


GEOSCIENCES MUSEUM, UNIVERSITY EXTENSION, AND KNOWLEDGE PRODUCTION: ARTICULATIONS AMONG TEACHING, RESEARCH, AND EDUCATIONAL TRAINING IN GEOGRAPHY, SCIENCE, AND HISTORY EDUCATION

MUSEU DE GEOCIÊNCIAS, EXTENSÃO UNIVERSITÁRIA E PRODUÇÃO DO CONHECIMENTO: ARTICULAÇÕES ENTRE ENSINO, PESQUISA E FORMAÇÃO EM EDUCAÇÃO, ENSINO DE GEOGRAFIA, CIÊNCIAS E HISTÓRIA

MUSEO DE GEOCIENCIAS, EXTENSIÓN UNIVERSITARIA Y PRODUCCIÓN DEL CONOCIMIENTO: ARTICULACIONES ENTRE ENSEÑANZA, INVESTIGACIÓN Y FORMACIÓN EDUCATIVA EN LA ENSEÑANZA DE GEOGRAFÍA, CIENCIAS E HISTORIA

 10.56238/revgeov17n4-059

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ABSTRACT

This study aims to analyze the contributions of research and extension projects linked to the Geosciences Museum of the State University of Northern Paraná (UENP), highlighting their

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articulation with teaching, teacher education, and scientific knowledge production. Methodologically, this is a qualitative study based on bibliographic review, document analysis, and systematization of institutional practices. The research is grounded in theoretical frameworks addressing the social role of the university, critical epistemology, and the role of museums as spaces of scientific mediation, drawing on authors such as Santos, Freire, Hooper-Greenhill, and Cavalcanti. The results indicate that the Geosciences Museum functions as a strategic space for integrating teaching, research, and extension, contributing to the preservation of geological and archaeological heritage, as well as to scientific education and geographical literacy. Furthermore, the study highlights advances in student training through participation in research and extension projects, particularly through the use of active methodologies, innovative teaching resources, and digital technologies. It is concluded that the articulation between university and society strengthens the construction of a more democratic, interdisciplinary, and socially engaged science.

Keywords: Geosciences. University Extension. Geography Teaching. Museum. Knowledge Production.

RESUMO

Este estudo tem como objetivo analisar as contribuições dos projetos de pesquisa e extensão vinculados ao Museu de Geociências da Universidade Estadual do Norte do Paraná (UENP), evidenciando suas articulações com o ensino, a formação docente e a produção do conhecimento científico. Metodologicamente, trata-se de uma pesquisa de natureza qualitativa, baseada em revisão bibliográfica, análise documental e sistematização das práticas desenvolvidas no âmbito institucional. O trabalho fundamenta-se em referenciais teóricos que discutem a função social da universidade, a epistemologia crítica e o papel dos museus como espaços de mediação científica, destacando autores como Santos, Freire, Hooper-Greenhill e Cavalcanti. Os resultados indicam que o Museu de Geociências configura-se como um espaço estratégico para a integração entre ensino, pesquisa e extensão, contribuindo para a preservação do patrimônio geológico e arqueológico, bem como para a promoção da educação científica e da alfabetização geográfica. Além disso, evidenciam-se avanços na formação de estudantes por meio da participação em projetos de iniciação científica e extensão, com destaque para o uso de metodologias ativas, recursos didáticos inovadores e tecnologias digitais. Conclui-se que a articulação entre universidade e sociedade, mediada por práticas extensionistas e educativas, fortalece a construção de uma ciência mais democrática, interdisciplinar e socialmente comprometida.

Palavras-chave: Geociências. Extensão Universitária. Ensino de Geografia. Museu. Produção do Conhecimento.

RESUMEN

Este estudio tiene como objetivo analizar las contribuciones de los proyectos de investigación y extensión vinculados al Museo de Geociencias de la Universidad Estadual del Norte de Paraná (UENP), destacando su articulación con la enseñanza, la formación docente y la producción del conocimiento científico. Metodológicamente, se trata de una investigación cualitativa basada en revisión bibliográfica, análisis documental y sistematización de prácticas institucionales. El estudio se fundamenta en enfoques teóricos que discuten la función social de la universidad, la epistemología crítica y el papel de los museos como espacios de mediación científica, con base en autores como Santos, Freire, Hooper-Greenhill y Cavalcanti. Los resultados evidencian que el museo se configura como un espacio estratégico para la integración entre enseñanza, investigación y extensión, contribuyendo a la preservación del patrimonio geológico y arqueológico, así como a la



educación científica y la alfabetización geográfica. Asimismo, se destacan avances en la formación de estudiantes mediante su participación en proyectos de investigación y extensión, con énfasis en metodologías activas, recursos didácticos innovadores y tecnologías digitales. Se concluye que la articulación entre universidad y sociedad fortalece la construcción de una ciencia más democrática, interdisciplinaria y socialmente comprometida.

Palabras clave: Geociencias. Extensión Universitaria. Enseñanza de Geografía. Museo. Producción del Conocimiento.



