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NATIONAL COMMON CURRICULAR BASE: INTERDISCIPLINARITY IN THE COMPETENCIES AND SKILLS OF THE AREA OF NATURAL SCIENCES AND THEIR TECHNOLOGIES

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ABSTRACT
This article discusses the BNCC, with emphasis on the competencies and skills defined for the area of Natural Sciences and its Technologies for high school. Through a qualitative documentary analysis, it was sought to identify whether they announce an interdisciplinary perspective. The results indicate that there is interaction of the curricular components Biology, Physics, and Chemistry in the competencies and skills, as well as components from other areas, evidencing an interdisciplinary perspective. However, these do not guarantee interdisciplinarity in practice, since their feasibility requires the intentionality of the subjects involved in the pedagogical work in the school.

Keywords: BNCC. Skills. Abilities. Interdisciplinarity.

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INTRODUCTION

The National Common Curriculum Base (BNCC) is a normative and propositional document of reference for the states and municipalities of the country, therefore, an orientation for basic education schools to organize their Political-Pedagogical Projects aligned with their curricular proposals. This document argues that essential knowledge should be guaranteed for all Brazilian students (Brasil, 2018) through the indication of a set of competencies and skills related to the areas of knowledge.

Such intentions, by themselves, demonstrate the relevance of conducting studies that seek to understand the meanings that the BNCC assumes as an expression of an educational project for society. It is to contribute to this debate that this article seeks to identify whether the competencies and skills for high school, defined for the area of Natural Sciences and their Technologies, present an interdisciplinary perspective. Specifically, it analyzes whether, in the competencies and skills of the BNCC, the treatment given to the objects of knowledge also expresses this type of perspective.

Despite the recognition of the relevance of adopting an interdisciplinary perspective in the school, the literature points out several obstacles to its implementation, such as lack of time for pedagogical planning (Carminatti; Del Piño, 2015); difficulty in understanding what interdisciplinarity is, since the literature itself does not offer a consensus on this (Klein, 1998); or problems related to teacher training arising from the organization of the curricula of teaching degree courses (Gozzi; Rodrigues, 2017).

It can be said that interdisciplinarity is a polysemic term and a possibility of enrichment of pedagogical practices that are still in the process of implementation. From these reflections, the following guiding question of this article is proposed: what advertisements are signaled by the BNCC for the development of an interdisciplinary perspective in the area of Natural Sciences and their Technologies in high school?

To reach possible answers, the study was developed as a qualitative research, through a documentary study, focusing on the competencies and skills defined in the BNCC for the area of Natural Sciences and their Technologies in high school. As for the procedures for data analysis, they were based on content analysis, as proposed by Bardin (2016).

To proceed with the analyses, also according to Bardin (2016), three steps were carried out. The first, the pre-analysis, consisted of a floating reading of the document (Bardin, 2016) previously defined for the study, in this case, the BNCC, intending to understand: (a) the general structure of the document; (b) its proposal for basic education; (c) its legal frameworks, as well as (d) the concept of competencies and skills that the document brings. With these data, it was possible to have a general overview of what the document announces, to identify, in the area of Natural Sciences and their Technologies, if there were clues in the competencies and skills described that could be admitted as elements that would favor an interdisciplinary approach.

The second stage, the exploration of the material, consisted essentially of coding, decomposition, or enumeration operations using previously formulated rules (Bardin, 2016). In it, it was sought to identify and select: (a) the objects of knowledge or contents addressed in each of the three competencies and 23 skills of the area; (b) the "registration units" related to the objects of knowledge that appear in the competencies and skills, linking them to the three curricular components of the area of Natural Sciences and their Technologies: Biology, Physics, and Chemistry.

In the third and last stage, treatment of the data generated, inference, and interpretation, we sought to understand the "context units" around the identified objects of knowledge and how they could express a certain perspective of interdisciplinarity in the three competencies and the 23 skills of the area in question.

It is important to note that the objects of knowledge are not made explicit by the BNCC in the competencies and skills of high school. Thus, these objects of knowledge were extracted by the authors during the documentary analysis from the understanding of competencies and skills that the document defends. For this document, the skills "express the essential learning that must be ensured to students in different school contexts" and, to this end, they are described to contemplate the cognitive processes (verbs that initiate the skill); a "complement of the verbs that explain the respective objects of knowledge" that were mobilized for a given skill and the "modifiers that explain the context and/or a greater specification of the expected learning" (BNCC, 2018, p. 29).

