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Ensino de Ciências, Parâmetros Curriculares Nacionais e Base Nacional Comum Curricular: uma análise à luz da pedagogia histórico-crítica[1]

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Resumo
O foco central deste estudo é o ensino de Ciências em dois documentos orientadores de currículo brasileiro: os Parâmetros Curriculares Nacionais (PCNs) e a Base Nacional Comum Curricular (BNCC). A pedagogia histórico-crítica é o referencial teórico adotado, possibilitando compreender esses documentos alinhados às ideologias neoliberais. O objetivo geral é analisar as principais mudanças do ensino de Ciências no ensino fundamental II, dos PCNs para a BNCC, em relação aos objetivos, conteúdos e metodologias. A pesquisa é qualitativa e de caráter documental. Verificamos as seguintes mudanças dos PCNs para a BNCC: objetivos mais alinhados com a pedagogia das competências; redução de conteúdos, impactando mais a área da Biologia, seguida da Química e da Física; e menos metodologias de ensino, com proeminência de métodos ativos. Portanto, há um alinhamento de ambos os documentos com as pedagogias do "aprender a aprender", sendo a pedagogia histórico-crítica um contraponto às mazelas produzidas pelas pedagogias dominantes.

Palavras-chave: Ciências da Natureza. Competência. Currículo de Ciências. Ensino fundamental. Neoliberalismo.

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Science teaching, National Curricular Parameter and National Common Curricular Base: an analysis in the light of the critical-historical pedagogy

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Abstract
The central focus of this study is Science education in two guiding documents of the Brazilian curriculum: the National Curricular Parameters (PCNs) and the National Common Curricular Base (BNCC). The historical-critical pedagogy is our theoretical framework, making it possible to understand that these documents are aligned with neoliberal ideologies. The general objective is to analyze the principal changes in Science education in elementary education II, from PCNs to BNCC, in objectives, contents, and methodologies. The research is qualitative and of a documentary character. We verify the following changes from PCNs to BNCC: objectives more aligned with the competency pedagogy; reduction of contents, impacting more the areas of Biology, followed by Chemistry and Physics; and fewer teaching methodologies, with the prominence of active methods. Thus, there is an alignment of both documents with the pedagogies of "learning to learn," with historical-critical pedagogy serving as a counterpoint to the problems produced by dominant pedagogies.

Keywords: Competence. Elementary School. Nature sciences. Neoliberalism. Science Curriculum.

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Enseñanza de las ciencias, Parámetro Curricular Nacional y Base Común CurricularNacional: un análisis a la luz de la pedagogía histórico-crítica

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Resumen
Este estudio se centra en la enseñanza de las Ciencias en dos documentos orientadores del currículo brasileño: los Parámetros Curriculares Nacionales (PCNs) y la Base Nacional Común Curricular (BNCC). La pedagogía histórico-crítica es el marco teórico adoptado, lo que permite comprender estos documentos alineados con las ideologías neoliberales. El objetivo general es analizar los principales cambios en la enseñanza de las Ciencias a nivel de educación secundaria, desde los PCNs hasta la BNCC, en relación con los objetivos, contenidos y metodologías. La investigación es cualitativa y de carácter documental. Observamos cambios como: objetivos más alineados con la pedagogía de las competencias; reducción de contenidos, especialmente en Biología, seguida de Química y Física; y menos metodologías de enseñanza, con predominio de métodos activos. Así, ambos documentos se alinean con las pedagogías del "aprender a aprender", siendo la pedagogía histórico-crítica un contrapunto a las deficiencias producidas por las pedagogías dominantes.

Palabras clave: Ciencias de la naturaleza. Competencia. Currículo de Ciencias. Enseñanza fundamental. Neoliberalismo.

1.Introduction

This work is theoretically grounded in historical-critical pedagogy and focuses on the teaching of Sciences in two guiding documents of the Brazilian curriculum: The National Curriculum Parameters (PCNs) and the Common National Curriculum Base (BNCC).

Historical-critical pedagogy originated in the early 1980s with researcher Dermeval Saviani. This theory represents a counter-hegemonic pedagogical perspective that sees the school as having the function of transmitting the scientific, artistic, and philosophical knowledge developed throughout human history (SAVIANI, 2000). Among these are the knowledge of "[...] the natural sciences, whose basic elements related to understanding the laws that govern nature are necessary to comprehend the transformations brought about by human action on the environment [...]" (SAVIANI, 2021a, p. 78).

Teaching Natural Sciences, as discussed by Saviani (1996), is seen as an instrument that enables a more accurate understanding of reality and promotes human development. This area of education integrates the school curriculum, understood as the set of educational contents distributed over time and space intended for the school (SAVIANI, 2016). It is necessary to differentiate between what is curricular and extracurricular, so that the latter is not prioritized to the detriment of the former (SAVIANI, 2000).

Historical-critical pedagogy allows for the analysis of curricular policies, considering the close relationship between school education and the restructuring of the capitalist system/market demands, understanding that:

> With the discourse of aligning schools with technological, cultural, and socioeconomic changes, what has been implemented is an intense process of reshaping education according to the standards imposed by the logic of capitalism at the end of the 20th century and the beginning of the 21st century, in line with neoliberal ideals (MALANCHEN; SANTOS, 2020, p. 3).

From these assumptions, it is understood that, in the 1990s, there was a rise of neoliberal policies in Brazil and Latin America (LIPORINI, 2020), which also influence educational and curricular policies (GIROTTO, 2017), as:

> [...] educational policies related to the curriculum are an expression of the struggles fought within the State and the developments assumed by it. From this perspective, these struggles are situated within the context of economic changes and, therefore, the restructuring of social relations under the hegemony of globalized capital and neoliberal ideology (MALACHEN, 2014, p. 17).