1 INTRODUCTION

The contemporary university faces the challenge of reaffirming its social function within a context marked by profound scientific, technological, and socio-environmental transformations. In this scenario, the articulation among teaching, research, and extension emerges as one of the primary pillars for the production of socially relevant knowledge, capable of engaging with societal demands and contributing to the critical formation of individuals.

In the field of Geosciences and Geography, this integration assumes an even more significant role, as these areas are dedicated to understanding the dynamics between society and nature, as well as analyzing the spatial processes that structure territory. The creation and consolidation of university museums, particularly those focused on Geosciences, are situated within this context as fundamental strategies for the democratization of scientific knowledge and the preservation of natural and cultural heritage.

According to Boaventura de Sousa Santos (2006), universities must overcome the logic of knowledge production detached from social reality, promoting an ecology of knowledge that values multiple epistemologies. In this perspective, university museums emerge as privileged spaces for mediating between science and society, contributing to the construction of a more plural, critical, and accessible science.

Moreover, the growing recognition of geological, archaeological, and environmental heritage reinforces the importance of initiatives aimed at its preservation and dissemination. In the specific case of the State University of Northern Paraná (UENP), the structuring of the Geosciences Museum at the Cornélio Procópio campus represents a strategic action that integrates scientific research, extension practices, and pedagogical activities, as evidenced in institutional projects.

Public universities play a fundamental role in structuring and developing contemporary society. They constitute instruments of social transformation, inclusion, and opportunity, while also addressing social inequalities and structural challenges that permeate the collective organization of society. These institutions consolidate themselves as environments for the mutual construction of scientific knowledge, critical reflection, and the promotion of cultural emancipation. Their importance lies, above all, in their accessibility to diverse social groups, enabling individuals to access high-quality higher education regardless of their socioeconomic condition.

Historically, Brazilian higher education was established in 1808 under strong Eurocentric influence, representing an initial framework of what would later become the public university system. As global transformations reshaped modes of teaching and learning,



education in Brazil evolved in response to both colonial demands and the socio-political conditions associated with the Portuguese Court.

The educator and jurist Anísio Teixeira (1989, p. 45) “highlights that Brazil was one of the last countries to establish universities”, a process deeply influenced by the urgent needs arising from the transfer of the Portuguese Crown to Rio de Janeiro. This context required specialized training, particularly in military and territorial knowledge, where Geosciences played a strategic role in territorial recognition and mapping practices.

Brazil presents a distinctive case in Latin America: while Spain established numerous universities throughout its colonies, Portugal limited higher education to institutions located in the metropolis, such as Coimbra and Évora (Teixeira, 1976⁹). This historical configuration contributed to the delayed institutionalization of higher education in Brazil and reinforced patterns of epistemological dependence.

By the end of the Imperial Period in 1889, higher education in Brazil had undergone gradual development, as both colonial authorities and the colony itself, particularly the emerging Brazilian elite, demonstrated strong resistance to the establishment of a national institution. This resistance stemmed from a patriarchal mindset and longstanding practice of sending their children to study in countries regarded as civilizational references and centers of knowledge production.

As a result, a process of overvaluation of foreign culture at the expense of national development became evident, its effects can still be observed today in the tendency to privilege foreign knowledge over that produced within national territory.

Furthermore, it is important to highlight that academic Eurocentrism contributed to the maintenance of epistemic inequalities, as it defined which forms of knowledge were considered valid and which were relegated to secondary positions. This dynamic has affected not only scientific production but also the formation of individuals within universities and broader sociocultural development (Quijano, 2005).

During this period, intellectual debates increasingly emphasized the importance of universities as foundational institutions for societal development. A significant milestone occurred in 1931¹⁰ with the Francisco Campos Reform, which regulated higher education and established greater administrative centralization. This reform also structured secondary and

⁹ Brazil is an exception in Latin America: while Spain spread universities throughout its colonies – there were 27 at the time of independence – Portugal, apart from the royal Jesuit colleges, limited us to the Universities of the Metropolis: Coimbra and Évora (Teixeira, 1976, p. 244).

¹⁰ Article 108. In order to implement measures of provision and beneficence in relation to the student bodies of higher education institutions, including the granting of scholarships, there must be an understanding between the Society of University Professors and the Central Student Directory, so that those measures are subject to strict criteria of justice and opportunity (Brazil, 1931).



higher education, contributing to the institutional consolidation of the Brazilian educational system (Coelho; Vasconcelos, 2009).

These transformations introduced new forms of academic organization and contributed to shaping the contemporary educational landscape. They also reflected broader efforts to align scientific production with state interests, reinforcing the role of universities as instruments of national development (Sguissardi, 1993).

Regarding the state of Paraná, in contrast to developments in other regions of the country, the first institution of higher education established was a university. The Paraná elite did not possess significant financial resources, and educational initiatives evolved alongside the economic development of the recently constituted state. According to Wachowicz (1983), efforts were directed toward the establishment of a generalist educational model, in which research had not yet been considered a central or indispensable component.