For the presentation, this article was structured in three sections. In the first, the fundamentals that define the BNCC for basic education are discussed, with emphasis on the guidelines for the area of Natural Sciences and their Technologies; in the second, a theoretical reflection is carried out on the concept of interdisciplinarity based on some categorizations built from Lenoir (2006) and Ramos and Ferreira (2020); in the third, the results of the analyses carried out are presented.

NATIONAL COMMON CURRICULAR BASE (BNCC): FOUNDATIONS AND PROPOSALS FOR THE AREA OF NATURAL SCIENCES AND THEIR TECHNOLOGIES

The Ministry of Education and Culture (MEC) defines the BNCC as a normative document that determines the organic and progressive set of essential learning that students must develop throughout the stages and modalities of basic education (Brasil, 2018).

Therefore, the BNCC is part of the national policy on basic education and contributes to the guidelines and alignments of policies and actions at the federal, state, and municipal levels, regarding teacher training, evaluation, preparation of educational content, and criteria for the provision of adequate infrastructure for the full development of education (Brasil, 2018).

The BNCC is provided for in the 1988 Constitution for elementary education and was expanded to secondary education with the approval of the National Education Plan (PNE), based on Law 13,005, of 2014, in line with Law No. 9,394, of December 20, 1996, which defines the Guidelines and Bases of National Education (Aguiar, Dourado, 2018).

Regarding the proposal for high school in the area of Natural Sciences and its Technologies, which involves the curricular components of Biology, Physics, and Chemistry, propositions are identified to reformulate the curricular proposals to expand and systematize the learning developed in elementary school, so that it can be

> explore the different ways of thinking and speaking of scientific culture, situating it as one of the forms of organization of knowledge produced in different historical and social contexts, enabling them to appropriate these specific languages. (BNCC, 2018, p.537).

To ensure these broader intentions, the BNCC brings specific competencies in the area, namely:

> I-Analyze natural phenomena and technological processes, based on the interactions and relationships between **matter and energy,** to propose individual and collective actions that improve production processes, minimize socio-environmental impacts, and improve living conditions at the local, regional, and global levels.
> II- To analyze and use interpretations about the dynamics **of Life, the Earth, and the Cosmos** to elaborate arguments, make predictions about the functioning and evolution of living beings and the Universe, and support and defend ethical and responsible decisions.
> III- To investigate problem situations and evaluate applications of scientific and technological knowledge and their implications in the world, using procedures and languages specific to the Natural Sciences, to propose solutions that consider local, regional, and/or global demands, and to communicate their findings and conclusions to various audiences, in different contexts and through different media and digital information and communication technologies (DICT); (Brasil, 2018, p.553).

In a brief reflection, in the first competency, an interaction between objects of knowledge is perceived that focuses on elements of matter and energy, which suggests an approach to the Physics curricular component, as well as an approach to Biology, when referring to the environment from the perspective of socio-environmental impacts. The second competence seems to be close to the area of Biology since it points to studies on the origin of life, the Earth, the Cosmos, and the evolution of living beings. In the last competency, the investigation of problems based on applications of scientific and technological knowledge in the area to propose and communicate relevant solutions to local, regional, and/or global demands is highlighted (Brasil, 2018, p.539).

Here, it is observed that the organization of the curriculum by areas of knowledge and by competencies and skills, as proposed by the BNCC, suggests, in the area of Natural Sciences, possibilities of interaction between the curricular components and their respective objects of knowledge. This interaction indicates interdisciplinary possibilities since it presupposes a dialogue between curricular components for learning to happen (Brasil, 2018).

Thus, it is observed that the proposition of competencies and skills, as previously indicated, despite the criticisms that can be made of the model and the process of its elaboration, promotes a certain degree of interaction between the components of the areas of knowledge through the connection between their objects of knowledge within each competence and skill proposed.

APPROACHES TO THE CONCEPT OF INTERDISCIPLINARITY

Talking about interdisciplinarity is still, today, a difficult and complex task due to the polysemy that the term has assumed over time. According to Ramos and Ferreira (2020, p.200), this polysemy refers to the "[...] existence of theoretical approximations and distancing on methods, objects and purposes related to it".

The term "interdisciplinarity" has been frequently used by professionals from different areas specifically from education and simplified in its practice. In the same direction, the BNCC also does not clearly define the concept of interdisciplinarity, although, for the document, the condition of its execution is well demarcated. It requires, in the document, the presence of elements that clarify or announce possible indications that ensure the possibility of organizing the pedagogical work aimed at interdisciplinarity. This fact accentuates the fragility in the teaching action that intends to develop practices focused on interdisciplinarity.

