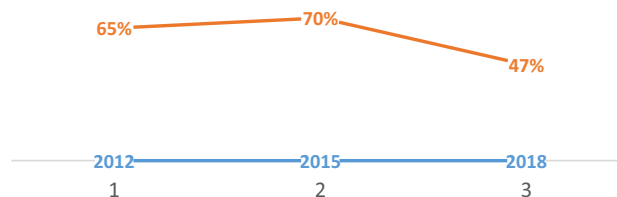


Fig. 1 Graph of comparative data (Personal files of the author)

more subtle mathematical problems, or violations of the several legal statutes collections must comply to.

It would be more complicated to compare the situation between early and recent assessments of elementary school textbooks, since this school level was increased from 4 to 5 years in 2010. The first 2 years of this period have classes only in Portuguese language and mathematics;²³ in 2013 this was increased for 3 years. From 2010 on, all assessments of textbooks for elementary school have been divided into those two parts: collection for the initial years (first, 2 years; later on, 3 years), and collections for the final years (first, 3 years; later on, 2 years), and some collections cover from first grade though ninth grade, while others cover only from first through fifth or from sixth through ninth grades, respectively.

Let us now look at the situation for high school and compare PNLD 2012, 2015, 2018 (Table 8).

A possible reason for the increase of the percentage of excluded collections from PNLD 2012 to PNLD 2015 is the presence, in the second assessment, of digital collections, which were very bad at the time, but the general trend is of improvement, as shown in Fig. 1.

A considerable improvement in textbook quality that happened because of assessment pressure is the following: Until the middle 1970s, mathematics textbooks depicted a very stereotyped vision of family and society. The father was the family provider; the mother cared for the children and the home; grandparents smiled benevolently at blond grandchildren who played happily in a well-kept garden. The family cook was usually a fat and happy African-Brazilian woman. Country life was idyllically shown, with children playing with sheep, collecting flowers, and looking at birds, while father and mother joyfully toiled the fields or cared

²³ Mathematics for these early years is called *alfabetização matemática*, that is, mathematical literacy.

for cows, sheep and chickens. In fact, more than half of Brazilian households do not conform to the traditional family model, and whites are less than 50% of the population. Indians and Orientals were very seldom shown, usually in highly stereotyped situations. Now, books are very careful, and one cannot find distortions such as these.

The assessment has definitely improved the quality of mathematics textbooks. But how are they chosen and used in the classroom? In 2001, the *Comissão Técnica* organized a pilot study on the choice and use of the textbooks used in public schools. This was supposed to be followed by a comprehensive research, which so far has not been carried out, despite many promises and false starts. More basically, neither PNLD as a whole nor its assessments have never been evaluated.

In an attempt to “modernize” the teaching and learning processes, MEC decided to distribute digital textbooks, starting with PNLD 2014. Publishers could also submit collections that, besides the printed books, had pdf versions with links to multi-media materials. In mathematics, the quality of this new kind of collection was very bad, and just a few digital collections were approved. This experience continued until PNLD 2017, with some variations: Due to increasing lack of funds, the digital collections approved for 2016 and 2017 were not bought by MEC and for 2018 only paper collections could be submitted. It is a pity MEC stopped buying digital materials; in the same way that paper textbooks improved slowly since the beginning of the assessments, there would be, hopefully, improvements in the digital collections. In particular, the mathematics coordination developed, for PNLD 2014 through PNLD 2017, an innovative methodology for the assessment of digital collections.

A recent development is that some big education groups have started to sell “educational packages” to counties, with textbooks, tests and exams, teacher-training courses, and so on. Since counties are not forced to accept the books freely distributed by MEC, more and more of them are buying these packages, in the hope that they will solve their students’ learning problems. One reason for this, it seems, are the mandatory state or national tests to assess school quality (Britto 2011), sometimes with financial rewards to schools whose students perform well. The textbooks provided by these packages do not pass any assessment. So far, this development has not been objectively studied.

