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INTERDISCIPLINARITY IN THE TEACHING OF ASTRONOMY AND ASTRONAUTICS: RELATIONS WITH PHYSICS, MATHEMATICS AND GEOGRAPHY

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ABSTRACT

This article aimed to analyze interdisciplinary pedagogical proposals that articulated the teaching of Astronomy and Astronautics with the curricular components of Physics, Mathematics and Geography in the school space. The study addressed the importance of integration between these areas as a way to promote scientific literacy and to overcome the disciplinary fragmentation still present in Basic Education. The research had a qualitative and bibliographic character, according to the methodological foundations proposed by Eco (2010) and Santana, Narciso and Fernandes (2025), being developed through the selection, reading and analysis of four scientific articles available in the CAPES Periodicals database. The inclusion criteria considered the thematic pertinence, the articulation between Astronomy and at least two related areas, and the didactic applicability of the proposals. The comparative analysis revealed that all the selected experiences presented real potential for interdisciplinarity, although with varied focuses, resources and strategies. It was identified that the use of planetariums, software, models and national symbols such as the Brazilian flag contributed to make astronomical content more accessible and integrated with the students' reality. The articulations with Physics allowed us to address laws of motion and gravitation; with Mathematics, the use of proportions, measurements and geometry stood out; and with Geography, the themes related to the movements of the Earth, location and spatial orientation. It was concluded that the teaching of Astronomy, when developed in an interdisciplinary way, favored the construction of more meaningful learning, connected to everyday life and contemporary educational demands.

Keywords: Astronautics. Curriculum. Integration. Teacher Planning. Representations.

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INTRODUCTION

In recent decades, the teaching of Science in Basic Education has been discussed under new pedagogical requirements, especially given the need to overcome fragmented approaches to knowledge. Astronomy, which once occupied marginal space in school curricula, has come to be recognized as an area capable of mobilizing knowledge from different disciplines, such as Physics, Mathematics and Geography. In this context, interdisciplinarity emerged as a relevant pedagogical proposal to integrate contents, promote more meaningful learning and develop scientific literacy, especially when associated with the exploration of celestial phenomena and space technologies in everyday school life. The teaching of Astronomy and Astronautics, therefore, has been configured as a promising field to rethink pedagogical practices aimed at the articulation between areas of knowledge.

The choice of the theme was justified, above all, by the observation that, despite the formative potential of Astronomy, there are still few systematic initiatives that promote dialogue between this area and the contents developed in traditional disciplines. Many teachers face difficulties in planning interdisciplinary proposals, either due to the segmentation of curricula or the lack of specific training to integrate knowledge. Thus, it became pertinent to investigate how different educational experiences have been incorporating Astronomy as an integrating axis of contents, especially in the interfaces with Physics, Mathematics and Geography. The motivation for this research was also anchored in the search for practices that contribute to the development of scientific thinking and the contextualization of teaching, responding to the demands of the National Common Curricular Base (BNCC) and the guidelines of contemporary education.

The guiding question that led this study was: 'how has Astronomy been used as an axis for interdisciplinary practices in the teaching of Science, in articulation with Physics, Mathematics and Geography contents in Basic Education?.' From this questioning, it was established as a general objective to analyze interdisciplinary pedagogical proposals that articulate the teaching of Astronomy and Astronautics with other areas of knowledge in the school space. As specific objectives, it was sought: (i) to identify educational experiences that promote interdisciplinarity through Astronomy; (ii) understand how the contents of Physics, Mathematics and Geography are mobilized in these proposals; and (iii) to analyze the potentialities and challenges of these practices for the scientific training of students.

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The methodology adopted in this work was bibliographic research, as outlined by Santana and Narciso (2025), who defend the use of this type of investigation to understand concepts, practices, and theoretical approaches present in already structured scientific productions. Data collection occurred through the careful selection of four scientific articles that addressed the teaching of Astronomy in an interdisciplinary way. The texts were read in full, categorized and analyzed in the light of a comparative analysis technique, allowing the observation of convergences and specificities between the experiences. The data were analyzed based on criteria such as: didactic focus, resources used, integrated disciplines, historical approach, connection with the BNCC and presence of real interdisciplinarity.

