

**Pedagogical practices for teaching science in rural education: a literature review**Iago Lima Cerqueira<sup>i</sup> 

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**Abstract**

This study addresses the design of educational practices for Science Teaching in Rural Education. The central objective was to carry out a literature review in national journals on the design of pedagogical practices aimed at teaching Science in Rural Education. Based on authors such as: Arroyo (2006), Caldart (2012), Freire (1997, 2011), Souza (2012), Augusto and Mendes (2022), the exploratory qualitative research was based on the analysis of six articles (2 in Scielo and 4 in the Revista Brasileira de Educação do Campo) published between 2018 and 2023. Rural Education, with its specificities and challenges, stands out for the need for contextualization and interdisciplinarity in Science teaching. The conclusion points to the existence of challenges to be overcome and the undeniable importance of continuing research in the area, highlighting the complexity of the educational modality and the need for specific approaches to promote quality education in the field.

**Keywords**

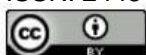
pedagogical practices; education in the Countryside; science teaching.

**As práticas pedagógicas para o ensino de ciências na educação do campo: uma revisão de literatura****Resumo**

Este estudo aborda a concepção de práticas educativas para o Ensino de Ciências na Educação do Campo. O objetivo central foi realizar uma revisão de literatura em periódicos nacionais sobre a concepção de práticas pedagógicas voltadas para o ensino de Ciências na Educação do Campo. Fundamentado em autores como: Arroyo (2006), Caldart (2012), Freire (1997, 2011), Souza (2012), Augusto e Mendes (2022), a pesquisa qualitativa exploratória baseou-se na análise de seis artigos (2 na Scielo e 4 na Revista Brasileira de Educação do Campo) publicados entre 2018 e 2023. A Educação do Campo, com suas especificidades e desafios, destaca-se pela necessidade de contextualização e interdisciplinaridade no ensino de Ciências. A conclusão aponta para existência de desafios a serem superados e a importância incontestável da continuidade de pesquisas na área, ressaltando a complexidade da modalidade educacional e a necessidade de abordagens específicas para promover uma educação de qualidade no campo.

**Palavras-chave**

práticas pedagógicas; educação no campo; ensino de ciências.



## Práticas pedagógicas para la enseñanza de las ciencias en la educación rural: una revisión de la literatura

### Resumen

Este estudio aborda el diseño de prácticas educativas para la Enseñanza de las Ciencias en la Educación Rural. El objetivo central fue realizar una revisión bibliográfica en revistas nacionales sobre el diseño de prácticas pedagógicas orientadas a la enseñanza de las Ciencias en la Educación Rural. Con base en autores como: Arroyo (2006), Caldart (2012), Freire (1997, 2011), Souza (2012), Augusto y Mendes (2022), la investigación cualitativa exploratoria se basó en el análisis de seis artículos (2 en Scielo y 4 en la Revista Brasileira de Educação do Campo) publicados entre 2018 y 2023. La Educación Rural, con sus especificidades y desafíos, se destaca por la necesidad de contextualización e interdisciplinariedad en la enseñanza de las Ciencias. La conclusión apunta a la existencia de desafíos por superar y la innegable importancia de continuar la investigación en el área, destacando la complejidad de la modalidad educativa y la necesidad de enfoques específicos para promover una educación de calidad en el campo.

### Palabras clave

prácticas pedagógicas; educación en el campo; enseñanza de las ciencias.

## 1 Introduction

Rural Education emerges as an essentially inclusive and transformative concept, aimed at valuing the cultural identities and socioeconomic realities present in rural communities. In this context, understanding the dynamics of Rural Education is crucial to recognize the intrinsic importance of this approach in educational formation and the comprehensive development of individuals residing in these regions (Arroyo, 2006).

As a transformative force, Rural Education goes beyond the mere transmission of curriculum content, as it is a movement that acknowledges and respects the specific challenges and unique challenges faced by rural communities. These communities, often distant from urban centers and their amenities, possess histories, cultures, and intricate relationships with the environment that surrounds them (Arroyo, 2006). In this sense, this mode of education seeks to promote genuinely contextualized education, capable of valuing local knowledge and contributing to the improvement of the living conditions of rural populations.