During the Estado Novo period, the concept of federalization emerged as an attempt to democratize access to education and to prevent it from being restricted to elite groups, as noted by Michelotto (2011). In alignment with this perspective, the sociologist Florestan Fernandes posed a critical paradox: “to have a wealthy university in a poor world, or a revolutionary university in a conservative society,” thereby emphasizing the importance of the university as an agent of social transformation and inclusion within the national context.

Within the broader trajectory of historical development and continuous processes of innovation, the twentieth century was marked by a multiplicity of ideological currents, modernization efforts, and an increasing emphasis on national development. Political and intellectual transformations emerged from a pressing need for renewal and from processes of decolonization, encompassing a range of critical theoretical approaches aimed at breaking with persistent structural constraints.

Critiques of Eurocentrism were further developed by Latin American scholars, particularly within debates surrounding the consolidation of national identity, highlighting the persistence of power structures within the epistemological domain. Among the dominant intellectual movements of the period, reformist and technocratic perspectives stand out.

The Escola Nova movement, as one of these currents, represents a perspective that integrates teaching, research, and extension. It sought to analyze and foster individual aptitudes, while also considering the prior cultural background brought by students. In opposition to traditional education, it advocated for active methodologies, emphasizing student protagonism in the construction of knowledge.

The emergence of the concept of “educational sciences” is also noteworthy, accompanied by the adoption of educational measures aimed at addressing what was



considered “the Nation’s primary problem.” This period was marked by the dissemination of psychological theories and techniques, the publication of didactic-methodological works, and the consolidation of pedagogy as an “experimental science” (Coelho; Vasconcelos, 2009, p. 9¹¹).

It is also necessary to consider the technocratic strand, which emerged from economic progress and was grounded in specialized training. As a capitalist instrument characterized by technical planning, it sought to rationalize the model of knowledge production through scientism, aiming to ensure greater efficiency and improved outcomes (Santos; Rothen, 2015).

[...] Technocracy must ensure that every individual is guaranteed the opportunity to access and complete their formal education within a public educational institution under the responsibility of the State (Santos; Rothen, 2015, p. 87¹²).

Thus, revisiting the arduous path through which Brazilian academia sought to establish itself within the national context, it becomes evident, repeatedly affirmed, that the academic rigor adopted in Brazil has historically privileged scientific models originating from Europe, treating them as benchmarks of legitimacy, methodological rigor, and absolute truth.

This perspective is directly related to the reflections of the sociologist Boaventura de Sousa Santos, who argues that decolonial studies promote subaltern narratives, enabling epistemological interventions that are often absent in postcolonial studies, thereby expanding the understanding of the complex intersections between race, gender, and class.

Furthermore, despite the challenges inherent in institutional development, it is now possible to speak of democracy within the university sphere. However, during the 1960s, academic life was profoundly shaped by the suppression of constitutional rights and marked by intense political violence. As such, universities, being integral components of society, were not immune to censorship and repression.

The dictatorial period, which lasted from 1964 to 1985, was responsible for numerous violations of individual and collective freedoms. Justified through Institutional Act No. 5 (AI-5), this period imposed strict control over literary production and significantly restricted resources allocated to research and extension activities.

¹¹ We speak of ‘educational sciences’, we use educational measures [...] ‘the main problem of the Nation’, we move on to the dissemination of psychological techniques and theories, the promulgation of didactic-methodological works, to the study of pedagogy as an ‘experimental science’ (Coelho; Vasconcelos, 2009, p. 9).

¹² [...] Technocracy must ensure that the human person has the opportunity to access and complete their educational training in a public educational institution, under the responsibility of the State (Santos; Rothen, 2015, p. 87).



Nevertheless, it is also important to acknowledge that this period witnessed increased investment in applied research, particularly through the creation of institutions such as the National Council for Scientific and Technological Development (CNPq), aimed at promoting technological advancement and fostering economic growth. In this regard, the economist Gary Becker (1993) later argued that “education and training increase individuals’ productivity, raising their future earnings” (Becker, 1993, p. 17).

From 1969 onward, there was a significant increase in public funding for the educational sector, which strongly stimulated research activities. In some cases, this expansion allowed for the replacement of prominent intellectuals who had been removed during the dictatorship with a new generation of scholars. Within this context, the national graduate education system was structured, as strategic sectors of the government were convinced of the importance of investing in education (Motta, 2014, p. 198¹³).

In contrast to the social functions associated with research and its resulting outputs, Farraco (2002) points out that “[...] the division between basic and professional disciplines has established a complex academic gap from which we have not yet managed to free ourselves.” This observation highlights, in particular, the field of physical geology, considering the interest in soil studies and the prioritization of strategic mining.

A brief examination of the gradual process of university formation proves to be essential. In discussions concerning the importance of promoting research and extension, historical memory is understood as a living element that adds value to scientific narratives, standing in opposition to obsolete concepts rooted in colonial legacies that persist in society. One of the main challenges faced by academia in the postmodern period is confronting the widespread discourse that implicitly undermines the social function of universities and education in general, reducing them to purely economic interests and disregarding their broader societal purpose.

