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Students' perception and knowledge about mammals in the cerrado: challenges in zoology education

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ABSTRACT

Mammals play essential ecological roles in maintaining ecosystem balance, especially in the Cerrado. However, their biodiversity is still scarcely addressed in Science and Biology curricula. This study investigated the perceptions and knowledge of 141 students from public schools in Brasília, Brazil, 60 from middle school and 81 from high school, about mammals, with an emphasis on native species of the Cerrado. Data were collected through a structured questionnaire with open-ended questions and a drawing activity, which allowed us to explore both conceptual and affective aspects. The results indicated that students mostly recognize mammals with which they have direct contact, such as dogs and cats, while humans are rarely associated with the group. Although many native species were mentioned, such as the maned wolf and the jaguar, domestic and exotic animals were also cited. High school students showed greater familiarity with the ecological roles of mammals, whereas middle school students included more non-mammalian animals in their graphical representations. The findings reveal gaps in the teaching of regional biodiversity and reinforce the importance of contextualized teaching resources that promote the appreciation of local fauna and scientific literacy.
KEYWORDS: Environmental Education; Student Perception; Nature Conservation.

Percepção e conhecimento dos estudantes sobre mamíferos no cerrado: desafios no ensino de zoologia

RESUMO

Os mamíferos desempenham funções ecológicas essenciais na manutenção do equilíbrio dos ecossistemas, especialmente no Cerrado. No entanto, sua biodiversidade ainda é pouco contemplada nos currículos de Ciências e Biologia. Este estudo investigou a percepção e o conhecimento de 141 estudantes da rede pública de Brasília, Brasil, sendo 60 do Ensino Fundamental e 81 do Ensino Médio, sobre os mamíferos, com ênfase nas espécies nativas do Cerrado. A coleta de dados foi realizada por meio de um questionário estruturado com perguntas abertas e de uma atividade de desenho, o que permitiu explorar tanto aspectos conceituais quanto afetivos. Os resultados indicaram que os estudantes reconhecem majoritariamente mamíferos com os quais mantêm contato direto, como cães e gatos, enquanto seres humanos são pouco associados ao grupo. Embora muitas espécies nativas tenham sido mencionadas, como o lobo-guará e a onça-pintada, também foram citados animais domésticos e exóticos. Estudantes do Ensino Médio demonstraram maior familiaridade com os papéis ecológicos dos mamíferos, ao passo que os do Ensino Fundamental incluíram mais animais não mamíferos em suas representações gráficas. Os achados evidenciam lacunas no ensino da biodiversidade regional e reforçam a importância de recursos didáticos contextualizados que promovam a valorização da fauna local e a alfabetização científica.

PALAVRAS-CHAVE: Educação Ambiental; Percepção dos Estudantes; Conservação da Natureza.

INTRODUCTION

Biodiversity constitutes one of the pillars of environmental sustainability and plays a central role in ecosystem stability, the regulation of natural cycles and the maintenance of life at multiple levels (MEA, 2005). Despite its importance, knowledge about biodiversity remains limited among basic education students, which represents a significant obstacle to nature conservation and to the development of a critical ecological awareness.

This limitation is largely related to the pedagogical approaches traditionally adopted in Science education, particularly in the fields of zoology and ecology. These approaches often privilege the fragmented transmission of content and disregard students' sociocultural and environmental contexts, which hinders their understanding of ecological processes and their recognition of the value of local biodiversity (Ballouard et al., 2011; Prokop & Tunnicliffe, 2008). As a result, students tend to construct a distorted image of fauna, with a preference for exotic, charismatic species that are widely represented in the media, to the detriment of regional species. This tendency contributes to low engagement in conservation initiatives and to the weakening of the bond between individuals and the environment in which they live (Ducarme et al., 2013; Melo et al., 2021).

Among the animal groups most affected by this limited perception are mammals, whose ecological importance is well documented. Species in this group perform key functions, such as seed dispersal, population control and the maintenance of trophic chain balance (Albert et al., 2018; Vale et al., 2023). However, research indicates that students' knowledge about mammals is strongly influenced by cultural references and media exposure, being restricted to domestic animals or iconic species such as lions and bears (Tunnicliffe & Reiss, 1999). This pattern reveals not only a conceptual gap, but also the absence of pedagogical proposals that promote the appreciation of local fauna as a structuring component of science education (Dinis et al., 2024).

This challenge becomes even more critical in the context of the Cerrado, a biome that covers about 22% of Brazil's territory and harbors a remarkable diversity of endemic mammals. The maned wolf (*Chrysocyon brachyurus* Illiger, 1815), the three-banded armadillo (*Tolypeutes tricinctus* Linnaeus, 1758), the jaguar (*Panthera onca* Linnaeus, 1758) and the giant anteater (*Myrmecophaga tridactyla* Linnaeus, 1758) are examples of species that play fundamental ecological roles, such as seed dispersal, maintenance of soil structure and regulation of populations. However, these ecosystem services are threatened by advancing deforestation, intensive agricultural expansion and habitat fragmentation (Klink & Machado, 2005; Nates et al., 2010).

