

**THE INTRODUCTORY CONTENTS OF ORGANIC CHEMISTRY IN A
TEXTBOOK: THE METHODOLOGICAL APPROACH FROM THE PERSPECTIVE
OF THE PNLD 2021 AND THE BNCC**

**OS CONTEÚDOS INTRODUTÓRIOS DA QUÍMICA ORGÂNICA EM UM LIVRO
DIDÁTICO: A ABORDAGEM METODOLÓGICA SOB A ÓTICA DO PNLD 2021 E
A BNCC**

**EL CONTENIDO INTRODUCTORIO DE LA QUÍMICA ORGÁNICA EN UN LIBRO
DE TEXTO: UNA APROXIMACIÓN METODOLÓGICA DESDE LA PERSPECTIVA
DEL PNLD 2021 Y LA BNCC**

 <https://doi.org/10.56238/sevened2025.036-063>

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ABSTRACT

The BNCC and PNLD are currently the main guidelines to be observed in the development of didactic material intended for Brazilian students, which demands constant evaluations of the textbooks adopted in schools. From this perspective, the work presented here describes an analysis of the pedagogical approach to the 'Fundamentals of Organic Compounds' present in a textbook from the 'Moderna Plus: Natural Sciences and their Technologies' collection, comparing it with the guidelines of the BNCC and PNLD 2021. Qualitative and descriptive in nature, the research was developed from a documentary analysis with the objective of investigating the conformity of the approach to the introductory content of Organic Chemistry, presented in this chapter, with the documentary guidelines, focusing on its potential in promoting a civic, critical, and contextualized education. The results revealed that, although the chapter partially addresses skills such as the construction of chemical representations and the application of knowledge in everyday contexts, its pedagogical approach remains traditional, content-based, and poorly connected to social, environmental, and cultural issues. The absence of experimental proposals, the superficiality in the interdisciplinary treatment, and the weak stimulus to critical reflection compromise the formative function of the chapter. Therefore, teacher mediation is essential to transform the content into an emancipatory tool, capable of going beyond memorization and contributing to a critical understanding of reality.

Keywords: Organic Chemistry. Textbook. High School. BNCC. Civic Education. PNLD 2021. Critical Education.

RESUMO

A BNCC e o PNLD constituem hoje as principais diretrizes a serem observadas na elaboração do material didático destinado ao estudante brasileiro, o que demanda a realização de avaliações constantes dos livros adotados nas escolas. Sob esse olhar, o

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trabalho aqui apresentado descreve uma análise da abordagem pedagógica dos Fundamentos dos Compostos Orgânicos presente em um livro da coleção didática 'Moderna Plus: Ciências da Natureza e suas Tecnologias', confrontando-a com as orientações da BNCC e do PNL 2021. De caráter qualitativo e descritivo, a pesquisa se desenvolveu a partir de uma análise documental com o objetivo de investigar a conformidade da abordagem dos conteúdos introdutórios de Química Orgânica, apresentada nesse capítulo, com as diretrizes documentais, focando o seu potencial na promoção de uma formação cidadã, crítica e contextualizada. Os resultados revelaram que, embora o capítulo contemple parcialmente habilidades como a construção de representações químicas e a aplicação de conhecimentos em contextos cotidianos, sua abordagem pedagógica permanece tradicionalista, conteudista e pouco conectada às questões sociais, ambientais e culturais. A ausência de propostas experimentais, a superficialidade no tratamento interdisciplinar e o fraco estímulo à reflexão crítica comprometem a função formativa do capítulo. Diante disso, a mediação docente é essencial para transformar o conteúdo em uma ferramenta emancipadora, capaz de ultrapassar a memorização e contribuir para uma leitura crítica da realidade.

Palavras-chave: Química Orgânica. Livro Didático. Ensino Médio. BNCC. Formação Cidadã. PNL 2021. Educação Crítica.