Subsequently, the redemocratization of Brazilian society was influenced by diverse social and academic movements, including the resistance of educational institutions and their articulation with broader social movements. In the state of Paraná, these processes can be observed through the expansion of the teachers’ movement and the reorganization of student bodies. At the national level, universities struggled to survive and reestablish themselves amid the difficulties imposed by the authoritarian period of military rule.

¹³ From 1969 onwards, there was a significant increase in public funding in the education sector, strongly boosting research, which in some situations allowed for the "replacement" of important names that had been removed by others from a new generation of professionals. In this context, the national postgraduate system was structured, when strategic sectors of the government were convinced of the importance of investments in education [...] (Motta, 2014, p. 198).



Later, with the need for a Constitution that prioritizes human dignity and prevents the erosion of civil and constitutional rights, Silva (2020) argues that the consolidation of a Democratic Rule of Law, grounded in popular sovereignty, depends fundamentally on the effective implementation of the rights enshrined within it. In this context, universities assume a strategic role in the materialization and institutionalization of these rights.

As established by the 1988 Federal Constitution, the right to quality education is recognized as a fundamental and collective right.

Quality is the essential criterion when discussing any service provided to society, and this principle equally applies to education. There is no doubt that the country requires a well-educated youth as its greatest guarantee for ensuring progress, development, and the maturation of present and future society. Families and students seek to improve their lives by investing in education, driven by the belief that it enables the realization of their aspirations. Ultimately, society as a whole recognizes that education plays a decisive role (Juliatto, 2005, p. 47¹⁴).

The integration between research and extension is responsible for maintaining a continuous link between the external community and the academic community, and this triad is intrinsically connected to processes of social construction and management. At the regional level, when considering Northern Paraná, this relationship is particularly relevant due to its geological and environmental diversity, which includes varied soils, sedimentary formations, and significant water resources.

With the promulgation of the Federal Constitution of 1988, which consolidated the role of universities as spaces for knowledge production and the formation of citizenship, these institutions assumed a central function within society, ensuring the realization and institutionalization of constitutional rights. In this context, the sciences, and particularly Geosciences, are entrusted with the responsibility of acting with both intellectual autonomy and social commitment.

Within this framework, public universities emerge as instruments of social transformation, contributing to the reduction of inequalities and to the construction of a more just society. By providing free and high-quality education, these institutions expand opportunities and enable the social mobility of historically marginalized groups. Furthermore, they are responsible for a significant portion of the country's scientific research, highlighting

¹⁴ Quality is what truly matters when we talk about any type of service offered to society. This principle also applies when the subject is education. There is no doubt that the country needs a well-educated youth as its greatest guarantee for ensuring the progress, development, and maturity of present and future society. Families and students seek to improve their lives by investing in education, believing that in doing so they realize their dreams. Simply put, we all believe that school makes a difference (Juliatto, 2005, p. 47).

their strategic role in technological advancement, innovation, and the formulation of effective public policies aimed at national development (Quijano, 2005).

It is also important to emphasize that Geosciences education in Brazilian universities is characterized by the articulation between theory and practice. Cordani and Ernesto (2018) argue that the discipline should operate in an integrated manner, fostering analytical, methodological, and scientific competencies among students. They also highlight that university extension connects geoscientific knowledge with society, making it accessible beyond academic boundaries and enabling students and researchers to engage directly in applied projects, thus reinforcing the notion of opportunity.

Alves and Barreto (2024) further emphasize that extension initiatives, such as scientific literacy programs in Geosciences, contribute to the democratization of knowledge by fostering interest and familiarization with concepts that were previously inaccessible to broader segments of society.

In summary, it is postulated that the university, as a historically constituted social institution, plays a central role in the formation of individuals, not only from a technical and professional standpoint, but, above all, in the development of critical, reflective, and socially engaged subjects. The articulation between Geosciences, geopolitics, society, and sustainability emerges as a central analytical axis for understanding contemporary dynamics related to territory and natural resources.

From this perspective, knowledge production is intrinsically linked to the principle of the inseparability of teaching, research, and extension. The valorization of a culture of learning within the university environment becomes an essential condition for the effectiveness of these formative processes. Viewing education as a continuous, collaborative, and socially situated practice, where knowledge is collectively constructed and oriented toward social transformation, constitutes an urgent necessity.

Thus, the present study aims to analyze the contributions of research and extension projects linked to the Geosciences Museum of UENP, highlighting their role in academic training, knowledge production, and the promotion of scientific education. It also seeks to reflect on the interfaces between heritage, memory, and epistemology, emphasizing the potential of such spaces in fostering a critical and interdisciplinary geographical education (Campos et al., 2024; Campos et al., 2025).

2 GEOSCIENCES MUSEUMS, HERITAGE, AND MEMORY

Geosciences museums play a fundamental role in the preservation and dissemination of geological and archaeological heritage, constituting spaces for the production and



socialization of scientific knowledge. Contrary to a traditional conception that defines them merely as repositories of objects, contemporary museums are understood as dynamic environments for the construction of meanings and cultural mediation.

According to Eilean Hooper-Greenhill (1992), museums should be understood as institutions that produce narratives and interpret the world, acting as active agents in the construction of knowledge. This approach shifts the focus from conservation alone to communication, emphasizing the educational and social roles of these institutions.