Despite its relevance, the Cerrado remains underrepresented in Brazilian school curricula, a situation that undermines the development of contextualized and socially relevant knowledge. This curricular invisibility is also observed in international contexts in which studies show that students' knowledge of local biodiversity is often incipient (Bebbington, 2005; Lindemann-Matthies & Bose, 2008).

The absence of contextualized teaching limits the development of scientific and environmental literacy, understood, following Laugksch (2000), as the capacity to mobilize scientific knowledge to interpret natural and social phenomena, make

informed decisions and participate in issues that affect the collectivity (Aikenhead, 2006; Sasseron & Carvalho, 2011). This literacy is not restricted to the acquisition of concepts; it also involves attitudinal and value dimensions that foster a critical understanding of science and its ethical, social and cultural implications. From this perspective, critical environmental education functions as an integrating axis between scientific and environmental literacy, since it emphasizes the formation of individuals who are aware, participatory and committed to transforming socio-environmental realities (Carvalho, 2008; Sauvé, 2005). Inspired by Freire's perspective on conscientization, this approach proposes that individuals analyze and question the relationships among science, technology, society and the environment, recognize the contradictions that permeate these relationships and adopt an ethical and transformative stance in the face of contemporary challenges (Freire, 1987).

Although several studies have investigated students' perceptions of biodiversity in the Cerrado, recurring patterns are observed, such as recognition limited to a few widely known species and the frequent inclusion of exotic or domestic animals (Borges & Simão-Ferreira, 2018; Calegari et al., 2025; Dias & Reis, 2018; Silva et al., 2024). These results reveal not only conceptual gaps in the understanding of native fauna, but also the influence of cultural and media representations that prioritize charismatic or familiar animals over local species. Such tendencies reflect the invisibility of Cerrado biodiversity in school curricula and in public discourse, despite the biome's high degree of endemism and ecological relevance. Recent research highlights the urgent need to expand dialogue on the popularization of scientific knowledge about the Cerrado and to develop pedagogical practices that promote awareness, appreciation and commitment to the conservation of endemic fauna (Dias & Reis, 2018). This need is particularly evident in the case of mammals, which perform essential ecological functions, such as seed dispersal, population control and the maintenance of ecosystem balance, yet remain underrepresented in teaching materials and school practices.

In this context, it is necessary to strengthen educational practices that promote articulation between curricular content and the ecological reality of the territories in which students live. The present study aims to investigate how basic education students' perception and knowledge of mammals, with an emphasis on species native to the Cerrado, relate to their conceptual understanding and to their conceptions of local biodiversity. The study seeks to answer the following question: how do basic education students understand the group of mammals, and to what extent does this knowledge reflect or distort the diversity of species in the Cerrado? Specifically, the study aims to analyze how students define the group of mammals, which characteristics they use to distinguish them from other animals and which species they most frequently recognize. By identifying conceptual gaps and distorted perceptions, the study is expected to support the development of pedagogical strategies capable of integrating Science education with the aims of critical environmental education and the conservation of local biodiversity.

MATERIALS AND METHODS

This study adopted a qualitative, exploratory approach with the aim of investigating basic education students' perceptions and knowledge about mammals, with

an emphasis on species native to the Cerrado. The choice of a qualitative approach is justified by its capacity to capture the meanings that participants attribute to their experiences, which allows for the analysis of implicit conceptions and socially constructed representations in specific educational contexts (Minayo, Deslandes, & Gomes, 2011). The exploratory nature of the study is grounded in the scarcity of research on this topic in the Brazilian context, particularly regarding students' understanding of local biodiversity, and it enables the formulation of interpretative categories that may contribute to improving Science and Biology teaching (Gil, 2002).

The research was conducted in two public schools located in peripheral regions of the Federal District, Brazil, intentionally selected based on their socioeconomic characteristics, to ensure greater homogeneity of the group investigated. Both schools serve students from low-income families who mostly live in urban areas with limited access to natural environments. A total of 141 students participated in the study, 60 enrolled in the eighth grade of lower secondary school and 81 in the third year of upper secondary school. The mean ages of the groups were 14.5 and 17.3 years, respectively, with a balanced gender distribution. The selection of school years followed the guidelines of the official curriculum documents of the Federal District, specifically the *Currículo em Movimento do Ensino Fundamental: Anos Finais* (Distrito Federal, 2014a) and the *Currículo em Movimento da Educação Básica: Ensino Médio* (Distrito Federal, 2014b), which ensured that content related to mammals and the Cerrado biome had already been addressed at the corresponding educational levels. It is worth noting that, at the time of data collection, the third year of upper secondary school was still governed by the curriculum in place prior to the implementation of the new upper secondary education reform.

The project was approved by the Research Ethics Committee for Human Subjects of the University of Brasília (CEP/CHS/UnB), under approval number 69457423.0.0000.5540. All participants, minors and adults, signed the Informed Consent Form or the Informed Assent Form, as appropriate, which ensured voluntary, informed and ethical participation in the study.

