Curriculum and Curriculum Integration: possibilities and challenges between Physical Education and Mathematics at BNCC

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Abstract: By investigating the possibilities of curricular integration between Physical Education and Mathematics from the Base Nacional Comum Curricular, we defend curricular integration as an integrated approach to learning and curricula that provide students and teachers with an expansion of different ways of teaching and learning by through new alternatives in the incorporation of the knowledge of these two disciplines. From the theoretical framework adopted, which refers to reflections on curriculum and curriculum integration, a qualitative research was developed through document analysis of the BNCC as well as the possibilities of this integration based on competences. The results indicate that, in general, the BNCC does not mention the term curricular integration, but it presents evidence in this sense that lack more theoretical specificity in our view that exist and can materialize in the relations of some competences present in the BNCC between these two disciplines.

Keywords: Curriculum. Curriculum Integration. Physical Education. Mathematics. BNCC.

Curriculum e Integração Curricular: possibilidades e desafios entre a Educação Física e as Matemáticas na BNCC

Resumen: Al indagar en las posibilidades de integración curricular entre Educación Física y Matemáticas desde la Base Nacional Comum Curricular, defendemos la integración curricular como un enfoque integrado del aprendizaje y currículos que brinden a estudiantes y docentes una ampliación de diferentes formas de enseñar y aprender a través de nuevas alternativas, en la incorporación de los conocimientos de estas dos disciplinas. A partir del marco teórico adoptado, que se refiere a las reflexiones sobre el currículo y la integración curricular, se desarrolló una investigación cualitativa a través del análisis documental de la BNCC, así como las posibilidades de esa integración a partir de competencias. Los resultados indican que, en general, la BNCC no menciona el término integración curricular, pero presenta evidencias en ese sentido que carecen de mayor especificidad teórica a nuestro juicio que existen y pueden materializarse en las relaciones de algunas competencias presentes en la BNCC entre estas dos disciplinas.

Palabras clave: Currículo. Integración curricular. Educación Física. Matemáticas. BNCC.

Curriculum e Integração Curricular: possibilidades e desafios entre

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Educação Física e Matemática na BNCC

Resumo: Ao investigarmos as possibilidades de integração curricular entre Educação Física e Matemática a partir da Base Nacional Comum Curricular, defendemos a integração curricular como sendo uma abordagem integrada de aprendizagens e de currículos que proporcionam aos estudantes e professores uma ampliação de modos diferentes de ensinar e aprender por meio de novas alternativas na incorporação dos conhecimentos dessas duas disciplinas. A partir do referencial teórico adotado, que remete às reflexões sobre currículo e integração curricular, foi desenvolvida uma pesquisa qualitativa por meio da análise documental da BNCC bem como as possibilidades dessa integração a partir das competências. Os resultados indicam que, de forma geral, a BNCC não cita o termo integração curricular, porém apresenta indícios neste sentido que carecem de mais especificidade teórica ao nosso olhar que existem e podem se materializar nas relações de algumas competências presentes na BNCC entre estas duas disciplinas.


1 Introduction

Many authors have highlighted the importance of the curricular dimensions that permeate history at different times, such as: Santomé (1998), Lopes and Macedo (2011), Moreira and Candau (2014), Godson (2018), Felício and Alonso (2016) and Sacristán (2000). Thus, investigating the issues of the curriculum puts us in front of the reality of which we are part, the school, and allows us to reflect on the scholars on this journey. In this study, we are in favor of a dynamic and flexible curriculum that allows the teacher and, consequently, the student, new ways of teaching and learning.

The definition of curriculum for Sacristán (2000, p. 34) appears as being “the cultural project, being culturally, socially, politically and administratively conditioned that fulfills the school activity and that becomes reality within the conditions of the school as it is configured”. For the author, the implementation of the curriculum depends on its format and the conditions in which it is developed.

For Lopes and Macedo (2011), investigations have defined curriculum in very different ways and several of these definitions have placed the curriculum in the school routine. Still for the authors, the curriculum and its manifestations are productions of meanings that partially direct the reader within a given historical moment, whether the curriculum is spoken, written or veiled. Thus, at the intersection of these meanings and different social and cultural discourses, this curriculum builds reality and projects our identity.

Other authors, such as Godson (2018, p. 10), recognize that the curriculum is
linked not only to social issues, but also to the identities of individuals included or excluded from society, considering that "different curricula produce different people, not only individual differences, but also social differences. In this same perspective, Moreira and Candau (2014) reinforce and defend the need for the curriculum at school to go through contextualization and understanding of the social processes to which it is inserted.

Thus, from the perspective of school education, one of these formats that Sacristán (2000) claims, the social contextualization indicated by Moreira and Candau (2014) and Godson (2018), and the production of meanings that Lopes and Macedo (2011) point out, can be via an integrated curriculum. According to Beane (2003), integrating courses is the action of incorporating, bringing together, different subjects, elements of two or more courses in the same learning situation of the school subjects. Therefore, we point our views in order to contribute to the discussions on curriculum issues that already exist within schools, through construction and deconstruction in relation to subjects and knowledge, aiming a more integrated perspective of both.

The use of the Base Nacional Comum Curricular, a document legally approved in 2017 for Early Childhood Education and Elementary Education, is justified because it is an official curricular document of reference for the elaboration of the curricula of state and municipal bodies, serving, according to the document itself, of direction for the democratic, egalitarian and integral development of education throughout the national territory, through policies and joint actions for this purpose. As we read in the BNCC, for the Early Years of Elementary School, it is emphasized that playful character must be present in this phase of children's learning situations, as this is the link between what was learned in Early Childhood Education (BRASIL, 2017).

