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Artigo

ENVIRONMENTAL AWARENESS AND THE SDGs IN PUBLIC SCHOOLS IN MARANHÃO, BRAZIL

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ABSTRACT

Objective: This study analyzed the environmental awareness process promoted among basic education students in Maranhão, Brazil, through an outreach intervention combining a short course on the 2030 Agenda with hands-on solid-waste reuse activities grounded in SDG 4, SDG 12, and the 8 Rs of sustainability.

Theoretical Framework: The application of the 17 SDGs in Brazilian basic education remains poorly systematized in the literature. Given Brazil's limited progress toward the 2030 Agenda targets, the school environment becomes a priority space for action.

Method: This qualitative action research was conducted by the State University of Maranhão in two public schools between 2022 and 2023, combining a short course on the 17 SDGs, emphasizing SDGs 4 and 12, with hands-on solid-waste reuse activities based on the 8 Rs of sustainability.

Results and Discussion: Results showed that Environmental Education is part of the pedagogical routine, reflected in students' command of concepts such as selective waste collection, though knowledge of the 2030 Agenda and the SDGs remained limited. Practical activities showed high creativity in producing objects from reusable materials, predominantly plastic, with distinct profiles: EJA students favored decorative items, while Elementary School II students favored playful, game-like objects.

Research Implications: The contextualized insertion of the SDGs in the school environment fosters ecological awareness, student protagonism, and the adoption of sustainable practices, contributing to advancing the 2030 Agenda.

Originality/Value: This study contributes to the still underexplored articulation between the SDGs and solid-waste reuse in Brazilian basic education, particularly within Elementary School and Youth and Adult Education.

Keywords: Environmental Education, Sustainable Development, SDG 12, Wastes, Adult Education, Elementary Education.

RESUMEN

Objetivo: Este estudio analizó el proceso de concienciación ambiental promovido entre estudiantes de educación básica en Maranhão, Brasil, mediante una intervención de extensión que combinó un curso breve sobre la Agenda 2030 con actividades prácticas de reutilización de residuos sólidos fundamentadas en el ODS 4, el ODS 12 y las 8R de la sostenibilidad.

Marco Teórico: La aplicación de los 17 ODS en la educación básica brasileña sigue poco sistematizada en la literatura. Dado el limitado avance de Brasil hacia las metas de la Agenda 2030, el ámbito escolar se convierte en un espacio prioritario de actuación.

Método: Esta investigación-acción cualitativa fue realizada por la Universidade Estadual do Maranhão en dos escuelas públicas entre 2022 y 2023, combinando un curso breve sobre los 17 ODS, con énfasis en los ODS 4 y 12, con actividades prácticas de reutilización de residuos sólidos basadas en las 8R de la sostenibilidad.

Resultados y Discusión: Los resultados mostraron que la Educación Ambiental forma parte de la rutina pedagógica, lo que se refleja en el dominio de conceptos como la recolección selectiva de residuos por parte de los estudiantes, aunque el conocimiento sobre la Agenda 2030 y los ODS se mantuvo limitado. Las actividades prácticas evidenciaron una alta creatividad en la producción de objetos a partir de materiales reutilizables, predominantemente plástico, con perfiles diferenciados: los estudiantes de la EJA privilegiaron los objetos decorativos, mientras que los de Enseñanza Fundamental II privilegiaron objetos lúdicos, similares a juegos.

Implicaciones de la Investigación: La inserción contextualizada de los ODS en el ámbito escolar fomenta la conciencia ecológica, el protagonismo estudiantil y la adopción de prácticas sostenibles, contribuyendo al avance de la Agenda 2030.

Originalidad/Valor: Este estudio contribuye a la articulación, aún poco explorada, entre los ODS y la reutilización de residuos sólidos en la educación básica brasileña, particularmente en la Enseñanza Fundamental y en la Educación de Jóvenes y Adultos.

Palabras clave: Educación Ambiental, Desarrollo Sostenible, ODS 12, Residuos, Educación de Adultos, Educación Primaria.

RESUMO

Objetivo: Este estudo analisou o processo de conscientização ambiental promovido entre estudantes da educação básica no Maranhão, Brasil, por meio de uma intervenção de extensão que combinou um minicurso sobre a Agenda 2030 com atividades práticas de reaproveitamento de resíduos sólidos fundamentadas no ODS 4, no ODS 12 e nos 8 Rs da sustentabilidade.