Data collection was carried out by means of a structured questionnaire composed of open-ended questions and a drawing activity. The use of multiple forms of expression was intended to broaden the capture of students' perceptions, allowing access to both cognitive and affective aspects that are often not revealed through written verbal language alone (Driessnack, 2005). The instrument was divided into two sections. The first section collected sociodemographic data, age, gender and school level. The second section included four open-ended questions and a request for a graphic representation, organized around the following thematic axes: (1) criteria used to classify an animal as a mammal; (2) mammals present in students' daily lives; (3) prior knowledge about species of the Cerrado; (4) understanding of the ecological role played by mammals in this biome; and (5) drawing of a typical Cerrado mammal.

The drawing activity was incorporated as a strategy that complemented written responses, with the aim of identifying symbolic, conceptual and affective elements associated with participants' prior knowledge. Studies indicate that graphic representations can reveal spontaneous conceptions and cognitive structures that do not always become explicit in verbal productions (Driessnack, 2005).

Data analysis followed the procedures of content analysis (Bardin, 2011), structured in the stages of pre-analysis, categorization and interpretation. In the pre-analysis stage, textual responses and drawings were organized by participant and school level, forming the empirical corpus. Next, an initial floating reading was conducted to identify units of recording, that is, words, expressions or visual elements that expressed meanings related to the topic of mammals and to the perception of fauna in the Cerrado. These units were grouped according to semantic and conceptual similarity, which gave rise to preliminary categories.

The categorization process was inductive, that is, the categories emerged directly from the data, without the imposition of prior schemes, and were refined through successive intra-and intergroup comparisons. Each category was validated based on criteria of recurrence, frequency of appearance in the responses, relevance, alignment with the study objective and representativeness, that is, the capacity to synthesize the content of students' statements. The integration of written responses and graphic representations broadened the interpretative scope and resulted in four main thematic axes: (a) conceptions about defining characteristics of mammals, (b) recognition of mammals in everyday life, (c) knowledge about species native to the Cerrado, and (d) perception of the ecological roles of these animals. Triangulation among different data sources strengthened the credibility of the analysis and supported a broader understanding of students' representations of biodiversity. Excerpts from students' responses are presented in quotation marks, followed by an anonymized code in parentheses. We use the format (Stud. XX, MS) or (Stud. XX, HS). In this notation, XX is a sequential number from the anonymized dataset, MS refers to students in lower secondary education, roughly equivalent to middle school (grades 6–9), and HS refers to students in upper secondary education, roughly equivalent to high school (grades 10–12).

RESULTS

Students' responses about mammals known from their daily lives were organized into four main categories: domestic mammals, wild mammals, humans and non-mammal animals. Table 1 presents the percentage distribution of these categories in the two groups analyzed.

Table 1

Percentage distribution of students' responses about mammals known from everyday life

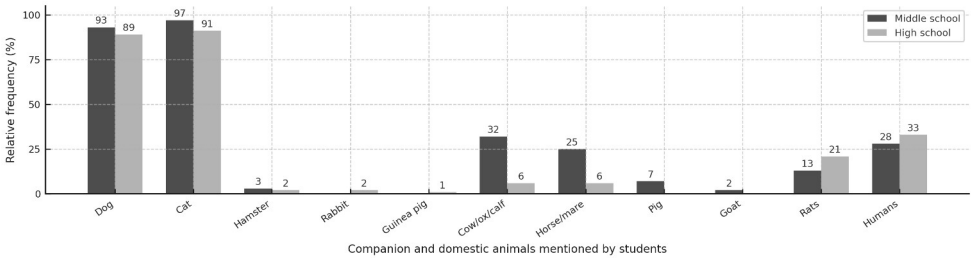
Category	Subcategory	Middle school		High school	
		N=60	%	N=81	%
Domestic mammals	Companion animals	58	97	78	96
	Farm animals	38	63	9	11
	Synanthropic animals	8	13	17	21
Wild mammals	Native to the Cerrado	9	15	27	33
	Exotic	2	3	1	1
Humans	----	17	28	27	33
Non-mammal animals	----	5	8	0	0

Source: Authors' elaboration (2024).

Companion animals, especially dogs and cats, were the most frequently mentioned by both groups. Other domestic species such as rabbits, hamsters and guinea pigs were reported less frequently (< 5%). High school students showed greater recognition of wild mammal's native to the Cerrado and a higher proportion of references to humans as part of the mammal group, a trend that was more pronounced at this educational level (Figure 1).

Figure 1

Relative frequency of domestic species mentioned by participants



Source: Authors' elaboration (2024).

To assess conceptual knowledge, participants were asked to describe characteristics that define mammals. The responses were grouped into five thematic categories, presented in Table 2.

Table 2

Characteristics of mammals mentioned by middle school (MS) and high school (HS) students

Category	Middle school		High school	
	N=60	%	N=81	%
Mammary glands / lactation	56	93	76	94
Presence of hair or fur	14	23	39	48
Type of embryonic development	15	25	13	16
Various anatomical characteristics	0	0	13	16
Unclear answers / no answer	22	37	25	31

Source: Authors' elaboration (2024).

Most students correctly identified lactation as a defining trait of the group. However, mention of the presence of hair or fur was less frequent, especially among middle school students. A substantial proportion provided vague or incomplete answers, which suggests important conceptual gaps.

Identification of species native to the Cerrado was analyzed based on written responses and drawings. Table 3 summarizes how often students mentioned or drew these species.