Physical Education, according to the text of the BNCC, makes up the area of languages and should provide students in the Early Years with practices that focus on traditional and contemporary children's culture, directing children to greater autonomy and protagonism (BRASIL, 2017). As for Mathematics, at this stage of school learning, the BNCC indicates that it should be committed to mathematical literacy, defined as the competences and abilities to reason, represent, communicate and argue mathematically, in order to favor the establishment of conjectures, the formulation and resolution of problems in a variety of contexts, using concepts, procedures, facts and mathematical tools (BRASIL, 2017, p. 264).
As much for Physical Education as for Mathematics and other courses, the BNCC comes, throughout the text, pointing out the need for a greater dialogue between the courses and their conjectures in favor of a more democratic and inclusive learning possible. In this context, and in the search for new meanings for the curriculum, we aim to: investigate the possibilities of curricular integration between Physical Education and Mathematics from the Base Nacional Comum Curricular.

In this search, we reiterate, first, the curriculum, its importance, its studies and authors that can guide us in this part of the crossing of the disciplinary curriculum until we reach the understanding of the curricular integration of which Beane (2003), Felício and Alonso (2016) and Lopes and Macedo (2011) talk about. The term curricular integration, which we address in this paper, is related to a curricular organization that provides an expansion in every way between two courses, Physical Education and Mathematics, towards a curricular perspective that has connections between knowledge, experiences and that make sense in the reality of students.

As for the methodological choices, several methods are used in qualitative research to promote an approximation with the social reality that is intended to be researched, and document analysis is the one that seeks to understand this reality (SILVA et al., 2009). Thus, we will analyze the possible dialogues and challenges of curricular integration between Physical Education and Mathematics through the document analysis of the BNCC, approved in December 2017, in relation to what the text brings in terms of curricular integration possibilities in general and the competences of these two courses, which can overlap in the two fields of knowledge in the same learning situation.

We will now describe the disciplinary curriculum that, over many years, is a concrete action in most schools around the world, as pointed out by Lopes and Macedo (2011), and then the discussions and considerations about the integrated curriculum, so that we can direct us to the possible answers to the outlined objective.

2 Disciplinary curriculum

In the present session, we took a tour of the curriculum in terms of the issues that mark its organization into disciplines in order to expand this understanding towards the integrated curriculum.

For teaching purposes, school knowledge can be organized in several ways.
According to Lopes and Macedo (2011), in teaching activities, school contents were curricularized in a disciplinary organization. For these authors, the disciplining of teaching means an organization based on the control of knowledge, subjects, spaces and times in a school. Notably, we see this in the day-to-day of this organization and in the control of the school when we observe the organization of schedules to follow, the arrangement of chairs in a row and the very configuration of the classroom, elements that can be taken as examples.

In addition to this disciplinary organization, translating what you want to teach into the limitations of time, space and content in this type of curriculum, centered on disciplines, also defines the type of citizen you want to train, its principles as well as the principles for teacher training, teaching methods, in addition to guiding certification and issuing of diplomas, as stated by Lopes and Macedo (2011).

According to Santomé (1998), this organization creates teaching rituals as a way of asking and documenting the answers in routines and languages that contribute to the legitimation and definition of this type of organization of the curriculum in a disciplinary way. In this dynamic, educational institutions have as their educational goal the ascension and approval in new stages and cycles. This linearity of the curriculum follows a sequence that, according to the same author citing Bernstein (1998), isolates the disciplines and their contents without any relation, minimizing the actions of both teachers and students on the curriculum. This author makes us think about the role of education in the cultural reproduction of power and class relations in which the curriculum is a form of social control.

In this respect, Santomé (1998, p. 106) points out that “concerns for an integral formation of the human being, to help them understand their society and enable them to be citizens with full rights, retreat before criteria of business profitability”. This organization of the curriculum in disciplines, according to the author, does not favor the global view of knowledge to intervene in reality in order to transcend the limits within which we work with each discipline. Therefore, we will bring the discussion about curriculum integration as an alternative for organizing the curriculum.

All these positions and criticisms of the disciplinary curriculum, over time, have not changed and have been perpetuated, as we still realize that in school spaces, alternative activities to the disciplinary curriculum are little encouraged. However, we do not want to expose that this way or another way of organizing the curriculum is
wrong, since what we intend is to propose another alternative to work with school knowledge in a less fragmented, more holistic and expanded way.

3 Integrated curriculum

When looking for the meanings of the word integration, according to Ferreira (1999), we found some synonyms, such as: incorporation, set, intersection, assimilation, aggregation, approximation, connection. Faced with so many meanings for curricular integration, the studies of authors such as Kilpatrick (1918), Decroly (1965) and Dewey (1959), cited by Santomé (1998), and Beane (2003), converge towards a critique of the disciplinary curriculum or to its limitations, as shown by Aires (2011). From the 1920s onwards, according to Santomé (1998), every major pedagogical movement has promoted the need for an education centered on childhood. A worldwide movement that arises as a reaction to some school institutions and pedagogical discourses dominated by academicism and the memorization of content that is not relevant to students (SANTÔMÉ, 1998, p. 35).