RESUMEN

El BNCC (Currículo Básico Común Nacional) y el PNL (Programa Nacional de Libros de Texto) son actualmente las principales directrices que deben observarse en el desarrollo de materiales didácticos para estudiantes brasileños, lo que exige una evaluación constante de los libros adoptados en las escuelas. Desde esta perspectiva, este trabajo describe un análisis del enfoque pedagógico de los Fundamentos de Compuestos Orgánicos presente en un libro de la colección didáctica 'Moderna Plus: Ciencias Naturales y sus Tecnologías', comparándolo con las directrices del BNCC y el PNL 2021. De naturaleza cualitativa y descriptiva, la investigación se desarrolló a partir de un análisis documental con el objetivo de investigar la conformidad del enfoque del contenido introductorio de Química Orgánica, presentado en este capítulo, con las directrices documentales, centrándose en su potencial para promover una educación cívica, crítica y contextualizada. Los resultados revelaron que, si bien el capítulo aborda parcialmente habilidades como la construcción de representaciones químicas y la aplicación del conocimiento en contextos cotidianos, su enfoque pedagógico sigue siendo tradicionalista, centrado en el contenido y poco conectado con cuestiones sociales, ambientales y culturales. La ausencia de propuestas experimentales, la superficialidad del tratamiento interdisciplinario y el escaso fomento de la reflexión crítica comprometen la función formativa del capítulo. Por lo tanto, la mediación docente es esencial para transformar el contenido en una herramienta emancipadora, capaz de ir más allá de la memorización y contribuir a una lectura crítica de la realidad.

Palabras clave: Química Orgánica. Libro de Texto. Enseñanza Secundaria. BNCC (Currículo Nacional Brasileño). Educación para la Ciudadanía. PNL 2021 (Programa Nacional de Libros de Texto). Educación Crítica.



1 INTRODUCTION

Guided by guidelines such as the National Common Curricular Base (BNCC), textbooks are challenged to present their content in a contextualized and interdisciplinary way (Vilanova, 2015; Brazil, 2017). This document also ratifies the organization of disciplines in the area of Natural Sciences and their Technologies in order to integrate Chemistry, Physics and Biology, focusing on the development of competencies and skills applicable to real situations of the student's daily life (Alves; Martins; Andrade, 2021).

However, these guidelines often come up against technicist approaches that prioritize memorization and contribute little to the construction of meaningful knowledge, especially in the case of Organic Chemistry, often treated as a sequence of naming rules and formulas detached from the social reality of the learner (Maciel; Leão, 2022; Shah; Ibiapina, 2023).

The challenge becomes even more evident in public schools, where the reduced workload of the subject, the precariousness of the infrastructure and the socioeconomic reality of the students aggravate the difficulties in working with the contents in a critical way and aimed at the exercise of citizenship (Gramowski; Delizoicov; Maestrelli, 2017).

Organic Chemistry, a branch of Chemistry that studies carbon compounds, including molecules that are fundamental to life, such as DNA, proteins, and vitamins, plays a strategic role not only in understanding the composition of matter and its transformations, but also in the changes that occur in society. From the fall of the Theory of Vitalism, in the first half of the nineteenth century, to contemporary innovations, with the emergence of RNA vaccines and smart tissues, the evolution of Organic Chemistry directly reflects on the scientific and technological advances that shape human daily life (Solomons; Fryhle; Snyder, 2023).

Thus, the articulation between the Teaching of Organic Chemistry and the major contemporary themes, such as the environment, health and technology, becomes fundamental to ensure a more relevant learning and connected to the students' experiences. In this context, the mastery of its basic concepts must go beyond the memorization of rules of nomenclature and classifications: it must constitute an exercise in critical thinking and reading of the world (Nelson; Cox, 2022).

However, what is observed in Brazilian schools, especially in the public network, is a teaching of Organic Chemistry marked by reductionist and decontextualized approaches. The contents are still often worked on in a fragmented way, with a focus on the fixation of formulas and mechanical repetitions, neglecting the connections of the subjects with social reality and contemporary themes (Paixão, 2019; Adam; Xavier; Maciel, 2009).



This perspective discourages the interest of students and compromises their comprehensive education, as it fails to establish bridges between scientific knowledge and the challenges of daily life, precisely what the BNCC proposes to overcome (Brasil, 2017). By sanctioning this document, the National Book and Didactic Material Program (PNLD) emerges as an essential regulatory tool in the process of choosing the textbook to be adopted in Basic Education schools across the country (Brasil, 2021).