According to Cajaiba, Santos, and Brito (2022), thinking about Rural Education means contemplating an educational model supported by the fight for social justice and quality education for all, whether in rural or urban areas. The importance of Rural

Education in educational formation lies in its ability to empower individuals, enabling them to understand and actively engage with the world around them. By providing education that aligns with local realities, this approach bridges the gap between academic knowledge and daily life experiences, fostering more contextual and therefore more meaningful and lasting learning. Furthermore, Rural Education contributes to strengthening the cultural identity of rural communities while promoting access to quality educational opportunities often lacking in these areas (Caldart, 2012).

The educational formation provided by this mode of teaching extends beyond the classroom; it encompasses community spaces, agriculture, environmental preservation, and the local economy. This approach encourages active participation of students and their families in knowledge construction, creating a dynamic interaction between formal education and everyday practical experiences. In doing so, it stimulates problem-solving skills, critical thinking, and creativity, essential for addressing the complex challenges that characterize rural settings (Caldart, 2012).

Considering the points raised above and believing in a teaching perspective, we will refer to the teaching of Science here, which takes into account the learner's context since we advocate for Science teaching in rural schools that engages with their specificities. Science teaching has evolved over the years, aiming to establish itself as a learning process based on the understanding of the complexity of natural phenomena. However, it is evident that many students often face challenges and difficulties in this process, resulting in criticism and even rejection of this discipline. This scenario is even more pronounced in the context of Rural Education, an educational modality that emerges as a response to social and educational inequalities, often perpetuating traditional pedagogical practices that are distant from students' realities.

We consider that greater attention must be given to the ways in which teaching and learning processes are established in Science teaching in Rural Education. It is necessary to emphasize a new didactic approach based on the perception of reality and practical teaching. This involves valuing students' pre-existing knowledge on certain topics (Moraes, 2019; Moraes et al. 2018; Sassi, 2020; Saul, 2018; Pavanelli, 2022).

The difficulties faced by students, especially those from rural communities, can be attributed to a series of interconnected factors. In many cases, conceptual errors accumulate throughout the school journey, resulting in gaps in understanding that affect

the assimilation of more advanced scientific concepts. Additionally, the traditional approach adopted by some teachers, focused on the transmission of content in an expository manner and disconnected from students' realities, can contribute to a lack of interest and motivation in the subject.

A central point in understanding these difficulties is the absence of a connection between the content taught and students' experiences. Rural Education, rooted in the ideas of Paulo Freire (2011), emphasizes the importance of contextual and dialogical education that engages with students' realities and knowledge. Freire argues that the educational process should be an "encounter of human beings mediated by the world", an opportunity to critically explore the relationships between humans and the world around them. In this sense, it seeks to overcome the banking model of education, in which knowledge is deposited into students, and aims for the collective construction of knowledge through dialogue, reflection, and action.

The approach proposed by Freire (2011) assumes particular relevance in Rural Education, where the experiences, knowledge, and challenges of rural life can be integrated into the teaching of Natural Sciences in a way that makes the content more meaningful and relevant to students. Through this approach, it is possible to stimulate critical thinking and problem-solving skills, allowing students not only to understand scientific concepts but also to establish connections with their own experiences and perspectives on the world. This not only enriches learning but also strengthens students' sense of belonging to their communities and the educational process, encouraging active participation and engagement in the construction of meaningful and contextualized knowledge.

In this regard, our objective is to conduct a literature review on the conception of pedagogical practices focused on Science teaching in Rural Education. This review aims to understand and analyze the different approaches, strategies, and pedagogical perspectives used in rural contexts, identifying their contributions, challenges, and trends. Additionally, we seek to establish a critical and up-to-date overview that can serve as a reference to enhance Science teaching in rural schools, promoting contextualized and quality education.

After the aforementioned considerations in the Introduction, we present the theoretical framework of the study; next, the methodology, where we present the

approach, procedures, and instruments used for data organization in the study; subsequently, we present the description and analysis of the data, and finally, the conclusion, where we revisit the general objective and research assumptions, as well as their relationship with the research process for the closure of the text.

### **Pedagogical practices, rural education, and science education**

Pedagogical practices in Science teaching in Rural Education play a crucial role in constructing meaningful and relevant education for rural communities. These practices are essential for promoting student engagement, valuing local knowledge, and connecting theory and practice, reflecting the specific contexts, challenges, and aspirations of rural areas. It recognizes the particularities of rural communities, values their experiences and local knowledge, and aims to promote education beyond mere content transmission.