In this context, the notion of memory becomes central to understanding the function of museums. As argued by Pierre Nora (1993), museums can be considered “sites of memory”, that is, symbolic spaces where collective experiences are materialized and preserved. In the case of Geosciences museums, this memory relates both to the natural history of the Earth and to human interactions with the environment.

Within the field of Geography, this discussion is articulated through the concept of territory, understood not merely as a physical space, but as a social and historical construction. According to Milton Santos (2006), territory results from the interaction between technique, time, and society, and is therefore fundamental for analyzing spatial dynamics. In this sense, the museum can be interpreted as a symbolic territory where science, culture, and memory converge.

Geosciences encompass a set of knowledge related to the physical and natural components that structure planet Earth, including fields such as pedology, geology, geomorphology, hydrology, among others. Their objective is to understand, through an interdisciplinary approach, the evolution, dynamics, and structure of the Earth. To achieve this, both theoretically and practically, Geosciences rely on institutional spaces that preserve and support scientific investigation, among which museums play a central role.

The museum may be defined as a space dedicated to research, study, and public engagement, adapted to the characteristics of its collections, whether natural or cultural (IBRAM, 1987). Its functions include scientific dissemination, education, preservation, and the safeguarding of memory, serving society through the communication of knowledge.

Within this framework of preservation, memory, and education, the importance of geological and archaeological heritage emerges as fundamental to the development of scientific knowledge. Geological heritage preserves abiotic elements of nature, encompassing components of geodiversity that are essential for understanding Earth’s evolution and dynamics. Archaeological heritage, in turn, preserves material evidence of human culture, representing the historical dimension of human-environment interaction.



These forms of heritage are preserved within museums, which function as institutions responsible for safeguarding both the natural and social legacies of the planet, often transcending temporal scales. In this sense, museums do not merely store objects, but rather conserve evidence of processes that connect past, present, and future.

According to Brilha (2009, p. 29), geological heritage constitutes a significant record of Earth's history, highlighting the importance of dedicated spaces for its preservation and dissemination, particularly for educational purposes. The author emphasizes that geodiversity should not be understood solely from a utilitarian or economic perspective, but rather as a sociocultural value that underpins human existence, giving meaning to the present through traces of the past.

Similarly, Pereira, Rios, and Garcia (2016, p. 199–200) argue that the conservation of geological and archaeological remains within educational and museum spaces is essential for promoting scientific literacy and fostering collective awareness. These practices contribute to the recognition of geodiversity as a fundamental element in the construction of geoscientific knowledge and environmental consciousness within society.

Within this perspective, the museum emerges as a space for both scientific production and dissemination, fulfilling a crucial communicative and educational role. The management of collections requires adherence to principles of scientific museology, which establish criteria for cataloging, conservation, and interpretation. Such practices ensure that museums transcend the condition of mere repositories of artifacts, becoming institutions committed to the accurate preservation and transmission of scientific knowledge (IBRAM, 1987).

Thus, Geosciences, when developed within spaces dedicated to scientific communication and knowledge production, such as museums, transcend the physical boundaries of institutions and become embedded in the relationship between memory and territory within society. Geological and archaeological heritage preserved in museums is not inert objects devoid of meaning; rather, they represent testimonies of the evolution of both natural and social spaces, forming the physical and symbolic basis of cultural identities.

In this sense, museums become territories of collective memory, where the understanding of biospheric dynamics, material cultural artifacts, and traces of the past contribute to strengthening a sense of belonging among local populations. These elements confer meaning and identity to territories, both in their material and immaterial dimensions.

Therefore, Geosciences museums consolidate themselves as essential interfaces between scientific knowledge and society, functioning as dynamic spaces for education, preservation, and memory. By safeguarding geological and archaeological heritage, these



institutions not only protect material evidence but also contribute to constructing meanings associated with the territories in which they are located.

By making visible the geological history of the Earth and the traces of human occupation, museums enable society to recognize its own identity, transforming geoscientific knowledge into an instrument for environmental awareness and the strengthening of collective memory.

In the specific case of the Geosciences Museum of UENP, the organization and cataloging of archaeological, mineralogical, and paleontological collections, as described in the institutional research project, reinforce its role as a space for preservation and knowledge production (Campos et al., 2024; Campos et al., 2025). The systematization of these materials not only ensures their conservation but also enables new scientific and educational interpretations.

3 RESEARCH METHODOLOGIES AND SCIENTIFIC PRODUCTION

Brazilian archaeology is grounded in the systematic analysis of material remains that reveal the social complexity, cultural diversity, and technological sophistication of pre-colonial populations. The development of this discipline in Brazil has evolved from an initial phase marked by the descriptive accounts of chroniclers and naturalists to a consolidated scientific field, structured upon geoscientific and archaeological methodologies aimed at understanding the interactions between humans and the environment (Prous, 1992).