From this point of view, according to Lenoir (2006), the discussion on interdisciplinarity is based on two distinct orientations: on the one hand, from the epistemological point of view, the search for a conceptual synthesis, that is, a unification of the sciences and the unity of knowledge, and, on the other hand, the emphasis on answers to social or technological issues through instrumental or procedural approaches. Such issues enter schools with increasing demands in search of integration and interaction between peers.

In the search for a conceptual synthesis, Lenoir (2006) tells us that the first conception marked by critical concerns in the epistemological, ideological, and social planes is mainly of the European tradition, and particularly French. Its central concern is the conceptualization and understanding of interdisciplinary knowledge. The second conception is focused on interdisciplinary practice and operational procedures for its implementation. Regarding this type of trend, studies produced in the United States stand out (Lenoir, 2006).

More recently, works by Fazenda (1979, 2008, 2011), among others, have revealed another trend that is added to the two signaled by Lenoir (2006). This tendency gives the conceptual debates of interdisciplinarity an attitudinal focus.

To advance the discussions on the concept of interdisciplinarity with different approaches, the following authors will be taken: Pombo (1992), Santomé (1998), Klein (2010), and Fazenda (2011). Notably, these researchers have interdisciplinarity as an object of discussion and, therefore, it will be possible to identify conceptual approaches that favor the achievement of the objectives proposed here.

From the perspective of Pombo (1992), interdisciplinarity is defined as

> [...] any form of combination between two or more disciplines to understand an object from the confluence of different points of view and have as its final objective the elaboration of a synthesis about the common object (p. 12).

In this way, interdisciplinarity would be indicated by a process of approximation of knowledge, scientific or other of a markedly conceptual nature (Pombo, 2008). Thus, the meaning of interdisciplinarity mentioned is mainly focused on the epistemological field, directed to the elements involved in the process of construction of scientific knowledge.

Regarding the pragmatic perspective of interdisciplinarity, associated with the North American trend, Klein (2010) states that interdisciplinarity is the result of a greater approximation and integration, at the level of its theoretical frameworks, but especially methodological, between the disciplines that share the same object of study.

Following this approach, Klein (2010) mentions that interdisciplinarity has been characterized as practices of integration, interaction, or collaboration between different perspectives that need to be repeatedly exercised. With this, interdisciplinarity is materialized through continuous action and practice among specialists through communication and reciprocal collaboration. Ramos and Ferreira (2020, p. 209) point out

> In this type of approach, it is observed that there is an emphasis on a pragmatic dimension of interdisciplinarity, a perspective that brings in its conceptual elaborations terms related to borrowings and collaborations of disciplines, especially in the scope of methods aimed at solving practical and theoretical problems.

As for studies on interdisciplinarity in Brazil, Hilton Japiassu and Ivani Fazenda stand out, with greater emphasis on the latter.

Fazenda (2011) defines it as a different attitude to be assumed in the face of the problem of knowledge, that is, it is the change from a fragmentary to a unitary conception of the human being. In this sense, the author argues that it is necessary to be more open to understanding hidden aspects of the act of learning, putting them into question. Their discussions highlight interdisciplinarity in the field of school education. For her, the interdisciplinary training of teachers involves the development of interdisciplinary principles, which are: humility, coherence, waiting, respect, and detachment (Fazenda, 2011). In other words, interdisciplinarity is understood as experience, as an exercise among peers (Fazenda, 1979).

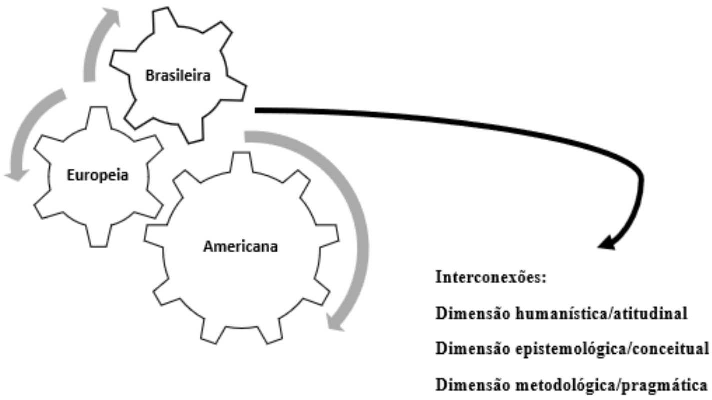
Still, according to the perspective favored by the same author, it can be said that interdisciplinarity is understood based on the attitudes adopted by the subjects. In this way, interdisciplinarity would be based on a perspective that requires the interaction between subjectivities, whose focus is on the attitudes of the subjects: researchers, teachers, etc. (Fazenda, 2011)

Given the above, and based on the studies of Ramos and Ferreira (2020) and Lenoir (2006), three dimensions are evident that can be identified when trying to conceptualize interdisciplinarity: the epistemological dimension - which emphasizes the processes of production and approximation of scientific knowledge or others of a conceptual nature; the methodological or pragmatic dimension - which reflects an approximation and/or integration, mainly methodological, between the disciplines that share the same object of study; and the attitudinal dimension - which highlights the action and continuous practice of communication and reciprocal collaboration between specialists.