In this context, pedagogical practices become essential tools for building scientific knowledge, allowing students to explore and understand the natural phenomena around them, as well as their interactions with social, economic, and environmental aspects. This implies a contextualized approach, where Natural Sciences content is related to the specific issues of rural communities, encouraging reflection on the implications of human actions on the environment and people's lives.

For Freire (1997), the teaching and learning process consists of a role reversal, where the teacher learns to listen, and the student learns to express themselves. Learning in this sense enables interaction through dialogical action, i.e., interaction through collaboration between the teacher and the student, stimulating active student participation, allowing them to think about unique situations to share their knowledge about a particular situation.

Thus, pedagogical practices in Rural Education are characterized by horizontal dialogue between educators and students, where students' prior knowledge is valued and incorporated into the teaching and learning process. This participatory and collaborative approach empowers students, stimulating their curiosity and critical thinking skills while preparing them to play an active role in knowledge construction and community development.

We perceive that the major challenge for teachers working in Rural Education is to establish a connection between historically constructed knowledge and the social practices in which the learner is embedded, so that they can establish interaction with the context. These students have knowledge acquired through experiences and social constructions.

We score that pedagogical practices in Science teaching in Rural Education should recognize and value local knowledge. Rural communities have a vast accumulated knowledge over generations about agricultural practices, environmental conservation, and sustainable use of natural resources. Integrating this traditional knowledge into the scientific curriculum not only enriches learning but also validates and preserves the cultural identity of communities.

According to Freire (1989) and Souza (2012), pedagogical processes should function as transformative ruptures because they are social practices guided by objectives, purposes, and knowledge in a social practice context. Considering this premise, we understand that the dimension of pedagogical practice goes beyond the school environment, as it permeates the entire sociocultural formation of a society.

In the words of Souza (2012, p. 28), pedagogical practices are:

Educational processes in progress, historically situated within a specific culture, intentionally organized by institutions designated for this purpose, involving the practices of all and each of its subjects in the construction of the knowledge necessary for social, technical, and technological action.

This conception by Souza (2012) is supported by Freire (1989) and presents the idea that Pedagogical Practice is not limited to the classroom, as it is present in the human social construct. The teacher's pedagogical practice will either validate critical/reflective pedagogical action or reproduce the dominant ideology, which instigates research in this area.

When we point out that Pedagogical Practice consists not only of elements present in school, we are assuming that it interacts with the political, social, cultural, and educational phenomena to which students belong. In this aspect, we are considering its multicultural character.

According to Paulo Freire (1997), the act of teaching goes beyond transmitting or "depositing" content into others; it is an act that allows the learner to construct meaningful knowledge in dialogue with their teacher, related to their life. This enables the student to

critically reflect on their presence in and for the world, recognizing themselves as agents of transformation. With this understanding, the teacher's pedagogical practice now requires an understanding that knowledge, from a critical perspective, contributes to the students' conscientization process.

When discussing this concept of Pedagogical Practice, we understand that it is achieved through struggle, resistance, and overcoming, as it is anchored in counter-hegemonic assumptions, just like Rural Education, which is also a movement of struggle and resistance against the hegemonic conception of education. Rural Education is an educational modality that stands out for its importance in promoting sustainable development and valuing rural populations. The specificities of this modality require equally specific Pedagogical Practices that consider the reality, culture, and challenges of rural communities.

Defining Rural Education implies, above all, understanding its multifaceted essence, which encompasses intrinsically intertwined educational, social, and political aspects. At the core of this approach is the rejection of the notion that knowledge is static and uniform, and it is more appropriate to adopt a perspective that promotes collective knowledge construction, integrating local experiences and knowledge as crucial elements of the educational process (Arroyo, 2006).

According to Fernandes, Cerioli, and Caldart (2004, p. 14), Rural Education seeks "quality education, focused on the interests of life in rural areas". This definition emphasizes the importance of establishing an intrinsic connection between the educational process and the realities experienced by rural communities. In this sense, educating in rural areas is not limited to a set of pedagogical techniques but encompasses a broad and transformative approach aimed at meeting the specific demands and local needs of students residing in rural areas.