In this context of alignment with neoliberal ideals, Brazilian curriculum reforms over the past three decades have had some milestones that assisted in the construction of national curriculum guidelines.

The Brazilian Constitution of 1988 (BRASIL, 1988), in article 210, establishes the necessity of creating minimum content for Brazilian schools: "Art. 210. Minimum content will be fixed for elementary education, ensuring a common basic education and respect for national and regional cultural and artistic values" (BRASIL, 1988).

The Lei de Diretrizes e Bases (Law of Guidelines and Bases of National Education), (LDB) nº 9394 of 1996, in articles 26 and 27, standardized national curricula for basic education:

> Art. 26. The elementary and secondary education curricula must have a common national base, to be supplemented, in each educational system and school, by a diversified part required by the regional and local characteristics of society, culture, economy, and student body (BRASIL, 1996, Section 1).
>
> Art. 27. The curricular contents of basic education shall also observe the following guidelines:
> I – The diffusion of fundamental values related to social interest, the rights and duties of citizens, respect for the common good, and the democratic order;
> II – Consideration of the educational conditions of students in each institution;
> III – Orientation towards work;
> IV Promotion of educational sports and support for non-formal sports practices (BRAZIL, 1996, Section 1).

In 1996, the approval of the LDB designed by Darcy Ribeiro, had significant national implications for education:

> [...] in practice, with the approval of Darcy Ribeiro's project, the government effectively stifled part of the fertility of the debates initiated by the educators' movement in the 1980s. Various banners raised during the movement became distorted or completely unrecognizable from their original intent. For example, teacher training was translated into professionalization; civil society participation took the form of collaboration with businesses and NGOs; decentralization meant the state was relieved of its obligations; autonomy took on the shape of freedom to raise funds; and the improvement of educational quality was equated with market alignment, transforming students into consumers (SHIROMA, MORAIS, EVANGELISTA, 2002 *apud* SANTOS, 2011, p. 8).

Following the guidelines established in the 1996 LDB, the subsequent years saw the creation of the National Curriculum Parameters (PCNs) for elementary education, initially for the first and second cycles (1st to 4th grades) in 1997 (BRAZIL, 1997), and in the following year, for the third and fourth cycles (5th to 8th grades) (BRAZIL, 1998a).

The PCNs for the third and fourth cycles of elementary education comprise ten volumes. The first, titled "Volume 01 - Introduction to the PCNs," outlines ten objectives for students. There is also a section called "Didactic Guidelines," which briefly indicates the methodologies that should be present in the different areas of knowledge and transversal themes. Volumes 2 through 9 cover the eight major areas of knowledge: Portuguese Language, Mathematics, Natural Sciences, Geography, History, Arts, Physical Education, and Foreign Language. Volume 10 is dedicated to Transversal Themes, organized into: Presentation, Cultural Plurality, Environment, Health, and Sexual Orientation.

The PCNs were guided by constructivist theory (GERONIMO; GATTI; BARBOSA, 2021), with eclectic constructivist Cesar Coll contributing to their development (DUARTE, 2001a). Furthermore, the alignment of the PCNs with competency-based education demonstrates their agreement with the New School pedagogy.

According to Tavares (2002), the PCNs are contradictory and unclear documents, as they repeatedly express the intention to contribute to a more democratic society; however, their formulation was not the result of a democratic construction. Many important voices were absent in the development of the PCNs, including those of basic education teachers, labor unions, social movements, scientific associations, among others. The document also lacks clarity, as it emphasizes the aim of "improving the quality of education" throughout the text, yet fails to define what is meant by educational quality.

In the 2000s, another significant document emerged: the National Curriculum Parameters for High School (PCNEM). This document aims to provide contextualized school knowledge, promote interdisciplinarity, and encourage reasoning and learning capacity. It also seeks to assist teachers in exploring new methodological approaches (BRAZIL, 2000, p. 4), aiming to form students capable of engaging in activities across three domains: "[...] **social life, productive activity, and subjective experience**" (BRAZIL, 2000, p. 15, emphasis added).

In 2002, the document "Orientações Educacionais Curriculares Complementares aos Parâmetros Curriculares Nacionais"(Supplementary Educational Curriculum Guidelines to the National Curriculum Parameters) (PCN+) was published, updating the previous document (the PCNEM). This supplement clarified the desired competencies associated with disciplinary knowledge and provided suggestions for educational practices aimed at preparing students "for life, qualifying for citizenship, and equipping for lifelong learning, whether through further studies or

directly in the workforce" (BRAZIL, 2002, p. 8). Once again, this followed the principles established by the 1996 LDB.

A critical analysis of these documents (PCNEM; PCN+) reveals that "educational policies begin to implement changes that align teaching work and pedagogical practice (methods, content, objectives, theoretical frameworks) with the demands posed by the new social logic of capitalism" (LIPORINI, 2020, p. 83).

In 2006, the 1996 LDB was revised to extend the duration of elementary education from 8 to 9 years, necessitating the ratification of the National Curriculum Guidelines (HILARIO; CHAGAS, 2020).

In 2015, the first proposal for the BNCC was presented, backed by three major supporters: the World Bank, the *Todos pela Educação* (Everyone for Education) movement, and the Lemann Foundation (GERONIMO; GATTI; BARBOSA, 2021). Following three public consultations, in December 2017, the National Education Council approved the proposal (HILARIO; CHAGAS, 2020), leading to the official creation of the BNCC (BRAZIL, 2018).

The BNCC is organized into five chapters: the first, titled "Introduction," outlines the goal of establishing a common learning standard, overcoming fragmentation, and improving education to prepare students for the new global landscape; the second, "Structure of the BNCC," presents the overall structure of basic education and explains how learning is organized, including the alphanumeric codes used to identify learning outcomes; the third, fourth, and fifth chapters address early childhood education, elementary education (initial and final years), and high school, respectively. For elementary education, the following areas of knowledge are proposed: Languages, Mathematics, Natural Sciences, Human Sciences, and Religious Education (BRAZIL, 2018). Regarding methodologies, the proposal implicitly suggests active methodologies and a foundation aligned with New School principles (LIPORINI, 2020).