Table 3

Percentage distribution of responses about mammals in the Cerrado

Category	Subcategory	Middle school		High school	
		N=60	%	N=81	%
Typical of the Cerrado	Written	47	76.7	79	97.5
	Illustrated	31	53.3	71	87.7
Non-typical / domestic	Written	14	23.3	2	2.5
	Illustrated	19	31.7	6	7.4
Exotic	Written	0	0.0	0	0
	Illustrated	2	3.3	0	0
Non-mammals animals	Written	0	0	0	0
	Illustrated	2	3.3	0	0
No response	Written	0	0.0	0	0
	Illustrated	5	8.3	4	4.9

Source: Authors' elaboration (2024).

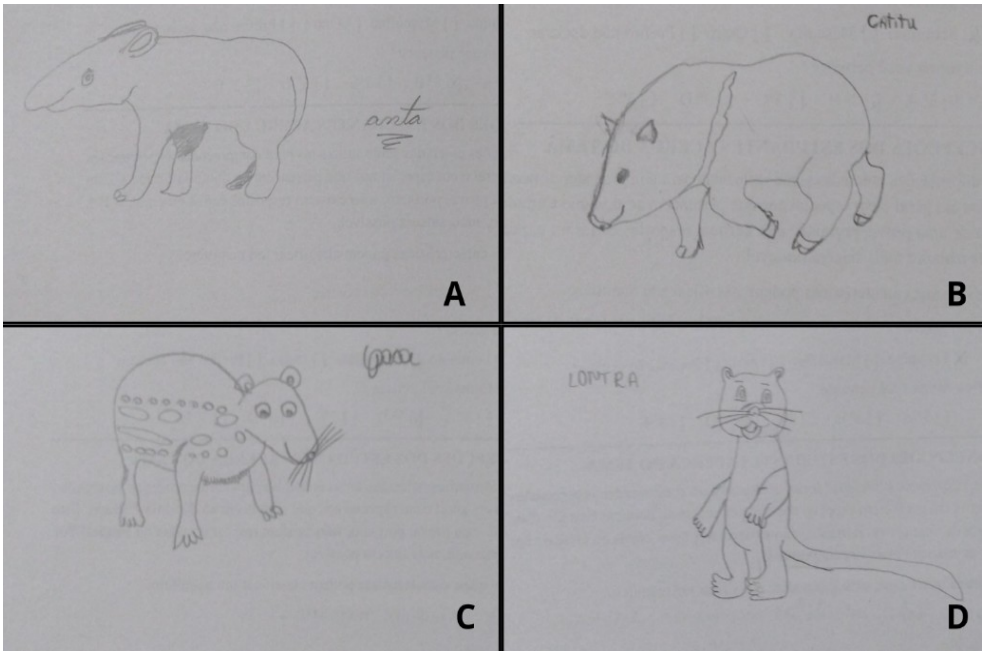
Among middle school students, the most frequently mentioned species were the maned wolf (*Chrysocyon brachyurus* Illiger, 1815), cited by 37% of participants, and the capybara (*Hydrochoerus hydrochaeris* Linnaeus, 1766), cited by 25%. These were followed by the jaguar (*Panthera onca* Linnaeus, 1758) (17%), the ocelot (*Leopardus pardalis* Linnaeus, 1758) (12%), the giant anteater (*Myrmecophaga*

tridactyla Linnaeus, 1758) (8%) and the three-banded armadillo (*Tolypeutes tricinctus* Illiger, 1811) (7%). Occasional mentions included the crab-eating raccoon (*Procyon cancrivorus* Cuvier, 1798), the coati (*Nasua nasua* Linnaeus, 1766), the black howler monkey (*Alouatta caraya* Humboldt, 1812) and the crab-eating fox (*Cerdocyon thous* Linnaeus, 1766), all with frequencies between 2% and 3%. The lowland tapir (Tapirus terrestris Linnaeus, 1758) and the pampas deer (*Ozotoceros bezoarticus* Linnaeus, 1758) were not mentioned by this group.

In high school, responses showed greater diversity and precision. The maned wolf was mentioned by 78% of students, followed by the jaguar (48%), the giant anteater (36%), the capybara (28%) and the three-banded armadillo (15%). There were also mentions of the lowland tapir (12%), the pampas deer (2%), the crab-eating fox (4%) and, occasionally, less common species such as the jaguarundi (*Herpailurus yagouaroundi* Geoffroy, 1803), the tayra (*Eira barbara* Linnaeus, 1758) and the bush dog (*Speothos venaticus* Lund, 1842). The illustrated responses mirrored the written mentions, with greater consistency among high school students, as shown in Figure 2.

Figure 2

Artistic representations of Cerrado mammals drawn by high school students. Note: A) lowland tapir (Tapirus terrestris Linnaeus, 1758); B) collared peccary (Pecari tajacu Linnaeus, 1758); C) lowland paca (Cuniculus paca Linnaeus, 1766); D) Neotropical otter (Lontra longicaudis Olfers, 1818).