At this moment, according to the author, the New School movement takes place in Europe and in the United States, the Progressive Education Association, which are the groups that defend school innovations at the time embedded in Rousseau's discourse with emphasis on the individual dimensions of each child. In Brazil, the New School, according to Lopes and Macedo (2011), gains strength from the conception that it was necessary to decide what to teach and how to teach it, starting with studies on the curriculum. Thus, the New School, according to Mesquita (2010), emerges from the criticism of the Traditional School and has its principles centered on students, as well as the methods and programs to encourage the student's own search for their knowledge.

Faced with a new educational concept, Santomé (1998) cites Dewey (1989) who, together with Piagetian and Vygotskian psychology, presents the importance of action and experiences in children's education. Still, citing Dewey, Santomé (1998) highlights that, in his studies, education had the task of emancipating and expanding experiences, which will later serve to feed studies on curricular integration. For Lopes and Macedo (2011), Dewey's principles (1959) are the basis for educational reforms in Brazil, which took place in the 1920s, mainly with Anísio Teixeira and Fernando de Azevedo.
Santomé (1998) states that the studies by Kilpatrick (1918), who also influenced Brazilian experiences, on the project method constitute another integrated proposal that will support the defense of children's experience as an important factor for learning, which will later corroborate, for the defense of curricular integration.

According to Beane (2003), the integrated curriculum is one that must be organized through questions that have personal and social meaning in everyday situations; it must value significant learning experiences, promote training that prioritizes values related to the common good, favor knowledge relevant to the wider society and not just the interests of elites and, finally, it must be imbued with a concept of integration beyond just an alternative technique to the disciplinary organization. It is with this understanding that Beane (2003) approaches a concept of curriculum, which seeks relationships in all directions called curriculum integration, which, for him, occurs from four purposes: integration of experiences, democratic social integration, integration of knowledge and integration as a curriculum concept.

When the author talks about the integration of experiences, he refers to integrating the ideas that people have about themselves and the world, as well as their beliefs, values and perceptions. For Beane (2003), with this set, accompanied by reflections, these experiences become resources to deal with problems and situations in everyday life. Therefore, the experiences and their schemes of constructive and reflective meanings broaden and deepen all knowledge for learning in new situations, which makes it meaningful.

The democratic social integration is directly linked to the sharing of these common and shared educational experiences among students that promote a sense of common values. Somehow, this social and democratic integration is linked to a general education directed towards what everyone should learn and not by a collection of required subjects. Beane (2003), in his understanding of knowledge integration as the third purpose of curriculum integration, engages with others to create democratic classroom situations for social integration and intelligent resolution of common problems among students.

When considering integration as a curriculum concept, Beane (2003) emphasizes the aspect of applying knowledge through projects and other activities that expand the possibility for students to “integrate their curricular experiences into their meaning schemes and experience the democratic process of problem solving”
(BEANE, 2003, p. 98). In this articulation, necessary for the author, the students' opinion and a list of their experiences are integral parts in the elaboration of the curriculum and in its concept of integration within a democratic education.

We agree with Beane (2003) and his purposes for curriculum integration when we understand that, by taking into account the integration of experiences, the social, the knowledge and the curriculum concept in a more democratic approach, we can enable the curriculum and the school agents, new and other teaching and learning opportunities in addition to a disciplinary curriculum.

In the light of this understanding, Felício and Alonso (2016), based on the analysis of legal provisions, such as the Constituição federal do Brasil 1988, Lei de Diretrizes e Bases da Educação Nacional (LDBEN) nº 9394/1996 and the Diretrizes Nacionais para o Ensino Fundamental (BRASIL, 2010), listed four major categories that they deem essential from the perspective of curricular integration: broad curriculum concept; articulation of knowledge of different natures; curriculum rooted in the environment; and curriculum as an educational project. Through these categories, and also supported by Beane (2003), the authors justify their studies so that changes in educational policies are carried out both in the organization of the curriculum and in its management in the classroom.

For the authors, understanding curricular integration as a broad conception of curriculum is an instrument in the face of stagnant areas organized in a traditional way that reinforces, in a certain way, a reductionist idea of knowledge in organization by disciplines. In this regard, we also agree with the authors that conceiving a curriculum broadly, in a dimension of education that is comprehensive to the different realities of students, helps them to integrate into their context and particularities.

The second category considered by Felício and Alonso (2016) concerns articulating knowledge of different natures in the curriculum that, according to them, can come from different sources, treated in different ways and mobilize different types of knowledge, contributing to student learning, as an individual and citizen.

The third category refers to the necessary dialogue between the curriculum and the reality in which it is inserted, the curriculum rooted in the surrounding environment. In this scenario, the authors point out that there must be a relationship between the curriculum and the territory in the sense that the former is thought of and constructed from the interaction of the latter's problems and situations.
When dealing with *the curriculum as an educational project*, one of the purposes of curricular integration, Felício and Alonso (2016) reveal that this vision of curriculum develops as a culture that is sustained from two aspects; one in the project itself, which directs decisions and interventions in the learning of school actors, and another aspect in collaborative work as a space for decision-making and communication around curricular issues.

All these aspects of curricular integration, outlined by the authors, reveal that in a school context it is necessary for the whole school to overcome isolated work and move towards a more collaborative perspective of learning and knowledge that, in an integrated way, can expand and reinforce the curriculum to beyond the disciplines. In the same direction, the four purposes of Beane (2003), previously mentioned, also support the understanding of curricular integration without excluding disciplinarity, but encouraging training work for teachers, in addition to enabling learning and new perspectives on the curriculum.