Therefore, the present research collaborated in the search for answers to the following questions: are the contents of Organic Chemistry, present in the textbooks approved by the PNLD 2021, in fact committed to the guidelines of the BNCC (Brasil, 2017)? Are these materials capable of really promoting critical and reflective learning? Do they really contribute to citizenship education?

In view of the above, this research aimed to analyze the alignment of the approach of the Fundamentals of Organic Compounds presented by chapter 10 of the book 'Scientific Knowledge', of the didactic collection 'Moderna Plus: Natural Sciences and their Technologies', with the guidelines of the BNCC, especially with regard to the promotion of critical, reflective learning aimed at citizenship formation.

2 METHODOLOGY

To achieve the proposed objective, this investigation was developed under a qualitative approach, and can be classified as descriptive as to its objectives, since it seeks to analyze the relationships between sets of ideas. As the research data were obtained from sources consisting of texts, it can be considered as being of the documentary type, since its main focus was to answer questions that require the analysis and discussion of written records (Malheiros, 2011).

The choice of chapter 10, of the book 'Scientific Knowledge', is justified by the fact that the content covered in it is responsible for introducing the study of Organic Chemistry in High School, exploring the essential conceptual basis for deepening in topics studied later.

In addition, the collection to which it belongs, 'Moderna Plus: Natural Sciences and their Technologies', is part of the teaching materials recommended by the PNLD 2021 (Brasil, 2021). Because it has an expressive national representation in the public educational scenario, it is being widely adopted in public schools in the city of Crateús-CE.

The intention of the analysis, therefore, was to verify, with special attention focused on citizenship education, to what extent the contents presented in the chapter dialogue with the



competencies and skills proposed by the National Common Curricular Base (BNCC) (Brazil, 2017), listed below:

(EM13CNT104) Evaluate the benefits and risks to health and the environment, considering the composition, toxicity and reactivity of different materials and products, as well as the level of exposure to them, taking a critical position and proposing individual and/or collective solutions for their responsible use and disposal.

(EM13CNT207) Identify, analyze and discuss vulnerabilities linked to the contemporary experiences and challenges to which young people are exposed, considering the physical, psycho-emotional and social aspects, in order to develop and disseminate actions.

(EM13CNT301) Construct questions, elaborate hypotheses, forecasts and estimates, employ measurement instruments and represent and interpret explanatory models, data and/or experimental results to construct, evaluate and justify conclusions in facing problem situations from a scientific perspective.

(EM13CNT302) Communicate, to varied audiences, in different contexts, results of analyses, research and/or experiments, elaborating and/or interpreting texts, graphs, tables, symbols, codes, classification systems and equations, through different languages, media, digital information and communication technologies (DICT), in order to participate and/or promote debates around scientific and/or technological topics of sociocultural and environmental relevance.

(EM13CNT303) Interpret texts of scientific dissemination that deal with themes of the Natural Sciences, available in different media, considering the presentation of data, both in the form of texts and in equations, graphs and/or tables, the consistency of the arguments and the coherence of the conclusions, aiming to build strategies for the selection of reliable sources of information.

(EM13CNT306) Evaluate the risks involved in daily activities, applying knowledge from the Natural Sciences, to justify the use of equipment and resources, as well as safety behaviors, aiming at physical, individual and collective, and socio-environmental integrity, being able to make use of digital devices and applications that enable the structuring of simulations of such risks.

(EM13CHS304) Analyze the socio-environmental impacts resulting from the practices of government institutions, companies and individuals, discussing the origins of these practices, selecting, incorporating and promoting those that favor socio-environmental awareness and ethics and responsible consumption (BRASIL, 2017, p. 555-560; 575).

The analysis procedure was developed in four main stages. The first consisted of the survey and selection of the material to be examined, with the choice falling on the corpus of the research already described. The second stage involved exploratory recognition,

comprising an initial reading of the chapter to familiarize with the content and preliminary identification of the structure and organization of the theme.