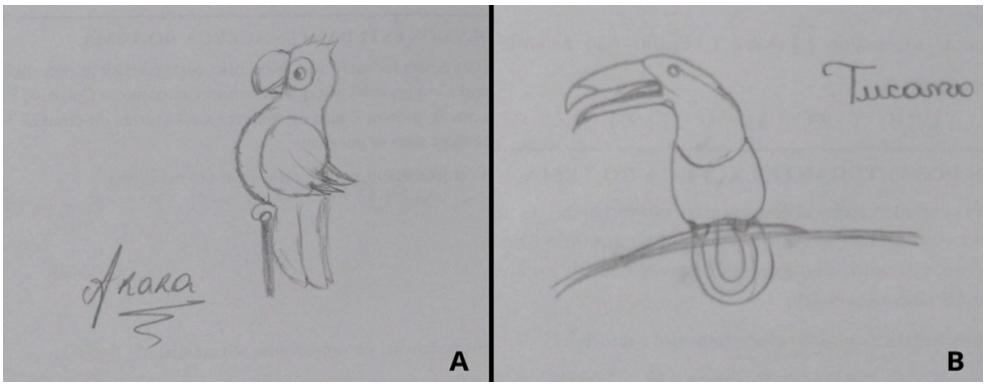
Source: Authors' elaboration (2024).

Mentions of domestic species and species that are not typical of the biome were more common among middle school students (25 percent), with cattle (22 percent) being the most frequently cited. Only 2 percent of high school students mentioned this type of animal. References to exotic species were rare. The wild boar (*Sus scrofa* Linnaeus, 1758) was cited by two middle school students. Only this group also produced drawings of non-mammal animals, such as birds, including the

blue-and-yellow macaw (*Ara ararauna* Linnaeus, 1758) and the toco toucan (*Ramphastos toco* Statius Müller, 1776), as illustrated in Figure 3.

Figure 3

Birds drawn by middle school students. A) blue-and-yellow macaw; B) toco toucan.



Source: Authors' elaboration (2024).

Finally, students' perceptions of the ecological roles of mammals in the Cerrado were classified into four categories: environmental balance, food chain, soil fertility and regeneration, and incomplete or incorrect responses. Table 4 presents the percentage distribution of these categories.

Table 4

about the ecological roles of mammals in the Cerrado

Category	Middle school		High school	
	N=60	%	N=81	%
Environmental balance	13	22	30	37
Feeding (food chain)	5	8	15	19
Soil fertility and regeneration	4	7	7	9
Incomplete or incorrect responses	38	63	29	36

Source: Authors' elaboration (2024).

The data indicate that, although some students recognized ecological functions of mammals, such as regulating population balance and participating in food chains, most responses contained gaps or inaccuracies. Examples include statements such as "they serve as food for us humans and also feed on potential pests" (Stud. 32, MS), "they help with the feline immune system, pest control and the food chain" (Stud. 06, HS) and "the life cycle of animals and their reproduction" (Stud. 21, HS). The difficulty in associating mammals with more complex ecological processes, such as seed dispersal, nutrient cycling or ecosystem engineering, points to a limited understanding of the role these animals play in maintaining biodiversity and in the functioning of Cerrado ecosystems.

DISCUSSION

The analysis of the results was grounded in the perspective of critical education, which conceives teaching as an emancipatory practice aimed at forming individuals who are capable of interpreting and transforming reality (Freire, 1987). In this direction, critical environmental education brings together ecological and social dimensions and promotes a contextualized understanding of the relationships between society and nature (Loureiro, 2007). In a complementary way, scientific literacy is understood as the reflective use of scientific knowledge to interpret phenomena and to act responsibly in the face of socioenvironmental challenges (Sasseron & Carvalho, 2011).

Based on these frameworks, the results highlight persistent challenges in zoology teaching, particularly in the construction of students' knowledge about mammals and in their understanding of the importance of these animals for the biodiversity of the Cerrado. The predominance of mentions of domestic animals, the low familiarity with native species and the difficulties in recognizing their ecological roles reveal conceptual gaps that limit both the appreciation of local fauna and the development of pro-conservation attitudes. These findings converge with studies that have observed, in both urban and rural contexts, the same tendency to prioritize domestic species and align with research that emphasizes the influence of everyday experience and pedagogical practices on the formation of school zoological knowledge (Prokop & Tunnicliffe, 2008; Tunnicliffe & Reiss, 1999).

In addition to reflecting conceptual limitations, these results suggest that affective factors and familiarity play a decisive role in how students construct their representations of mammals. The high frequency of mentions of companion animals, such as dogs and cats, indicates that direct contact and emotional bonds strongly influence the perception and cognitive salience of species (Giumelli & Santos, 2016). This tendency reinforces the idea that everyday proximity is one of the main determinants of animals' visibility in students' imaginations, a phenomenon that has been widely documented in different cultural and environmental contexts (Ballouard et al., 2011; Clutton-Brock, 2012; Twardek et al., 2017).

The presence of synanthropic mammals in high school students' responses, such as rats, may reflect not only greater exposure to school content but also an increasing recognition of urban fauna and of its interactions with human-modified environments (Barbosa et al., 2014; Flores-Santiago et al., 2024). According to the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA, 2006), synanthropic fauna includes native or exotic species that live alongside humans and partially or permanently depend on resources from altered environments. This finding reinforces the need to address, in Science classes, the coexistence between humans and other mammals in urban spaces, to broaden students' ecological and ethical understanding of relationships between society and nature.