Referencial Teórico: A aplicação dos 17 ODS na educação básica brasileira permanece pouco sistematizada na literatura. Diante do avanço limitado do Brasil em relação às metas da Agenda 2030, o ambiente escolar torna-se um espaço prioritário de atuação.

Método: Esta pesquisa-ação qualitativa foi realizada pela Universidade Estadual do Maranhão em duas escolas públicas entre 2022 e 2023, combinando um minicurso sobre os 17 ODS, com ênfase nos ODS

4 e 12, com atividades práticas de reaproveitamento de resíduos sólidos baseadas nos 8 Rs da sustentabilidade.

Resultados e Discussão: Os resultados mostraram que a Educação Ambiental integra a rotina pedagógica, o que se reflete no domínio de conceitos como a coleta seletiva de resíduos por parte dos estudantes, embora o conhecimento sobre a Agenda 2030 e os ODS tenha permanecido limitado. As atividades práticas evidenciaram alta criatividade na produção de objetos a partir de materiais reaproveitáveis, predominantemente plástico, com perfis distintos: os estudantes da EJA privilegiaram itens decorativos, enquanto os do Ensino Fundamental II privilegiaram objetos lúdicos.

Implicações da Pesquisa: A inserção contextualizada dos ODS no ambiente escolar fomenta a consciência ecológica, o protagonismo estudantil e a adoção de práticas sustentáveis, contribuindo para o avanço da Agenda 2030.

Originalidade/Valor: Este estudo contribui para a articulação, ainda pouco explorada, entre os ODS e o reaproveitamento de resíduos sólidos na educação básica brasileira, particularmente no Ensino Fundamental e na Educação de Jovens e Adultos.

Palavras-chave: Educação Ambiental, Desenvolvimento Sustentável, ODS 12, Resíduos, Educação de Adultos, Ensino Fundamental.

1 INTRODUCTION

The concept of sustainable development gained international prominence following the United Nations Conference on the Human Environment, held in Stockholm in 1972, amid growing debate about the need to reconcile economic development with environmental preservation. At the time, the concept was the target of criticism and skepticism, often regarded as an abstract idea or one of limited practical applicability (Cruz, 2020).

Against this backdrop, the United Nations established the 2030 Agenda, comprising the Sustainable Development Goals (SDGs), conceived as a global action plan aimed at mitigating urgent challenges and improving population well-being. The Agenda is structured around 17 goals and 169 targets, spanning themes such as climate change, the economy, the environment, health, education, and labor (Bolsi, 2024), with a collective commitment extending special attention to the most vulnerable groups, notably children and young people, to whom its future implementation belongs (UN, 2000).

Brazil actively participated in shaping the SDGs, engaging in the discussions and assuming commitments as a member state of the United Nations. However, the country still faces the challenge of translating these commitments into concrete actions capable of genuinely transforming its social, economic, and environmental reality (Libório, 2021).

Among the seventeen goals that make up the Agenda, SDG 12 (Responsible

Consumption and Production) and SDG 4 (Quality Education) become central when considering the transformations arising from globalization, industrialization, and contemporary socio-environmental crises, since both converge on the need to re-educate patterns of consumption, disposal, and resource reuse (Guimarães & Serafim, 2018). According to De Oliveira *et al.* (2025), this reeducation constitutes a fundamental condition for promoting effective changes in the population's habits, and the school environment emerges, in this process, as a privileged space for building and disseminating such knowledge.

Despite this recognized centrality, the SDGs have gained wide visibility in scientific and institutional discussions over the past decade unevenly across levels of education: while higher education has seen a proliferation of research and outreach projects focused on sustainability, basic education still incorporates these themes in an incipient and sporadic manner (Amber-Montes *et al.*, 2024).

It is against this gap that the central problem of this study takes shape: to what extent can an outreach intervention organized around the 17 SDGs, combined with hands-on solid-waste reuse activities, broaden basic-education students' understanding of sustainability and, from that understanding, mobilize more conscious everyday practices? To address this question, this study aimed to analyze the environmental awareness process promoted among students of the Centro Educa Mais Paulo VI (Youth and Adult Education program – EJA) and the Prof.^a Rosa Raimunda Paixão Garcez Municipal School (Elementary School II), through educational actions that included a short course and hands-on activities centered on SDGs 4 and 12 and on the application of the 8 Rs of sustainability.