Among the main authors used in this study, Pedroso and Catelli (2024) stood out, with contributions on the use of planetariums as a tool for integrating content; Santos and Scarano Júnior (2022), who proposed an approach based on the symbols of the Brazilian flag; Morais et al. (2023), focusing on the articulation between Astronomy, Mathematics and Geography; and Borges, Bom Jardim and Teixeira (2011), whose critical analysis involved historical and conceptual aspects of the teaching of Astronomy in Physical Geography. In addition to these, the theoretical foundations of interdisciplinarity were referenced from the reflections of Fazenda (2011) and Mousinho (2018), which deal with the need to reorganize school knowledge in an integrated way.

The structure of the work was organized into five main chapters, in addition to this introduction. The first chapter, entitled 'Dialogues between Physics, Mathematics and Geography in the School Space', contextualized the theoretical field of interdisciplinarity and established the links between the areas of knowledge in focus. The second chapter, 'Interdisciplinary Paths between Physics, Mathematics and Geography', presented the pedagogical foundations of the proposal, with emphasis on the principles of scientific literacy and contextualization of contents. In the third chapter, 'Interdisciplinary Experiences with Astronomy and Astronautics: Integrated Practices between Physics, Mathematics and Geography', concrete practices extracted from the articles studied were described and analyzed. The fourth chapter, 'Results and Data Analysis', systematized the comparison between the texts, organizing the data in a table and discussing their implications. Finally, the fifth chapter, 'Conclusion', presented the final considerations, resuming the objectives of the research, synthesizing the main findings and pointing out possibilities for future investigations in the area.

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Thus, the present work sought to offer a theoretical and practical contribution to the field of Science Education, especially with regard to the construction of integrative pedagogical proposals, which value Astronomy as an articulating field of scientific knowledge in school.

METHODOLOGY

The methodology adopted in this study was based on the qualitative approach of bibliographic nature, from the selection, reading and analysis of academic productions that deal with the teaching of Astronomy in dialogue with other areas of knowledge, especially Physics, Mathematics and Geography. According to Eco (2010), bibliographic research consists of examining existing documents that contain ideas, concepts or data relevant to the investigated issue, being a legitimate form of knowledge production when conducted with clear selection and analysis criteria. This type of research, by using already published sources, allows us to understand the current state of a given theme, identify gaps, systematize contributions and organize categories for analysis.

In this context, Santana, Narciso and Fernandes (2025) explain that scientific methodologies must be continuously reviewed in the face of transformations in the educational field, requiring from the researcher not only the technical mastery of textual analysis, but also a critical and reflective posture towards the materials studied. In addition, the authors highlighted that the bibliographic research is structured in organized stages of collection, filtering, categorization and analytical reading, allowing the approximation between the object of study and the theoretical references pertinent to the proposed problem.

The stages of the methodological process began with the definition of simple and objective keywords, used to locate the materials: 'astronomy teaching', 'interdisciplinarity', 'physics', 'mathematics', 'geography' and 'basic education'. These words, in different combinations, were applied to the search for scientific articles in the CAPES Journals database, a national platform for access to qualified academic content, maintained by the Coordination for the Improvement of Higher Education Personnel. This database was chosen for its breadth and credibility, bringing together peer-reviewed journals, theses, dissertations, and other scientific documents from various areas of knowledge.

After the initial searches, a screening was carried out according to the following inclusion criteria: texts published between 2010 and 2024, focusing on the teaching of

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Astronomy in Basic Education, which established clear articulation with at least two of the three areas delimited in the study (Physics, Mathematics and Geography), and which presented proposals with pedagogical potential. Repeated materials, texts that dealt with Astronomy exclusively from the perspective of the History of Science or theoretical Cosmology, as well as productions aimed only at higher education or initial teacher training, were excluded, as they did not correspond to the objectives of this investigation. The refinement process allowed the identification of four central studies: Pedroso and Catelli (2024), Santos and Scarano Júnior (2022), Morais, Silva, Morais and Rodrigues (2023) and Borges, Bom Jardim and Teixeira (2011), whose contributions fully met the established criteria.