On the other hand, the low frequency of mentions of mammals native to the Cerrado reveals weaknesses in the treatment of regional fauna in school curricula. Research indicates that Biology teaching tends to privilege globally charismatic species, such as lions, pandas or bears, to the detriment of local diversity, which hinders the construction of ecological and identity bonds between students and the environments in which they live (Borges & Ferreira, 2018; Muller & Delazeri, 2017). Although emblematic species such as the maned wolf and the jaguar were

more frequently mentioned, their visibility seems to be more closely associated with their representation in conservation campaigns and in the media than with the effective integration of these contents into formal teaching (Gomes et al., 2019).

The results also showed that students had difficulty distinguishing native from exotic species, as seen, for example, in the inclusion of the wild boar as part of the Cerrado fauna. This type of conceptual confusion tends to reflect a lack of contextualization in teaching, which rarely establishes connections between school content and the ecological reality of territories (Bezerra & Nascimento, 2015; Dias & Reis, 2018; Flores-Santiago et al., 2024). This gap is reinforced by the frequent presence of exotic species in zoos and by the widespread circulation of their images in media and educational materials aimed at children and adolescents, which contributes to consolidating distorted representations and to making native fauna invisible (Moraes-Scalfi & Barata, 2019).

With regard to the defining characteristics of mammals, the results show some familiarity with lactation, but they also reveal important conceptual difficulties concerning other attributes, such as the presence of hair or fur. These findings are consistent with studies that point to an excessively classificatory approach in the teaching of vertebrates, in which lists of morphological characteristics are presented in a decontextualized way, without articulation with ecological or functional aspects (Ligo & Giona, 2019; Richter et al., 2017; Silva et al., 2021). Emphasis on taxonomy, when dissociated from adaptive biological functions, limits the construction of an integrated understanding of organisms and of their roles in ecosystems.

The analysis of students' perceptions of the ecological roles of mammals revealed substantial gaps. Concepts such as seed dispersal, population control and maintenance of trophic balance were rarely mentioned, which reflects the superficial way in which ecology is still addressed in basic education (Hickman et al., 2022). The absence of investigative, contextualized and interdisciplinary methodologies in Science teaching undermines the internalization of concepts and students' ability to apply this knowledge to concrete conservation situations (Bizerril & Faria, 2003; Pacheco et al., 2016).

Although the *Base Nacional Comum Curricular* (BNCC, Brazilian National Common Core Curriculum) emphasizes the importance of scientific thinking, valuing biodiversity and developing socioenvironmental competences (Brasil, 2018), the results of this study show that these guidelines are still only partially implemented in practice. This distance between normative discourse and school reality reflects the contradictions of a document that, while it proposes a holistic education, also acts as an instrument of curricular standardization (Azevedo & Alle, 2022). As Marsiglia et al. (2017) argue, the BNCC leads to an emptying of school content by subordinating education to a technicist and productivist logic guided by business interests and by the pursuit of efficiency in training. This perspective weakens the social role of the school as a space for critical reflection, restricts teacher autonomy and hinders the construction of contextualized practices that connect scientific knowledge to the ecological and sociocultural realities of territories. Rather than promoting an education oriented toward understanding and valuing local biodiversity, the curriculum tends to reproduce a uniform model that is detached from the concrete challenges experienced by students.

The persistent emphasis on approaches based on memorization and formal classifications, combined with the limited inclusion of regionalized content, undermines the development of a critical and ecosystemic environmental awareness (Pacheco et al., 2016). This scenario contributes to the reproduction of a fragmented view of nature, in which living beings are studied in a decontextualized way and disconnected from local ecological dynamics. At the same time, the presence of an anthropocentric and utilitarian perspective in students' representations reinforces the urgency of a curricular reorientation grounded in ecocentric principles, which recognize the intrinsic value of species and their roles in ecosystems, independently of their utility for humans (Flores-Santiago et al., 2024; Razera et al., 2007).

In this context, it becomes essential to adopt diversified and contextualized pedagogical strategies that can bring students closer to local biodiversity and promote meaningful learning. The use of active methodologies, such as project-based learning, the development of educational materials, monitoring of regional fauna and the use of interactive digital resources, has produced promising results in promoting scientific literacy and fostering pro-conservation attitudes (Buchanan et al., 2018; Dinis et al., 2024; Mollah, 2024; Singha & Singha, 2024). In addition to supporting engagement and curiosity, these practices stimulate intellectual autonomy and the development of investigative, critical and argumentative competences, which are essential for consolidating scientifically informed and environmentally responsible citizenship.

Given the challenges identified, this study reinforces the importance of rethinking Science teaching from a more critical, contextualized and interdisciplinary perspective. Integrating zoological knowledge with ecology and conservation, with a focus on valuing native species of the Cerrado, is an essential step toward consolidating teaching as a tool for socioenvironmental transformation. Forming students who can understand the complexity of ecosystems and act ethically and responsibly in the face of threats to biodiversity ultimately depends on the construction of educational practices that break with fragmented teaching and promote reflection on the relationships among nature, science and society.