2 THEORETICAL FRAMEWORK

2.1 THE 2030 AGENDA AND THE SUSTAINABLE DEVELOPMENT GOALS: GLOBAL AND NATIONAL OVERVIEW

The 2030 Agenda did not emerge in isolation but as a direct evolution of the Millennium Development Goals (MDGs), in effect between 2000 and 2015. Sachs (2012) argues that the MDGs represented a historic milestone in global mobilization by translating complex social priorities (poverty, hunger, disease, and gender inequality) into a set of eight measurable, time-bound targets, which fostered

political accountability and social monitoring of results. According to the author, however, the MDGs structurally neglected the environmental dimension of development, treating it as a peripheral theme rather than a cross-cutting axis – a gap the 2030 Agenda sought to address by expanding its scope to 17 goals and 169 targets, explicitly articulating the social, economic, and environmental dimensions of sustainable development (UN, 2015).

This broadened scope, however, did not fully resolve the structural dilemmas inherited from the previous model. In their analyses, Bali Swain and Yang-Wallentin (2020) identify impasses within the 2030 Agenda, such as the coexistence of frequently competing targets – for instance, accelerated economic growth versus environmental preservation – and the absence of formal prioritization mechanisms among the 17 Goals, which allows countries to select politically convenient targets to the detriment of others that are equally urgent.

The Brazilian scenario illustrates these dilemmas precisely. A survey conducted among Brazilian health experts revealed low expectations regarding the country's achievement of any of the 17 SDGs, with Quality Education (SDG 4) identified simultaneously as one of the most urgent goals and the one that would most contribute to advancing the Agenda's other goals (Moreira *et al.*, 2019). This diagnosis remains current: the 2030 Agenda Civil Society Spotlight Report shows that, between 2023 and 2024, only 12 of Brazil's 169 targets (7.14%) showed satisfactory progress, while 75 targets (44.62%) remained stagnant, regressed, or had their progress threatened by political choices and budgetary constraints (Grupo de Trabalho da Sociedade Civil para a Agenda 2030 [GTSC A2030], 2025).

2.2 SOLID WASTE AND THE 8 RS OF SUSTAINABILITY: CONCEPTUAL FOUNDATIONS OF REUSE PRACTICES

In Brazil, solid waste management is regulated by the National Solid Waste Policy (Law No. 12,305/2010), which hierarchizes priority actions: non-generation, reduction, reuse, recycling, and, lastly, environmentally sound disposal (Brasil, 2010). This hierarchy underlies the pedagogical 8 Rs model – Reflect, Respect, Reduce, Reuse, Recycle, Repair, Take Responsibility, and Pass On – which extends the traditional "3 Rs" by incorporating cognitive and ethical steps preceding and following disposal itself (Kirchherr *et al.*, 2017).

Reflect and Respect precede consumption, questioning the actual need for a good and recognizing each choice's environmental impact. Reduce and Reuse minimize waste generation and extend materials' useful life, consistent with the PNRS's non-generation principle. Recycle and Repair, the most widely disseminated steps, transform discarded materials into new products or repair damaged items. Take Responsibility and Pass On shift the focus to the collective and intergenerational dimension, involving shared responsibility and the dissemination of practices to others – bringing this model close to the 2030 Agenda's own multiplying spirit (Instituto Akatu, 2011). This expanded hierarchy resonates with the Circular Economy debate, oriented toward eliminating the concept of waste by keeping materials in use as long as possible (Kirchherr *et al.*, 2017).

However, application of these principles to Brazilian basic education remains poorly systematized. Isidoro-Gonçalves *et al.* (2026), reviewing 931 studies (2018-2022, 109 addressing the topic directly), found a predominantly technical approach with little discussion of socioeconomic and cultural causes, and a scarcity of studies on Early Childhood Education and EJA. Carvalho and Cruz (2025) identify workshops crafting products from reusable materials as among the most effective strategies for internalizing the Circular Economy within Environmental Education, while Gunamantha and Dantes (2025) show that Indonesian elementary students' attitudes toward the "3 Rs" predict environmentally responsible behavior more strongly than conceptual knowledge alone, underscoring the value of practical, experience-based approaches.

3 METHODOLOGY

3.1 METHODOLOGICAL PROCEDURES

This is a qualitative action research study (Thiollent, 2011), in which UEMA researchers and outreach staff acted simultaneously as intervention agents and observers. The design followed three phases: (1) diagnosis of students' prior knowledge; (2) pedagogical intervention, via a short course and hands-on workshop; and (3) evaluation of student-generated products, with certification of participants.