In this sense, it is also pointed out that the epistemological and methodological dimensions are similar in terms of collaboration between different disciplines both from a conceptual and procedural point of view, respectively, since they are interdependent acts and are not dissociated. In the same way, the methodological dimension is close to the attitudinal (humanistic) dimension at a time when interdisciplinary practice requires the attitude of people through interaction, collaboration, and communication around certain objects of study.

In this understanding, the American, European, and Brazilian tendencies presuppose a sense of "complementarity, addition, encounter, coherence, affinity as a kind of gear in which harmonic movement depends fundamentally on the interconnections between these concepts" (Ramos, 2016, p. 96), as expressed in the following figure:

Figure 01. Interconnection between the perspectives of Interdisciplinarity



Source: Ramos, 2016, p. 96.

Thus, the epistemological/conceptual, methodological/pragmatic and attitudinal/humanistic dimensions must be perceived in a way that complements each other to ensure a broader understanding of the concept of interdisciplinarity. In an attempt to signal a concept of interdisciplinarity that articulates these three dimensions without, however, privileging any of them, Ramos and Ferreira (2020, p.211) situate interdisciplinarity from the point of view of "connection/communication/interaction between knowledge/knowledge/methods/people".

INTERDISCIPLINARY POSSIBILITIES OF OBJECTS OF KNOWLEDGE IN AREA COMPETENCIES AND SKILLS

In the BNCC for high school, objects of knowledge are defined as "contents, concepts, and processes" (Brasil, 2018, p. 28). For the area of Natural Sciences and their Technologies, they are organized into the following thematic units: Matter and Energy, Life and Evolution, Earth and Universe (Brasil, 2018).

For this analysis, initially, the objects of knowledge of the curricular components of the area were identified, as defined in the BNCC. Then, objects related to other components and also about digital technologies were listed, which were signaled using italics and colors, namely: Biology/green; Physical/blue; Chemical/orange; Scientific and Technological Knowledge/lilac and Others/yellow, according to subtitles. Finally, it was verified which component these objects are articulated with and the relationship between them. This exercise can be seen in the tables presented below.

It is worth noting that these highlights, as well as the interpretations, depend, to a certain extent, on who reads them and, naturally, analyzes them. Therefore, they are dynamic interpretations and open to other possibilities of reading. However, they become valid to the extent that this study and selection of the objects of knowledge had as reference the Curricular Referential Document of Bahia (DCRB) for High School, which points out essential objects of knowledge for each curricular component. It is important to highlight that this study aims to reaffirm the possibilities of connection between the curricular components based on the proposal of curricular organization present in the BNCC and does not commit to accurately listing all the objects of knowledge that can be related.

Table 01. Competencies of Natural Sciences and their Technologies and their objects of knowledge (BNCC, 2018).

SPECIFIC COMPETENCIES OF NATURAL SCIENCES AND THEIR TECHNOLOGIES	OBJECTS OF KNOWLEDGE
Analyze natural phenomena and technological processes, based on the interactions and relationships between *matter and energy* to propose individual and collective actions that improve production processes, minimize socio-environmental *impacts* and improve living conditions at the local, regional and global levels.	Matter and Energy
	Social and environmental impacts
Analyze and use interpretations about the *dynamics of Life*, Earth *and the Cosmos* to elaborate arguments, make predictions about the functioning and *evolution of living beings and the Universe*, and support and defend ethical and responsible decisions.	Dynamics of life, the Earth and the Cosmos
	Evolution
Investigate problem-situations and evaluate applications of *scientific and technological knowledge* and their implications in the world, using procedures and languages specific to the Natural Sciences, to propose solutions that consider local, regional and/or global demands, and communicate their findings and conclusions to varied audiences, in different contexts and through different media and digital information and communication technologies (DICT).	Scientific and technological knowledge

Source: BNCC, 2018, p.554. Table prepared by the authors, 2021. **Color Legend:** Reference Curricular Components

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In table 01, competence (I) points out the objects of knowledge "matter and energy" articulated with the Physics component and "environmental impacts" associated with the field of Biology and Chemistry. By proposing that a competence articulates objects of knowledge from different curricular components, there is a clear indication of interaction between different areas.