Pina and Gama (2020) point out that there is a complete alignment of the BNCC with business groups and, consequently, with their projects for basic education, which are based on pillars such as: privatization; technical division of labor (formulators and executors); accountability for student performance; and a minimalist level of school education. These pillars have led to profitable partnerships for companies, alienation, and the precarization of teaching work and student training, limiting them to everyday experiences.

The BNCC is recent and has been the subject of various studies, but there are few scientific works that compare the content, objectives, and methodologies regarding the teaching of Sciences in

the final years of elementary education in the PCNs and the BNCC, especially from the perspective of historical-critical pedagogy. This limitation may also affect the teaching of Biology, as Liporini (2020, p. 65) found in a bibliographic survey of curricula and Biology teaching from 2007 to 2017 that among the 85 identified works, "no study was found that facilitates the relationship between curriculum, Biology teaching, and historical-critical pedagogy."

In this context, the development of studies analyzing the teaching of Natural Sciences in both documents from a critical education perspective - historical-critical pedagogy - becomes justified.

The guiding question of this study was: What are the main changes in the teaching of Sciences for the final years of elementary education in the PCNs and the BNCC? The overall objective of the research was to analyze, in light of historical-critical pedagogy, the main changes that occurred from the PCNs of elementary education II to the BNCC regarding objectives, content, and methodologies in the teaching of Sciences. The specific objectives were: to identify the objectives, content, and methodologies in the teaching of Sciences proposed by the PCNs for elementary education II; to identify the objectives, content, and methodologies in the teaching of Sciences proposed by the BNCC for elementary education II; and to identify the main changes proposed by the BNCC for the teaching of Sciences in elementary education II compared to those proposed by the PCNs.

The choice to analyze objectives, content, and methodologies stems from the understanding that these three elements are interconnected and dependent on each other, as stated by Libâneo (1994, p.154):

> The teaching method is determined by the relationship between objectives and content, but it can also influence the determination of objectives and content. In effect, the subject matter serves as a reference for formulating specific objectives that, once defined, guide the articulation of content and methods, focusing on the students' study activities. In turn, the methods, as they express the means of transmitting and assimilating specific subjects, play a role in selecting objectives and content.

Thus, it is understood that analyzing these three elements (objective, content, and method) allows for a broader and more integrated understanding of the documents.

2.Methodology

The research is qualitative, as it addresses a reality that cannot be measured, dealing with a universe of meanings, motives, aspirations, beliefs, values, and attitudes that cannot be reduced to mere variable operationalization (MINAYO, 1994). It is also characterized as documentary research,

which is essential for understanding educational policies (FÁVERO; CENTENARO, 2019). This approach seeks information in documents that may not have scientific treatment, employing techniques and instruments to capture, comprehend, and analyze these documents, which can include written texts, films, videos, and more (SÁ-SILVA; ALMEIDA; GUINDANI, 2009).

Thus, it requires accessible instruments for the researcher, demanding time and attention. The researcher must engage actively with the document, carefully reading to "capture" the clues provided by the text. Often, documents contain rich information that is not explicitly stated or is incomplete. Theory plays a crucial role in the researcher-document relationship, as it mediates the documentary analysis (EVANGELISTA, 2008; FÁVERO; CENTENARO, 2019).

The objects of analysis in this study are the PCNs (BRASIL, 1998b) and the BNCC (BRASIL, 2018), both available online. The analysis focused on sections of the PCNs and BNCC directly related to the Area of Natural Sciences for the final years of elementary education, concentrating on content, objectives, and methodology.

The analysis of the PCNs encompassed the entire section titled "2nd Part," which includes the subsections: "Natural Sciences in the Third and Fourth Cycles"; "Third Cycle"; "Fourth Cycle"; "Didactic Guidelines for the Third and Fourth Cycles." For the BNCC, the complete section "4.3.1.2. Sciences in Elementary Education – Final Years: Thematic Units, Objects of Knowledge, and Skills" was analyzed.

Engagement with the study objects was guided by three phases aligned with the recommendations of Gomes (1994) and derived from Bardin's (1979) content analysis, which are: pre-exploration; exploration of the material; and treatment of the results obtained. In the first phase, contact was made with the study object and the structure of the documents to identify analytical guidelines. In the second phase, repeated readings of the same material were conducted to better understand the document and perceive nuances. In the third phase, while not excluding statistical information, the aim was to uncover underlying contents, such as ideologies and trends. Initially, the first and second phases were conducted with the PCNs, followed by the BNCC, and then the third phase was completed individually for each document.

In analyzing the documents, as noted by Gomes (1994), it is crucial to remain vigilant against the illusion that the results will reflect the complete reality of what is being researched. This can lead to superficial and erroneous conclusions. As Kosik (1976) explains, a phenomenon does not fully explain reality, even though it presents elements that constitute its essence, which can only be grasped

by reaching multiple determinations that make up reality. Thus, in scientific research, our understanding must progress from the immediate to the concrete.

3.Results and Discussion

The results and discussions were organized into three topics: Objectives, Contents, and Methodologies. General information about them is presented in Table 1.

Chart 1 - General Information on the Objectives, Contents, and Methodologies of the PCNs and the BNCC

Analysis	**PCN**s	**BNCC**
General Objectives	Comprehension of scientific concepts and development of competencies, emphasizing the use of technologies.	Commitment to scientific literacy and the ability of students to understand, interpret, and transform the world, based on theoretical knowledge.
Areas of Knowledge	Earth and Universe Life and Environment Human Being and Health Technology and Society.	Matter and Energy Life and Evolution Earth and Universe
Methodologies	Methodological practices centered on inquiry-based learning, problematization, and projects.	Methodological practices based on inquiry-based learning. The investigative process as a central element in students' education.