The third stage included the analysis itself, conducted through systematic reading with a focus on the identification and registration of elements related to the skills of the BNCC (Brasil, 2017), and on the critical appreciation of the pedagogical approaches and contextualizations presented by the chapter. The fourth and final stage, carried out from the data collected in the light of the theoretical foundation, comprised the interpretation and synthesis of the articulation between the findings and the guidelines of the BNCC (Brasil, 2017), culminating in the construction of inferences about the formative potential of the material analyzed.

The entire analytical process was performed manually, with the systematic recording of the skills identified, the pedagogical approaches used and the contextualization elements present in the material. This procedure allowed to raise evidence about the alignment (or not) of the content presented in the chapter with the BNCC guidelines, contributing to a critical reflection on the role of the textbook in the construction of a more meaningful Chemistry Teaching focused on citizenship formation (Brasil, 2017).

3 RESULTS AND DISCUSSION

In this section, the results of the analysis of chapter 10, entitled 'Fundamentals of Organic Compounds' of the book 'Scientific Knowledge' (volume 1), are presented, having as its core the alignment of the approach of the content and the suggested activities with the guidelines contained in the BNCC and citizen education (Brasil, 2017).

3.1 A TOPICAL ANALYSIS

The chapter begins on page 115, connecting science and everyday life through an illustration containing acarajé dumplings, a typical dish of Afro-Brazilian culture (Figure 1), aiming to relate its ingredients to chemical substances (organic compounds) important for nutrition, such as methionine and lysine. This approach has the potential to stimulate reflections on cultural diversity, food, health, and history, aligning with the EM13CNT104 ability of the BNCC (Brasil, 2017).

Figure 1

Initial illustration of Chapter 10 showing acarajé associated with some organic compounds. Page 115 of the book analyzed



Source: Amabis *et al.* (2021, p. 115).

The text located just below this illustration brings a brief history of Organic Chemistry, differentiating organic from inorganic compounds through everyday examples, which can contribute to encourage a critical analysis of how science is communicated to the public. Interdisciplinarity appears when relating chemistry to nutrition, history and geography, opening space for ethical and social debates on food production and consumption. There is also mention of the artificial production of organic compounds, a useful topic for discussions addressing Science, Technology, Society and Environment (CTSA), although it has been treated in an irrelevant way.

The content of this text also raises questions about the symbology in molecular representations, which could be a starting point to develop the students' investigative and argumentative thinking, as long as it is well explored by the teacher. By encouraging students to observe and question molecular representations, highlighting, for example, the absence of the carbon symbol and the meaning of zigzag strokes, its last paragraph explores EM13CNT301, EM13CNT302 and EM13CNT303 skills.

In Topic 1, located on page 116, the concepts related to structural formulas are revisited, but the approach does not stimulate the exercise of full critical reasoning, although it presents the model of spheres and rods to facilitate spatial understanding.

On page 117, in the sections 'Dialoguing with the text' and 'Group activity' (Figure 2), students are asked to compare molecular models and research compounds such as anethole and estragole. This performance could be further enriched with sensory experiences (smell, touch, sight), since these are substances contained in simple materials, such as fennel and basil, and which can be easily manipulated with due care.

Figure 2

Presentation of the sections 'Dialoguing with the Text' and 'Group Activity'. Chapter 10, page 117 of the book analyzed

The image shows two sections from a textbook. The left section, titled 'Dialogando com o texto', is enclosed in a red-bordered box. The right section, titled 'Atividade em grupo', is enclosed in a light blue-bordered box. Both sections contain text in Portuguese related to organic chemistry, specifically discussing the structures and properties of anethole and estragole.

Dialogando com o texto

Compare cada um dos modelos moleculares ao lado com as respectivas fórmulas estruturais e verifique a correspondência entre as representações. Como parte da interpretação, deduza quais são as esferas usadas para representar os átomos de cada elemento químico, no modelo molecular.

Atividade em grupo

A substância **anetol** é responsável pelo aroma da erva-doce, bastante usada no Brasil para fazer chás e doces.

Já a substância **estragol** está presente em algumas variedades de manjeriço, contribuindo para seu aroma.

Pesquisem na internet a fórmula estrutural desses dois compostos e analisem-nas. Qual é a diferença entre as moléculas de ambas?

Deduzam a fórmula molecular das duas substâncias e comparem-nas. A fórmula molecular, isoladamente, é suficiente para designar de modo inequívoco essas substâncias? Argumentem para justificar.