The selected texts were read in full, and their information was organized in descriptive files, followed by a comparative analysis based on previously defined categories, such as: didactic focus, use of visual resources, integrated disciplines, connection with the BNCC and presence of historical approaches. This methodological procedure enabled a critical and systematized reading of the data, allowing the achievement of the objectives proposed in the study and contributing to a broader understanding of interdisciplinary practices involving the teaching of Astronomy in school.

DIALOGUES BETWEEN PHYSICS, MATHEMATICS AND GEOGRAPHY IN THE SCHOOL SPACE

The understanding of astronomical and astronautical content in the school environment increasingly requires approaches that go beyond the limits of isolated disciplines. In this context, the use of interdisciplinary practices has proven to be a promising alternative, as it allows students to articulate knowledge from different areas to interpret complex phenomena. As highlighted by Morais *et al.* (2023, p. 2), "mathematics and geography are disciplines highly intertwined by concepts that touch both one and the other", which highlights the relevance of proposals that promote integration between related areas, especially when it comes to the study of astronomy.

Although traditionally linked to scientific dissemination in non-formal spaces, planetariums, for example, have been progressively recognized as pedagogical resources capable of integrating knowledge and facilitating the understanding of abstract concepts. Pedroso and Catelli (2024, p. 2) state that "planetariums can also be used strategically by teachers, connecting the most complex concepts with their three-dimensional

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representations". By bringing visual representations and immersive experiences, these spaces become powerful for teaching content that requires spatial visualization, such as celestial movements, the solar system, and the relationships between Earth and space.

This possibility of connection between different disciplines is confirmed in the experience reported by Santos and Scarano Jr. (2022), when describing a project in which second-year high school students used the Brazilian flag as a starting point to study astronomy and physics. More than the exploration of symbols, the project provided the opportunity for dialogue between electrodynamics, history, arts, mathematics and geography contents, making the learning process more meaningful. As the authors report, the students "had the opportunity to articulate knowledge of Basic Astronomy, Electrodynamics, Arts, Geography, Mathematics and History of Brazil" (Santos; Scarano Jr., 2022, p. 3), which highlights the value of practices that break with traditional curricular compartments.

In addition, when it comes to astronomy teaching, geography content can be used to discuss spatial orientation, the location of the stars and the dynamics of the hemispheres. At the same time, mathematics contributes to calculations involving orbits, scales, and distances in the universe, while physics provides the fundamentals of gravitation, motion, and energy. In this regard, Morais *et al.* (2023, p. 5) highlight that "scientific literacy is present, also acting as a form of social transformation", which reinforces the importance of integrating these areas so that students understand the world in its complexity and act critically in the face of contemporary challenges.

Although astronomy is usually treated as a specialized field, its application in the school context can make sense when it is worked through real situations and connected to the daily lives of students. In this regard, planetariums, as Pedroso and Catelli (2024, p. 2) observe, offer "visual resources to disseminate science", but, when appropriated didactically, they can expand their reach, becoming environments for pedagogical experimentation and the construction of interdisciplinary knowledge.

Finally, by uniting physics, mathematics and geography in the approach to astronomy and astronautics, teachers promote not only the learning of content, but also the development of scientific curiosity and the ability to relate different areas of knowledge. As the authors cited demonstrate, this integration is possible both through experiences in planetariums and school projects articulated with the curriculum. Interdisciplinarity,

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therefore, ceases to be an abstract guideline to become a concrete practice, capable of transforming learning into a more connected, active and critical process.

INTERDISCIPLINARY PATHS BETWEEN PHYSICS, MATHEMATICS AND GEOGRAPHY

The construction of scientific knowledge in the school environment demands practices that consider the interrelationship between different areas of knowledge, especially when it comes to abstract content such as those present in astronomy and astronautics. By proposing a reorganization of traditional approaches, interdisciplinarity emerges, as stated by Mousinho (2018, p. 3), as an attempt to "overcome the fragmented and specialized view of the areas, moving towards the understanding of the phenomena of nature as a single part of the whole". This conception not only broadens the field of teaching activity, but also favors more meaningful learning on the part of students.