The systematization of Brazil's archaeological heritage began in an incipient manner through the records of colonial chroniclers, who identified sites such as shell mounds (sambaquis) and rock inscriptions, albeit without a clearly defined scientific purpose. From the nineteenth century onward, particularly with the arrival of the Portuguese Court and the work of naturalists such as Peter Wilhelm Lund, archaeological research acquired a more systematic and methodological character. Lund, considered the father of Brazilian paleontology, conducted extensive studies in the Lagoa Santa region, documenting hundreds of caves and establishing the basis for discussions on the antiquity of human occupation in the Americas (Prous, 1992).

The institutionalization of archaeological collections was consolidated with the creation of institutions such as the National Museum, the Paulista Museum, and the Museu Paraense Emílio Goeldi. Between 1965 and 1971, the National Archaeological Research Program (PRONAPA) represented a major milestone in the national systematization of archaeological research, promoting surveys that resulted in the identification of thousands of sites and the definition of ceramic traditions.



Currently, archaeological heritage in Brazil is protected by Law No. 3.924/1961, which establishes that archaeological monuments are property of the Union, prohibits their economic exploitation, and ensures their preservation for scientific purposes (Prous, 1992).

The production of archaeological data depends on the application of methodological techniques that vary according to the nature of the site and the research objectives. Stratigraphy constitutes a fundamental method for determining the sequence of sediment deposition, providing a relative chronology of archaeological remains (Leal; Silva, 2025).

In Brazil, methodological approaches are commonly divided into two main strategies:

- Natural levels: Following the pre-existing microtopography and geological layers, allowing for the identification of synchronous contexts and the visualization of occupation structures.
- Arbitrary levels: Defined layers of constant thickness (generally between 10 and 15 cm), used when natural stratigraphy is not clearly distinguishable or when artifact density is low.

Archaeological analysis is based on the identification of structures, understood as meaningful assemblages of material remains (Leal; Silva, 2025). These structures are classified into:

- Macrostructures: Related to territorial organization and patterns of economic exploitation.
- Meso-structures: Associated with the internal organization of sites, including domestic, ritual, or refuse areas.
- Microstructures: Comprising isolated features such as hearths, storage pits, burial areas, or postholes.

Geoscientific methods are also applied in paleoenvironmental studies, involving the analysis of sediments, fossil pollen, and micro-remains to reconstruct past climates and vegetation dynamics (Severino, 2014).

Scientific production in Brazilian archaeology faces specific challenges, particularly due to the humid tropical climate, which accelerates the degradation of organic materials and promotes soil acidification, thereby hindering the preservation of bones and plant remains. Consequently, much of the available knowledge is derived from more durable materials, such as lithic artifacts and ceramics (Severino, 2014; Leal; Silva, 2025).

The contemporary landscape of archaeological research in Brazil is characterized by the expansion of university research centers and the consolidation of academic institutions. The creation of the Brazilian Archaeological Society (Sociedade de Arqueologia Brasileira – SAB) in 1980 marked an important step in strengthening the field. Archaeology has since



evolved from a marginal discipline into a consolidated scientific area, increasingly integrated with historical studies addressing quilombos, Jesuit missions, and colonial fortifications.

Moreover, the establishment of radiocarbon dating laboratories in Brazil has significantly enhanced the precision of chronological frameworks, enabling more robust temporal interpretations. This advancement has contributed to the growing scientific autonomy of Brazilian archaeology, with a substantial proportion of bibliographic references now produced by national researchers (Prous, 1992).

In summary, archaeological methodology in Brazil has evolved into an interdisciplinary approach that seeks not only the analysis of isolated artifacts but also the reconstruction of lifeways and ecological adaptations of past populations.

Within the broader field of Geosciences, scientific knowledge production is directly linked to the adoption of rigorous methodologies for the collection, cataloging, documentation, and analysis of materials. In the context of the Geosciences Museum of UENP, these procedures form the basis for the consolidation of a scientific and educational collection, as evidenced in the institutional research project.

The cataloging and documentation of archaeological artifacts and geological samples are fundamental processes for the preservation and interpretation of scientific heritage. These procedures involve systematic steps such as inventorying, photographic recording, typological classification, and proper storage, ensuring both the organization and accessibility of information.

According to Lewis Binford (2001), archaeology must be guided by rigorous scientific methods capable of producing well-founded interpretations of human behavior in the past. This perspective underscores the importance of systematic data organization and contextual analysis of material remains.

Additionally, the methodological approach adopted in the project highlights the integration of different fields of knowledge, including Geology, Archaeology, and Physical Geography. This interdisciplinary perspective contributes to a more comprehensive understanding of natural and social processes, enhancing the scientific potential of the collection.

Another relevant aspect concerns the use of digital technologies for collection management, such as cataloging systems and databases. These tools not only facilitate data organization but also promote broader dissemination, enabling access for researchers, students, and the wider community.



4 UNIVERSITY EXTENSION AND SOCIAL IMPACT

University extension constitutes one of the fundamental pillars of higher education, as it promotes the articulation between knowledge produced within the university and the demands of society. In the field of Geosciences, this dimension assumes particular relevance, as it enables the dissemination of scientific knowledge and fosters public awareness regarding environmental, patrimonial, and territorial issues.