The immense cultural diversity existing in rural areas, despite the processes of emptying and silencing promoted by neocolonial thinking, persists. In this sense, we recognize the need for the academic community to respect and value the identity and culture of rural people. We point out this need because among the principles of Rural Education, we find respect for popular cultures and their preservation. As we can see in article 2 of the decree of the Rural Education of no. 7352/10 on Rural Education, which

presents the five principles that govern, guide, and mediate the entire process of constructing pedagogical practices adopted by Rural Education. They are:

I - Respect for the diversity of rural areas in their social, cultural, environmental, political, economic, gender, generational, and racial/ethnic aspects; II - Encouragement of the formulation of specific political-pedagogical projects for rural schools, stimulating the development of school units as public spaces for research and the coordination of experiences and studies aimed at socially, economically just, and environmentally sustainable development, in coordination with the world of work; III - Development of education professional training policies to meet the specific needs of rural schools, considering the concrete conditions of the production and social reproduction of life in rural areas; IV - Valuation of the identity of rural schools through pedagogical projects with curriculum content and methodologies appropriate to the real needs of rural students, as well as flexibility in school organization, including adapting the school calendar to the phases of the agricultural cycle and weather conditions; V - Social control of the quality of school education, through effective participation of the rural community and social movements (Brazil, 2010).

Based on these principles, Rural Education becomes a form of education and plays a fundamental role in the struggle for a popular education based on social practice, the principles, and values of rural subjects.

This demand points for contextualized teaching. As mentioned above, our focus here is on the teaching of Science, and this discussion and advocacy for contextualized Science teaching should contribute to the learning of basic concepts of Natural Sciences and their application in understanding the relationships between Science and society. Science teaching for Rural Education must ensure the transmission and systematization of regional and local knowledge and culture because we generally understand that the knowledge of Sciences is related to various social and cultural contexts, which can lead students to play a fundamental role in the formation of critical and conscious citizens capable of understanding and addressing scientific and environmental issues in their daily lives.

We consider it essential that the discussion of Science teaching in the rural context be based on the Freirean educational understanding that is focused on dialogical action through questioning, in order to go beyond the repetition of knowledge. We emphasize that the relevance of historically produced and socialized knowledge should not be removed from the context of the teaching and learning process.

According to Botelho (2016, p. 106), education should start from local problems and conflicts to "[...] build understandings and sociabilities resistant to the dominant logic of hierarchizing knowledge in the name of established power and of docilizing



consciences for the acceptance of the contradictions in which they are socially and historically situated". Such an understanding fits perfectly with the guidelines and principles of Rural Education.

We perceive that in the Freirean approach, experience is the starting point for dialogical education practice because students' interests are directly linked to their experiences and should be foreseen in the organization of content contained in the rural school curriculum, as advocated by the principles of Rural Education.

The role of Sciences in the education of rural students goes beyond the boundaries of disciplinary knowledge, extending to the promotion of the holistic development of the individual and the strengthening of rural communities. In a context where education is recognized as an agent of transformation and empowerment, contextualized and relevant educational approach plays a fundamental role in promoting meaningful learning and building a more promising future for students residing in rural areas (Arroyo, 2006).

Augusto and Mendes (2022, p. 275) point out that they do not deny that Science teaching requires its own language for orality, with the use of formulas and symbols, but the authors argue:

"[...] the need to create dialogical connections between the specificities of Chemistry and the cultural universe of the students, due to the diversity of rural individuals, their ways of life, their spaces of belonging. Thus, giving meaning to the lessons allows the learner to understand themselves as a fundamental part of the teaching and learning process, enabling them to play a role as knowledge builders, elaborating, giving meaning to Sciences in their own words in order to facilitate knowledge construction."

Just like the authors, we advocate that the teaching of Science should value and take into account the culture, social involvement, and everyday way of life of the rural population. In rural schools, particularly in the teaching of Science, it is necessary to ensure this contextualization of teaching anchored in life to ignite in the students the desire to understand the relationship between humans, nature, and society, and how they can transform and self-transform in the environment in which they live, thus being essential to understand science and its foundations. In accordance with this premise, we see that the LDB<sup>1</sup> 9394/96, regarding the rural population, in Article 28,

preconiza que: Na oferta de educação básica para a população rural, os sistemas de ensino promoverão às adaptações necessárias à sua adequação às

<sup>1</sup> Acronym in Portuguese for Lei de Diretrizes e Bases (Law of Guidelines and Bases).

peculiaridades da vida rural e de cada região, especialmente: I – conteúdos curriculares e metodologias apropriadas às reais necessidades e interesses dos alunos da zona rural; II – organização escolar própria, incluindo adequação do calendário escolar às fases do ciclo agrícola e às condições climáticas; III – adequação à natureza do trabalho na zona rural (Brasil, 1996, p. 10).

