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High School Reform in Line With PNLD Changes: The Disarticulation of Scientific Concepts in the Subject of Chemistry

A Reforma do Ensino Médio em Consonância com as Mudanças do PNLD: A Desarticulação de Conceitos Científicos na Disciplina de Química

La Reforma de la Enseñanza Secundaria en Consonancia con los Cambios del PNLD: La Desarticulación de los Conceptos Científicos en Química

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Abstract

Within the scope of the 2018 National Textbook Plan (PNLD), books concerning the field of Natural Sciences were divided into disciplines: Chemistry, Physics, and Biology. Following the reform of the New High School (NEM), the 2021 PNLD predicts the amalgamation of these disciplines into a single textbook. Thus, an articulated examination of the arrangement of scientific concepts present in the Chemistry books of the 2018 PNLD (pre-reform) was compared with the books in the Natural Sciences area approved by the PNLD in 2021 (post-reform). The aim was to highlight the changes resulting from the NEM in Natural Sciences textbooks and the possible implications of these alterations on Chemistry Education, resulting from this new curriculum organization. As a methodological option, a qualitative documentary approach was used, constituting an exploratory study. For this purpose, two collections of books approved by the PNLD in 2018 and 2021 were selected for analysis. Content analysis was used as the analytical method. Four categories were used as parameters, two a priori, simple conceptual approach and broad conceptual approach; and two a posteriori, partially simple conceptual approach and partially broad conceptual approach. The predominance of the broad conceptual category in the 2018 PNLD, contrasted with the notable reduction in this category in the 2021 editions, suggests the need for further investigations into other thematic units and collections of Natural Sciences. Such studies could gather additional evidence regarding the lack of fundamental scientific concepts, which may impact students' civic education in the context of the New High School.

Keywords: PNLD, high school reform, Natural Sciences, Chemistry

Resumo

No âmbito do Plano Nacional do Livro Didático (PNLD) de 2018, os livros concernentes à área de Ciências da Natureza eram divididos por disciplinas: Química, Física e Biologia. Após a reforma do Novo Ensino Médio (NEM), o PNLD de 2021 prevê a junção dessas disciplinas em um único livro didático. Assim, examinou-se, de modo articulado, a disposição de conceitos científicos presentes nos livros de Química do PNLD do ano 2018 (pré-reforma), em comparação com os livros de Ciências da Natureza aprovados pelo PNLD em 2021 (pós-reforma), no intuito de evidenciar as mudanças decorrentes do NEM para a área e as possíveis implicações dessas alterações no Ensino de Química, resultantes dessa nova organização curricular. Como opção metodológica, foi utilizada a abordagem qualitativa de cunho documental, perfazendo um estudo de natureza exploratória. Para isso, foram selecionadas, para análise, duas coleções de livros aprovadas pelo PNLD em 2018 e 2021. A análise

de conteúdo foi utilizada como método analítico. Utilizaram-se quatro categorias como parâmetros, sendo duas *a priori*, abordagem conceitual simples e abordagem conceitual ampla; e duas *a posteriori*, abordagem parcialmente simples e abordagem parcialmente ampla. A predominância da categoria conceitual ampla no ano 2018, contrastada com a notável redução dessa categoria nos exemplares de 2021, sugere a necessidade de investigações mais aprofundadas em outras unidades temáticas e coleções de Ciências da Natureza. Tais estudos poderiam reunir evidências adicionais sobre a falta de conceitos científicos fundamentais, os quais podem ter impacto na formação cidadã dos estudantes no contexto do Novo Ensino Médio.

Palavras-chave: PNLD, reforma do ensino médio, Ciências da Natureza, Química

Resumen

Dentro del marco del Plan Nacional del Libro de Texto (PNLD) de 2018, los libros relacionados con el campo de las Ciencias Naturales se dividían en disciplinas: Química, Física y Biología. Tras la reforma de la Nueva Educación Secundaria (NEM), el PNLD de 2021 prevé la fusión de estas disciplinas en un solo libro de texto. Así, se examinó de manera articulada la disposición de conceptos científicos presentes en los libros de Química del PNLD de 2018 (pre-reforma) en comparación con los libros del área de Ciencias Naturales aprobados por el PNLD en 2021 (post-reforma). El objetivo fue resaltar los cambios resultantes de la NEM en los libros de Ciencias Naturales y las posibles implicaciones de estas alteraciones en la Educación Química, resultantes de esta nueva organización curricular. Como opción metodológica se utilizó un enfoque cualitativo de corte documental, realizando así un estudio de naturaleza exploratoria. Para ello, se seleccionaron dos colecciones de libros aprobadas por el PNLD en 2018 y 2021 para su análisis. Se empleó el análisis de contenido como método analítico. Se utilizaron cuatro categorías como parámetros, dos a priori: enfoque conceptual simple y enfoque conceptual amplio; y dos a posteriori: enfoque conceptual parcialmente simple y enfoque conceptual parcialmente amplio. La predominancia de la categoría conceptual amplia en el PNLD de 2018, contrastada con la notable reducción en esta categoría en las ediciones de 2021, sugiere la necesidad de investigaciones más profundas en otras unidades temáticas y colecciones de Ciencias Naturales. Dichos estudios podrían recopilar evidencia adicional sobre la falta de conceptos científicos fundamentales, los cuales pueden impactar en la formación cívica de los estudiantes en el contexto de la Nueva Educación Secundaria.

Palabras clave: PNLD, reforma de la escuela secundaria, Ciencias Naturales, Química

Introduction

This article is the result of a study whose *corpus* is a collection of chemistry textbooks from the 2018 and 2021 National Textbook Program (PNLD), with a view to the High School Reform implemented in 2017 by Law No. 13,415[1] . This reform originated from a civil, legal and media coup that took place in Brazil in 2016 by the then vice-president, Michel Temer, against the government of President Dilma Rousseff.

1 Law No. 13,415 of February 16, 2017. Amends Law No. 9,394, of December 20, 1996, which establishes the guidelines and bases of national education, and Law No. 11,494, of June 20, 2007, which regulates the Fund for Maintenance and Development of Basic Education and Valorization of Education Professionals, the Consolidation of Labor Laws (CLT), approved by Decree-Law No.5. 452, of May 1, 1943, and Decree-Law No. 236, of February 28, 1967; repeals Law No. 11,161, of August 5, 2005; and establishes the Policy for Promoting the Implementation of Full-Time High Schools. http://www.planalto.gov.br/ccivil_03/_Ato2015-2018/2017/Lei/L13415.htm.

The law, initially instituted as Provisional Measure 746, published on September 22, 2016, established changes to the Brazilian socio-educational scenario (Provisional Measure No. 746, 2016; Singer et al., 2016; Gonçalves, 2017; Frigotto, 20167; Ministry of Education, 2018). These changes permeated and still permeate the organization of the national curriculum structure, the arrangement of subjects in curricular components, the workload corresponding to school years, the compulsory nature of subjects considered essential and the inclusion of training itineraries in the Brazilian curriculum (Ministry of Education, 2018).

Supported by questionable bankruptcy justifications, such as school dropout, the bottleneck in the Brazilian education system, the low attractiveness of curricula for students, the overload of compulsory subjects and low performance in national and international assessments (Zank & Malanchen, 2020). The High School Reform restructured the National Education Guidelines and Bases Law (LDB) (Brasil, 1996). In this restructuring, colossal loopholes have opened up for financial and business organizations to take over debates, discussions and decision-making that impassibly concern the school community, which has been veiled from the process, while financial entities impose substantial sponsored changes that "reorganize" and finance education, under the tutelage of neoliberal policies (Bassi et al., 2017; Ferreti & Silva, 2017; Ministry of Education, 2018; Branco et al., 2018; Ferreti, 2018; Lopes, 2019; Branco & Zanatta, 2021).