Through the integration of curricula between Physical Education and Mathematics, we envision seeking the competences established for each in the BNCC. In this association, teachers may have alternatives for expanding their own knowledge, as well as that of students in new teaching and learning situations. For this, we will situate the BNCC understanding its purpose related to the curriculum, its organization and the studies on which we are based.

### 4 Focusing on the BNCC: possible analyzes

We investigated the possibilities of curricular integration found in the BNCC and divided it into two moments: At first, we will analyze the introductory text of the document and the presentation for the Initial Years of Elementary School. In a second, more specific moment, we will analyze the Physical Education and Mathematics texts, taking into account the competences that can, among them, be integrated.

For the analysis of the introductory texts of the BNCC, we consider the proposals of Felício and Alonso (2016), regarding curricular integration as a *broad conception of curriculum and the articulation of knowledge of different natures*. These categories brought by the authors and anchored in Beane (2003) meet the objectives of this study. Still with regard to Beane (2003), we also use his purposes related to curricular integration: *the integration of experiences, democratic social integration, the*
integration of knowledge and integration as a curriculum concept.

For the second moment, the analysis is made from the category referring to the competences proposed for Physical Education and Mathematics. Regarding competences, we rewritten each link in order to form seven competences integrated into a category we call Integrated Competences between Physical Education and Mathematics. In the rewriting of these competences, we intend to bring what is stated in the BNCC in a fragmented way so that, according to the authors studied, we can understand the knowledge of these two disciplines in an integrated way.

It is worth mentioning that, in the BNCC, each curricular component presents its specific competences that are related to different objects of knowledge (content, concepts, processes) organized in thematic units. Physical Education is part of the Languages area and has six thematic units: Play and Games, Sports, Dances, Fights and Adventure Body Practices. The thematic units defined for Mathematics in the Initial Years are: Numbers, Algebra, Geometry, Quantities and Measures, Probability and Statistics.

In light of this understanding, we used the BNCC (BRASIL, 2017) as a corpus of analysis, as this is the document that will support the elaboration of state and municipal curriculum guidelines across the country, the starting point for the reflections of this study and other reflections coming. Next, we will move on to analysis.

5 First moment: possibilities of curricular integration based on the BNCC

Thinking about curriculum integration as a broad concept of curriculum is the first essential category for Felício and Alonso (2016, p. 18), as it is a fundamental condition for understanding “curricular integration as an orientation capable of responding to the training demands presented by contemporary Society, marked by the complexity, provisionality and diversity of knowledge”. Thus, if we take into account the way we organize the curriculum, most of the time, in a disciplinary way, we limit each content to an isolated learning and distant from a global student formation.

In general, the BNCC indicates that, in the Initial Years of Elementary School, students need to experience new ways of relating to the world, its possibilities, hypotheses and conclusions, having an active attitude towards the knowledge learned (BRASIL, 2017). With this information in hand, we agree with Felício and Alonso (2016) when we consider that a broadly thought curriculum does not mean more content, but
an education made on a permanent basis with objectives linked to the life experience of students, in the experience of these new ways of relationship with the world and with knowledge.

However, for this to happen, not only in the Early Years of Elementary School, but in the other stages of learning, Felício and Alonso (2016) show that it is necessary to think about students globally, promoting this development in different dimensions and preparing them for the exercise of citizenship that the legal documents speak so much about.

We identified in the BNCC text the broad concept of curriculum using other terms, as we can see below:

In this context, the BNCC explicitly states its commitment to **comprehensive education**. It recognizes, therefore, that Basic Education should aim at **global human formation and development**, which implies understanding the complexity and non-linearity of this development, breaking with reductionist visions that privilege the intellectual (cognitive) or affective dimension. It also means taking a plural, singular and integral view of children, adolescents, young people and adults - considering them as subjects of learning - and promoting an education aimed at their reception, recognition and **full development**, in their singularities and diversities. In addition, the **school, as a space for learning and inclusive democracy**, must be strengthened in the coercive practice of non-discrimination, non-prejudice and respect for differences and diversities (BRASIL, 2017, p. 14, emphasis added).

We can see in this passage that the text aims to aim at the **formation and global human development by breaking with reductionist views of the dimensions of knowledge and learning of the individual**, which shows that it is in agreement with the broad conception of curriculum, discussed by Felício and Alonso (2016), and which we share in this study.

This **plural, singular and integral vision of children, adolescents, young people and adults** aimed at full development in the school environment as a democratic learning space, highlights the need for work in school environments that provides and promotes the development of these agents in all directions, situations and diverse knowledge, which permeates the vision of the curriculum in a broad way (FELÍCIO and ALONSO, 2016). We understand, therefore, that the educational work, as well as the organization of the curriculum to encompass these exposed objectives, must go beyond isolated disciplinary knowledge.

Understanding the relationship of the BNCC with the curricula, we read that they
“identify themselves in the communion of principles and values that, as already mentioned, guide the LDB and the DCN. In this way, they recognize that education is committed to training and global human development, in its intellectual, physical, affective, social, ethical, moral and symbolic dimensions” (BRASIL, 2017, p. 16).

In this respect, the commitment to training and global human development at the BNCC is close to the broad concept of curriculum, discussed by Felício and Alonso (2016), as it takes into account various dimensions of education for student learning. When taking this perspective into account, knowledge should not be limited only to the limits of each discipline, but rather overcome barriers, possibilities and challenges for curricular integration in the Initial Years of Elementary School.