Source: Amabis *et al.* (2021, p. 117).

Activities of this nature can promote the visualization of molecules from different perspectives, and encourage the formulation of hypotheses about their properties, such as color and odor. By interpreting different molecular representations, students develop skills to communicate results and select reliable sources, preparing for reasoned scientific debates.



In the section 'Applying knowledge', also located on page 117, students are led to identify and interpret different types of formulas (molecular, structural, condensed and with lines), exercising the process of structural deduction. However, the contextualization of theobromine and theophylline is superficial, not allowing the content to be deepened (Skill EM13CNT207).

Although these sections seek to stimulate reasoning, they are less critical and more formal, seeming to meet curricular requirements, without worrying about promoting an in-depth understanding. Practical activities, such as building molecular models with simple materials, could enrich learning by connecting theory and practice, and encourage the formation of critical thinking.

Despite this, the proposed questions seem to present adequate complexity to the level of knowledge explored, stimulating the logical thinking of students when they challenge them to compare carbon and hydrogen atoms in different molecules, reinforcing the learning of the content related to structural analysis.

Topic 2, 'Carbon chain' (page 118), explores the identification of carbon chains in molecules such as limonene and methyl anthranilate. Using subtitles, the authors relate molecular structure to compounds present in everyday life, such as BHT, a preservative and antioxidant. It also addresses the concepts of heteroatoms and the classification of carbons (primary to quaternary).

This favors the understanding of the applicability of the knowledge of Organic Chemistry (EM13CNT306), and consolidates the learning of basic terminology (EM13CNT301). However, the methodological approach is characterized as transmissive, without stimulating teamwork, the development of critical thinking or practical application.

In Topic 3, 'Benzene ring' (page 119), the concept of resonance is briefly presented without going into depth. However, the description of benzene toxicity stimulates reflection on health and safety risks (EM13CNT104). The group activity on this same page proposes research and discussion on amino acids containing benzene rings in their molecules, which can promote the construction of scientific argumentation and knowable communication (EM13CNT302).

The text of Topic 4, 'Attributes of carbon chains' (page 120), presents the appropriate terminology to recognize carbon chains and their classifications (saturated, unsaturated, branched, for example), and also promotes a minimal construction of critical thinking, without delving into the real importance of scientific communication in ethical and environmental



issues. The suggested group activity on the synthetic production of indigo relates structural formula, organic synthesis and green chemistry, encouraging research, the development of critical analysis and the discussion on Science and Sustainability (EM13CNT302).

Topic 5, 'Stereochemistry of saturated carbon' (page 121), addresses essential concepts related to the theme discussed in this part, but does not stimulate the development of critical thinking or contextualize the relevance of stereochemistry in areas such as pharmacology and biomedicine. The lack of suggestions to stimulate dialogue and group activities limits the aspect related to citizenship formation. A richer proposal could include collaborative research on chiral molecules, interdisciplinary connections, and ethical debates.

Despite this, Topic 5 stands out for offering images of the three-dimensional molecular structure of methane (page 121), which can help in understanding the concept of molecular geometry. However, this section prioritizes technical and mechanical learning, focused on assessments, without encouraging ethical reflection or interdisciplinarity.

The questions suggested at the end of this topic, in the section 'Applying knowledge' (page 122), ask the reader to make inferences and argue about the structure-property relationship, using examples such as the molecules of lysine, cadaverine and threonine. This practice is capable of stimulating the development of critical textual and graphic analysis to consolidate learning.

Topic 6, 'Polymers' (page 123), addresses natural and synthetic macromolecules, highlighting ethical and environmental issues related to the production and disposal of plastics. The explanation of the polymerization reaction and the structure of starch connects the molecular structure to the properties of polymers, contributing to the development of EM13CNT306 ability.

In the 'Group activity' section, it is suggested to prepare a video for scientific dissemination, stimulating argumentation, systematization of knowledge and accessible communication (EM13CNT301 and EM13CNT302). This topic also highlights, through an illustration and a short text, the scientist Stephanie Kwolek, inventor of Kevlar, illustrating the practical application of polymers.