It is noteworthy that the way in which this new basic education policy has been consolidated in Brazil, not only in its outline, but also in practice, is dizzyingly summarized in the flexibilization of curricula and classroom teaching, removing indispensable scientific knowledge from curricular structures, and intensifying the provision of vocational and technical training, with significant incentives for the job market (Bassi et al., 2017; Gonçalves, 2017).

In a skewed way, the prominent gaps in the current curriculum of schools praise a bourgeois curricular conception, through the hegemony of the business and privatist class, expressed in the new architecture of secondary education, and show that the intentionality of the Reform has another objective that is divergent from education (Marsiglia et al., 2017), because they neglect other factors that influence teaching and learning processes, such as: the infrastructure of educational institutions, the valorization of teachers' work and social inequality, which is also present within schools (Krawczyk & Ferretti, 2017).

The scenario that is projected for basic education in secondary school imposes major changes to the way the curriculum is laid out, which, in this new model, organizes the subjects into areas of knowledge, with the expression "and its technologies" added to the nomenclature (I — languages and their technologies; II — mathematics and its technologies; III — natural sciences and their technologies; IV — applied human and social sciences; and V — technical and professional training) (Provisional Measure No. 746, 2016; Silva, 2018). In an undemocratic way, "the areas of knowledge were at the mercy of what specialists selected by the Ministry of Education (MEC) deemed relevant for teaching" (Mattos et al., 2022, p. 24).

Considering the national curriculum documents prior to this new legislation, such as the National High School Curriculum Parameters (PCNEM), the curricular organization by areas of knowledge is established due to the similarity between the objects of study and their forms of combination. This enables dialogues between disciplines, without denying or suppressing concepts, but recognizing their individuality and their constitutive elements within the curriculum (MEC, 2000; Selles & Oliveira, 2022).

However, the current teaching model does not adopt this approach and proposes a more fragmented and decontextualized curriculum, emphasizing the diversification of education systems and reducing the centrality of subjects at the final levels of basic education (Lopes, 2019). According to the new reformulation, the curriculum is structured in two ways: a common curriculum for all students, governed by the National Common Curricular Base (BNCC), aimed at basic general education, with only Portuguese Language and Mathematics as compulsory subjects in high school; and another curriculum, of individual choice, relating to the Formative Itineraries (Gonçalves, 2017; Kuenzer, 2017).

It is worth mentioning that, apparently, it is in the interest of the aforementioned legislation to blame students for their failure at school, urging them to make decisions about their careers, as students and future professionals, when they choose which route to take (Gonçalves, 2017). According to Duarte (2018, p. 142), the claim of freedom of choice masks a fragmented, weakened and neglected education, based on the fact that it deprives students of "the perspective of the full and multilateral development of the human being".

As a result, Cássio and Catelli Junior (2019) understand that the BNCC has currently been configured as a policy of curricular control and, at the same time, curricular emptying, while increasing the workload for the full implementation of the curriculum and solving the "problems" of Brazilian education, and significantly reducing basic general education from 2,400 hours to 1,800 hours, even allowing part of the teaching to take place at a distance.

In this scenario of changes, the concept of discipline is presumably not considered, nor is its significance in structuring the curriculum, seen only as a pile of information that overloads teaching and exhausts students (Ferreti & Silva, 2017). Lopes (2019), bringing up Ivor Goodson (1983) on the subject of curriculum, emphasizes the author's argument on the subject and states that school subjects are, in fact, educational institutions that guide essential aspects of student training, from the production of diplomas to the fulfillment of social requirements, and that they have great significance as a curricular policy that guides the individual. It is therefore understood that, contrary to what is claimed in the law, the subjects that make up the curriculum do not overload it, but rather enrich it from an educational point of view, especially in terms of the student's civic education.

Curricular change policies are implemented under the aegis of economic interests and modernization processes that invariably affect the instruments that help teaching practice, such as textbooks distributed by the PNLD, which seek to follow the recommendations and guidelines expressed in the BNCC (Rocha, 2016; Nilles & Leite, 2021).

According to Choppin (2004), books have well-defined functions in the school context: instrumental, referential, ideological, cultural and documental. However, the agents responsible for curriculum policies who have relations with the educational context, manage expectations in relation to it, in relation to them, by stimulating and promoting various resources, in order to appropriate them, re-signifying the function of the book once defended by Choppin (2004), making them "bearers of meanings that go beyond their link to the school space" (Martins & Garcia, 2019, p. 178) and fulfilling a mercantilist function, described by Munakata (2012, p. 59) as the "good business is the didactic".

The same authors mentioned above argue that the production of textbooks has been managed with significant complexity over the years, especially in the context of PNLD public notices. In this scenario, the publishers responsible for cataloging the works treat textbooks as products that can make a profit, aligning themselves with the economic field. This creates a contradictory situation between cultural agents and market professionals, resulting in intense disputes of interest in the field of education (Martins & Garcia, 2019).

In this way, gaps in the structuring of curricula are implanted, and this is consolidated in the works distributed by PNLD, notably in the 2021 works, which are systematized by area of knowledge, agglutinating concepts arbitrarily and without coherent junction, "guided by de-ideologization" (Süssekind, 2019, p. 98). Textbooks have thus played the role of consolidators of a modified and restructured national curriculum, fulfilling the mission of bringing to schools the changes envisaged in the reforms imposed on education systems and the National Textbook Program (Krawczyk & Ferretti, 2017; Souza & Bairro, 2021).

As a result, the curriculum, which should present itself as an instrument of emancipation for students through scientific knowledge that is closer to everyday realities, has actually suppressed access to this knowledge, while prioritizing knowledge that is flexible, technical, practical, objective and simplified, as well as, of course, ahistorical, which minimizes the knowledge historically accumulated by humanity, not giving teachers freedom in the teaching process (Corti, 2019). This undermines the development of the skills and competences provided for in the BNCC for all areas, given the homogenized and centralized way in which they are arranged (Moura et al., 2020; Reis et al., 2021).

In the case of the area of Natural Sciences, this new conjecture provides for the amalgamation of the curricular components of Chemistry, Physics and Biology in the same unit, under the argument of a questionable "strengthening of relations" between components, generating interdisciplinarity and dialogue between different types of knowledge (Ministry of Education, 2018). Medrado (2016), however, sees this argument as a false educational discourse, permeated by economic and market interests, which camouflages its inclinations through unconvincing arguments of curriculum integration.

From this atrocious context, which makes teaching more flexible, reduces the workload and reorganizes the curriculum, one should ask: *How are scientific concepts arranged in the pre- and post-reform high school textbooks for the area of Natural Sciences, more specifically in the subject of Chemistry?*

From this perspective, we examined, in an articulated way, the arrangement of scientific concepts present in the Chemistry books of the PNLD of the year 2018 [pre-reform], in comparison with the books of the area of Natural Sciences approved by the PNLD in 2021 [post-reform]. Thus, the purpose of this study is to highlight the changes resulting from the New High School (NMS) in natural sciences textbooks in the context of scientific concepts and the possible implications of these changes for chemistry teaching as a result of this new curricular organization.