Next, we find two actions from the BNCC text that should be considered in the elaboration of a curriculum in action in schools that will adapt the curriculum to the reality of each school, which leads us to an integrated curriculum:

contextualize the contents of the curricular components, identifying strategies to present them, represent them, exemplify them, connect them and make them meaningful, based on the reality of the place and time in which the learning takes place; [...] decide on forms of interdisciplinary organization of curricular components and strengthen the pedagogical competence of school teams to adopt more dynamic, interactive and collaborative strategies in relation to teaching and learning management (BRASIL, 2017, p. 16).

In the first action, we can identify, considering the readings carried out, that when we connect the contents in a learning situation of two or more subjects, we promote a broad conception of curriculum integrating the time and place of the various possible learning. In the second action, when dealing with forms of interdisciplinary organization, we can understand that different demands of a contemporary society require that knowledge from different sources be worked or treated in an interdisciplinary way, which considers only the knowledge of the disciplines. For Felício and Alonso (2016), curricular integration is more comprehensive, since it admits the mobilization of all types of knowledge, in addition to disciplinary knowledge.

The conception of Beane (2003), in his studies on curriculum integration, is also close to these two actions present in the BNCC text with regard to the contextualization of the knowledge taught and learned in the daily life of the school. For him, for the integration of a curriculum to happen, it is necessary to expand theory and practice, transcending the prescribed academic curriculum and relating it to real life and the local reality of school agents.
Considering what the authors say about the articulation of knowledge of different natures, we identified that the BNCC proposes overcoming the radically disciplinary fragmentation of knowledge, encouraging its application in real life, the importance of the context to give meaning to what is learned and the role of the student in their learning and in the construction of their life project (BRASIL, 2017, p. 15).

In relation to this approach, the BNCC advocates an education that must occur in a democratic and global way and that, for this, must be taken into account all dimensions of the individual, his space and his culture, as well as the dimensions of the school subjects of ways to overcome the fragmentation of knowledge. As the BNCC is an official federal document that supports the construction of curricular guidelines in state and municipal bodies, we understand that it is possible that this shared construction influences the organization of knowledge of different natures so that new learning possibilities can emerge from what is set in the direction of the integrated curriculum.

For Beane (2003), this concept of integrated curriculum also seeks relationships in knowledge in various directions, aiming to promote learning that integrates diverse experiences and knowledge. This author treats knowledge as a dynamic instrument to make sense and application in students' lives, making it possible to solve problems in each one's reality.

In fact, for Beane (2003), curricular integration occurs when knowledge and experiences are dynamically integrated, giving the curriculum new meanings and new points of view in relation to broader interests of society beyond school subjects. Thus, when the BNCC proposes to overcome fragmented knowledge into disciplines, it shows that the aspect of knowledge integration treated by Beane (2003), and also by Felício and Alonso (2016), based on this author's studies, contributed to the understanding of that curricular integration is especially possible and contributes to the integrated action of the curriculum in schools.

However, in addition to presenting, through texts, conceptions about an education that has an integrated meaning and its importance in the BNCC document, we identified that this extended conception of curriculum could be more specified in some examples or situations within the text itself, putting into practice these curriculum actions. In addition, if it is so important, as we perceive in the BNCC, an *integral*
education, the formation of individuals in a globalized way and a necessary overcoming of fragmented knowledge, no less important and necessary that the BNCC itself explores these elements more, not only in a general way, but also between the disciplines themselves more specifically.

In this context, in the next section, we present two categories for analysis of the BNCC text that can direct us to this curricular integration between the Physical Education and Mathematics disciplines beyond the text, taking into account, in general, the competences and skills established for the Early Years of Elementary School.

6 Second moment: curricular integration between Physical Education and Mathematics at BNCC

When we think about integrating the competences between the two subjects, Physical Education and Mathematics in the Initial Years of Elementary School, we intend to combine the different corporal, cognitive, affective and behavioral dimensions, among others, to the thematic units of these two curricular components, enabling new forms of construction of the knowledge at this stage of schooling.

Therefore, considering the characteristics of the knowledge and experiences of both Physical Education and Mathematics, according to what the BNCC (BRASIL, 2017) establishes in relation to the specific competences of each one and what Beane (2003), Felício and Alonso (2016) and Lopes and Macedo (2011), we sought this integration from the category: Integration by Integrated Competences between Physical Education and Mathematics. It is worth mentioning that the competences in the BNCC are related to concepts, procedures, cognitive and socio-emotional practices, attitudes and values so that the student can solve problems of everyday life and in the world of work.

Let’s see below the analyzes and possible articulations in these two units, based on this category: Integration by Integrated Competences.

7 Category: Integration by integrated competences between Physical Education and Mathematics

We highlight, in this first category, the possible links between the specific competences of these subjects in the BNCC, being ten of Physical Education and eight of Mathematics, and, from that, we rewrite an integrated competence for each link, a
total of 5, which we envision a possible integration. Thus, in this exercise of rewriting these competences into an integrated competence, we want, from the BNCC and with the authors, to seek new ways of understanding what is stated in the official documents and reflecting on it.