Source: Author's Own Work (2024).

Some studies have conducted a comparative analysis of the PCNs (National Curricular Parameters) and the BNCC (Base Nacional Comum Curricular), highlighting the similarities between these documents. Girotto (2017) considers that there are common characteristics in the documents, including: both were influenced by neoliberal ideologies; they appointed "specialists" as the only ones capable of defining theoretical and methodological principles; and they had implications for teaching practice and careers through the control of teacher efficiency and bonus systems. Regarding the differences between the PCNs and the BNCC, see Table 2.

Chart 2 - Differences between the PCNs and BNCC

Document	**PCNs**	**BNCC**
Cycle of Knowledge	Two-Year Cycle	One-Year Cycle
Areas of Knowledge	Thematic Axis	Thematic Units
Content	Content Overview	Objects of Knowledge
Objective	Objectives Overview	Competencies and Skills
Foundation	Constructivist	Not Explicit

Assessment	Intended for Teachers	External Assessments
Cross-Cutting Themes	Presents	Does Not Present

Source: Geronimo, Gatti and Barbosa (2021).

The alignment of both documents (PCNs and BNCC) with neoliberal ideologies has been the subject of analysis by various authors (PINA, GAMA, 2020; LIPORINI, 2020; CRUZ, 2021), identifying a continuity in the active pedagogies of the New School and the proposal of competencies.

3.1. Objevtives

Initially, we highlight that the BNCC refers solely to competencies and skills, which is why we analyzed the excerpt from the lower secondary education level that outlines the skills for this stage of education.

The data obtained from the analysis of the objectives found in the PCNs and BNCC were organized into three different categories:

Knowledge of Natural Sciences and Their Technologies: objectives aimed at forming concepts or procedures in natural sciences.

Skills in Natural Sciences and Their Technologies: objectives aimed at developing cognitive, motor, or socio-emotional skills, such as critical and reflective thinking, problem-solving, operational methods, and treatment techniques.

Attitudes, Values, Behaviors, or Habits: objectives that centralize the dimension of values or attitudes related to convictions/principles for life in society, such as the development of dignity, respect, and loyalty.

We emphasize that the categories created are not exclusive, as the objectives found sometimes expressed more than one category at a time. After analyzing the objectives, we arrive at Table 1.

Tabela 1 - Categorization of Objectives from the PCNs and BNCC

Categorias	PCNs	BNCC
Knowledge	14	57
Skills	9	60
Attitudes/Values	7	5

Source: Own authorship (2024).

Some examples of objectives found are presented in Chart 3.

Chart 3 - Examples of Knowledge, Skills, and Attitudes/Values from the PCNs and BNCC

Categories	PCNs	BNCC
Knowledge	Understand how the geocentric and heliocentric theories explain the movements of celestial bodies, relating these movements to observational data and the historical significance of these different views;	(EF09CI09) Discuss the ideas of Mendel on heredity (hereditary factors, segregation, gametes, fertilization), considering them to solve problems involving the transmission of hereditary traits in different organisms.
Skills	Interpret situations of environmental balance and imbalance by relating information about human interference and the dynamics of food chains;	(EF06CI03) Select the most appropriate methods for separating different heterogeneous systems based on the identification of material separation processes (such as the production of table salt, petroleum distillation, among others).
Attitudes/Values	Value the dissemination of socially relevant information to members of their community;	(EF08CI05) Propose collective actions to optimize the use of electricity in their school and/or community, based on the selection of equipment according to sustainability criteria (energy consumption and energy efficiency) and habits of responsible consumption.

Source: Own authorship (2024).

In general, the number of objectives presented in the BNCC was greater than those found in the PCN, as the PCNs present the objectives for the first cycle (6th and 7th grade) and the second cycle (8th and 9th grade), while the BNCC establishes a list of competencies and skills for each grade level. Comparing the two documents, the categories “Knowledge” and “Skills” were more prominent in the BNCC than in the PCNs. Finally, regarding “Attitudes/values,” we observe that the PCNs present more than the BNCC. The category that stands out the most in the PCNs was “Knowledge,” whereas in the BNCC, it was “Skills.”

The BNCC considers learning objectives equivalent to competencies and skills, a decision aligned with competency-based pedagogies (ZAJAC and CÁSSIO, 2023). According to Liporini (2020), this rationale justifies the focus on competencies and skills by asserting that content alone does not yield significant gains; it must be associated with skills and competencies to be mobilized and effectively put into practice: “[...] accumulated knowledge is no longer sufficient, as one cannot master a new situation simply by applying knowledge” (PERRENOUD, 1999, p. 32).

Therefore, the prominence of skills in the BNCC is expected, as Ramos (2002) indicates that skills are positioned as conditions for achieving competencies, as evidenced in the document itself: “To ensure the development of specific competencies, each curricular component presents a set of skills.” (BRASIL, 2018, p. 28). And to achieve these skills, the necessity of content is presented:

"These skills are related to different objects of knowledge – here understood as content, concepts, and processes, which, in turn, are organized into thematic units." (BRASIL, 2018, p. 28).

Zajac and Cássio (2023) note that although the competency approach was also present in the PCNs 20 years prior to the BNCC, the pedagogy of competencies in the BNCC presents a much more refined focus than in the previous document.

Competencies originate from the field of psychology (RAMOS, 2002), then entered the world of work in the 1970s, and were later introduced into education through official pedagogical documents (KUENZER, 2002).