Methodological Path

This study adopts a qualitative documentary approach and is exploratory in nature. It is based on Stake (2011, p. 30), who describes that "the analysis of materials (including documents) [...]" is one of the most common methods for this type of research, with textbooks being the focus of this analysis.

It should be emphasized that this research is an excerpt from a broader investigation, corresponding to a master's thesis conducted at a public university in the Northeast of Brazil. As a *corpus* of analysis, only two book collections approved by PNLD in 2018 and 2021 were selected, concerning the Chemistry and Natural Sciences collections[2] , respectively, from a range of 13 collections, six of which were 2018 collections, with three volumes each, totaling 18 books (see Figure1); and seven 2021 collections, with six volumes each, totaling 42 books (see Figure 2).

Figure 1

List of books approved for PNLD/2018

Book ID Code	Book Name	Authors	Publisher/Edition	Year
LD1 (textbook 1) (vols. 01, 02 and 03)	Química (Chemistry)	Martha Reis	Ática, 2nd edition	2016
LD2 (textbook 2) (vols. 01, 02 and 03)	Química (Chemistry)	Andréa Horta Machado and Eduardo Fleury Mortimer	Scipione, 3rd edition	2016
LD3 (textbook 3) (vols. 01, 02 and 03)	Vivá: Química (Vivá: Chemistry)	Novais and Tissoni	Positivo, 1st edition	2016
LD4 (textbook 4) (vols. 01, 02 and 03)	Ser Protagonista: Química (Being a Protagonist: Chemistry)	Aline Thaís Bruni et al.	SM, 3rd edition	2016
LD5 (textbook 5) (vols. 01, 02 and 03)	Química (Chemistry)	Ciscato, Pereira, Chemello and Proti	Moderna, 1st edition	2016
LD6 (textbook 6) (vols. 01, 02 and 03)	Química Cidadã (Citizen's Chemistry)	Eliane Nilvana Ferreira de Castro et al.	AJS, 3rd edition	2016

2 In light of the High School Reform, the nomenclature of textbooks was changed, no longer being described as a curricular component (i.e., Chemistry, Physics and Biology) and adopting the area reference in a condensed form, as in the case of Natural Sciences.

Figure 2

List of books approved for PNLD/2021

Book ID Code	Book Name	Authors	Publisher/Edition	Year
LD1 (textbook 1) (vols. 01, 02, 03, 04, 05, 06)	Moderna Plus — Ciências da Natureza e Suas Tecnologias (Moderna Plus — Natural Sciences and Their Technologies)	Laura Celloto Canto Leite; Jose Mariano Amabis et al.	Moderna, 1st edition	2020
LD2 (textbook 2) (vols. 01, 02, 03, 04, 05, 06)	Diálogo: Ciências da Natureza e suas Tecnologias (Dialog: Natural Sciences and Their Technologies)	Ana Carolina N. Santos Ferraro; Vanessa S. Michelan et al.	Moderna, 1st edition	2020
LD3 (textbook 3) (vols. 01, 02, 03, 04, 05, 06)	Ciências da Natureza — Lopes & Rosso (Natural Sciences — Lopes & Rosso)	Sergio Rosso; Sônia Lopes et al.	Moderna, 1st edition	2020
LD4 (textbook 4) (vols. 01, 02, 03, 04, 05, 06)	Conexões — Ciências Da Natureza e Suas Tecnologias (Connections — Natural Sciences and Their Technologies)	Murilo Tissoni Antunes; Vera Lucia Novais; Hugo Reis et al.	Moderna, 1st edition	2020
LD5 (textbook 5) (vols. 01, 02, 03, 04, 05, 06)	Ser Protagonista: Ciências da Natureza E Suas Tecnologias (Being a Protagonist: Natural Sciences and Their Technologies)	Vera Lucia Mitiko Aoki; Rodrigo Marchiori Liegel; Zamboni et al.	SM, 1st edition	2020
LD6 (textbook 6) (vols. 01, 02, 03, 04, 05, 06)	Multiversos — Ciências da Natureza (Multiverses — Natural Sciences)	Wolney C. Melo; Rosana Maria Dell Agnolo; Leandro Godoy	FTD S.A, 1st edition	2020
LD7 (textbook 7) (vols. 01, 02, 03, 04, 05, 06)	Matéria, Energia e Vida: Uma abordagem interdisciplinar (Matter, Energy and Life: An interdisciplinary approach)	Danusa Munford; Andréa Horta; Eduardo Mortimer et al.	Scipione S.A., 1st edition	2020

The *corpus* of analysis of this research is therefore comprised of one of the three volumes of the book "Química — Martha Reis", approved in the 2018 PNLD, as highlighted in Figure 1, alongside three volumes of the book "Multiversos — Ciências da Natureza", from a range of six volumes approved in the 2021 PNLD, as shown in Figure 2.

The selection criterion used to choose the respective collections is based on the rate at which the collections have been used by state schools in the basic secondary education network of a state in the Northeast of Brazil, thus seeking to analyze works that have been and are being used in schools in a significant way. Thus, according to the survey carried out using data made available by the National Education Development Fund (FNDE)[3] , mediated by the Book, Reading and Library Center (NULLB), and in consultation with the Didactic Material Control System (SIMAD), these collections represent the choice and acquisition made by state schools, in agreement with the teachers of each component and area at stake.

Figures 3 and 4 below show the percentage of textbooks adopted by the state's schools in the respective years, in order to ensure the choice of the aforementioned *corpus*.

Figure 3

Take-up rate of chemistry textbooks by school (2018)

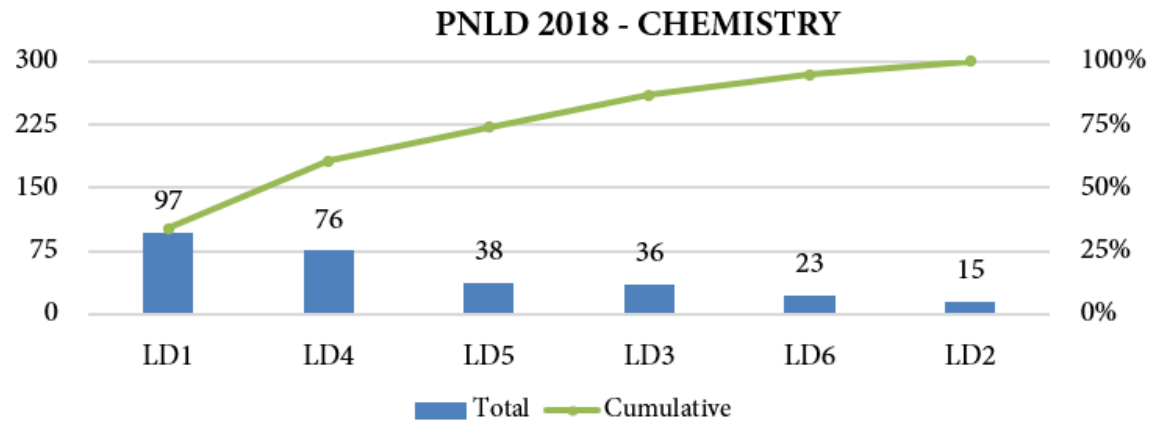
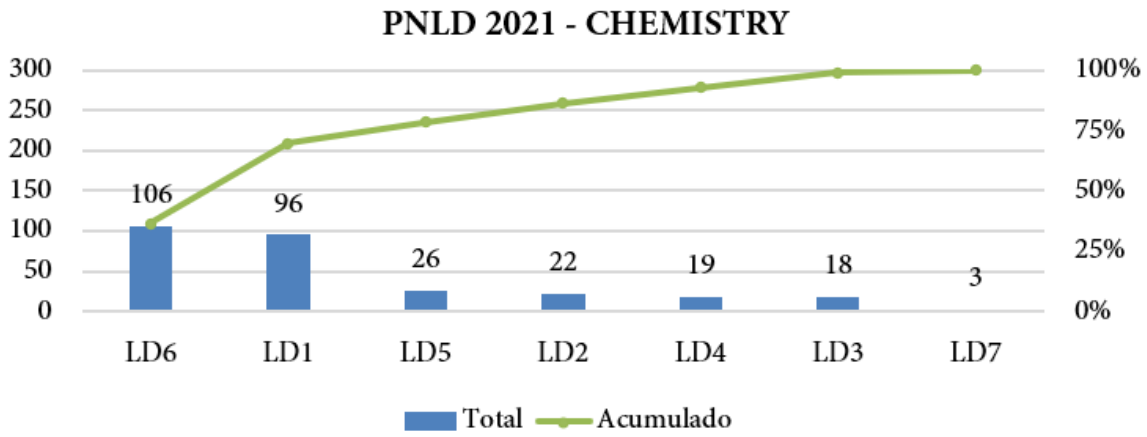