When we bring Table 1, we attest to what Beane (2003) says in relation to the Integration of knowledge, as we provoke a more comprehensive understanding of it by relating two or more disciplines in the same learning situation. Felício and Alonso (2016), also in the same direction, say that the integration through the articulation of knowledge of different natures makes the learning process amplified, as well as the cognitive abilities for problem solving beyond just the specialization of knowledge.

Table 1: Integrated Competences between Physical Education and Mathematics

<table>
<thead>
<tr>
<th>Physical Education Competences</th>
<th>Mathematics Competences</th>
<th>Integrated Competences</th>
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<tbody>
<tr>
<td>6. Interpret and recreate the values and meanings attributed to different bodily practices, as well as to the subjects who participate in them. (BRASIL, 2017, p. 221)</td>
<td>5. Use mathematical processes and tools, including available digital technologies to model and solve everyday, social and other knowledge problems, validating strategies and results. (BRASIL, 2017, p.265)</td>
<td><strong>Integrated Competence 1:</strong> Recreation the senses and meanings attributed to different bodily practices such as games and use them as a mathematical tool to solve everyday problems and other areas of knowledge, validating curricular integration strategies and their results.</td>
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<tr>
<td>3. Critically reflect on the relationship between the performance of bodily practices and health/disease processes, including in the context of work activities. (BRASIL, 2017, p. 221)</td>
<td>1. Recognize that Mathematics is a human science, the result of the needs and concerns of different cultures, at different historical moments, and is a living science, which contributes to solving scientific and technological problems and to underpinning discoveries and constructions, including impacts on the world of work. (BRASIL, 2017, p. 265)</td>
<td><strong>Integrated Competence 2:</strong> Using Physical Education and Mathematics in an integrated way as human and cultural sciences in a lively way, understanding and contributing to issues related to health/disease impacts and processes, including in the context of the world of work.</td>
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<tr>
<td>10. Experiment, enjoy, appreciate and create different games, dances, gymnastics, sports, fights and adventure body practices, valuing collective work and protagonism. (BRASIL, 2017, p.221)</td>
<td>8. Interact with peers in a cooperative manner, working collectively in the planning and development of research to answer questions and in the search for solutions to problems, in order to identify consensual or non-consensual aspects in the discussion of a given issue, respecting the way of thinking peers and learning from them. (BRASIL,</td>
<td><strong>Integrated Competence 3:</strong> Integrate peer participation in a cooperative manner between Physical Education and Mathematics by creating different possibilities of connections between the thematic units of each knowledge, favoring collective work and the protagonism of both teachers and students in the planning and development</td>
</tr>
<tr>
<td>2017, p. 265)</td>
<td>of research to seek solutions to certain issues respecting and learning from each other.</td>
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<td>4. Identify the multiplicity of standards of performance, health, beauty and body aesthetics, critically analyzing the models disseminated in the media and discussing consumerist and prejudiced attitudes. (BRASIL, 2017, p. 221)</td>
<td><strong>Integrated Competence 4:</strong> Develop integrated curriculum projects between Physical Education and Mathematics that address social issues based on ethical, democratic, sustainable, and solidary principles, valuing the diversity of opinions of individuals and social groups, without prejudice of any kind. (BRASIL, 2017, p. 265)</td>
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<td>5. Identify the forms of production of prejudice, understand its effects and combat discriminatory positions in relation to body practices and their participants. (BRASIL, 2017, p. 221)</td>
<td><strong>Integrated Competence 5:</strong> Develop mathematical knowledge (logical reasoning, research spirit) to understand and produce convincing arguments in relation to the right to access bodily practices, proposing and producing alternatives to expand community networks, sociability and health promotion.</td>
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<td>8. Use body practices autonomously to enhance involvement in leisure contexts, expand sociability networks and health promotion. (BRASIL, 2017, p. 221)</td>
<td><strong>Integrated Competence 5:</strong> Develop mathematical knowledge (logical reasoning, research spirit) to understand and produce convincing arguments in relation to the right to access bodily practices, proposing and producing alternatives to expand community networks, sociability and health promotion.</td>
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<td>9. Recognize access to bodily practices as a citizen's right, proposing and producing alternatives for their realization in the community context. (BRASIL, 2017, p. 221)</td>
<td><strong>Integrated Competence 5:</strong> Develop mathematical knowledge (logical reasoning, research spirit) to understand and produce convincing arguments in relation to the right to access bodily practices, proposing and producing alternatives to expand community networks, sociability and health promotion.</td>
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**Source:** Research Author

Table 1, carried out in this study, brings to important purposes of curriculum integration. Beane (2003) brings, for example, the integration of knowledge in which there is a broader understanding of the organization and use of this knowledge and, therefore, to solve a problem, for example, we can relate knowledge from different disciplinary areas. Another important point made by this author about curricular integration is that, since knowledge is synonymous with power, when we prioritize its organization into separate disciplines, we determine boundaries in relation to knowledge itself, as well as to the teaching and learning processes. In the same direction, Felício and Alonso (2016), also anchored in Beane (2003), point to curricular integration that seeks a uniqueness between two or more disciplines in the construction of more articulated knowledge.

Regarding competence 5 of Mathematics, registered in Table 1, the BNCC
reiterates the need to use different tools such as games, in order to solve problems in other areas of knowledge. Thus, when we use Games in Physical Education, we can give another meaning and meaning to student learning, in order to expand the knowledge attributed both to physical education body practices, competence 6, and to Geometry, for example, using Games beyond of an end in themselves.