The pedagogy of competencies was notably advanced by the author Philippe Perrenoud (BASCHETTI, 2014) and is grounded in constructivist pedagogy, which places the formation of competencies at the center of the educational process, defined as "the ability to act effectively in a specific type of situation, supported by knowledge but not limited to it" (PERRENOUD, 1999, p. 7). Competencies orchestrate a set of mental schemas that enable the mobilization of knowledge, methods, rules, and information (PERRENOUD, 1999). Some examples of competencies include:

> Analyze a text and reconstruct the author's intentions; Translate from one language to another; Argue with the purpose of convincing a skeptic or an opponent; Formulate a hypothesis and test it; Identify, state, and solve a scientific problem; Detect a flaw in the reasoning of an interlocutor; Negotiate and manage a collective project. (PERRENOUD, 1999, p. 7).

The focus on competencies shifts attention away from content learning, from the full development of students, and their consequent psychological development, redirecting education towards what Libâneo (2012) calls minimal training. Pina and Gama (2020) argue that these competencies aim to shape individuals aligned with capitalist society, promoting flexible training for work and practical knowledge for life. The following excerpts make this explicit, as seen in the PCNs: "We live in an era marked by competition and excellence, in which scientific progress and technological advances set new demands for young people entering the workforce [...]" (BRASIL, 1998a, p. 5, emphasis added). In the same vein, the BNCC states:

> Through the clear indication of what students should "know" (considering the formation of knowledge, skills, attitudes, and values) and, above all, what they should "know how to do" (considering the mobilization of this knowledge, skills, attitudes, and values to solve complex demands of **everyday life,** fully exercise citizenship, and participate in the workforce), [...] (BRASIL, 2018, p. 13, emphasis added).

Historical-critical pedagogy offers a counterpoint to the approach found in the BNCC, as it argues that education should not have the sole mission of preparing individuals for the workforce, but rather aim for the full development of the individual, including cognitive and social development, as well as their consciousness and interaction with the world, among other aspects.

Schools should not limit themselves to training for the workforce, nor should they shy away from this role. In this sense, Saviani argued that the link between instruction and productive work in elementary education occurs indirectly. Starting at the ages of 14-15, corresponding to the high school phase, explicit and direct training becomes necessary, equipping students with both theoretical and practical knowledge and helping them understand its connection to the productive process:

> As a result, if in elementary education the relationship is implicit and indirect, in high school, regarding education and work, the connection between knowledge and practical activity should be addressed explicitly and directly. It is not enough to simply master the basic and general elements of knowledge. Now, it is about making explicit how science becomes a material force in the production process. This clarification should involve not only theoretical mastery but also practical understanding of how knowledge is integrated into the productive process (SAVIANI, 2021b, p.212)

We emphasize that school is one of the few places where students will have the opportunity to come into contact with historically accumulated knowledge, as heavy workloads and the precariousness of labor reduce the possibilities for study (Kuenzer, 2002). Moreover, the same author states that it is not the school's role to train for competencies because:

> Attributing to the school the function of developing competencies is to disregard its nature and specificity as a space for the appropriation of socially produced knowledge, and therefore, for intellectual work with reference to social practice. Once again, this seeks to undermine its purpose, particularly to the detriment of those who live by their labor (KUENZER, 2002, p. 10).

3.2. Content

When analyzing the science content in elementary education, it is important to consider that it encompasses knowledge from three areas: Biological Sciences, Chemistry, and Physics. Thus, the content was categorized into: knowledge related to Biological Sciences, knowledge related to Chemistry, and knowledge related to Physics. Within these categories, subcategories were established: nine for knowledge related to Biological Sciences; four for knowledge related to Physics; and two for knowledge related to Chemistry. In counting the amount of content found in the PCNs and the BNCC in each area, Table 2 was created.

Table 2 - Total Content from the PCNs and BNCC

Document	Areas			
	Knowledge related to Biological Sciences	**Knowledge related to Physics**	**Knowledge related to Chemistry**	**Total**
PCN	131	6	12	149
BNCC	69	20	11	100

Source: Own authorship (2024).

In total, the PCNs contain more content than the BNCC. If we analyze knowledge related to Biological Sciences and Chemistry, there is more content in the PCNs than in the BNCC. However, knowledge related to Physics is more prevalent in the BNCC.

Next, we indicate how many science content items (involving knowledge of Biological Sciences, Physics, and Chemistry) are present only in the PCNs, how many are present only in the BNCC, and how many content items the PCNs and BNCC have in common, as shown in Table 3.

Table 3 - Content Retained, Excluded, and Added to the PCNs and BNCC

Identified Content	Areas			
	Knowledge related to Biological Sciences	**Knowledge related to Physics**	**Knowledge related to Chemistry**	**Total**
Only in the PCNs	100	5	10	115
Only in the BNCC	38	19	9	66
PCNs and BNCC	31	1	2	34

Source: Own authorship (2024).

In knowledge related to Biological Sciences, there are 31 common content items; in Chemistry, 3 content items; and in knowledge related to Physics, only 1 content item. We found that, in knowledge related to Biological Sciences, more content was excluded than added when transitioning from the PCNs to the BNCC. In knowledge related to Chemistry, there was an almost equal number of content items excluded and added, while in knowledge related to Physics, more content was added than removed.

There was a decrease in the amount of Natural Sciences content in the PCNs to the BNCC for EF II (Middle School), particularly in knowledge related to Biological Sciences. In knowledge related to Chemistry, the numbers are close, and in Physics, there was a slight increase in content. It is

noteworthy that the number of content items related to knowledge in Chemistry and Physics remains low compared to those in Biological Sciences.

The analysis also identified subfields of knowledge related to Biological Sciences, Chemistry, and Physics, as shown in Chart 4.