This finding reveals possibilities of connections between components based on the development of competence I through the interaction between objects of knowledge. This interaction exemplifies one of the dimensions signaled in the study by Ramos and Ferreira when they argue that interdisciplinarity enables "interaction, interconnection, combination, and cooperation, to identify and advance the understanding of common objects of study" (2020, p. 205). In this way, these objects would act as articulators for the interaction between the components of the area, announcing the need for a change in the approach to pedagogical practices in the school.

In the second competency, the relationship between the objects of knowledge "dynamics of life" and "cosmos and evolution" is verified, both related to the Biology component. In this case, there is a possibility of communication between branches of knowledge of the same component, which also suggests a movement of interaction, interconnection between objects of knowledge.

The last competency signals a connection between "scientific knowledge and digital technologies". In this case, although it is not considered an area of knowledge in the BNCC (2018), digital technologies are present as a necessary complementarity that should guide basic education curricula and, therefore, should transit in the various areas.

During the analysis, it was also observed the presence of Transversal Contemporary Themes (Brasil, 2019) in the competencies of the area, such as: "environment", in competence (I) and "science and technology" in competence (III), which suggests a starting point to promote the interaction of these objects with the distinct components.

It can be inferred that these Themes enable the interaction between the different curricular components, as well as enable the establishment of connections with situations experienced by students in their realities, contributing to bring context and contemporaneity to the objects of knowledge described in the BNCC (Brasil, 2018).

Chart 02 analyzes the same aspects seen in Chart 01, this time with the description of skills articulated with area competencies.

Table 02. Skills of the first Competence in the area of Natural Sciences and their Technologies and their objects of knowledge (BNCC, 2018).

CODE	SKILLS OF COMPETENCE I	OBJECTS OF KNOWLEDGE
(HAB01)	Analyze and represent, with or without the use of specific digital devices and applications, the transformations *and conservation in systems* that involve quantities of *matter, energy* and movement to make predictions about their behavior in everyday situations and in production processes that prioritize *sustainable development*, the conscious use of *natural resources* and the preservation of life in all its forms.	Matter and Energy Sustainability Natural resources
(HAB02)	Perform forecasts, evaluate interventions and/or build prototypes of thermal systems aimed at *sustainability*, considering their *composition* and the effects of *thermodynamic* variables on their operation, also	Sustainability Thermodynamics Thermal compositions

	considering the use of digital technologies that help in *the calculation of estimates* and support the construction of prototypes.	Calculations and estimates
(HAB03)	Use knowledge about *radiation* and its origins to evaluate the potential and risks of its application in everyday equipment, in *health*, in the *environment*, in industry, in agriculture and the generation of electricity.	Radiоactivity Health Environment
(HAB04)	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.	Health Environment Toxicity Reactivity
(HAB05)	Analyze *biogeochemical cycles* and interpret the effects of *natural phenomena* and human interference on these cycles, to promote individual and/or collective actions that minimize *harmful consequences to life.*	Biochemical Products harmful to life Natural phenomena
(HAB06)	Evaluate, with or without the use of digital devices and applications, technologies and possible solutions for the demands involving the generation, transportation, distribution and consumption of *electricity,* considering the availability of resources, energy efficiency, cost/benefit ratio, geographical and *environmental* characteristics, waste production and socio-environmental *and cultural* impacts.	Electrical energy Environment Social and environmental impacts
(HAB07)	Perform qualitative and quantitative forecasts on the operation of generators, electric motors and their components, coils, transformers, batteries, and *electronic devices,* based on the analysis of the energy transformation and *conduction processes* involved – with or without the use of digital devices and applications – to propose actions aimed at *sustainability*.	Electronic devices Power Conduction Sustainability

Source: BNCC, 2018, p.555. Table prepared by the authors, 2021. **Color Legend:** Reference Curricular Components

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From this analysis, it can be seen that in HAB01, HAB03, HAB06 and HAB07 of competence I, the objects of knowledge identified refer more to the Physics and Biology components, simultaneously. In HAB02, in addition to Physics and Biology, they also bring together objects of knowledge from Chemistry and Mathematics through "thermal compositions/calculations and estimates". This last ability suggests the interaction between four different components, one of which is external to the area of Natural Sciences.

In HAB04 and HAB05 the objects of knowledge are related to the components of Biology and Chemistry. Given this, it is understood that interaction can occur when, for example, from physical phenomena and chemical reactions, there are biological manifestations.