In this respect, Integrated Competence 1 refers us to the integrated curriculum, which Felício and Alonso (2016) speak of, by articulating knowledge of different natures, which, for this study, is between Physical Education and Mathematics. In this articulation, according to the authors, teachers and students can make their teaching and learning more meaningful as they associate this different knowledge with possible solutions to common problems, in broader ways and together in their teaching and learning practices.

Considering that the curriculum in schools, for the most part, is organized in a disciplinary way, we agree with Felício and Alonso (2016) that it makes no sense to say that, by integrating disciplines, we exclude the importance of disciplinarity, once we organize the curriculum in an integrated way, we create other disciplinary structures with other effects on the citizen we want to train, as we do when we rewrite what is stated in the BNCC.

To these thoughts, which converge with those of Beane (2003), he adds that, although in most places curricular integration takes place at a given time in schools, it is necessary to think of an integrated approach to the curriculum that is close to the proposals or guidelines curriculum. At this point, for understanding, the BNCC could approach and bring curricular integration closer to its text and its possibilities between disciplines, more explicitly in the Initial Years of Elementary School, thus providing state and municipal bodies with alternatives for organizing the curricula beyond the disciplinary.

Regarding this integration of knowledge, we find in Beane (2003) the statement that this provides a more comprehensive understanding of the organization and use of knowledge. Thus, the subjects themselves bring to their real lives a greater functionality for this knowledge.

In addition to experimenting and analyzing the different forms of expression of the curricular components of Physical Education, competences 3 and 1 of Mathematics, the BNCC indicates that this knowledge can influence the issues of the
world of work and that, if we think about this connection with the Integrated Competence 2 in the school context, we can combine these situations of everyday life with problem solving, such as health and illness issues at work. These aspects of integration, as a conception of the curriculum, are brought by Beane (2003) when he points out how important it is for students and teachers to link knowledge and their teaching and learning processes with their curricular experiences and meaning schemes in Problem solving.

Beane (2003) states that, generally, what happens in schools when we need to solve a problem or challenge in a particular discipline is to resort to this knowledge in isolation without relating it to other areas of knowledge. Felício and Alonso (2016) attest that the action towards the integration of the curriculum is relevant, as it favors the contents worked at school and contributes to teachers and students being active subjects in the context in which they work, increasing the ability to “build and apply mathematical concepts” and, at the same time, “increase the possibilities of learning body practices” as it is in the BNCC.

Next, we have competence 10 of Physical Education and competence 8 of Mathematics, which indicate such a perspective of creating different contents of Physical Education, valuing collective work and the protagonism of school subjects, and Mathematics, punctuating the importance of interaction cooperatively and collectively in the search for solutions to problems respecting and learning from each other. These BNCC guidelines point out that the elaboration of curricula can happen from the school agents themselves, when putting it into action in the reality of each one. In view of this, Integrated Competence 3 reinforces the idea that collaborative practices in the school environment lead to a curriculum concreted in an integrated way and that, therefore, can collaborate so that “teaching content and activities occur in a significant way in the learning process” (FELÍCIO and ALONSO, 2016, p. 26).

This significance that students attribute to activities is related to the fact that they “facilitate the relevance and functionality of the learning they provide, because they are related to everyday experiences and because they direct activities in the classroom” (FELÍCIO and ALONSO, 2016, p. 26). Thus, Beane (2003) also presents us with a concept of integration in which the curriculum's emphasis is on promoting common values and a common good.

Competences 4 and 5 of Physical Education allow us to recognize the role of
this discipline in relation to combating the prejudice of body practices or their participants and regarding the establishment of unique standards of beauty. Competence 7 of Mathematics deals with the importance of developing and discussing projects that deal with matters of social urgency, which collaborate for the dissemination of any type of prejudice, valuing the diversity of opinions and individuals.

In view of the Integrated Competence 4, we can understand that, by carrying out integrated projects of the curriculum between Physical Education and Mathematics, we expand the possibilities of the social reach of the project as well as the discussions and reflections regarding prejudice and discrimination of any nature. Thus, according to Beane (2003), when we approach integration as a curriculum conception, we increase the possibilities for students to integrate their experiences and meaning schemes to solve problems in a more democratic way.

Finally, competences 8 and 9 of Physical Education highlight the importance of expanding and enhancing sociability networks, health practices, leisure and greater access to bodily practices as a citizen’s right. Competence 2 of Mathematics makes these citizens aware that, to act in the world, they need to develop an investigative spirit and logical reasoning to also understand it.

Thus, the Integrated Competence 5 invigorates that, through the association of these competences, citizens can be inserted into their world so that they can act in it, making use of the knowledge worked in the articulation of Physical Education with Mathematics, by bringing bodily practices, health and leisure as rights for their ability to investigate and reason about these rights, and about them. This is what Physical Education themes suggest as a “research scenario”, a concept brought by Skovsmose (2008, p. 64). Given this concept, Mathematics “does not occur through repetition or mechanization, but it is a social practice that requires student involvement in meaningful activities” (NACARATO, 2019, p. 31). In this case, this meaning in this study came from the relationship established in all the processes of integrated knowledge between these two disciplines.

So, we can understand that, “with each action experienced, new relationships are established, new meanings are produced, and in this movement, qualitative advances in mathematical thinking are possible” (NACARATO, 2019, p. 31). In this integrated action between Physical Education and Mathematics, we re-signify the teaching and learning of school agents and, for that, the teachers, by assuming this
attitude towards the curriculum, make these and other scenarios integrated into their teaching practice possible.