The section that closes the chapter, 'Final Activities' (page 124), presents external evidence questions that require interpretation and analysis of molecular structures. It is worth noting that one of them alludes to the degradation process of glyphosate, awakening the student to the optimization of the understanding of environmental problems.



However, many of these questions are inexpressive and practically make the content disconnected from the student's daily life, that is, they do not adequately explore the ability EM13CHS304. It would be necessary, therefore, for these activities to truly contribute to fostering debates on ethics and socio-environmental impacts.

3.2 A GENERALIZED ANALYSIS

Chapter 10, 'Fundamentals of Organic Compounds', of the book 'Scientific Knowledge', addresses fundamental contents of Organic Chemistry with some attempts at contextualization, however it remains stuck in a traditionalist and contentist approach. Although it brings examples from everyday life and group activities, there is a lack of depth in the ethical, socio-environmental, and interdisciplinary discussion, essential elements, according to the LDB (Brazil, 2023) and the BNCC (Brazil, 2017), to form critical and conscious citizens.

Activities often focus on memorization and preparation for assessments, failing to explore the potential to promote relevant critical debates on sustainability, social impact, and scientific responsibility (EM13CNT306). There is a lack of incentive for the development of simple and low-cost experimental activities, limiting the practical and investigative application of knowledge, which is fundamental for citizenship education. Thus, the chapter leaves something to be desired by integrating theory, practice and socio-environmental awareness, essential in preparing students for the challenges of the contemporary world.

In order for the chapter to fully achieve the objectives of the BNCC (Brasil, 2017), the active mediation of the teacher and the school is indispensable. Therefore, it is necessary for these actors to transform the content into opportunities for dialogue, critical reflection and interdisciplinarity, connecting Chemistry to themes related to ethics, the environment, biology, history and society. In addition, encouraging simple experimental activities and the use of digital technologies can contribute to student engagement, making learning more practical, investigative, and aligned with the socio-emotional and scientific competencies provided for in the curriculum guidelines.

Without this mediation, the didactic material runs the risk of being just a repository of technical information, disconnected from reality and contemporary educational demands. The critical and integrative performance of the teacher is essential to transform the content into living knowledge, capable of fostering citizenship education, socio-environmental responsibility and the potential of students to apply science in a conscious and innovative



way in their daily lives. In this way, teaching ceases to be a mere transmission to become an active process of construction and transformation.

The chapter is right to use acarajé as a bridge between Organic Chemistry and everyday life, highlighting the African origin of this dish. However, this success is restricted to the small text that accompanies the illustration of the dumplings, since the entire text of the chapter's introduction is dominated by traditionalism. There are no reflections on the ethnic-racial issues associated with the dish, nor even a discussion of religious syncretism, the role of black women in the Bahian tradition or the impact of colonization on the formation of Brazilian food culture.

It is worth noting that the LDB determines the mandatory teaching of Afro-Brazilian history and culture (Brazil, 2023), and the BNCC (Brazil, 2017) reinforces the appreciation of diversity and the fight against inequalities. Ignoring this deepening reinforces historical invisibilities, treating Afro culture only as a 'curiosity' and not as an essential part of the construction of national identity. The chapter thus wastes a potent trigger for the promotion of interdisciplinary debates on cultural heritage, resistance and belonging.

Despite exhibiting different ways of representing molecules (structural, rod, sphere, and rod formulas, among others) as tools for understanding the structure of compounds, the analyzed material lacks a critical and historical approach that can answer questions such as: Why do these representations exist? How did they come about? What limitations do they present?

Without this perspective, the opportunity to develop epistemological thinking, the look at science as a social construction, is lost. In addition, there are no experimental activities that allow students to build physical or digital models, which would make learning more concrete and accessible. The BNCC advocates the use of different languages and media to promote scientific understanding, which requires practical actions, and not just passive visual reading (Brasil, 2017). The absence of these practices makes the content abstract and exclusionary, hindering meaningful learning and the democratization of scientific knowledge.