It should be noted that, although the sample in this study includes only two public schools in the Federal District, located in socioeconomically vulnerable regions, which limits the generalization of the results, this focus made it possible to analyze the sociocultural and environmental specificities of the context investigated. The study should therefore be understood as an exploratory investigation that contributes to understanding students' perceptions of the local mammal fauna of the Cerrado and their implications for Science teaching. These considerations reinforce the need to broaden the scope of research that integrates cognitive, affective and contextual dimensions in the analysis of the relationship between students and biodiversity. Future studies conducted in different school systems and contexts may deepen our understanding of how Zoology and Environmental Education teaching can contribute to strengthening ecological awareness and to valuing the fauna of the Cerrado.

CONCLUSION

The results of this study indicate that basic education students' understanding of mammals is superficial and marked by fragmented conceptions. Most students associate the concept of mammals with familiar examples, especially dogs and cats, which suggests that zoological knowledge is constructed mainly from everyday experience rather than from systematized biological criteria. The infrequent mention of defining characteristics, such as the presence of hair or fur and lactation, reinforces the conceptual fragility observed and the predominance of empirical knowledge that is only weakly connected to formal Science content.

This conceptual limitation is directly reflected in how students represent species diversity in the Cerrado. The scarce reference to native mammals, except for emblematic species such as the maned wolf and the jaguar, points to a restricted and distorted view of local fauna. This distortion is accentuated by the recurrent inclusion of exotic or domestic animals, which reveals the low visibility of regional biodiversity in teaching and learning processes.

The differences observed between educational levels suggest gradual, yet still insufficient, advances. High school students show greater accuracy in species identification and some awareness of the ecological roles of mammals, whereas middle school students present a high number of vague or incorrect answers, often confusing mammals with other animal groups. This discrepancy indicates cumulative gaps in scientific education throughout schooling.

The discrepancies between written responses and visual representations indicate that students draw on different levels of understanding depending on the mode of expression. While written responses are more closely aligned with formal knowledge, drawings reveal spontaneous conceptions and conceptual errors. This pattern underscores the importance of using multiple, contextualized assessment approaches.

In sum, students' understanding of mammals reflects little of the actual diversity of the Cerrado and tends to distort it, replacing native fauna with representations centered on domestic or exotic animals. This tendency suggests that the teaching of Zoology remains weakly connected to the local ecological context. Strengthening scientific literacy requires pedagogical practices that bring school knowledge closer to regional biodiversity and promote the recognition, appreciation and conservation of local fauna.

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REFERENCES

Aikenhead, G. S. (2006). *Science education for everyday life: Evidence-based practice.* Teachers College Press.

Albert, C., Luque, G. M., & Courchamp, F. (2018). The most charismatic species. *PloS one*, 13(7), e0199149. https://doi.org/10.1371/journal.pone.0199149

Azevedo, A. L. K., & Alle, L. F. (2022). Avaliação do conteúdo de evolução biológica em coleções didáticas brasileiras pós-BNCC. ACTIO: docência em ciências, 7(1), 1-23. https://periodicos.utfpr.edu.br/actio/article/view/14885

Ballouard, J. M., Brischoux, F., & Bonnet, X. (2011). Children prioritize virtual exotic biodiversity over local biodiversity. *PloS one*, 6(8), e23152. https://doi.org/10.1371/journal.pone.0023152

Barbosa, M. M., Oliveira, J. L. F., Mendonça, V. A. D., & Rodrigues, M. F. (2014). Teaching of ecology and synanthropic animals (pests): connections between attitudes and concepts. *Ciência & Educação* (Bauru), 20, 315-330. https://doi.org/10.1590/1516-73132014000200004

Bardin, Laurence(2011). *Análise de Conteúdo*. 1º. ed. Tradução: Luís Antero Reto, Augusto Pinheiro. São Paulo: Edições 70.

Bebbington, A. (2005). The ability of A-level students to name plants. *Journal of Biological Education*, 39(2), 63-67. https://www.tandfonline.com/doi/abs/10.1080/00219266.2005.9655963

Bezerra, R. G., & Nascimento, L. M. C. T. (2015). Concepções do bioma Cerrado apresentadas por estudantes do ensino fundamental de Formosa – Goiás. *Cadernos de Educação Tecnologia e Sociedade*, 8(1), 8-21. https://doi.org/10.14571/brajets.v8.n1.8-21

Bizerril, M. X. A., & Faria, D. S. (2003). A escola e a conservação do cerrado: uma análise no ensino fundamental do Distrito Federal. *Revista Eletrônica do Mestrado em Educação Ambiental*, 10(1), 19-31.

Borges, P. S., & Ferreira, J. S. (2018). Percepção ambiental dos alunos de Ensino Fundamental sobre a biodiversidade do Cerrado. *Revista Ciências & Ideias* ISSN: 2176-1477, 1-18. https://doi.org/10.22407/2176-1477/2018.v9i1.640

Brasil. Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (2006). Instrução normativa nº 141, de 19 de dezembro de 2006: Regulamenta o controle e o manejo ambiental da fauna sinantrópica nociva. IBAMA. https://www.ibama.gov.br/echnologi/echnologi/?legislacao=112966&view=echnologi.