Figure 3 shows that, in 2018, of the 285 schools in the basic education network in the state investigated, as identified by the FNDE in 2018, 97 of them chose textbooks from the "Química — Martha Reis" collection. Additionally, this figure comprises 34% of the schools in question, thus indicating greater expressiveness among the others. The second book with the highest take-up was "Ser Protagonista", with 76 schools taking part in the year, accounting for 27% of the institutions. This was followed by "Química — Ciscato, Pereira, Chemello", which was chosen by 38 schools, representing 13%, similarly to "Vivá — Química", which also accounted for 13%, with 36 schools adopting it. The two that appear in smaller numbers are "Química cidadã" and "Química — Andréa Horta Machado and Eduardo Fleury Mortimer", with 8% and 5% respectively. Figure 4 below shows the percentage of textbook take-up rates in the state investigated, for the area of Natural Sciences in 2021.

3 The data referred to in the research was obtained by the first author from an e-mail request to the Reading and Library Book Center [deleted for ethical reasons], which mediated the dialogue with the FNDE Support Coordination for Education Networks, which provided the spreadsheets containing the list of schools and textbooks purchased in 2018 and 2021.

Figure 4

Take-up rate of natural sciences textbooks by school (2021)



For the year 2021, in which the textbooks are organized by areas of knowledge, it was noted that the collection that appears in greater proportion, in the 290 schools analyzed, as shown in Figure 4, refers to "Multiversos — Ciências da Natureza" collection, with a take-up rate of 37%, which accounts for a total of 106 schools. This was followed by the "Moderna Plus" collection, with adoption by 96 schools, representing 33% of schools; "Ser Protagonista", with adoption by 26 schools, accounting for 9%; "Diálogo — Ciências da Natureza e suas Tecnologias", with adoption by 22 schools, accounting for 8% of schools; and "Conexões", "Ciências da Natureza — Lopes e Rosso" as well as "Matéria, Energia e Vida: Uma Abordagem Interdisciplinar" collections, accounting for 7%, 6% and 1%, respectively.

Analysis of PNLD Books (2018–2021)

The process of analyzing the *corpus* followed the assumptions advocated by Content Analysis, following the guidelines of Bardin (1977, p. 24), who describes the method as:

> A set of techniques for analyzing communications with the aim of obtaining, through systematic and objective procedures, a description of the content of the messages, which allows the inference of knowledge related to the conditions of production/reception of these messages.

Methodologically, this study adopted the technique of analysis by categories, which starts by breaking down texts into units, and units into categories, seeking to achieve a level of understanding from the *corpus* analyzed, which meets the objective initially outlined in the research. Based on this, it is necessary to follow the methodological stages proposed by Bardin (1977), which are: (a) Pre-analysis; (b) Exploration of the material; and (c) Treatment of the results; followed by Iinference; and Iinterpretation.

Thus, the pre-analysis in this study started with the formulation of the question '*How are scientific concepts arranged in pre and post-reform high school textbooks for the area of Natural Sciences, more specifically in the subject of Chemistry?*' and the choice of documents. To this end, the methodological action used was floating reading of the 2018 and 2021 Guides, to identify which collections were approved. In these respective years, in the state schools surveyed, the survey and result obtained, as described in the methodological path of this study, indicated "Chemistry — Martha Reis" and "Multiversos — Ciências da Natureza" as the collections most used by schools, in the aforementioned years 2018 and 2021, respectively.

Based on this, we then began to explore the material, which involved reading, re-reading and cataloguing the chemical concepts in tables, in order to better observe the arrangement of these concepts, putting them into dialogue, and observing possible gaps in the curricular organization of these teaching materials. By cataloging the *corpus,* the registration units were identified, considering that the research question is based specifically on scientific chemical concepts, we searched *the corpus* for concepts that are present in both the 2018 collection and the 2021 collection.

For example, the concept of "physical state", expressed by the term "physical state", is present in both collections, so the presence of this expression in the *corpus* can be described as a factor that can be analyzed and, together with other concepts, show a certain characteristic of the textbook and the way it approaches it, whether simple or broad, by observing the meaning given to the expression and measuring its frequency of repetition. It is noteworthy that the presence/absence of this concept in the textbook alone is insufficient to express how it is being dealt with throughout the work.

The keywords, which are referred to here as recording units, were classified into context units, which will make up possible subcategories, bearing in mind that in this study we will be working with *a priori* categories, when the researcher already has the categories, which in this case derive from the research question and objective, and which are referred to here as "Simple conceptual approach" and "Broad conceptual approach". Both categories best share the trend of information we are looking for in terms of how concepts are approached in the corpus analyzed.

In order to gather the context and record units relating to the concepts and their fragments, respectively, the methodological guidelines proposed by Bardin (1977) were used, referring to mutual exclusion, homogeneity, pertinence and objectivity, and fidelity.

In order to propose the criteria for each approach, we used as a reference the work of Vasconcelos and Souto (2003), which is based on the National Curriculum Parameters (1998) and the proposal of the National Textbook Program. Thus, in defining them as *a priori* categories, it is necessary to describe what was adopted as the simple and broad approach, as a parameter for analysis (see Figure 5).