By this line of thinking, Rural Education becomes a project of struggle that addresses the needs and peculiarities of rural individuals. Recognizing this demand is the first step in reflecting on the formation and development of pedagogical practices in Science teaching that engage with Rural Education, bringing about a more enjoyable and satisfying teaching that recognizes the learner as a fundamental part of the knowledge-building process.

## 2 Methodology

This study is characterized as a qualitative and exploratory bibliographic research. According to Minayo (2010), the methodology includes epistemological discussions about the researched object, the set of techniques that allow the construction of reality, and the guidance for answering the specific inquiries of the investigator. Also, according to this author, the qualitative approach does not aim to discover or understand what is right or wrong but to work with the universe of meanings, aspirations, beliefs, values, and attitudes, which leads to a deeper space of relationships, processes, and phenomena that cannot be reduced to the operationalization of variables. The choice of the methodological path was essential to enable us to research the proposed objective effectively.

The study focused on relevant and authoritative sources, specifically scientific articles available on the Scientific Electronic Library Online (SciELO) and the Brazilian Magazine of Rural Education (Revista Brasileira de Educação do Campo, RBEC), covering the period from 2018 to 2023. We selected the works based on their titles and then read the abstracts and keywords to reach the object of study. According to Gil (2002, p. 44), bibliographic research "is developed based on already elaborated material, consisting mainly of books and scientific articles". The choice of these databases was due to their extensive coverage and credibility in the field of educational research, as well as their concentration of studies related to Rural Education and the teaching of Sciences in this context. The temporal delimitation from 2018 to 2023 was established to ensure

the timeliness and relevance of the analyzed data, considering the advances and changes that may have occurred during this time frame.

Data collection involved a systematic and thorough search for articles that explored the specific research theme. Relevant keywords were used, such as "Rural Education", "Pedagogical Practices", "Science Education", among others, aiming to identify studies that investigated and discussed pedagogical approaches used in the teaching of sciences in rural areas.

The selection of articles was based on criteria of relevance, scientific rigor, and contribution to the field of education. From this selection, a full-text reading of the selected texts was conducted, and an in-depth analysis was carried out to extract pertinent information about the conceptions of Pedagogical Practices adopted in Rural Education contexts.

### 3. Results and Discussion

Throughout this section, we present the main findings of the research, highlighting the different pedagogical approaches and methodological strategies identified in the analyzed articles. We examined the convergent and divergent points between the studies, as well as the practical implications of these conceptions in the teaching of Sciences in rural schools.

Six articles were found, with 2 of them in SciELO and the other 4 in the Brazilian Magazine of Rural Education, as shown in Table 1.

**Table 1.** Works identified in the Scielo and Revista Brasileira em Educação do Campo journals.

Year	Title	Author	Periodical
2018	Earth paint workshop: contextualizing pigments in the History of Chemistry discipline at LEdoC/UFMA	JUNIOR, Meubles Borges; SOARES, Matheus Casimiro Ferreira; ARANHA, Carolina Pereira	<i>Brazilian Magazine of Rural Education</i>
2019	Supervised internship experiences in Natural Sciences in a rural school: reflection on pedagogical practices in the initial training of Rural Education teachers	ARAÚJO, Andiara dos Santos; PORTO, Klayton Santana	<i>Brazilian Magazine of Rural Education</i>
2020	Rural education in the voice of research in science education	SOUZA, Josiane de; OSTERMANN, Fernanda; REZENDE, Flavia.	<i>Science Education Research Essay</i>

			<i>Base SciELO</i>
2021	Rural Education and Science Education: Experiences in a riverside school in the south of the State of Amazonas	MELO, Paula Regina Humbelino de; BATISTA, Eliane Regina Martins; CAMARGO, Tatiana de Souza	<i>Brazilian Magazine of Rural Education</i>
2021	Rural Education, CTS, Paulo Freire and Curriculum: research, confluences and approaches	WERLANG, Jair; PEREIRA, Patrícia Barbosa	<i>Science &amp; Education</i>
2022	Teaching and learning methodologies in Science Education at Euclides Moreira Pontes School, Quilombola Community São Benedito do Vizeu - Pará	LOPES JÚNIOR, et al.	<i>Base SciELO</i> <i>Brazilian Magazine of Rural Education</i>

Source: The authors, 2023..