5 Pnld and the publishing houses

How did publishers and authors react to the assessment program? Zúñiga (2007) investigated how some authors changed and adapted their textbooks to meet the stronger and stronger requirements of PNLD. Some of them, as she

Table 9 Summary of books printed in Brazil in 2 years

	Books printed in Brazil	
	2015	2016
Textbooks	221,214,936	220,458,397
Total	446,848,572	427,188,993

FIPE (2016). Table organized by the author

Table 10 Summary of textbooks sold in Brazil in these years

	Textbooks sold in Brazil	
	2015	2016
To the Government	128,622,634	147,631,141
To others	50,772,492	47,962,585

FIPE (2016). Table organized by the author

shows, screamed and kicked during this process, but the collections were improved.

Another response to the assessment has been the suppression of troublesome points. Typical examples of this can be found in high school texts, which started being assessed for the 2004 school year.²⁴ At first, many collections presented an introduction to the differential calculus, basically the derivative, as an aid to the study of the variation of functions and of simple maxima and minima problems. There were serious errors in some of these treatments and the subject practically disappeared from high school textbooks. For example, in the last high school assessment, for PNLD 2018, only three collections included an introduction to differential calculus, in a total of 15.

Publishers need PNLD, they would not survive without it; they do not like the assessment, but have learned to live with it. They are very good at lobbying, have very good connections both in FNDE and the Brazilian congress, and have competently, particularly since 2010, weakened the assessment program. They won the right to appeal and to correct small mistakes and starting with PNLD 2019, the books will be disposable each year, since the students will be required to write the answers to the exercises in the books. This of course means a great increase in government acquisitions.

It is surprising how publishing houses keep presenting very bad new collections for assessment. In PNLD 2018, there were 15 collections presented for assessment, of which only four were new collections; of these, only one was not excluded! Since very little is known about the internal working of textbook publishing in Brazil, we do not know the

²⁴ Only in 2012 did the high school textbooks assessments become part of PNLD.

decision making process to choose which manuscripts will be printed.

Textbook publishing is big business in Brazil, due to the great number of books the government buys each year. It represents, year after year, more than 50% of the total number of books published and sold in Brazil (Cassiano 2005, 2007). The money involved has attracted, in the last decade, international publishers (Cassiano 2007). On the other hand, it is a market very dependent on government acquisitions.

Brazil is among the top 10 countries in book sales (Cassiano 2007, p. 96), and textbooks represent around 50% of books sold. For the years 2015 and 2016 we have the following data (Table 9).

For the total of textbooks sold in the same years, we have the following results (Table 10).

We see indeed that the textbook industry is greatly dependent on government acquisitions. Prior to 1997, publishers had a perfect situation: an assured market, which grew steadily, because of the educational policies to promote inclusion, and no assessment of what they sold. Therefore, it was to be expected that they would react strongly against the first PNLD book assessment (Munakata 1997).

In Brazil, there have been few studies of the publishing of mathematics textbooks. I mention, Zúñiga's doctoral dissertation (Zúñiga 2007), which shows how authors and publishers changed their collections to fit PNLD's assessment requirements; Munakata has studied the role of the several participants involved with textbooks (government, publishers, textbook authors, teachers) (Munakata 1997). Cassiano's dissertation (Cassiano 2007), does not specifically study mathematics textbooks, but how textbook publishing changed in Brazil in the last 20 years, particularly during the twenty-first century, with the growing concentration of publishers and the presence of big international firms. More generally, there have not been many research studies on textbook publishing. Among these, I should mention the work of Oliveira et al. (1984), Meksenas (1992) and, more recently, Earp and Kornis (2005).

If we compare the first assessment of mathematics textbooks for PNLD 1997, aimed at elementary school, with the assessment of the same school grades for PNLD 2016, we see a great decrease in the number of publishers that submitted books: from 35 to 11! Even if we take into account that some small publishers may have stopped presenting books due to lack of success, there is still a decrease. If we compare the numbers of publishers for the first three assessments with the publishers for 2016, we see a reduction from 16 to 11. The same number of publishers (11) presented books for PNLD 2018. Of the 15 collections assessed for PNLD 2018 (high school), only three were new collections. The situation for the other school

grades is similar:²⁵ This appears to show the existence of a general pattern: publishers have some collections approved in past assessments that are presented repeatedly, and, each time, a few new ones that in most cases are not successful. Informally, we might say that publishers have “tamed” the mathematics assessments. By this, we mean that, due to the stability and reliability of the assessments, they know that collections approved in the past will hardly be excluded, so they do not see the need to improve them, and they send each time a few new collections, in the hope—usually wrong—that they might be approved. Therefore, there is not much renovation.