According to Paulo Freire (1996), education should be understood as a practice of freedom, grounded in dialogue and in the collective construction of knowledge. Within this perspective, extension activities are not limited to the transmission of content; rather, they are configured as formative processes that promote critical awareness among individuals.

The extension project focused on the structuring of the Geosciences Museum at UENP exemplifies this approach by developing activities that involve both the academic community and society at large. These include exhibitions, workshops, lectures, and science outreach initiatives, all of which aim to strengthen the role of the university in disseminating knowledge and contributing to the cultural and educational enrichment of the communities involved.

Furthermore, the use of digital media, particularly social networks, significantly expands the reach of extension activities, enabling broader access to scientific information. According to Manuel Castells (2010), digital networks have transformed contemporary communication processes, allowing for new forms of interaction and knowledge circulation.

In this context, the Geosciences Museum of UENP emerges as a space for mediation between science and society, promoting the integration of academic and popular knowledge systems, and contributing to the development of critical awareness regarding socio-environmental issues (Campos et al., 2024; Campos et al., 2025).

5 GEOGRAPHY TEACHING AND TEACHER EDUCATION

Geography teaching plays a central role in the formation of critical subjects, capable of understanding and interpreting spatial dynamics and the complex relationships between society and nature. In this context, the incorporation of non-formal educational spaces, such as museums, significantly expands pedagogical possibilities, contributing to the construction of more meaningful, contextualized, and interdisciplinary learning processes.

According to Cavalcanti (1998), Geography teaching should be grounded in students' lived realities, enabling the construction of knowledge based on their concrete experiences. From this perspective, Geosciences museums, by providing direct contact with materials such as rocks, fossils, and archaeological artifacts, facilitate the materialization of abstract



concepts, enhancing the understanding of geographical content and strengthening the articulation between theory and practice.

In the same vein, Callai (2005) emphasizes the importance of articulating lived space and represented space within the teaching-learning process. The museum, as a pedagogical mediation space, allows students to establish connections between scientific knowledge and their everyday reality, fostering a more critical and integrated understanding of geographic space.

Another relevant aspect concerns teacher education. According to Castellar (2012), museums constitute privileged environments for both initial and continuing teacher training, as they enable the experimentation of innovative and interdisciplinary methodologies. Within Geography education, engagement with museum spaces contributes to the development of more reflective, investigative, and contextualized pedagogical practices.

In undergraduate Geography programs, pedagogical practice acquires new meanings when it moves between formal and non-formal educational spaces. The Geosciences Museum, through university extension initiatives, consolidates itself as a field of pedagogical investigation and experimentation, where academic theory is directly articulated with educational practice.

As discussed by Lopes and Murriello (2005, p. 24), museums should not be understood merely as exhibition spaces, but as institutions that integrate education and science, playing a fundamental role in building communication networks with diverse audiences. In this context, the integration of archaeological collections with geoscientific materials expands educational possibilities by promoting an interdisciplinary approach to knowledge.

To deepen this relationship, it is useful to refer to Milton Santos' (2006, p. 39) concept of geographic space, defined as an "inseparable set of systems of objects and systems of actions." Within the museum environment, archaeological artifacts and geological samples constitute the "objects" that materialize human actions and natural processes over time. In this way, Geography students can concretely understand how human techniques have developed in interaction with available natural resources.

In this sense, the use of active methodologies within museum contexts enables students and visitors to move beyond passive roles in the learning process, assuming a protagonistic position in knowledge construction. As highlighted by Pontuschka, Paganelli, and Cacete (2007, p. 132), Geography teaching should be grounded in investigation, where fieldwork and direct contact with objects stimulate observation, description, and critical analysis of space.



Thus, by mediating interaction with archaeological and geological materials, students involved in these projects, particularly scholarship holders, develop pedagogical practices that connect past technical systems to contemporary social dynamics, fostering a broader and more critical understanding of geographic space.

Within the scope of the project developed at UENP, activities carried out in the Geosciences Museum significantly contribute to the training of Geography teaching students, as they provide experiences that integrate theory and practice, strengthening the construction of a critical, contextualized, and socially engaged geographical education.

6 PEDAGOGICAL INNOVATION AND STUDENT TRAINING

The articulation between teaching, research, and extension constitutes the fundamental foundation of Brazilian higher education, establishing a feedback cycle that enhances both undergraduate training and the educational realities of the communities involved. In the field of Geography, this triad acquires specific contours when oriented toward pedagogical innovation, aiming to overcome traditional teaching models that are predominantly mnemonic and descriptive.

The participation of students in Scientific Initiation programs and extension projects enables future teachers to experience theory in practice, transforming academic research into concrete didactic solutions. This process strengthens the connection between scientific production and pedagogical application, contributing to the development of reflective and critically engaged educators.

As established by the National Policy on University Extension (FORPROEX, 2012), extension is understood as an educational, cultural, and scientific process that articulates teaching and research in an inseparable manner. By bringing new methodologies to public schools, such as the use of digital technologies and visual languages, universities fulfill their social role while providing undergraduate students with critical immersion in the realities of their future professional practice.

This experience aligns with what Demo (2011) defines as “learning through research”, in which knowledge is constructed actively through questioning, investigation, and experimentation, rather than passively received.