In the same way, based on the skills of the first competency, objects of knowledge of Biology were identified in practically all of them. With this, the possibility of interaction between Biology, Physics and Chemistry arises, by inserting knowledge such as "sustainability", "environment", "health" related to "thermodynamics" and "products harmful to life", as highlighted in Chart 02.

The interaction and communication between the disciplines of Biology, Physics, Chemistry and Mathematics, observed in the skills, differs from the idea of fragmentation of knowledge. On this issue, Simoneti (2015) points out that it has been going on for a few decades. In this sense, Santomé (1998, p.8) emphasizes that "educational goals should not lead to atomizations in school content and tasks; otherwise, the structure that gives meaning to school work will be lost sight of."

Regarding the skills of the second competency, the following results were found.

Table 03. Skills of the second competence in the area of Natural Sciences and the objects of knowledge (BNCC, 2018).

CODE.	SKILLS-COMPETENCE 2	OBJECTS OF KNOWLEDGE
(HAB01)	Analyze and discuss models, theories and laws proposed in different times and cultures to compare different explanations about the emergence and *evolution* of Life, Earth *and the Universe* with the scientific theories accepted today.	Evolution Earth and the universe
(HAB02)	Analyze the various forms of manifestation of life at its different levels of organization, as well as the favorable *environmental conditions* and the limiting factors to them, with or without the use of digital devices and applications (such as simulation and virtual reality software, among others).	Environmental conditions
(HAB03)	Evaluate and predict the effects of interventions on *ecosystems*, and their impacts on living beings and the human body, based on the mechanisms of life maintenance, the *cycles of matter*, and *the transformations and transfers of energy,* using representations and simulations on such factors, with or without the use of digital devices and applications (such as simulation and virtual reality software, among others).	Ecosystems Energy transfers Cycles of matter
(HAB04)	Develop explanations, predictions, and *calculations* regarding the movements of objects on Earth, in the *Solar System, and the Universe* based on the analysis of *gravitational interactions,* with or without the use of digital devices and applications (such as simulation and virtual reality software, among others).	Solar system and universe Calculations Gravitational interactions
(HAB05)	Interpret results and make predictions about experimental activities, natural phenomena and technological processes, based on the notions of *probability and uncertainty,* recognizing the explanatory limits of the sciences.	Experimental activities; Natural phenomena. Probability and uncertainty Natural phenomena

(HAB06)	Discuss the importance of preserving and conserving *biodiversity*, considering qualitative and quantitative parameters, and evaluate the effects of human action and environmental policies to ensure the *sustainability of the planet*.	Biodiversity Sustainability
(HAB07)	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, to develop and disseminate actions for prevention and promotion of *health and well-being.*	Health and well-being
(HAB08)	Apply the principles of biological *evolution* to analyze *human history*, considering its origin, diversification, dispersion across the planet and different forms of interaction with nature, valuing and respecting human ethnic and cultural diversity.	Evolution Human history
(HAB09)	Analyze *stellar evolution* by associating it with models of origin and distribution of *chemical elements* in the Universe, understanding their relationships with the conditions necessary for the emergence of *solar and planetary systems,* their structures and compositions and the possibilities of the existence of life, using representations and simulations, with or without the use of digital devices and applications (such as *software* simulation and virtual reality, among others).	Solar and planetary system Stellar evolution Chemical elements

Source: BNCC, 2018 p. 557. Table prepared by the authors, 2021. **Color Legend:** Reference Curricular Components

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When analyzing the skills HAB01, HAB02, HAB06 and HAB07, it was initially observed that they present objects of knowledge associated with the field of Biology. In the HAB03 and HAB04 skills, the interconnections between Physics and Biology stand out, through specific objects of knowledge of these disciplines.

In the same context, in the skills HAB05 and HAB09, in addition to biological concepts, elements of Chemistry are identified, expressed in the terms 'chemical elements' and 'experimental activities'. This knowledge can even establish connections with other components, such as Physics and Biology. In HAB08, in turn, objects of knowledge from Biology and History are highlighted.

In the same way as in the skills of Competency I, in the HAB04 of Competency II, objects of knowledge in the field of Biology were also identified, associated, in this case, with those of Mathematics. These findings show the presence of an interaction between Biology and components that encompass other areas of knowledge, such as Mathematics and its Technologies, as well as Applied Human and Social Sciences.

Chart 04, presented below, reproduces the same exercise carried out with the skills of Competence III for the area of Natural Sciences and its Technologies.

Table 04. Skills of the third competence in the area of Natural Sciences and the objects of knowledge (BNCC, 2018).