Chart 4 - Criteria for the Classification of Content into Specific Subfields

Knowledge related to areas	**Subfield**	**Content**
Biology	Astronomy	Content related to questions about the universe and the origin of life.
	Ecology	Specific content in ecology and concepts that connect the environment and living organisms, indicating interactions.
	Evolution	Specific content in evolution or content that aids in understanding what evolution is.
	Geology	Specific content in geology and concepts related to the Earth as a geosphere and its geological processes.
	Physiology	Content related to the functioning and processes associated with the biology of organisms, systems, organs, tissues, cells, among others.
	Genetics	Specific content in the field of genetics.
	Paleontology	Content related to fossils and records of ancient life forms, extinct or not..
	Microbiology	Content related to microorganisms such as bacteria, fungi, and processes related to these organisms.
	Biological Systematics	Content related to the phylogeny of living organisms.
Physics	Electromagnetism	Content related to electricity, magnetism, or electromagnetic waves.
	Thermal Physics	Concepts and laws related to temperature and heat, that is, the degree of energetic agitation of particles.
	Mechanics	Content related to Kinematics, Dynamics, Statics, Hydrostatics, and Hydrodynamics.
	Optics	Content related to phenomena involving light and its behavior in a given medium.
Chemistry	Analytical Chemistry	Content on chemical reactions, identification, or quantification of substances.

	General/Inorganic Chemistry	Content dealing with nanoscopic structures, the periodic table, chemical bonds, among others.

Source: Own authorship (2024).

It is important to clarify that Astronomy was included as a subfield of knowledge related to Biological Sciences and not Physics, as the content proposed in the PCNs and BNCC involves the formation of planet Earth and the origin of life, the formation of the Earth's atmosphere, the influence of cosmic conditions on the origin of life, and/or climate-related issues.

Table 4 shows the number of content items in each subfield.

Table 4 - Content in Each Subfield Found in the PCNs and BNCC

Natural Sciences Content			
Knowledge related to areas	**Subfields**	**PCNs**	**BNCC**
Biology	Astronomy	34	21
	Ecology	29	20
	Evolution	13	7
	Geology	10	8
	Physiology	36	11
	Genetics	2	1
	Paleontology	3	1
	Microbiology	2	0
	Biological Systematics	2	0
Physics	Electromagnetism	3	9
	Thermal Physics	1	9
	Mechanics	2	1
	Optics	0	1
Chemistry	Analytical Chemistry	6	5
	General/Inorganic Chemistry	6	6
Total	15 subfields	149	100

Source: Own authorship (2024).

The knowledge related to Biological Sciences in the PCNs encompasses content across all subfields, with an emphasis on Physiology, Astronomy, Ecology, Evolution, and Geology. In the BNCC, two subfields of knowledge related to Biological Sciences are absent, and the emphasis is placed on only two subfields, Astronomy and Ecology. Thus, when comparing the knowledge related to Biological Sciences in the PCNs with that of the BNCC, the BNCC had a greater impact (reduction) in the Physiology subfield, although all other subfields also saw a notable decrease in content.

Regarding knowledge related to Physics, the BNCC includes content covering all subfields, with more emphasis on Electromagnetism and Thermal Physics. In the PCNs, the subfield of Optics is absent, and there is more content on Electromagnetism. Therefore, when comparing Physics-related knowledge in both documents, the BNCC introduced more content, especially on Electromagnetism and Thermal Physics.

Finally, regarding knowledge related to Chemistry, there is a similarity between the PCNs and the BNCC, as both address the same two subfields, with very similar amounts of content in these areas.

In comparison, between the two documents, the BNCC saw a reduction in content related to Biological Sciences across all subfields, with the most significant reduction in the Physiology subfield. Additionally, in the BNCC, regarding knowledge related to Physics, there are more subfields and a greater amount of content in Electromagnetism and Thermal Physics. As for Chemistry-related knowledge, there is little variation in content between the PCNs and the BNCC.

Therefore, we indicate that, in addition to the presence of a perspective that deprioritizes knowledge, knowledge is effectively being reduced in the BNCC. The result aligns with the findings of Zajac and Cássio (2023). In analyzing the different versions of the BNCC, they pointed out that the issue of content was concerning from the first version of the document. Moreover, with the development of subsequent versions, no improvement was made: in the second version, legal issues accounted for 36% of the document, whereas in the final version, they represented 60% of the document.

Another issue analyzed in previous studies relates to the Science, Technology, and Society (STS) movement. Hilario and Chagas (2020), when analyzing the PCNs and the BNCC for elementary education, observed a continuity in the association with the myths of the Science, Technology, and Society (STS) movement, such as: the neutrality of scientific thought; the savior role of science and technology; and the view that society improves with the advancement of technology (ANTUNES JÚNIOR; CAVALCANTI; OSTERMANN, 2021).

It is understood that the articulation between STS (Science, Technology, and Society) is legitimate insofar as science enables the expansion of cutting-edge knowledge, providing a foundation for new technologies that can be used as contributions to society. However, this articulation is distorted by market logic, as even though there is a connection between science and technology, this does not always translate into benefits for society as a whole, but rather for a specific

group or those who can afford it. Thus, mythical views regarding STS obscure important ideological issues.

Therefore, the association with STS allows us to understand that certain foundations regarding the role of education remained consistent between one document and the other, reinforcing the understanding that there are continuities between the PCNs and the BNCC.

We understand that scientific knowledge is a type of knowledge that represents reality with a higher degree of fidelity and offers greater possibilities for psychological development, due to the complexities required for thinking (MARTINS, 2013). This study argues that the teaching of Natural Sciences content should enable students to gain a basic understanding of nature, its relationship with science, technology, and society, contributing to intellectual autonomy as well as political and cultural participation (GERALDO, 2009).

It is only through the appropriation of the cultural heritage already produced by humanity that the children of the working class can achieve emancipation (DUARTE, 2013), as a greater understanding of reality offers more opportunities for its transformation (SAVIANI, 1996). For this reason, historical-critical pedagogy opposes the relativism of school content and the subordination of this content to pragmatic everyday life, perspectives evident since the PCNs (MALANCHEN, 2014) and continued in the BNCC (LIPORINI, 2020).