Figure 5

Description of a priori categories: simple and broad conceptual approach

A priori categories	
Simple conceptual approach	**Broad conceptual approach**
a) "Concept" is understood to mean a broader idea or general notion about something. Thus, when it comes to conceptualization in the textbook, it is understood that the text should present information and explanations developed in such a way as to allow the student to understand the topic in question. Therefore, scientific concepts will take on the simple conceptual approach when there is no or limited conceptualization of the topic. Or when the concept does not exist in explicit form and/or is poorly supported for the student to formulate ideas.	a) In order to understand a conceptual approach as broad, we will first consider the development of concepts and definitions, as well as the clear and objective explanation of unfamiliar terms, generally characterized as technical, which tend to hinder students' understanding of concepts. In this way, when they appear in a descriptive, clear and explicit way to the student, it will be considered a broad conceptual approach.
b) The lack of contextualization will also be considered as a constitutive element of the simple conceptual approach.	b) Clarity between the proposed concepts and their respective curricular component, which in this case will be Chemistry, will also be considered, since the main themes can recur in all the volumes of a collection, as is the case with the PNLD/2021 textbooks.
c) The presence of pure chemistry concepts that do not encourage problematization with real, everyday issues will also be described as a characteristic element of the simple conceptual approach.	c) The indication or appearance of complementary sources of information will also contribute to describing the concept as a broad approach, as it expands the area of discussion and includes new perspectives for the student.
d) The recurrence of the curriculum component (Chemistry) throughout the chapters will also be a criterion that defines the type of approach to the concepts. When scientific concepts are suppressed throughout the units, the approach will be described as simple.	d) Contextualizing the concept with the students' everyday lives will also be considered as a criterion for a broad conceptual approach. In short, contextualizing consists of establishing a relationship between scientific knowledge and the diverse and plural socio-cultural reality in which the student is inserted.
e) The problematization of a scientific concept is described by the practice of looking for possible relationships, applications, approximations, questions and doubts inherent in the concept in question. Thus, when the Science, Technology and Society (STS) dimension is not articulated with the concept, the conceptual approach will be simple.	e) Stimulating problematization and the level of approximation and application of knowledge will also underpin the broad approach. In this way, the Science, Technology and Society (STS) relationship needs to be present, as the information provided in textbooks should promote student contact with scientific knowledge, technology and the society in which they are inserted.

Figure 5

Description of a priori categories: simple and broad conceptual approach (continuation)

A priori categories	
Simple conceptual approach	**Broad conceptual approach**
f) The same criterion (implicit and explicit) will be used for images, illustrative figures and their quality throughout the text, as well as their veracity and dialog with the theme. When these elements appear in an unexplained way, with little coherence with the concepts worked on or even when they do not appear, the simple conceptual approach will be assumed.	f) Finally, visual communication, such as figures, images, as well as the quality of the illustrations, insertion throughout the text, veracity of the information contained in the illustration and the possibility of contextualization and degree of relationship with the information contained in the text will be described as essential elements to the broad conceptual approach.

It is important to note that, during the analysis process, new categories emerged that had not initially been foreseen. These new categories were as follows:

a) Partially Comprehensive Conceptual Approach, which refers to approaches that, although comprehensive, have gaps in certain conceptual aspects;

b) Partially Simple Conceptual Approach, which describes approaches that, despite being clear and accessible, do not explore the depth required for a complete understanding of the concepts.

These emerging categories were incorporated into the analysis to provide a more accurate assessment of the changes and implications resulting from the Reform in the Secondary School curriculum.

After constructing the analysis parameters, the first book analyzed was Química — Martha Reis, by Editora Ática, from 2016. The collection comprises three volumes (1st, 2nd and 3rd year of secondary education, respectively), and each volume is divided into units, which group together chapters. Volume 1 deals with concepts of General and Inorganic Chemistry; volume 2, which refers to the second year of secondary education, considers aspects of Physical Chemistry; and volume three, which closes the collection, mentions Organic Chemistry, with the study of organic compounds.

Due to space constraints, this manuscript has chosen to analyze only units 1 and 2, comprising five chapters of volume 1 in the collection Química — Martha Reis (2018). Thematic unit 1 (TU1) is entitled **Climate change**; and thematic unit 2 (TU2), **Oxygen and ozone**. Among the scientific concepts present in the chapters are "The study of chemistry and physical quantities" — chapter 1; "Properties of matter" — chapter 2; "Substances and mixtures" — chapter 3; "Transformations of matter" — chapter 4; and "Chemical notations" — chapter 5. Within each chapter, chemical concepts also appear specifically in sub-themes (as described in Figure 6), which we will call by the codes C1, C2, C3 ... Cn., which refer to the concepts and thematic units (TU), for example UT1C1 — Thematic unit 1, concept 1.

Figure 6

Chemical concepts by unit and chapter (2018)

Volume 1		
Thematic unit	**Chapter**	**Concepts**
(UT1) Climate change	Chap. 1 — The study of chemistry and physical quantities	- (UT1C1) What is chemistry? - (UT1C2) Physical quantities
	Chap. 2 — Properties of matter	- (UT1C3) Properties that define matter - (UT1C4) Chemical properties - (UT1C5) Properties of groups
	Chap. 3 — Substances and mixtures	- (UT1C6) Classification of materials - (UT1C7) Phases of a material - (UT1C8) Separation of mixtures
(UT2) Oxygen and ozone	Chap. 4 — Transformations of matter	- (UT2C1) Chemical equations - (UT2C2) Chemical reactions and the constitution of matter - (UT2C3) Combustion - (UT2C4) Law of conservation of mass or Lavoisier's law - (UT2C5) Law of constant proportions or Proust's law - (UT2C6) Scientific method - (UT2C7) Dalton's atomic model - (UT2C8) Gay Lussac's volumetric law - (UT2C9) The concept of a molecule
	Chap. 5 — Chemical notations	- (UT2C10) Current nomenclature - (UT2C11) Symbol of the elements - (UT2C12) Substance formulas - (UT2C13) Balancing chemical equations - (UT2C14) Molecular mass and atomic mass - (UT2C15) Chemical formulas - (UT2C16) Allotropy

The books in the 2021 PNLD, on the other hand, show a strong difference in the structural organization of the curriculum concepts compared to 2018. It is important to note that, unlike the 2018 PNLD, which had three volumes for each component, this new PNLD has six volumes in total, which combine the concepts of the natural sciences from the first to the third year of secondary education. There is a repetition of the Science thematic units from Primary School (Matter and Energy, Life and Evolution, Earth and Universe), but now they are more in-depth, covering concepts related to Secondary School, including the three significantly broad components (Chemistry, Physics and Biology).

According to the PNLD Guide, the books in 2021 are classified as self-contained, in which the teacher has the freedom to choose the sequence of volumes that best suits their school planning (Ministry of Education, 2020). In addition, the Guide points out that Volume 1 deals with the concepts of life, matter and energy. Volume 2 deals with movement and balance in the three components. Volume 3 deals with electrical energy, its generation and use in society. Volume 4 deals with the origin and evolution of the universe and living beings; Volume 5 focuses on the characteristics and properties of various materials and thermal phenomena related to the production and handling of materials, while Volume 6 focuses on technologies.

Considering the importance of analyzing the same concepts in both 2018 and 2021 in the same way, volume 1 (Matter, energy and life), volume 2 (Movements and balances in nature) and volume 4 (Origins) of the 2021 collection were selected, since these volumes contain the respective concepts from 2018, differing in nomenclature but with corresponding themes. Figure 7 below shows the chemical concepts structurally present in the 2021 book "Multiversos".