Within this context of pedagogical renewal, the incorporation of playful and interactive languages, such as educational games, digital media, and comic books, emerges as an essential response to the demands of scientific and cartographic literacy. Castellar (2012) argues that geographical education should prioritize the development of spatial reasoning,



requiring educators to adopt strategies that stimulate students' perception and analysis of their lived environments.

Educational games, in particular, play a dual role in the teaching-learning process: a ludic function, which ensures engagement and motivation, and an educational function, focused on the acquisition of specific concepts and competencies. This duality enhances both cognitive development and student participation.

In addition to educational games, comic books and digital media provide an essential visual bridge for understanding geographical phenomena that often appear abstract in traditional textbooks. Rama and Walty (2004) emphasize that comics employ a hybrid language, combining textual and visual elements, which facilitates didactic transposition and enables complex themes such as geopolitics, environmental issues, and urbanization to be addressed in a dynamic and interdisciplinary manner.

Interdisciplinarity, in this context, represents one of the most significant gains of innovative pedagogical approaches, as it allows Geography to engage in dialogue with the Arts, Language Studies, and Natural Sciences, thereby overcoming the fragmentation of school knowledge.

The training of students through scientific initiation projects focused on media and educational languages also contributes to the development of technological competencies that are increasingly indispensable in contemporary education. The use of digital platforms, software, and audiovisual resources in Geography teaching is not merely an aesthetic enhancement, but a pedagogical necessity in light of the digital culture that characterizes contemporary society. As Lévy (1999) argues, cyberculture transforms the ways individuals learn and interact with knowledge, making it imperative for school Geography to incorporate these new informational supports.

Thus, the integration of academic research and university extension, mediated by pedagogical innovation, creates a favorable environment for the development of original and contextually grounded teaching materials. When undergraduate students design educational games or comics based on scientific research related to specific territories, they effectively synthesize academic rigor and pedagogical practice.

This process strengthens the professional identity of future geographers and contributes to the construction of a more diverse, technologically oriented, and critically engaged public education system, capable of forming citizens who can understand and interpret the complexities of the contemporary world.

Furthermore, the incorporation of innovative methodologies into educational processes has proven essential for the development of more dynamic, participatory, and



inclusive pedagogical practices. Within the context of the Geosciences Museum of UENP, several initiatives stand out, particularly those that integrate multiple languages and teaching strategies, including educational games, visual resources, and digital media.

The use of educational games, such as the one developed within the project (“Who am I?”), is grounded in Jean Piaget’s (1972) constructivist perspective, which emphasizes the role of activity and interaction in cognitive development. These strategies stimulate curiosity, logical reasoning, and active participation in the learning process.

Complementarily, Edgar Morin (2000) proposes an education based on complexity, which integrates multiple forms of knowledge and overcomes disciplinary fragmentation. The articulation between Geology, Archaeology, and Geography observed in museum activities exemplifies this interdisciplinary approach.

The use of digital media and visual resources also stands out as a relevant strategy for disseminating scientific knowledge. According to Howard Gardner (1993), individuals possess multiple forms of intelligence, making it necessary to diversify pedagogical strategies to address different learning styles.

In this sense, the production of accessible educational content, such as comic books and social media publications, expands the reach of educational actions and promotes more inclusive and meaningful learning experiences.

Additionally, student participation in scientific initiation and extension projects contributes significantly to academic and professional development, enabling the acquisition of skills such as research, critical analysis, teamwork, and scientific communication (Campos et al., 2024; Campos et al., 2025).

7 FINAL CONSIDERATIONS

The analysis developed throughout this study demonstrates that the articulation between teaching, research, and extension constitutes a structuring axis for the operation of contemporary public universities, particularly in the fields of Geosciences and Geography. In this context, the Geosciences Museum of the State University of Northern Paraná emerges as a strategic space for the production, mediation, and dissemination of scientific knowledge.

It is observed that the structuring of the museum goes beyond the material dimension of organizing collections, configuring itself as an educational and symbolic territory in which heritage, memory, and epistemology are articulated. This perspective reinforces the role of university museums as spaces for the construction of meaning, capable of promoting the democratization of knowledge and the valorization of science within society.



In the field of education, the museum's contributions to Geography teaching and teacher education stand out, particularly by enabling the integration of theory and practice, as well as the use of active and interdisciplinary methodologies. The activities developed contribute to the construction of a critical geographical education, committed to understanding socio-spatial dynamics and to the formation of socially aware individuals.

Moreover, extension activities highlight the importance of strengthening the relationship between the university and the broader community, expanding access to scientific knowledge and promoting processes of scientific and cultural literacy. The use of digital technologies, innovative teaching resources, and accessible languages contributes to the development of more inclusive and contemporary educational practices.

Finally, it is concluded that the projects analyzed reaffirm the role of the public university as an agent of social transformation, integrating scientific production, academic training, and social commitment. In this sense, initiatives such as the structuring of the Geosciences Museum prove to be fundamental for strengthening a critical, interdisciplinary, and socially engaged science, aligned with the challenges of the contemporary world.

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