The text of the chapter mentions the toxicity of benzene and refers to the National Health Surveillance Agency (ANVISA), but in a decontextualized way and without delving into the practical and political implications of these issues (Brasil, 1999). There is a lack of discussions about how inspections occur, what regulatory criteria are used or what are the legal limits for exposure to hazardous materials. In addition, the role of regulatory standards,



such as NR-15 (unhealthy activities), which are crucial for occupational safety, is completely ignored (Brasil, 2022).

This gap is serious, as it prevents students from understanding Chemistry beyond the classroom and as part of their lives; as a tool to assess risks, demand rights and propose solutions (EM13CNT306). The BNCC also encourages students to critically evaluate the impacts of materials and processes on the environment and public health. By not discussing safe or sustainable alternatives and by ignoring the debate on the use and disposal of chemical substances, the chapter fails in the process of forming critical and conscious citizens (Brasil, 2017).

4 FINAL CONSIDERATIONS

Chapter 10 of the book 'Scientific Knowledge', from the collection 'Moderna Plus: Natural Sciences and their Technologies', offers an introductory approach to Organic Chemistry distributed in six topics and some activities, including molecular representations, carbon chains, the benzene ring, the stereochemistry of saturated carbon and polymers.

In his presentation, specific attempts to connect the content to the student's daily life are highlighted, such as the association of some chemical compounds present in acarajé to the Afro-Brazilian culture, which demonstrates the potential to stimulate cultural and nutritional reflections, in addition to promoting the ability to critically evaluate the benefits and risks that some chemical substances can offer (EM13CNT104).

The pedagogical approach adopted by the chapter, however, remains marked by a traditionalist and content-based bias, with an emphasis on memorization and with little openness to the development of investigative practices, critical reflections or meaningful interdisciplinary connections. In other words, the chapter studied disappoints by not fully exploring the transformative potential of teaching the discipline of Chemistry.

Nevertheless, it is possible to say that it does not fulfill the function of satisfactorily introducing the fundamentals of Organic Chemistry in High School, since it contemplates only some of the skills provided by the BNCC, such as the construction and interpretation of chemical representations (EM13CNT301, EM13CNT302 and EM13CNT303) and the application of knowledge in real contexts (EM13CNT306).

Although there is potential to transit in a process of citizenship education, especially in topics such as chemical safety, cultural diversity and environmental impacts, this potential is underutilized. The superficiality with which the authors deal with ethnic-racial themes, the



absence of accessible experimental activities and the omission of discussions about regulations and the world of work, reveal limitations that compromise the emancipatory role of science education. The material lacks a broader formative intentionality, which goes beyond technical preparation and is capable of promoting a critical reading of the world, as recommended by the BNCC and the LDB.

The sections 'Dialoguing with the Text' and 'Applying Knowledge' offer questions and activities aimed at the development of technical knowledge and logical reasoning, but fail to promote in-depth critical discussion, interdisciplinarity and active engagement of students. Group activities are limited and underexplored in terms of collaborative and investigative development. Although research and discussions are proposed, there is a lack of stimuli for students to build practical or sensorial experiences, such as the manipulation of molecular models, which could strengthen their understanding and interest in the subject.

With regard to interdisciplinarity and socio-environmental awareness, the chapter approaches relevant topics, such as the use of polymers and their environmental impacts, but without deepening discussions on ethics, sustainability and responsible consumption (EM13CHS304).

The questions that end the chapter seem to be mainly focused on the preparation of students for school evaluations and external tests, since they focus on memorization and mechanical problem solving, leaving aside the stimulus to critical reflection and the contextualization of contents. All these characteristics observed in the chapter limit the formative potential of the material, reducing the scope of the competencies associated with citizenship-oriented education.

In view of these findings, teacher mediation becomes essential. It is the teacher's role to reinterpret the book, transforming it into a tool for dialogue, reflection and student protagonism. This requires planning, creativity, and commitment to transformative education.

From another perspective, it is necessary that the publishers and bodies responsible for the PNLD consider, in future editions, the insertion of pedagogical proposals capable of promoting the appreciation of cultural diversity and the development of scientific thinking, expanding the social reach of Chemistry Teaching. This means more contextualizing, interdisciplinary, critical approaches that value experimentation. Only in this way will it be possible to bring the learning of Organic Chemistry closer to the lives of students and, above all, to show them the importance of this knowledge for the exercise of citizenship.



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