3.3. Methodology

In methodologies, procedures, strategies, and teaching activities were included. According to Viveiro (2020), the terminology related to teaching methodologies overlaps depending on the literature used as a reference. As proposed by the same author, in this study, procedures, strategies, and teaching activities were identified as equivalent to teaching and learning methodologies.

Although resources may be linked to procedures, strategies, and teaching activities, the resources mentioned in the documents were not considered, as "a resource is merely a tool to be used in the selection of a strategy, which in turn is directly related to the content and objectives of the teaching and learning process" (VIVEIRO, 2010, p. 44).

Despite this, Chart 5 presents some resources identified in the PCNs and the BNCC.

Chart 5 - Recursos metodológicos encontrados no PCNs e na BNCC

Teaching Resources in the PCNs and the BNCC

PCNs	Models, mockups, three-dimensional representation, object manipulation, computer animation, drawing, diagrams, figures, films, photography, graphs, sound recordings, images, computing, inventory, timeline, narratives, posters, videos, tables, text, illustrations, games, playful activities, simulations, production of records of various types, caption creation.
BNCC	Models, three-dimensional representation, text.

Source: Own authorship (2024).

We found that the quantity and diversity of resources suggested throughout the PCNs are greater than those in the BNCC.

Returning to the teaching methodologies identified in the documents, categories were organized according to Libâneo (1994, p. 161-172):

Method of exposure by the teacher: students have receptive activity and the teacher makes the exposition of the matter can be verbal, demonstrative, through illustrations and examples.

Independent work method: methodologies that focus on the student in the learning process, with the teacher acting as a coordinator and guide, allowing students to learn through different means. Some examples are: preparatory tasks; tasks for assimilation and application of content; personal elaboration tasks.

Collaborative method: occurs when there is an active interaction between the teacher and students, the most typical form being didactic conversation, where questions are used to elicit more complex responses from students.

Group work method: involves activities where students form groups to cooperate on completing a task. Applications include debates, brainstorming, seminars, among others.

Special activities: These complement the teaching methods in the previous categories with the goal of active content assimilation, for example, media studies, school newspapers, student assemblies, school museums, theater, school libraries, etc.

Chart 6 presents the methodologies found in both documents: PCNs and BNCC.

Chart 6 - Categorization of methodologies in the PCNs and BNCC

Categories	**Procedures/Strategies/Activities**

Lecture by the teacher	Introduction of the subject; Presentation; Demonstration; Offering of information; Clarification.
Independent work	Guidance for students; Teacher coordination; Analysis; Experimentation; Investigation; Reading; Observation; Problematization; Data collection; Comparison of prior knowledge with the results; Research; Conducting interviews; Creation of hypotheses/assumptions; Proposal of solutions; Knowledge dissemination/Socialization of knowledge.
Collaborative work	Teacher listening to students; Teacher participation; Student questions as a starting point; Teacher acknowledging student doubts.
Group work	Discussion; Debates; Role-playing; Seminar; Group activities; Collective activities.
Special activities	Projects; Visits; Excursions; Direct contact of students with the object of study; Examining the object of study in its environment; Report production; Individual and group evaluation.

Source: Own authorship (2024).

In the analysis of Table 6, it is evident that the category that gathers the most methodologies is the "Independent Work" category, with a greater variety of references compared to any other category in the same table.

Table 5 shows the number of methodologies by category in the PCNs and BNCC.

Table 5 - Total number of methodologies by category in the PCNs and BNCC

Documents	**Methodological categories**					**Total**
	Teacher lecture	**Independent work**	**Collaborative work**	**Group work**	**Special activities**	
PCN	5	17	4	6	5	37
BNCC	1	5	0	2	0	8

Source: Own authorship (2024).

We identified more indications of methodologies in the PCNs (37) than in the BNCC (8) across all categories, with the "Independent Work" category being more emphasized in both documents.

In the analysis, methodologies present only in the PCNs and those present only in the BNCC were also identified, as shown in Table 6.

Table 6 - Methodologies Retained, Excluded, and Added in the PCNs and BNCC

Document	**Methodological categori**					**Total**
	Teacher lecture	**Independent work**	**Collaborative work**	**Group work**	**Special activities**	
Only in the PCNs	4	12	4	4	5	29

Only in the BNCC	0	0	0	0	0	0
PCNs and BNCC	1	5	0	2	0	8

Source: Own authorship (2024).

There are a total of 30 methodologies indicated in the PCNs that were not identified in the BNCC. There are also 8 methodologies common to both the PCNs and the BNCC. No new methodologies were added to the BNCC.

In the overall analysis for all categories, we found that they follow the same pattern: quantitatively higher in the PCNs, with the "Collaborative Work" and "Special Activities" categories not identified in the BNCC. Furthermore, no new methodologies were added in any of the categories.

Overall, the PCNs contain more methodological indications than the BNCC, and also have more exclusive methodologies, i.e., methodologies that were not found in the other document. The removal of methodologies impacted all categories in general, with "Independent Work" being the category that saw the most removal, but also the one most present in the BNCC. Additionally, this category shares the most methodologies in common between the PCNs and the BNCC.

The specific methodologies in the "Independent Work" category that were preserved in the BNCC include: Analysis; Proposal of solutions; Experimentation; Investigation; and Problematization.

There is a clear emphasis in both curriculum-guiding documents on methodologies that place students in an independent learning role, due to the theoretical alignment of both documents with "learning to learn" pedagogies. These inevitably introduce, though at different levels, the following propositions:

> 1) Learning that occurs without the transmission of knowledge by someone is more desirable; 2 The method of constructing knowledge is more important than the knowledge already socially produced; 3) The student's activity should be driven by the interests and needs of the individual; 4) Education should prepare individuals for a constant process of adaptation and readjustment to a rapidly changing society (DUARTE, 2001b, p. 151).