The research covered two public schools in Maranhão: EJA students at Centro Educa Mais Paulo VI, and 6th- to 9th-grade Elementary School II students at Prof.^a

Rosa Raimunda Paixão Garcez Municipal School. Two visits were conducted at each institution across the 2022 and 2023 academic terms.

The first visit delivered a short course on the 2030 Agenda and its 17 SDGs, using multimedia presentation and informational flyers (Figure 1); prior knowledge was assessed through oral questioning during this stage. The hands-on workshop followed, opening with a display of pieces made by the research team from recyclable waste to demonstrate reuse possibilities. This introduced the "Sustainable Proposal" activity, grounded in SDG 12 and the 8 Rs of sustainability, through which students created their own materials from recyclable waste.

Figure 1

Informational flyer given to students.



The second visit, in turn, was intended to assess the knowledge mobilized during the short course and the products made by the students, with certification awarded for the work presented. It is worth noting that the schools chose to incorporate the project as a complementary activity, granting extra credit in specific subjects as a strategy to boost student engagement.

The project was grounded especially in three SDGs (Figure 2): SDG 4 (Quality Education); SDG 12 (Responsible Consumption and Production); and SDG 17 (Partnerships for the Goals), the latter materialized through institutional

cooperation among UEMA, CEM Paulo VI, and the Prof.^a Rosa Raimunda Paixão Garcez Municipal School.

Figure 2

Sustainable Development Goals addressed in the project.



Source: Adapted from UN (2026).

The data produced throughout these stages were systematized through participant observation recorded in a field diary, photographic records of the activities carried out, and the compilation of the recyclable materials made by the students, treated as learning artifacts.

3.2 CHARACTERIZATION OF THE STUDY AREAS

The study was conducted in two public educational institutions in the State of Maranhão, one belonging to the state school system and the other to the municipal school system. The first, Centro Educa Mais Paulo VI, is located in an urban area in the Cidade Operária neighborhood, in São Luís (MA) (Figure 3A), where the project was carried out with EJA classes. The second, Escola Municipal Prof.^a Rosa Raimunda Paixão Garcez, is located in the Juçatuba neighborhood, in São José de Ribamar (MA) (Figure 3B), where the study was conducted with Elementary School II students.

Figure 3

Facades of the educational institutions and their respective locations on the map:

(A) Centro Educa Mais Paulo VI; (B) Escola Prof.^a Rosa Raimunda Paixão Garcez.



Source: Adapted from Google Maps (2026).

3.3 ETHICAL ASPECTS

At no stage did the research involve interventions that would constitute human-subjects research under National Health Council Resolution No. 510/2016, and therefore did not require Research Ethics Committee approval. Additionally, the study is guided by the ethical principles of Copyright Law No. 9,610/98, concerning respect for the rights of the cited publications (Brasil, 1998).

3.4 AI USE STATEMENT

The artificial intelligence tool ChatGPT (OpenAI, GPT-5.5 model) was used to support the linguistic and grammatical revision of the text, as well as the standardization of the bibliographic references.

4 RESULTS

During the first visit to Centro Educa Mais Paulo VI, a certain shyness was observed among most students, associated with conceptual difficulties regarding the topics addressed: although they showed familiarity with the term “sustainability,” most were unable to define it precisely, and knowledge of the Sustainable

Development Goals proved limited, particularly regarding the concept and purpose of the 17 SDGs.

This picture contrasted, however, with the same students' performance regarding the 8 Rs of sustainability: when addressed on this topic, they showed greater conceptual mastery, particularly with respect to selective waste collection, which was reflected in more active participation, especially during the identification of the colors and purposes of the selective waste bins.

A similar pattern was observed at the Prof.^a Rosa Raimunda Paixão Garcez Municipal School, where the SDGs had, until then, been little known to Elementary School II students. Even so, this group showed marked interest in the short course topic, expressed through questions and comments that broadened interaction throughout the activities and enabled both the clarification of doubts and the stimulation of critical thinking, notably regarding reflection on their own actions and those of others in the socio-environmental domain.