Figure 7

Chemical concepts by unit and theme (2021)

Volumes 1, 2 and 4		
Unit	**Theme**	**Concepts**
U1 — The composition environments (vol. 1)	T1 — Physical states of matter	- (U1T1C1) The constitution of matter - (U1T1C2) Physical states of matter - (U1T1C3) Changes of physical state - (U1T1C4) Water cycle
U1 — The composition environments (vol. 1)	T2 — Substances and mixtures	- (U1T2C1) Physical state changes of pure substances and mixtures - (U1T2C2) Types of homogeneous mixtures - (U1T2C3) Separation of mixtures - (U1T2C4) Separation factors

Figure 7

Chemical concepts by unit and theme (2021) (continuation)

U2 — Studying the subject (vol. 1)	T1 — Atoms	- (U2T1C1) Atomic models (Dalton) - (U2T1C2) Chemical elements and some properties of atoms - Isotopes*
U3 — Transformations of matter and energy - Chemical reactions and Metabolism (vol. 1)	T1— Chemical functions and reactions	- (U3T1C1) Chemical equations - (U3T1C2) Law of conservation of mass - (U3T1C3) Law of definite proportions - (U3T1C4) Chemical functions and reactions - (U3T1C5) Acids - (U3T1C6) Bases
U3 - Quantitative chemistry, chemical equilibrium, solutions and homeostasis (vol. 2)	T1 — Mol and the stoichiometric calculation	- (U3T1C1) Mol - Amount of matter - (U3T1C2) Mol and its relations - (U3T1C3) Interpreting a chemical equation using the concept of mol - (U3T1C4) Stoichiometric relationships between reaction participants
U1 - Origin, formation and observation of Universe (vol. 4)	T2 — Stellar cycle and formation chemical elements	- (U1T2C1) The life cycle of stars and the formation of chemical elements/chemical elements/Beginning of the formation of chemical elements The life cycle of stars and the formation of chemical elements - Life cycle of massive stars* - Filling in the periodic table*

Unlike Martha Reis's collection (2018), the Multiversos collection (2021) structures the concepts in units and themes (shown in Figure 7). Units 1, 2 and 3 of the first volume of 2021 contain the concepts corresponding to 2018, as do units 3 and 1 of volumes 2 and 4, respectively. We will call the codes (U) for unit, (T) for theme and (C) for concept, following the increasing numerical order of the concepts in the collection and within the selected units. Therefore, the condensed coding will appear, for example, U1T1C1. The next section presents the results and discussion.

Results and Discussion

The *corpus* analyzed, made up of only one volume from 2018 and three volumes from 2021, presented 44 concepts in total, including twenty-four from the Martha Reis collection and twenty from the Multiversos collection. For the 2018 collection, two thematic units were selected, with five chapters[4]. For the 2021 collection, the volumes

4 The preference for units 1 and 2 of the Martha Reis — Química (2018) collection was due to the possibility of continuing this study in future research, giving room for sequential analysis of the other units that were not covered in this article.

were selected according to the conceptual similarity of the 2018 concepts. In practical terms, the Multiversos collection sought out the same concepts contained in units 1 and 2 of the Martha Reis book. Thus, in a fragmented and relatively disconnected way, the corresponding concepts were partially found in volumes 1, 2 and 4 of the Multiversos collection, distributed in units and themes.

Compared to 2018, concepts 1, 2 and 24 — "What is chemistry?", "Physical quantities" and "Allotropy" — were absent from the 2021 PNLD collection. Floating reading revealed that none of the volumes in the 2021 collection addresses the conceptualization of these topics, which may indicate a possible limitation of the collection. In addition, the concept of chemical elements only appears in two of the six volumes of the Multiversos book, which has the potential to signal a conceptual gap or discontinuity resulting from the fragmentation and shuffling of essential information.

The process of defining the categories was based on the criteria established for each type of approach (as described in Figure 3), which served as a reference for analyzing the concepts. Initially, *a priori* categories were used, called "Simple Conceptual Approach" and "Broad Conceptual Approach". However, during the analysis of the *corpus*, two new *a posteriori* categories were identified, understood as emerging, called "Partially Simple Conceptual Approach" and "Partially Broad Conceptual Approach".

These two new categories emerged due to the fact that the concepts analyzed in the first two categories were not suitable, as they had both broad and simple characteristics at the same time. Thus, the first emerging category, called "Partially simple conceptual approach", was established for concepts that were predominantly simple in nature, but had one or two aspects of the broad approach. As an example, the concepts of Scientific Method (UT2C6) and Current Nomenclature (UT2C10), present in the 2018 collection, and the concept of Stoichiometric Relationships between the participants in the reaction (U3T1C4) — (vol. 2), from the 2021 collection, which presented simple characteristics, such as the absence of complementary sources, quantity of images, and coherence with the concept addressed, not contextualization, application and problematization, but had clear and objective concepts related to the themes, which did not make them totally simple. The 2021 concept (U3T1C4), on the other hand, did not clearly present the concept of stoichiometric relationships, nor did it contextualize it, nor did it have any images, but it did propose solved problem situations that exemplified stoichiometric relationships and suggested a complementary source for the concept.

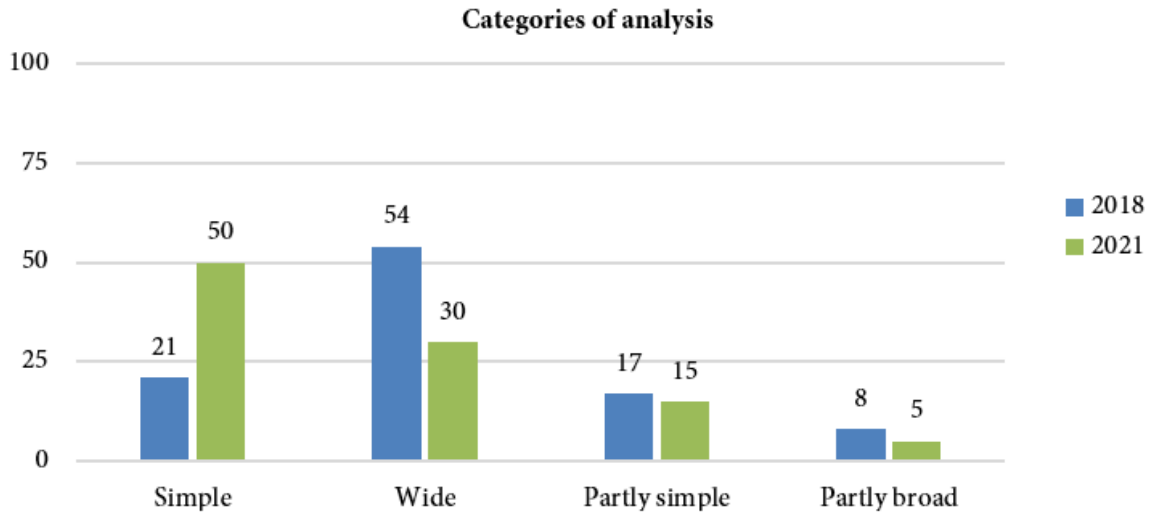
Similarly, the "Partially broad conceptual approach" emerged from the concepts that predominantly presented aspects of a broad nature, but which occasionally did not fully meet all the criteria, highlighting an incompleteness in the conceptual approach of the concept that would make it broad. As an example, we can cite the concept of classifying materials (UT1C6), which, despite presenting a clear and objective explanation of substance and mixture, corresponding to the respective curricular

component, clarifying technical terms, containing figures in the form of diagrams and complementary text, contained, at the same time, aspects of the simple approach, such as: the absence of contextualization and the presence of pure chemistry concepts, without problematizations linked to the student's reality.

Thus, from the corpus analyzed, substantial evidence was extracted on how the concepts in the 2018 and 2021 PNLD books are approached. It was observed that the Martha Reis collection presents, numerically, five concepts that fall under the simple conceptual approach, corresponding to 21% of the total number of concepts in 2018; t. Thirteen concepts corresponding to the broad conceptual approach, with a percentage value of 54%; four concepts that fell within the partially broad conceptual approach, equivalent to 17%; and two concepts that presented the partially simple conceptual approach, characterizing 8% of the total. Figure 8 below presents these figures objectively.