In this sense, the PCNs and the BNCC emphasize student learning through active methodologies, which are:

> [...] a conception of the teaching and learning process that considers the effective participation of students in constructing their learning, valuing the different ways in which they can be involved in this process so that they learn better, at their own pace, time, and style (BACICH; MORAN, 2018, p. 23).

The methodologies present in the documents align with active methodologies, which, under a critical perspective, present a naive view of the learning process, as they propose challenging activities related to everyday life or the professional world, requiring student autonomy for problem-solving (LIPORINI, 2020). Moreover, the same author points out that certain teaching strategies support the principles of active methodologies, such as experimentation, problem-based learning, and project-based learning.

These methodologies shift the focus of educational work from "teaching" to "learning," necessitating an emphasis on methodologies to meet these expectations. And for that:

> [...] Methodology takes center stage in the teaching-learning process, as it should align with the actions or the working process of the learner. The situations that make up the curriculum should encompass challenging, real or simulated problems and projects that trigger problem-solving actions, aligned with typical situations in the professional field (RAMOS, 2002, p. 408).

It is important to highlight that, in contrast to hegemonic trends, historical-critical pedagogy proposes an articulation between content, form, and recipient for the teaching and learning activity. This triad is an essential premise of historical-critical pedagogy and historical-cultural psychology for the effective transmission of scientific knowledge in schools (QUEIROZ, 2019).

Regarding content, historical-critical pedagogy understands that it is essential for students to appropriate the scientific, artistic, and philosophical knowledge historically accumulated by humanity (SAVIANI, 1999). To identify what these knowledge areas are, it is necessary to "analyze in social history what has constituted effective humanization, that is, the development of humanity, and what, in this same process, in this same historical dialectic, has been characterized as alienation" (DUARTE, 2013, p. 67).

Considering the form, historical-critical pedagogy proposes the five steps of critical historical pedagogy, which are: 1) Social practice; 2) Problematization; 3) Instrumentalization; 4) Catharsis; and 5) Social practice, understood from a dialectical logic rather than in a sequential, mechanical manner, or even disassociated from each other (LAVOURA; MARTINS, 2017). As explained by Saviani (1999):

> Instead of steps arranged in a chronological sequence, it is more appropriate to refer to moments that are articulated in a single, unified, and organic movement. The weight and duration of each moment will obviously vary according to the specific situations in which the pedagogical practice is developed (SAVIANI, 1999, p. 84).

According to Saviani (1999), the first step is social practice, a moment when the teacher and student may be positioned differently, as they are different social agents with distinct knowledge and

experiences. At this moment, the teacher has a rudimentary synthesis understanding, while the student has a syncretic understanding. Problematization emerges from social practice, with the aim of facilitating overcoming, and instrumentalization is the moment when students appropriate theoretical and practical knowledge to address the raised problem. In catharsis, there is the effective instrumentalization of the previously appropriated cultural elements, allowing the student to deepen their understanding of social practice, enabling new ways of perceiving it. The final social practice is not the same as that found at the beginning, as the teacher presents a less rudimentary synthesis, while students possess a more synthetic understanding of social practice, meaning they have transitioned from syncretism to synthesis. As a consequence of this process, "students demonstrate the ability to express an understanding of practice in terms as elaborate as was possible for the teacher" (SAVIANI, 1999, p.82).

Lavoura and Martins (2017) emphasize:

> [...] the impossibility of materializing classes based on historical-critical pedagogy without a profound understanding of its theoretical foundations, which are precisely the constitutive pillars of the pedagogical method in question. The theoretical categorical arsenal is what enables the method to be put into motion in its teaching activity, enriching pedagogical practice coherently in light of theory (LAVOURA; MARTINS, 2017, p. 536).

Finally, the recipients of the process are the students concrete students, not empirical ones as discussed by Saviani (1999), aiming for the maximum of their development. Queiroz (2019) points out that historical-critical pedagogy seeks to foster in students the elevation of syncretic capacity, towards theoretical thinking, which is the most complex expression of development.

4. Final considerations

This study finds that in the area of Science teaching in the PCNs, the objectives were more related to the formation of knowledge, despite the emphasis on competencies. In terms of content, there are quantitatively more topics in the PCNs than in the BNCC, indicating greater complexity, given the reduction found in the latter document. The teaching methodology in the PCNs is more diverse than in the BNCC, although both documents focus on individual work.

In response to the research question, we consider that there are changes between the PCNs and the BNCC, and as pointed out by other authors, the latter document is characterized as a refinement of the ideas already present in the former.

It is important to highlight that the dominant ideology is neoliberalism, which permeates various aspects of our society, including schools. The alignment with competency-based education demonstrates a connection with the new school pedagogy and learning to learn, bringing individualism, adaptation, and competitiveness to the forefront of educational issues. In other words, it promotes the formation of individuals adapted to the current system.

Historical-critical pedagogy presents itself as a counterpoint to the perspective found in these documents, understanding the school as a space that contributes not only to reproduction but also to social transformation. For this, the socialization of developed knowledge is fundamental for the effective humanization of individuals, as only by being aware of reality can individuals transform it.

We argue that the triad of content-form-recipient is an essential premise for assisting in the cohesive formulation of a curriculum or, in our case, a curriculum guiding document. This understanding allows us to see content as abstract formulations representing the objective world; through language, they enable the transmission of the subjective image of objective reality to the student. The form articulates the content, taking into account the objectives and the identity of the recipients. Finally, the recipient is considered as a concrete student; thus, the aim is to develop the maximum human potential.

Although the analysis is limited to the objectives, content, and methodology of Natural Sciences in Elementary School II, it is believed that similar results may be found when compared to other teaching areas and even other educational levels, such as high school. Nevertheless, research in this direction can be conducted and also brings contributions to the field.

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