CODE.	SKILLS-COMPETENCE 3	OBJECTS OF KNOWLEDGE
(HAB01)	Construct questions, elaborate hypotheses, forecasts and estimates, employ measurement instruments and represent and interpret explanatory models, data and experimental results to construct, evaluate and justify conclusions in facing problem situations from a *scientific perspective.*	Scientific perspective
(HAB02)	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), to participate and/or promote debates around scientific and/or technological themes of sociocultural relevance and *environment*.	Graphs, tables, symbols, codes, and equations. Environment
(HAB03)	*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.	Text interpretation Graphs, tables and equations.
(HAB04)	Analyze and debate controversial situations on the application of knowledge in the area of Natural Sciences (such as *DNA technologies,* stem cell treatments, *neurotechnologies,* production of defense technologies, pest control strategies, *among others), based on consistent, legal, ethical and responsible arguments, distinguishing different points of view.*	DNA technology Stem cells Neurotechnology Pest control
(HAB05)	Investigate and discuss the misuse of knowledge from the Natural Sciences in justifying processes of *discrimination*, segregation and deprivation of *individual and collective rights*, in different social and historical contexts, to promote equity and respect for diversity.	Discrimination Individual and collective rights
(HAB06)	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.	Life risks in everyday activities Social and environmental integrity Physical, individual and collective integrity
(HAB07)	Analyze the *properties of materials* to assess the suitability of their use in different applications (industrial, everyday, architectural or technological) and/or propose safe and *sustainable solutions* considering their local and everyday context.	Properties of materials Sustainability

Source: BNCC, 2018, p. 559. Table prepared by the authors, 2021. **Color Legend:** Reference Curricular Components

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HAB07 presents objects of knowledge in Biology and Chemistry by addressing the themes of 'sustainability' and 'material properties'. In HAB01, the object 'scientific perspective' stands out, common to all components of the Area and other areas of knowledge. In HAB02, content from other areas, such as Mathematics, is again observed through the reference to 'tables, graphs and symbols', interacting with the objects of knowledge of Biology.

In HAB03, objects of knowledge of Mathematics and Portuguese Language associated with Biology are identified when dealing with 'interpretations of texts', 'equations, graphs and tables' for the understanding of scientific texts and reliability of information. In HAB04 and HAB06, the objects of knowledge of the Biology component articulated only with their technologies are evidenced, while HAB05 presents the objects of knowledge 'discrimination', 'individual and collective rights' from a scientific perspective, associated with the components of the area of Applied Human and Social Sciences and their Technologies.

The previous analysis indicates that of the three competencies in the area, one stands out for the evident interactions it signals between the disciplines of Natural Sciences and other areas. Of the 23 skills that make up the three competencies, 17 present objects of knowledge that show explicit approximations between various components, thus favoring the movement of dialogue presupposed by interdisciplinary practice. This suggests an "intense and dynamic process of connection, communication, and interaction, in which reciprocity, mutuality, and dialogicity can be present between knowledge and knowledge" (Ramos and Ferreira, 2020, p. 213-214), indicating a significant path taken. However, it is not possible to guarantee that this same process applies to methods and people (Ramos and Ferreira, 2020).

Among the 17 skills that enable a more objective dialogue between the reference components and others, groupings were identified that show the following connections, as shown in Chart 5.

Table 05. Interactions between disciplines of references in the Skills in the area of Natural Sciences and their Technologies.

GROUP	INTERACTION BETWEEN DISCIPLINES	SKILLS
G1	Interaction between Biology and Physics	(EM13CNT101), (EM13CNT103), (EM13CNT106) and (EM13CNT107);
G2	Interaction between Biology and Chemistry	(EM13CNT104), (EM13CNT105), (EM13CNT209), (EM13CNT307) and (EM13CNT307).
G3	Interaction between Biology, Physics and Chemistry.	(EM13CNT102) and (EM13CNT203).
G4	Interaction between Biology and other disciplines, such as Mathematics, History, Portuguese Language, Physical Education and Sociology.	(EM13CNT204), (EM13CNT205), (EM13CNT208), (EM13CNT302), (EM13CNT303) and (EM13CNT305).

Source: Table prepared by the authors (2022).

Based on the results, it is possible to verify that 23% of the seventeen skills are related to the interaction between Biology and Physics; and 12% of them bring interactions between the disciplines of Biology, Physics and Chemistry. A percentage of 30% was evidenced in the skills that presented a relationship between Biology and Chemistry, and 35% for Biology with other disciplines.

These interactions express, therefore, an interdisciplinary perspective when we take as a reference the need for dialogue between the disciplines of the school curriculum as one of its conditions, thus allowing the production of innovative and dynamic resources in which learning can be contextualized and expanded (Bonatto, 2012).