The study by Junior, Ferreira, Aranha (2018) entitled "Earth Paint Workshop: Contextualizing Pigments in the History of Chemistry Discipline in LEdoC/UFMA" explores innovative pedagogical practices in Science Education, particularly in Rural Education. The earth paint workshop, presented in the study, serves as an example of a practical and contextualized approach to teaching Chemistry, emphasizing the relationship between Science, Technology, Society, and Environment (in Portuguese, *Ciência, Tecnologia, Sociedade e Ambiente, CTSA*).

The methodology includes lectures, reading and interpretation of scientific articles, debates, and practical activities such as the production of earth paint and the painting of ceramic artifacts. The workshop aims to deepen students' knowledge of pigment chemistry in a way that relates to their experiences and daily realities, promoting more meaningful learning.

Junior, Ferreira, Aranha (2018) point to an increase in student engagement and understanding as a result, suggesting that this practical and contextualized approach is effective in Science teaching in Rural Education. They emphasize the importance of pedagogical practices that integrate theoretical knowledge with practical and real experiences through a contextualized approach to Science Education, especially in Rural Education.

Araújo and Porto (2019) adopted an investigative and documentary approach to analyze the supervised internship experience in Natural Sciences at a rural school, focusing on pedagogical practices in the initial training of Rural Education teachers.

The research highlights the relevance of the internship in teacher education, providing a deeper understanding of the educational reality in rural areas and the integration of theory and practice, as well as the importance of interdisciplinarity, content contextualization, and teacher preparation to face the specific challenges of Rural Education.

The authors emphasize the importance of education that is grounded in students' reality and that promotes an interdisciplinary approach with the integration of content from different disciplines and areas of knowledge. However, they point out that this approach still faces significant challenges, such as the lack of teacher preparation to develop interdisciplinary practices aligned with the principles of Rural Education. This may be related to the absence of initial and ongoing training focused on this approach, as well as the teachers' work in areas that may differ from their original training.

The study conducted by Souza, Ostermann, and Rezende (2020) presents a literature review on Science teaching in Rural Education, exploring national and international references on the subject. The research focused on the discursive analysis of the convergence between these two areas, seeking to understand how this integration is addressed in academic literature.

Through the literature review, the authors were able to examine how discussions and approaches in Science teaching relate to the specific needs and characteristics of Rural Education. They highlight that despite Rural Education being on the agenda in Brazil since 2009 and the emergence of various Rural Education degree programs with an emphasis on Science over the years, the presence of discussions about this intersection in national and international scientific publications on Science Education is not as significant as expected.

This finding points to a gap in academic literature regarding Science teaching in Rural Education. Despite efforts and advances observed in the educational landscape, there seems to be a significant gap in academic discussions and reflections on how Science can be effectively and contextually taught and learned in rural schools.

In conclusion, the work of Souza, Ostermann, and Rezende (2020) emphasizes the importance of filling this gap in the literature, encouraging researchers to explore more deeply the relationship between Science teaching and Rural Education, thus

contributing to the development and improvement of education in these specific communities.

Melo, Batista, and Camargo's research (2021), entitled "Rural Education and Science Teaching: Experiences in a Riparian School in the Southern State of Amazonas", offers an in-depth analysis of the integration of Science teaching with the reality of riparian communities in the Amazon. This qualitative and descriptive study investigates how traditional and popular knowledge can be harmonized with formal Science teaching using participatory methods that include questioning, practical classes, and drawings.

The research highlights the importance of connecting local knowledge to scientific concepts, proposing an educational approach that values the social, cultural, and environmental dimensions inherent in Rural Education. This multidimensional approach recognizes the need for a curriculum that is relevant to the specific realities of riparian communities, where traditional knowledge plays a crucial role in students' daily lives.

The analysis of the results obtained by the researchers demonstrates that when local knowledge and scientific knowledge are integrated effectively, they can significantly improve the quality of education offered to rural and riparian communities, not only enriching the curriculum but also strengthening students' cultural identity and their understanding of Science as a useful tool in their life context.