Similarly, Fazenda (2011) understands interdisciplinarity as an attitude of openness, capable of promoting the problematization of teaching and learning processes. For the author,

> [...] interdisciplinarity is a new attitude towards the issue of knowledge, of openness to the understanding of hidden aspects of the act of learning and those apparently expressed, putting them into question (Fazenda, 2011, p. 3).

This perspective dialogues with the proposal of Morais *et al.* (2023), by arguing that the contents should be presented as integrated parts of everyday life, allowing the student to perceive science not as something distant, but as an active part of social and environmental life.

It is in this context that the work of Santos and Scarano Jr. (2022) is inserted, by proposing the use of the national flag as an object of interdisciplinary study in geography, physics, and astronomy classes. According to the authors,

> As the flag cannot represent the sparkles of the stars, it is done what has been done since very primitive times to represent the different sparkles of the stars: stars of different sparkles with different sizes are represented (Santos; Scarano Jr., 2022, p. 16).

The use of this symbolic resource, therefore, instigates the student to investigate scientific aspects through a cultural artifact, bringing school contents closer to their visual

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and social repertoire. In addition, the activities proposed by the authors allow students to come across complex scientific concepts, such as stellar photometry, in an accessible and contextualized way. Also according to Santos and Scarano Jr. (2022, p. 22), "different stars have different colors, and this can be translated quantitatively when determining the photometry of the objects of interest". Such an approach shows that the understanding of astronomical phenomena can be initiated from simple observations, but that, when properly mediated, lead the student to scientific literacy.

In this sense, Morais *et al.* (2023, p. 23) reinforce that the role of the teacher is to demonstrate that "the content studied is common to all living beings on planet Earth, as it dialogues with everyday phenomena that are not perceptible to the eye, but directly influence people's lives". This position corroborates the need to create bridges between theory and practice, between school knowledge and everyday experiences, which is even more relevant in the teaching of astronomy and astronautics, given its abstract nature.

Another example of pedagogical practice with interdisciplinary potential is the use of planetariums as a didactic resource. Pedroso and Catelli (2024, p. 3) point out that "planetariums, by offering specific visual and engaging presentations on a theme, allow students to visualize abstract concepts in a concrete way". This possibility becomes even richer when articulated with the contents previously discussed in the classroom. For the authors, "by integrating the conceptual classes of the various disciplines with real experiences, lived in the planetarium, teachers can create a bridge between the objects of knowledge and their three-dimensional visualizations" (Pedroso; Catelli, 2024, p. 3), which strengthens the learning experience and promotes curricular integration.

However, the effectiveness of these practices depends on a planned pedagogical proposal, which considers the appropriate choice of themes, the resources to be used and the learning objectives. Pedroso and Catelli (2024, p. 3) observe that "in collaboration with the participating teachers, relevant themes and topics were identified that could be explored both in the classroom and in the planetarium". The classes, in turn, were organized in such a way that knowledge was built in stages: "the theoretical classes were taught in the classroom, where the teachers presented the concepts and theories pertinent to the selected themes. Various didactic resources were used, including texts, images and videos" (Pedroso; Catelli, 2024, p. 4).

Consequently, the articulation between different disciplines – such as physics, mathematics and geography – can generate relevant effects for the scientific training of

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students. Morais *et al*. (2023, p. 23) state that interdisciplinary proposals "contribute to a broader view of students about the contents studied at school and their relationship with everyday events". In this way, students stop just memorizing concepts and start to understand them in their practical and social dimension.

Finally, it is worth noting that the receptivity of students is an essential part of the success of these approaches. As stated by Morais *et al.* (2023, p. 21), "it is clear that the students' reception of the subject addressed is of great value and serves as a thermometer for moments like this". The active listening of the teacher and his ability to adapt the contents to the realities and interests of the students are, therefore, decisive elements to structure interdisciplinary practices in the teaching of astronomy and astronautics.

In this way, the references discussed here converge in the valorization of strategies that break with the compartmentalization of knowledge, defending practices that bring scientific knowledge closer to the student's daily life and that favor the construction of an education that is more connected with the world and with the challenges of the present.