8 Final Directions: beyond an integrated or disciplinary curriculum

The perception, when we carry out this study and recognize its importance, is directed to the fact that we put into discussion the knowledge studied about curriculum and curriculum integration allied to the objective of analyzing these possibilities when integrating two disciplines, Physical Education and Mathematics, according to the BNCC, and for the desire to promote new collaborative practices in the school.

In the history of the curriculum, both disciplinary and integrated, the importance it assumes in the face of societal transformations and their consequences for education is emphasized. The curriculum conception understood in this study is in accordance with the actions and elements used in the social construction, inside and outside the school, as well as cultural in relation to the contents and the orientations that lead us, above all, to analyze the concrete and possible contexts of student learning.

Thus, Felício and Alonso (2016) reinforce that when we look at the Initial Years of Elementary School, we should automatically converge this same look at issues related to the initial and continuing education of teachers. We need to move towards a training that integrates different curricular components necessary for these and other ways of teaching and learning that we envision when integrating Physical Education and Mathematics, for example. Thus, it is also necessary to think that the continuing education of teachers converges to a greater understanding of the prescribed curriculum that is in place and that should guide the practices of the curriculum in action in schools.

Santomé (1998) showed us, through his studies, that the world we live in is already global and, thus, obtaining a curriculum integrated by experiential knowledge must happen to facilitate the understanding of students’ reality in a critical and reflective way. Through this author’s readings, we understand the beginning of curriculum studies that would later reflect on discussions about the integrated curriculum.

In general terms, as we read in the BNCC (BRASIL, 2017), there are indications of curriculum integration throughout the text that also align with the categories of Felício and Alonso (2016) that we used — Extended curriculum conception and Articulation of knowledge from different natures — and those of Beane (2003) — Integration of
experiences, Social democratic integration, Integration of knowledge and Integration as a curriculum concept. However, given the importance that both authors and legal provisions understand about curricular integration and what we also reaffirm, it is necessary to overcome the fragmentation of knowledge to be taught and learned by articulating different knowledge such as Physical Education and Mathematics. That is, it is necessary that the curriculum, after the experience, supported by the facts, put into practice, glimpse more clearly and objectively this intention of integrating knowledge.

In relation to these possibilities of integration, the signs found were expressions such as: a global education, integral education of individuals, full development of the individual, school as a space for learning and democracy. Thus, based on Beane (2003) and Felício and Alonso (2016), we reaffirm that these evidences found in the BNCC, in view of the categories of these authors that we mentioned, directed us to a curriculum in action in schools thought of in an integrated way. However, we agree with Aguiar and Dourado (2018) with regard to these signs that we find in the text to be displaced from development and without a fundamental theoretical reference support for this desired education and nation project.

From the elaborated category, Integrated Competences between Physical Education and Mathematics, we can, in this search and study exercise, reflect from the competences put in the BNCC articulated with studied theories, related to an integrative curricular proposal, consider that their integration in the classroom may occur through the development of thematic units together teachers and students, especially taking into account the knowledge shared in the group, its organization, use and also with regard to competences.

The Base Nacional Comum Curricular is a normative and fundamental document for the three spheres of government – federal, state and municipal – to align themselves in the elaboration of actions and policies to promote a more inclusive and democratic education, both in terms of access and in the permanence of students in school education. We understand, however, that the document, in the introductory part of the Initial Years of Elementary School, presents signs of integration, since we realize that some highlighted excerpts from the text give an understanding of what this integrated curricular conception intends without, however, bringing the associations of competences beyond the disciplinary curriculum. It registers, however, that the
municipal and state instances, when building their respective curricula, take into account their particularities and realities for the necessary adjustments.

In fact, it is essential that the teacher, in the face of the disciplinary curriculum that is set by the BNCC in the Initial Years of Elementary School, be clear about the real possibilities that can provide the curricular integration between Physical Education and Mathematics, such as, to relate the geometric contents to the corporal experiences of the Games and Plays, seeking to relate the knowledge learned to the lived experience, privileging the dialogue between the pairs within the context and reality in which they find themselves.

We understand, according to the BNCC and the authors read that, when the teacher uses different instruments and expanded ways of teaching, allows not only the student, but also the teacher himself, other ways of building learning in an integrated context of these disciplines. Thus, it becomes essential to understand how curricular issues as well as the competences of the integrated subjects can expand the knowledge and beliefs of individuals in order to enable other learning and approaches in the school context. Considering what is stated in the BNCC guidelines, we understand that it is possible to rethink and refound the knowledge provided here, expanding and giving new meanings to the curriculum in schools.

At the same time, we hope that the official documents expand the possibilities of curricular integration between Physical Education and Mathematics in the Initial Years of Elementary School, for the construction of an education increasingly directed to collaborative and integrated teaching and learning processes. Therefore, we reiterate the need for more research that discusses curriculum integration based on other official documents, such as municipal and/or state curriculum proposals, which, in addition to those studied in this research, may lead to other reflections and analysis of the curriculum.

We consider that the elements presented here on the possibilities of curricular integration between Physical Education and Mathematics, in the light of the BNCC through integrated competences and the associations of their abilities, have the potential to give rise to the conjecture between these two disciplines in the teachers’ practice, being, of course, further discussions and reflections about the integrated curriculum necessary in face of an education that is still of a traditional nature, in a society with other and new demands for teaching and learning.
References