The work of Werlang and Pereira (2021) addresses the relationship between Rural Education, Science, Technology, and Society (in Portuguese, *Ciência, Tecnologia e Sociedade, CTS*), Paulo Freire's Pedagogy, and Curriculum and explores how these dimensions interconnect and contribute to innovative and contextualized pedagogical practices in Rural Education. The research reflects on the importance of a curriculum that combines scientific knowledge with the socio-economic and cultural context of rural students. There is an emphasis on the use of active teaching methodologies that promote students' active participation in knowledge construction. This includes strategies such as Project-Based Learning, case studies, and practical experimentation, aligned with Paulo Freire's principles. This involves discussing topics such as sustainability, natural resource management, and appropriate technologies for rural contexts.

Another point emphasized by Werlang and Pereira (2021) is the need for curriculum contextualization, adapting Science content to reflect the specific realities and

challenges of rural communities. This may include studies on agroecology, sustainable resource management, and local agricultural practices.

Participatory research is presented as a valuable tool, where students and teachers collaborate with local communities on research projects that address real problems faced by rural residents. This approach encourages critical thinking and the practical application of scientific knowledge.

Science teaching in Rural Education, as presented in the article, requires a holistic, contextualized, and participatory approach that values local knowledge and promotes the integration of Science, Technology, and Society, following the principles of Freirean education.

The article "Teaching and Learning Methodologies in Science teaching at the Euclides Moreira Pontes School in the São Benedito do Vizeu Quilombola Community - Pará" by Júnior et al. (2022) investigates Science teaching strategies in a Quilombola community in Pará. The focus is on developing methodologies that respect and integrate the history and culture of the Quilombola community, combating the fragmentation of Science Education. The study uses interviews and observations to assess how different pedagogical practices, including experiments, games, and practical lessons, can increase student motivation and interest, providing more meaningful learning.

Júnior et al. (2022) emphasize the need to align Science teaching with the cultural and social realities of Quilombola students. By incorporating the community's history and values into the curriculum, the proposed methodologies aim to create a more engaging and effective learning environment. The research suggests that innovative and contextualized pedagogical practices can be extremely beneficial in diverse learning environments, such as Quilombola communities.

Through the observed practices and interviews conducted, the researchers point out that when students can relate scientific content to their life experiences and culture, they become more engaged and interested in learning. This approach not only improves students' academic performance but also values and preserves local culture.

The research reveals that traditional teaching methods are often insufficient or inadequate to address the specific educational needs of Quilombola communities. In contrast, innovative methodologies, including practical and playful activities, prove to be

more effective in this context. They allow students to explore scientific concepts in a more applied and relevant manner to their cultural and social context.

The study emphasizes the need for a pedagogical approach that is both inclusive and respectful of local traditions and culture. By doing so, Science teaching can become more meaningful, relevant, and inspiring for students, contributing to a more comprehensive and effective education in Quilombola communities.

All of these studies highlight the importance of research on Pedagogical Practices in Science teaching for Rural Education and how they can contribute to the social, democratic, and critical development of rural students.

## 5 Final considerations

During the course of this study, our central objective was to map pedagogical practices, challenges, and opportunities that permeate this educational context, with the intention of deepening the understanding of the complex interactions between Science teaching and the particularities of Rural Education.

The analysis of the examined works clearly revealed that Rural Education is an educational modality that presents a series of specificities and challenges. The interconnection between Science teaching and Rural Education emerges as promising ground for promoting contextualized and meaningful pedagogical practices. Such practices have the potential to engage students in a learning process that values their local experiences while promoting a broader and more critical understanding of the world around them.

It became evident, however, that there are challenges to be overcome. The absence of teaching materials that reflect rural reality, the lack of adequate teacher training, and the need for a pedagogical approach that takes into account the particularities of Rural Education are issues that still require attention and joint efforts from educators, administrators, and educational policymakers.

In light of these considerations, it is undeniable that research in this field is ongoing and essential. Rural Education, combined with Science Education, has significant transformative potential for rural communities and for the construction of a more aware, participatory, and committed society towards sustainability and comprehensive



development. Therefore, this study, by highlighting relevant aspects of this scenario, seeks to inspire future research and pedagogical improvements that can further enrich education in rural areas, contributing to the formation of citizens prepared to face the challenges of an ever-evolving world.

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