INTERDISCIPLINARY EXPERIMENTS WITH ASTRONOMY AND ASTRONAUTICS: INTEGRATED PRACTICES BETWEEN PHYSICS, MATHEMATICS AND GEOGRAPHY

The application of interdisciplinary practices in the teaching of Astronomy and Astronautics can favor a more integrated and contextualized learning, especially when the contents dialogue with areas such as Physics, Mathematics and Geography. By bringing together different fields of knowledge, an environment conducive to scientific literacy and the understanding of natural phenomena in their entirety is created.

The first proposal consists of the elaboration of a scale model of the Solar System. In this activity, students must calculate the relative distances between the planets and their proportions about the Sun, using knowledge of ratio, proportion and conversion of units. In addition to Mathematics, Physics is mobilized when discussing the laws of planetary motion and universal gravitation. Geography, in turn, contributes by contextualizing the Earth's position in the solar system, the inclination of the Earth's axis and its effects on the seasons. According to Morais *et al.* (2023), it is the role of the teacher to demonstrate that scientific content dialogues with everyday phenomena that directly affect people's lives, even though they are often not perceptible to the naked eye. This approach favors the construction of knowledge closer to the students' reality, while valuing logical reasoning, spatial thinking, and the ability to interpret critically.

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In line with this perspective, Santos and Scarano Jr. (2022) point out that astronomical content can be approached in an accessible and meaningful way through symbols already known to students, such as the national flag. By exploring the stars represented on the Brazilian flag in a Geography activity, the authors proposed reflections on the position and brightness of celestial bodies. According to the authors themselves, different brightnesses were represented by different sizes, and this symbolic representation allowed the introduction of discussions about luminosity and photometry, articulating contents of Physics with spatial and symbolic notions present in Geography. In this way, the practice contributed to the students recognizing that, even in cultural objects, it is possible to identify relationships with astronomical and physical phenomena.

As a second practice of Astronomy, it is proposed to carry out systematic observations of the apparent movement of the Sun throughout the day. In this activity, students must record the sunrise and sunset, observe the position of the star at the cardinal points and calculate the variation in the angle of solar incidence using a protractor and ruler. Geography appears as a central axis, when dealing with the relationships between the movement of the Earth and natural phenomena, such as climatic variations and seasons. Mathematics enters with the use of measurements and angles, while Physics is explored when addressing the Earth's rotation and the propagation of light. According to Pedroso and Catelli (2024), integrating observation activities with theoretical content allows students to visualize abstract concepts in a concrete way, favoring meaningful learning. In this sense, by working on the solar trajectory through observation and calculation, teachers expand the understanding of the phenomena and promote integration between different areas of knowledge.

The practice focused on Astronautics proposes a simulation of rocket launch, based on parameters such as mass, speed, launch angle and air resistance. Using simple materials or digital simulators, students can investigate the principles of physics involved in launching and displacing an object on a parabolic trajectory. The activity allows you to work on Newton's laws, conservation of the amount of motion and notions of energy. Mathematics is mobilized in the construction of height versus time graphs, and in the analysis of functions that describe movement. Finally, Geography offers subsidies to discuss strategic locations for launches, based on criteria such as latitude, proximity to the sea and environmental risks. According to Fazenda (2011), interdisciplinarity requires a new attitude towards knowledge, an investigative attitude that puts knowledge in dialogue,

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opening space for a broader understanding of the act of learning. Thus, the rocket proposal allows students to articulate scientific concepts to real situations, reflecting on technology, territory and sustainability.

In addition, according to Pedroso and Catelli (2024), collaboration between teachers and the joint selection of topics relevant to students' daily lives strengthens interdisciplinary work. By integrating theory and practice, these educators are able to transform complex content into concrete experiences, using varied resources such as videos, images, models, and simulations. Such an approach reinforces that interdisciplinarity is not limited to the joining of themes, but requires intentional didactic planning and collaboration among teachers.