Figure 8

Comparative table of analysis categories for 2018 and 2021



These data reveal, in a sample way, the form of conceptual approach expressed in the chemistry textbooks governed by the PNLD/2018, highlighting the constituent elements of these materials. The highest percentage identified in the Martha Reis collection converges on the broad conceptual approach category, which encompasses contextualization based on scientific knowledge expressed in objects of knowledge linked to the student's reality, problematization as a tool to stimulate reflection and criticality based on multiple everyday aspects, clarity of concepts governed by objectivity, and the absence of textual contradictions and visual language conveyed through resources such as figures, images and illustrations that support the understanding of the concept. Figure 9 below shows the concepts through their respective forms of approach for 2018.

Figure 9

Concepts and conceptual approach categories (2018)

Broad conceptual approach	(UT1C1) What is chemistry?(UT1C2) Physical quantities; (UT1C3) Properties that define matter; (UT1C4) Chemical properties; (UT1C5) Properties of groups; (UT1C8) Separation of mixtures; (UT2C1) Chemical equations; (UT2C2) Chemical reactions and the constitution of matter; (UT2C11) Symbols of the elements; (UT2C13) Balancing chemical equations; (UT2C14) Molecular mass and atomic mass; (UT2C15) Chemical formulas; (UT2C16) Allotropy.
Simple conceptual approach	(UT2C3) Combustion; (UT2C5) Law of constant proportions or Proust's law; (UT2C7) Dalton's atomic model; (UT2C8) Gay-Lussac's volumetric law; (UT2C9) The concept of molecules.
Partly broad conceptual approach	(UT1C6) Classification of materials; (UT1C7) Phases of a material; (UT2C4) Law of conservation of mass or Lavoisier's law; (UT2C12) Substance formulas.
Partly simple conceptual approach	(UT2C6) Scientific method; (UT2C10) Current nomenclature.

The concepts classified in the broad conceptual approach in the 2018 PNLD Chemistry textbook emphasize a set of criteria that highlighted the preference for this approach. These include contextualization, stimulation of problematization, practical approaches and applications, aspects of the relationship between Science, Technology and Society and the concept, suggestions for complementary sources and, notwithstanding this, the didacticism provided by the visual resources contained in the figures with good print quality, their veracity with the subject studied and the self-explanatory illustrations that provide support in the stage of understanding the concepts.

Antagonistically, the data extracted from the 2021 PNLD textbooks shows evidence that points to different perceptions, in which only 6 of the concepts analyzed correspond to the broad conceptual approach category, representing 30% of the total. On the other hand, the simple conceptual approach holds 50% of the concepts investigated (equivalent to 10 concepts); the partially broad conceptual approach has 3 concepts, corresponding to 15% of the total; and the partially simple conceptual approach has only 1 concept, which refers to 5% of the universe surveyed in 2021.

In contrast, it is possible to infer that there have been substantial changes in the 2021 textbooks. Among these changes is the removal of fundamental concepts, such as the concept of "What is Chemistry?". In addition, there has been a reduction in the number of pages in Nature Science textbooks, which, although not the main focus of this analysis, is worth mentioning. This reduction can be considered an important variable in the suppression of concepts, especially when specific curricular components are unified into a single unit.

In order to clarify which concepts correspond to each category, Figure 10 below represents, in a structured way, the concepts analyzed in 2021 through their respective approaches and the predominance of the simple conceptual approach in the themes present in the 2021 textbook.

Figure 10

Concepts and conceptual approach categories (2021)

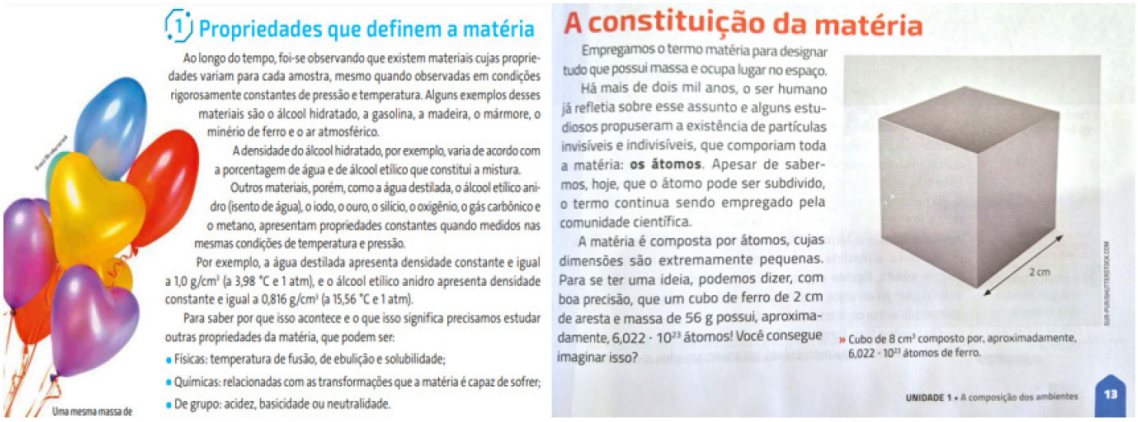
Broad conceptual approach	(U1T1C2) Physical states of matter; (U1T1C3) Changes of physical state; (U1T1C4) Water cycle; (U3T1C3) Law of definite proportions; (U3T1C5) Acids; U3T1C6) Bases.
Simple conceptual approach	(U1T1C1) The constitution of matter; (U1T2C1) Changes of physical state of pure substances and mixtures; (U1T2C2) Types of homogeneous mixtures; (U1T2C4) Separation factors; (U2T1C1) Atomic models (Dalton); (U3T1C2) Law of conservation of mass; (U3T1C4) Chemical functions and reactions; (U3T1C1) Mol — Quantity of matter — Vol 2.(U3T1C2) Mol and its relations — Vol 2; (U3T1C3) Interpretation of a chemical equation based on the concept of mol — Vol 2.
Partly broad conceptual approach	(U1T2C3) Separation of mixtures; (U2T1C2) Chemical elements and some properties of atoms; (U1T2C1) Life cycle of stars and the formation of chemical elements / Chemical elements / Beginning of the formation of chemical elements — Vol. 4; (U3T1C1) Chemical equations.
Partly simple conceptual approach	(U3T1C4) Stoichiometric relationships between reaction participants — Vol 2.

As a result, it can be inferred that the 2021 textbooks present a reduced panorama for the broad conceptual approach category, with only 30% of the concepts analyzed. This condition reflects differences between the 2018 PNLD and the 2021 PNLD, which open up space for new discussions concerning the new curriculum proposed by the BNCC, its intentions and the quality of the scientific concepts contained in these copies. This is further intensified when the evidence points to the categorical percentage corresponding to the simple conceptual approach, which makes up half of the concepts investigated, more precisely 50%.

In order to highlight the approaches adopted during the two years of analysis, fragments common to both textbooks were selected, allowing a clearer visualization of the suppressive trend observed in the 2021 material. The concepts selected refer to "(UT1C3) Properties that define matter", in the 2018 textbook; and "(U1T1C1) The constitution of matter", in the 2021 textbook.

Figure 11

Fragments of the 2018 and 2021 books



a) b)

When comparing the two approaches to the properties of matter, it is possible to observe significant differences in the focus and depth of the explanations. In a), the authors focus on explaining the physical and chemical properties that define matter, distinguishing between materials with variable properties (such as mixtures) and those with constant properties (such as pure substances). This highlights the authors' concern to explain "What is Chemistry?" before tackling the topic, an aspect absent from the 2021 textbook.