The delivery of the short course also incorporated adjustments to each institution's reality. At Prof.^a Rosa Raimunda Paixão Garcez School, due to the proximity of the Juçatuba neighborhood to coastal areas, additional emphasis was placed, beyond SDG 12, on SDG 14 (Life Below Water) and SDG 6 (Clean Water). At Centro Educa Mais Paulo VI, in turn, a presentation of the Lattes Platform of the National Council for Scientific and Technological Development (CNPq) was included, as it was unfamiliar to the students. A captioned tutorial video on the platform's importance and registration process was shown and later made available to the school administration. This action was consistent with the principles of SDG 4 (Quality Education), contributing to the promotion of informational inclusion and the democratization of access to educational and scientific opportunities.

Regarding the products made during the second visit, both classes organized themselves into groups and showed a high level of creativity in producing the materials, albeit with distinct profiles between them. In both classes, plastic was the predominant material used, combined with other materials. EJA students used plastic, cardboard, metal, and other reusable waste, producing mainly decorative items, toys, and school supplies – such as Christmas trees and ornamental vases made from PET bottles, a pencil case made from reused cans, bicycle miniatures

made from wire and plastic straws, and a tank made from cardboard boxes (Figure 4).

Figure 4

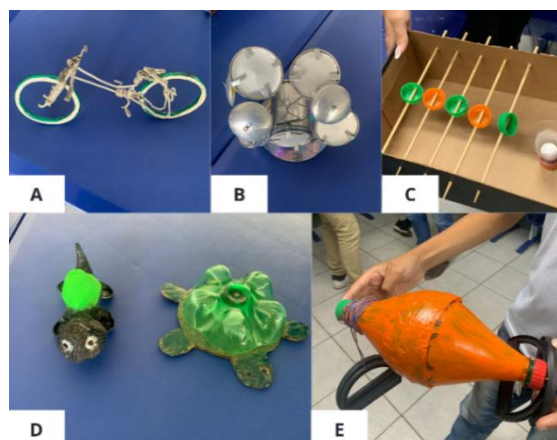
Display of materials produced by the EJA class students.



Elementary School II students, in turn, used cardboard, wooden sticks, thread, metal, and plastics. The resulting products showed a greater inclination toward the world of play. Among the items produced, notable examples include a musical instrument miniature made from metal pieces and wires, a balance game assembled with wooden sticks and PET bottle caps on a cardboard base, a decorative turtle made from a cardboard egg carton and plastic bottles, and the “Back and Forth” game, made from a reused plastic package (Figure 5). Taken together, these products reflect both the participants' inventiveness and their everyday needs and interests linked to the world of play.

Figure 5

Materials produced by Elementary School II students: (A) Bicycle miniature; (B) Musical instrument miniature; (C) Balance game; (D) Decorative turtle; (E) "Back and Forth" game.



5 DISCUSSION

The results reveal that Environmental Education is already consolidated in the curriculum of the institutions investigated, which underlies students' conceptual mastery regarding selective waste collection and the 8 Rs of sustainability. This corroborates Junior *et al.* (2024), for whom the National Common Curricular Base (BNCC) incorporates sustainability as a cross-cutting axis, lending Environmental Education an interdisciplinary character already internalized in pedagogical routine. This mastery, however, did not extend to the 2030 Agenda and the SDGs, evidencing that school Environmental Education does not yet incorporate the SDGs as a structuring reference – a gap that reinforces the diagnosis of Amber-Montes *et al.* (2024) regarding the incipience of the SDGs in basic education relative to their dissemination in higher education.

The workshop activities showed effective contribution to creativity, environmental awareness, and student protagonism, reinforcing in practice the principles of reuse and recycling. Veiga (2010) highlights the strategic position of educational institutions in promoting sustainable practices. Convergent results were reported by Nunes *et al.* (2023), in artistic reinterpretations using recyclable materials with EJA students, and by Araújo *et al.* (2025) and Rios *et al.* (2024), who attest to the relevance of active methodologies (lectures, games, argumentative texts, technical visits, seedling planting) for dynamizing the teaching of Biological Sciences and extending beyond the boundaries of the traditional classroom.

Conceptually, Dechaume and Lubart (2021) define creativity as the capacity to generate novel, contextually adjusted content, mobilizing personal experiences and cognitive-emotional aspects. Analysis of the materials produced by both classes indicates that this creative capacity was strongly anchored in participants' playful universe and everyday needs, reflecting identity and affective dimensions beyond mere technical execution of the school task.