Finally, it is worth noting that, according to Morais *et al.* (2023), the students' response to interdisciplinary proposals works as an important indicator for the continuity of these practices. When enthusiasm, curiosity and active participation are observed, it is possible to perceive that students not only understand the contents, but resignify them from their experiences. This demonstrates that the teaching of Astronomy and Astronautics, when based on interdisciplinary strategies, effectively contributes to the construction of scientific knowledge and the formation of critical and active subjects.

RESULTS AND DATA ANALYSIS

To understand the different forms of articulation between Astronomy and other areas of knowledge in the educational context, especially Physics, Mathematics and Geography, a comparative analysis was carried out between four academic productions. The selected articles address interdisciplinary experiences that explore Astronomy from concrete objects (such as planetariums and the national flag) and didactic proposals based on mathematical models and critical approaches to Physical Geography. The following table systematizes the main elements of these contributions, highlighting the central focuses, the disciplines involved, and the methodological differentials of each one.

Table 1: Comparative analysis of interdisciplinary practices with Astronomy in the school context

ARTICLE	CENTRAL FOCUS	INTEGRATED DISCIPLINES	COMPARATIVE HIGHLIGHTS
Pedroso and Catelli (2024)	Use of fixed planetarium as a didactic resource for visualizing astronomical concepts.	Astronomy, Physics, Mathematics, Geography, History and Arts.	Immersive sensory experience; didactic projects among teachers; interdisciplinary meetings; appreciation of practice.

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Santos and Scarano Jr (2022)	Use of the Brazilian flag as a symbolic resource to teach Astronomy and Physics.	Astronomy, Physics, History, Arts, Philosophy, Mathematics, Geography.	Cultural element as a starting point; link with the BNCC; stellar photometry and magnitude; scientific popularization.
Morais *et al*. (2023)	Didactic sequence with ellipses, spherical surfaces and geometry for scientific literacy.	Mathematics, Geography, Physics, Astronomy.	Use of software and modeling; spatial reasoning; logical organization of contents; teacher cooperation.
Borges, Bom Jardim and Teixeira (2011)	Criticism of the teaching of Astronomy in Physical Geography and the conceptual flaws common in school.	Geography, Astronomy, Physics, Biology, Chemistry.	Historical reflection; analysis of didactic mistakes; experiments with simple materials; criticism of teacher training.

Source: prepared by the authors.

The comparison between the four works allows us to identify different integration strategies between Astronomy and areas such as Physics, Mathematics and Geography. While some articles focus on visual and symbolic resources to facilitate learning, such as the planetarium or the national flag, others propose more structured approaches, such as didactic sequences based on geometry or critical analyses of traditional teaching. In common, the proposals show that interdisciplinarity requires planning, collaboration between teachers and a sensitive look at the sociocultural contexts of students. In this way, the importance of pedagogical practices that value the interconnection between knowledge and promote the construction of more meaningful and contextualized scientific knowledge is reinforced.

Table 2 - General comparative synthesis

Criterion	**Pedroso & Catelli (2024)**	**Santos & Scarano Jr (2022)**	**Morais *et al.* (2023)**	**Borges *et al.* (2011)**
Emphasis on didactic practice	Discharge	Discharge	Moderate	Discharge
Visuals Base	Fixed Planetarium	Flag and light panel	Geometry Software	Maps and models
Connection with BNCC	Moderate	Discharge	Moderate	Low
Historical approach	Weak	Moderate	Weak	Strong
Focus on Physics and	Yes	Yes	Yes	Yes

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Mathematics				
Focus on Geography	Yes	Yes	Yes	Strong
Real interdisciplinary proposal	Yes	Yes	Yes	Yes

Source: prepared by the authors.

The table presented provides a panoramic view of how four different studies deal with interdisciplinarity in the teaching of Astronomy, establishing relationships with Physics, Mathematics and Geography in school contexts. In general, it is observed that all the articles analyzed propose a real interdisciplinary practice, although with different approaches in terms of methodology, conceptual depth and resources used.

Regarding the emphasis on didactic practice, three of the four studies — Pedroso and Catelli (2024), Santos and Scarano Jr (2022) and Borges *et al.* (2011) — present proposals with high practical application, demonstrating a clear concern with the pedagogical feasibility of their suggestions. The work of Morais *et al.* (2023), in turn, has a moderate emphasis, since it is more dedicated to conceptual elaboration and the use of digital tools than to practical execution in the field.