Details such as the density of specific substances (for example, distilled water and anhydrous ethyl alcohol) are presented with precise values, which helps to solidify the understanding of the concepts. In addition, the properties of matter are classified into physical, chemical and group properties, providing a comprehensive and organized overview. To illustrate, the authors use specific examples and numerical values, such as the density of different substances, to represent the variations and constancies in the properties of matter.

In b), there is a more introductory and specific approach to matter, based on a more fundamental concept, in which the idea that matter is made up of atoms is discussed for the first time, without concrete examples to illustrate this statement. Although there is a historical connection in mentioning that the existence of atoms was already being speculated about more than two thousand years ago, the respective approach has an expressively introductory and unrepresentative character, which may be more accessible to beginners.

In summary, the first approach offers a more in-depth, detailed and conceptual analysis, focusing on the measurable properties of matter and providing a solid basis for understanding the differences between mixtures and substances later on, e. While the second approach, on the other hand, is more introductory and technical, reaffirming its simplistic conceptual approach.

It is important to note that this category included concepts that were conceptually superficial and lacked any compelling information to support students' understanding. The lack of contextualization and the absence of problematization were also aspects that shaped the concepts present in this category, as well as the lack of complementary sources and the scarcity of illustrative images and figures throughout the text, a condition that indicates, above all, content that is free of didactic-pedagogical approaches that encourage student reflection, as well as characteristics such as the relationship between Science, Technology and Society.

This last point was also highlighted as a shortcoming in Conceição and Lorenzetti's (2023) study of the new PNLD Nature Sciences textbooks. The aforementioned authors point to the lack of integration of concepts with the relationship between Science, Technology and Society, highlighting the difficulty in approaching scientific concepts in an interdisciplinary way. In view of this, it is reasonable to agree with Rezende and Suart (2024), who highlight the importance of textbook content being aligned with contextualized teaching, since these materials play a fundamental role in teachers' lesson planning.

The absence of this aspect, therefore, weakens the students' connection with scientific concepts in their technological and social contexts, hindering the development of the skills and values necessary for critical and responsible decisions, which are essential prerogatives of the CTS field, as pointed out by Santos and Mortimer (2001); Krasilchik and Marandino (2004); and Santos (2008).

It can thus be seen that there have been significant changes in the structure of the textbooks analyzed. While the 2018 collection presented a clear division of concepts into broader thematic units, the 2021 collection adopted a fragmented and environmentally disconnected approach, merging specific disciplines into a single volume. Machado et al. (2023) argue that this tendency to reduce scientific concepts reflects the neo-technical focus of the new BNCC, which prioritizes, above all, the development of skills aimed at professional training.

Bastos et al. (2022) measure a reduction of approximately 55% in the number of pages from 2018 to 2021. This variable may also justify the evidence extracted regarding the forms of approaches, namely that, in the 2018 PNLD, each subject had an average of 864 pages in the three years of Secondary Education (288 pages distributed per year), while now, in the 2021 PNLD, the maximum amount is 160 pages for each volume, an aspect that may represent the secondarization of teaching, which leads to the precariousness of education.

It seems that the reduction in the number of pages is part of the government's intention to reduce costs, a poorly-founded decision that could compromise the pedagogical context attributed to textbooks (Artuso et al., 2019). We recognize, therefore, that the conceptual fragility, followed by the arbitrary reduction in the number of pages in the 2021 textbooks, could compromise students' civic education, since the shallow depth and breadth of scientific chemical concepts, in our view, impact on the full education of students in the context of the New High School.

In this way, it can be said that the new curriculum model advocated by the BNCC has a significant impact on the sciences, including chemistry and chemistry teaching, which are structurally dispersed within the new BNCC, being treated not as autonomous topics, but rather as subcomponents of the area of Natural Sciences and their Technologies, in an approach that disregards the particularities of each science and suggests an emptying of the specific knowledge of these disciplines (Reis, 2023).

As Baruffi (2020) points out, there is significant concern among chemistry teachers about the integration of natural science subjects. They fear that when these subjects are worked on together, there will be an unbalanced valorization of specific themes from one curricular component to the detriment of others. This apprehension manifests itself both in the selection of concepts and in the distribution of the workload allocated to each component, which could jeopardize the equitable and comprehensive approach to content that is essential to students' education. According to Martins (2020, p. 87), this new restructuring also has an impact on teaching activity, so that "[...] it is not clear what the distribution of curricular components will be like, making them question their training".

Final Remarks

In this study, we sought to answer the following guiding question: *How are scientific concepts arranged in pre and post-reform high school textbooks for the area of Natural Sciences, more specifically in the subject of Chemistry?*

The collections analyzed were "Química — Martha Reis" and "Multiversos — Ciências da Natureza", governed by the PNLD 2018 and PNLD 2021, respectively. In the analysis of these collections, it was found that the scientific concepts in the 2018 textbook cover the four categories established as parameters for analysis, with the broad conceptual approach category being the most prevalent, representing 54% of the concepts analyzed. This indicates that the concepts present in the Martha Reis textbook, classified in this category, are presented clearly, descriptively and explicitly to the student, as well as being applicable to the context or aspects of the context in which the student is inserted.

On the other hand, the 2021 textbooks showed reduced coverage for the broad conceptual approach category, with only 30% of the concepts analyzed. These results suggest that the concepts in 2021 PNLD do not aim to promote citizen education that is participatory, reflective, critical and contextualized with students' experiences. The shuffling of concepts into self-contained and fragmented volumes might not be, in our opinion, the best alternative for a sequential and logical structuring of scientific knowledge, both for students and teachers, knowing that the latter will need to carry out a "conceptual mining" to identify when and which concept fits the reality of their classroom.

In this new structuring, we also identified that the conceptual disarticulation of scientific knowledge begins with the identification of key chemistry concepts in the textbook, starting with the title and table of contents of each volume, which legitimizes

our concern about the triviality attributed to the specificities of the natural sciences, which is more of a threat to the now unified curricular components, to the detriment of interdisciplinarity which, up until now, has been suppressed by the conceptual fractioning of knowledge which, visually, is not articulated or in dialogue with each other. This disarticulation of concepts in textbooks makes it difficult to plan and conduct lessons, compromising the effectiveness of chemistry teaching. This results in superficial and less critical learning, limiting the mobilization of students' skills in applying chemical knowledge to real situations.

It is understood, therefore, that the macro and real intention, clearly evident in the PNLD 2021, is to train multi-skilled citizens, with utilitarian perspectives for society, through a poorly structured and disjointed curriculum, which is in line with the overvaluation of flexibility and the new criteria established for Brazilian secondary education. This technicist orientation, instead of fostering a complete and conscious citizen's education, contributes to an education that emphasizes technical and professional skills, without delving into the social, ethical and critical dimensions. In this sense, the new curriculum is limited to preparing students for the job market, without promoting reflection on their role as active and conscious citizens, committed to social and ethical issues.

In short, the observation of the predominance of the broad conceptual category in the 2018 PNLD, contrasted with the notable reduction of this category in the 2021 copies, suggests the need for more in-depth investigations in other thematic units and collections of Natural Sciences. Such studies could gather additional evidence about the lack of fundamental scientific chemical concepts, which could have an impact on students' civic education in the context of the New High School.

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