6 Final considerations

This paper described, in rough lines, the mathematics textbooks assessments for the Brazilian National Textbook Program (PNLD), from 1997 to 2018. This last mentioned year marks indeed the first major policy change in PNLD, which will have, from now on, very different characteristics. 20 years of assessments slowly improved the quality of mathematics textbooks. Of course, they are not perfect, and good textbooks alone do not ensure good teaching and learning.

What can we learn from this 20 years' experience?

In the first place, it was successful because of the political backing of a powerful high official in the government, namely the Minister for Education during the years 1996–2003. He had a very competent and hardworking secretary for elementary and middle school education who wholeheartedly backed the assessments. Also, the then president of FNDE, responsible for PNLD, had long experience in dealing with publishers, and strongly defended the assessments against their attacks. The officials directly in charge of the assessments also shared this belief in the importance of good assessments. We see then a fortunate situation in which all involved officials wanted the assessments to be honest and successful. Starting with 2004, the high turnover of Ministers for Education (ten, in the period 2004–2018) and of officials at MEC weakened the program.

Particularly after 2010, pressure from conservative groups increased constantly. They had strident complaints against the approved textbooks for science and social studies. Some were against the presentation, in science books, of evolution as a scientific theory; it should at most be mentioned as a hypothesis, they say. In social studies, a more controversial area, they were against presenting, for example, Mao Zedong's accomplishments in uniting china. In addition,

²⁵ Personal files of the author, covering all the assessments, from PNLD 1997 through PNLD 2018.

they were squarely against discussing gender issues, as is done in some textbooks. These groups had access to the media and influence with congressional representatives, who often complained of distortions in the assessments, claiming it was in the hands of irresponsible university professors who had no idea of children and adolescents' education. As a result, in 2017, a very conservative Minister of Education took the assessments away from universities and back to MEC, starting with PNLD 2019.

How do the mathematics assessments compare to the others? In mathematics, as already mentioned, there has been great stability in the coordinating group, which, incorporated, along the years, persons from other institutions, competent to eventually carry on the assessments. Also, the assessors were always chosen from the five great Brazilian geographic regions and had a varied background. They were continuously screened: assessors that did not do good work were not invited again. As a result, a very reliable group of persons, from all over the country, could be invited to participate in the assessments.

This situation was more or less the same for the other areas, with sometimes striking differences: once, an area coordinator chose all the assessors from his university. Another time, the official responsible for the assessments, chose as coordinator a professor of a university that had no experience whatsoever with textbook assessments; the result was disastrous and much of the work had to be redone. By far, the most stable assessments were in the areas of mathematics and language, with long lasting participation of the same groups in coordination.

A continuing issue in PNLD in general, which would affect the assessments, is the tension of centralization versus decentralization. Some authors, among them Britto (2011) argue forcefully that the program's execution should be watched over by Congress and the society at large, and that decentralization would mean a more democratic and fair program (Höfiling 1998). An argument for decentralization is that you cannot choose a textbook that will fit all of Brazil's varied regions. But PNLD takes that into account, since the social studies textbooks may have regional editions, assessed for PNLD. Also, some federated states have tried in the past to institute their own assessment and book buying programs, but changed their minds when it was exposed that their approved collections had errors, and had not been approved by PNLD and shied away from the complexities of organizing the selecting, buying and distribution of the books for their respective schools.

I mentioned accomplishments and problems of the mathematics assessments that may help other persons involved in similar projects to strive for the success of first period, avoid the complications of the second, and I hope to see more research and studies of mathematics textbooks assessments, both in Brazil and in other countries.

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