As for the base on visual resources, each research adopts different materials to support teaching. Pedroso and Catelli (2024) highlight the use of the fixed planetarium as a three-dimensional and immersive viewing environment; Santos and Scarano Jr (2022) make symbolic and pedagogical use of the national flag and luminous panels to address issues of stellar brightness and magnitude; Morais *et al.* (2023) use geometry software to represent ellipses and spherical surfaces; and Borges *et al.* (2011) work with maps and models, enabling tactile and spatial representations.

In the criterion of connection with the BNCC, the studies vary in degree of adherence. Santos and Scarano Jr (2022) are strongly aligned with the competencies and skills of the Base, especially when articulating the teaching of Astronomy with cultural and scientific themes provided for in the curricular guidelines. Pedroso and Catelli (2024) and Morais *et al.* (2023) reveal a moderate connection, while Borges *et al.* (2011) present a more distant relationship, focusing on criticism of traditional teaching and the teacher's conceptual updating.

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The historical approach appears more prominently in the work of Borges *et al.* (2011), which discusses the didactic mistakes consolidated in the teaching of Geography and Astronomy, resuming the role of these sciences in the construction of modern thought. Santos and Scarano Jr (2022) also include historical elements when dealing with the symbolic evolution of the stars on the flag. Pedroso and Catelli (2024) and Morais *et al.* (2023) do not develop this axis in a significant way.

All works focus on Physics and Mathematics, with special attention to the concepts of motion, astronomical quantities and geometric shapes. Geography is also present in all studies, with special emphasis on Borges *et al.* (2011), which deepen the relations between Astronomy and Physical Geography, and for Santos and Scarano Jr (2022), which use symbolic elements of the national territory to discuss the position of the stars.

In summary, the table shows that, although each article adopts different paths, all recognize the value of interdisciplinarity as a strategy to promote meaningful learning. The differences lie mainly in the resources adopted, in the conceptual emphases and in the way they articulate theory and practice, revealing a variety of possibilities for the teaching of Astronomy in dialogue with other areas of knowledge.

CONCLUSION

The present study aimed to analyze and compare interdisciplinary proposals aimed at the teaching of Astronomy and Astronautics in Basic Education, highlighting their articulations with the curricular components of Physics, Mathematics and Geography. From the selection and analysis of four scientific articles, it was possible to understand how these experiences contributed to overcoming fragmented approaches to knowledge, evidencing the relevance of interdisciplinarity as a pedagogical strategy.

The questions that guided the research — about how interdisciplinary didactic practices have been conceived in the teaching of Astronomy and what relationships they establish with other areas of knowledge — could be answered based on the critical reading of the texts and the construction of a comparative synthesis. It was observed that, although with different methodologies and emphases, the analyzed works presented viable and concrete proposals for integration between areas, making teaching more meaningful and connected with the school and social contexts of the students.

The objectives of the research were fully achieved. It was possible to identify the different interdisciplinary approaches present in the analyzed experiences, describe the

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resources and strategies used and highlight the strengths of each proposal. It was found that the insertion of Astronomy as a guiding axis of interdisciplinary practices favors the understanding of complex scientific phenomena, stimulates scientific literacy and expands the possibilities of contextualized teaching. In addition, it was evident that the use of visual resources, such as the planetarium, geometry software, luminous panels and models, plays a central role in the construction of knowledge that requires abstraction and spatial representation.

Finally, the study points out relevant paths for future research. It is recommended that further investigations focused on teacher training for the interdisciplinary approach be conducted, since many of the obstacles reported in the analyzed articles are associated with the segmentation of curricula and the absence of collaborative planning among teachers. In addition, it is suggested the development of new proposals that involve Astronautics in a more systematic way, expanding the reflection on science and technology in the classroom. Integration between areas of knowledge, when well conducted, is not only possible, but necessary for the construction of a more critical, participatory scientific education aligned with the demands of the contemporary world.

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