Furthermore, the predominance of plastic among the reused materials dialogues with the global expansion of its production and consumption. Law (2017) describes plastic pollution as a central threat to ocean ecosystems, given its progressive fragmentation and persistence within the biota. This finding gains further relevance in light of insufficient recycling rates worldwide: of the 365 million tons of plastic produced annually, only 19.5% are effectively recycled (Ferdous *et al.*,

2021). In Brazil, solid waste generation has tracked population growth and economic intensification, and advances in the sorting of recyclable materials remain below the country's existing potential (ABREMA, 2025). The predominance of plastic thus reflects the consumption pattern of contemporary society, rather than mere availability in the school setting, reiterating the relevance of educational initiatives aimed at responsible consumption and adequate disposal.

At Escola Prof.^a Rosa Raimunda Paixão Garcez, the territorial contextualization of the content proved particularly fruitful. The proximity of the Juçatuba neighborhood to coastal areas justified the emphasis placed on SDGs 14 and 6, linked to Marine and Coastal Environmental Education (MCEE), a formative field aimed at the critical understanding of issues such as climate change, coastal ecosystem degradation, and marine pollution (De Oliveira *et al.*, 2024). This is because beaches constitute leisure spaces widely experienced by the students, which reinforced their affective bond with the topic among this young audience.

In turn, the dissemination of knowledge about the Lattes Platform, conducted with EJA students, proved especially relevant given the class's prior unfamiliarity with the platform. The inclusion of the tutorial video in the short course was justified by the need to introduce students to digital tools relevant to their educational and professional development. Considering that many EJA students are already part of the workforce or are seeking new opportunities, knowledge of the Lattes Platform broadens prospects for access to higher education, research, qualification courses, and academic selection processes, directly connecting to SDG 4 (Marques, 2010).

In summary, environmental awareness geared toward the 17 Sustainable Development Goals in the school context proves fundamental to shaping a deeper ecological consciousness in new generations. From this perspective, integrating the SDGs into pedagogical practices is essential to consolidating formative processes aligned with the demands of the 2030 Agenda, particularly with regard to promoting a culture of sustainability. By incorporating Environmental Education transversally, woven into the school curriculum and effectively connected to the 17 SDGs, the educational institution reaffirms its role in shaping individuals who are more conscious of and committed to the well-being of present and future generations (Bhullar & Ashraf, 2025; Leite *et al.*, 2023).

6 CONCLUSION

The results demonstrate that the intervention organized around the 17 SDGs, combined with hands-on solid-waste reuse activities, broadened students' understanding of sustainability and mobilized, from that understanding, concrete reuse practices within the school context. This confirms that environmental awareness-raising anchored in the articulation between Environmental Education and the SDGs constitutes a viable and replicable pedagogical strategy for basic education in Maranhão, evidencing that the distance between the global normative framework and everyday school practice can be effectively reduced when Environmental Education already consolidated in the curriculum is taken as a starting point.

It was also found that different age groups understand and appropriate sustainability concepts in distinct ways, reinforcing that socio-environmental perception is built from the experiences and contexts of each group. This research made clear that EJA students showed a greater inclination toward producing decorative objects, such as ornaments and pencil holders, while upper Elementary School students opted for toys and games – a finding that reinforces the need for pedagogical strategies sensitive to the age profile of the target audience.

A limitation of the study is the qualitative, situated nature of the action research employed here, which, by prioritizing depth of insight into two specific school contexts, does not allow for statistical generalizations. It is therefore recommended that future research adopt quali-quantitative and longitudinal designs capable of assessing, over time, the impacts of these initiatives and their effectiveness in other realities of Brazilian basic education.

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DECLARAÇÃO DE CONTRIBUIÇÃO DOS AUTORES – Taxonomia CRediT:

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Pedro Henrike Ferreira Serra – Execução do projeto, participação ativa na análise dos dados e escrita do texto (Análise Formal; Metodologia; Redação – Preparação do rascunho original; Escrita – revisão e edição).

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DECLARAÇÃO DE CONFLITO DE INTERESSE:

Os autores declaram que não há conflito de interesse com o presente artigo.

DECLARAÇÃO DE DISPONIBILIDADE DE DADOS DA PESQUISA:

Todo o conjunto de dados de apoio aos resultados deste estudo foi publicado no próprio artigo.

DECLARAÇÃO DE USO DE IA:

A ferramenta de inteligência artificial ChatGPT foi utilizada para auxiliar na revisão técnico-gramatical do texto e normalização de referências.

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