This condition becomes relevant, because interdisciplinarity stems from the interaction between the components based on the understanding of the multiple factors that intervene in the reality that conditions them. In addition, this focus implies working with several languages that are essential for the production, communication, and negotiation of meanings, as well as for the systematic recording of results (Brasil, 2018).

Therefore, it can be stated that the BNCC (Brasil, 2018), in the areas of Natural Sciences and their Technologies, both about competencies and skills, makes explicit one of the assumptions to foster interdisciplinarity in the structuring of school curricula: the interaction between the components through conceptual and epistemological approximations. This point highlights the nature of the document under analysis. The BNCC, as mentioned, serves as a reference for the organization of other curricula, local and transversal. In this context, as it is conceived based on a vision of approximation of concepts, it represents a significant advance. However, we argue that, currently, interdisciplinarity transcends this movement of conceptual approximations. It incorporates other dimensions and practices that involve not only the approximation of methods, but also depend, in an essential way, on people's attitudes.

FINAL CONSIDERATIONS

The research in question focused on the analysis of the National Common Curricular Base (BNCC) for the area of Natural Sciences and its Technologies in high school, aiming to identify a possible interdisciplinary perspective present in the competencies and skills outlined by the document. The study started from the understanding that the BNCC is a normative and propositional instrument for the organization of the Political-Pedagogical Projects of the schools, guiding the offer of fundamental knowledge to Brazilian students. In this context, the article questioned how the competencies and skills proposed by the BNCC for the area in question reflect an interdisciplinary approach. By addressing challenges associated with the implementation of interdisciplinarity, such as the lack of time for pedagogical planning and the ambiguous understanding of this concept in the literature, the research proposed to critically analyze the presence of interdisciplinary elements in the BNCC. The study used a qualitative approach, with documentary analysis of competencies and skills, adopting the content analysis methodology proposed by Bardin (2016).

The results of this research highlighted that the BNCC competencies for the area of Natural Sciences and their Technologies in high school, express the "interaction between objects of knowledge", suggesting an interdisciplinary perspective. Similarly, most of the skills in the BNCC are outlined from this approach, highlighting interaction in 17 of the 23 skills.

It is relevant to note, especially about competencies, the presence of contemporary themes that encompass contents of the three curricular components of the area of knowledge Natural Sciences and their Technologies, evidenced in competencies I and II. In addition, it was observed the presence of skills that involve the interaction between curricular components of other areas of knowledge, such as Mathematics, History, Sociology and Portuguese Language.

The results indicate that most of the competencies and skills present evidence of an interdisciplinary approach articulated to the perspectives discussed in this work. Thus, the importance of these results is highlighted, especially considering the relevance of the BNCC for basic education in the country, as a national curriculum reference with the explicit intention of enabling interdisciplinarity.

It is concluded, therefore, that the document for the area of Natural Sciences and its Technologies presents more interdisciplinary than disciplinary aspects, establishing several components to foster a new approach to the objects of knowledge in schools. However, it is necessary to recognize that the proposal of interaction between objects of knowledge by the BNCC, indicative of an interdisciplinary approach, does not guarantee its effective adoption in everyday school life. Interdisciplinarity will only be achieved through the intentionality of those involved in the pedagogical work, reiterating that it needs to be practiced as a praxis, requiring connection, interaction and dialogue between knowledge, methods and people so that it acquires meaning and promotes substantial changes in schools, as Ramos and Ferreira announce (2020).

Finally, it is hoped that this study will contribute to the reflection on interdisciplinarity as praxis, adopting a broad and complex perspective in which the interaction between disciplines is an important, but not exclusive, condition. The importance of elements such as dialogue, interaction, communication and connection between knowledge, methods and people to understand interdisciplinarity as spaces of new knowledge and collective practices in complex scenarios is highlighted. This highlights the intentionality that characterizes interdisciplinarity as a praxis, aiming at the transformation of schools into spaces that respect the social practices of students and contribute to the construction of a fairer society.

And, as a recommendation of this research, to further expand the understanding of interdisciplinarity in the BNCC for Natural Sciences and their Technologies in high school, it would be interesting to explore the practical implementation of these guidelines in schools, investigating the challenges faced by educators in the effective incorporation of the interdisciplinary approach. In addition, it would be valuable to examine students' perceptions of interdisciplinarity and how it influences their engagement and learning. Another promising path would be the comparative analysis between schools that adopt interdisciplinary strategies and those that follow a more traditional approach, seeking to identify impacts on pedagogical practices and educational outcomes. These investigations could contribute significantly to the improvement of educational policies and school practices, promoting a more integrated education aligned with contemporary demands.

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