Brasil. Ministério da Educação. (2018). Base Nacional Comum Curricular. MEC/ Secretaria de Educação Básica. http://basenacionalcomum.mec.gov.br/

Buchanan, J., Pressick-Kilborn, K., & Maher, D. (2018). Promoting environmental education for primary school-aged students using digital echnologies. *Eurasia Journal of Mathematics, Science and Technology Education*, 15(2), em1661. https://doi.org/10.29333/ejmste/100639

Calegari, A. D. S., Santana, C. M. B., Almeida, E. A. E. D., Soares, J. P. R., Jorge, J., Carvalho, G. S. D., & Franzolin, F. (2025). “Quais seres vivos existem aqui?” Composição da biodiversidade na visão de estudantes paulistas e em seus materiais didáticos. *Ensaio Pesquisa em Educação em Ciências* (Belo Horizonte), 27, e52031. https://doi.org/10.1590/1983-2117-52031

Carvalho, I. C. de M. (2008). *Educação ambiental: A formação do sujeito ecológico*. São Paulo: Cortez.

Clutton-Brock, J. (2012). *Animals as domesticates: a world view through history*. MSU Press.

Dias, R. I., & Reis, B. E. (2018). Conhecer para conservar: reconhecimento da fauna nativa do cerrado por alunos do Distrito Federal. *Revista Brasileira de Educação Ambiental* (RevBEA), 13(4), 260-280.

Dinis, A., Rainho, A., de Campos, C. B., & Martins, C. S. (2024). Promoting coexistence with jaguars and pumas in the Caatinga: two approaches to reach school children. *Human Dimensions of Wildlife*, 29(2), 210-227. https://doi.org/10.1080/10871209.2023.2212693

Distrito Federal. (2014a). Currículo em movimento da Educação Básica: Ensino Fundamental – Anos Finais. Secretaria de Estado de Educação do Distrito Federal. http://www.cre.se.df.gov.br/ascom/documentos/subeb/cur_mov/4_ensino_fundamental_anos_finais.pdf

Distrito Federal. (2014b). Currículo em movimento da Educação Básica: Ensino Médio. Secretaria de Estado de Educação do Distrito Federal. http://www.se.df.gov.br/curriculo-em-movimento-da-educacao-basica-2/

Driessnack, M. (2005). Children's drawings as facilitators of communication: a meta-analysis. *Journal of pediatric nursing,* 20(6), 415-423. https://doi.org/10.1016/j.pedn.2005.03.011

Ducarme, F., Luque, G. M., & Courchamp, F. (2013). What are "charismatic species" for conservation biologists. *BioSciences Master Reviews*, 10(2013), 1-8.

Flores-Santiago, I., Baena, M. L., Delfín-Alfonso, C. A., Silva-Rivera, E., & Pérez-Chacón, J. L. (2024). Perception and uses about mammals in México: a literature review. *Ethnobiology and Conservation*, 13. https://doi.org/10.15451/ec2024-08-13.22-1-12

Freire, P. (1987). *Pedagogia do oprimido*. 17ª. Ed. Rio de Janeiro: Paz e Terra, 3, 343-348.

Gil, A. C. (2002). *Como elaborar projetos de pesquisa* (Vol. 4, p. 175). São Paulo: Atlas.

Giumelli, R. D., & Santos, M. C. P. (2016). Convivência com animais de estimação: um estudo fenomenológico. *Revista da abordagem gestáltica: phenomenological studies*, 22(1), 49-58.

Gomes, M. A. D. A., Goncalves, T. V., Teresa, F. B., da Cunha, H. F., Lima, F. P., & Nabout, J. C. (2019). High school students' knowledge of endangered fauna in the Brazilian Cerrado: A cross-species and spatial analysis. *PloS one*, 14(4), e0215959. https://doi.org/10.1371/journal.pone.0215959

Hickman, C. P., Roberts, L. S., & Larson, A. (2022). *Princípios Integrados de Zoologia* (17ª ed.). Rio de Janeiro: Guanabara Koogan.

Klink, C. A., & Machado, R. B. (2005). Conservation of the Brazilian cerrado. *Conservation biology*, 19(3), 707-713. https://doi.org/10.1111/j.1523-1739.2005.00702.x

Laugksch, R. C. (2000). Scientific literacy: A conceptual overview. *Science education*, 84(1), 71-94. https://doi.org/10.1002/(SICI)1098-237X(200001)84:1<71::AID-SCE6>3.0.CO;2-C

Ligo, A. B., & Giona, R. M. (2019). Percepções de estudantes do 6º ano do ensino fundamental sobre os morcegos (Mammalia, Chiroptera) em Leme (SP). *Revista Brasileira de Educação Ambiental* (RevBEA), 14(3), 168-184.

Lindemann-Matthies, P., & Bose, E. (2008). How many species are there? Public understanding and awareness of biodiversity in Switzerland. *Human ecology, 36, 731-742*. https://doi.org/10.1007/s10745-008-9194-1

Loureiro, C. F. B.(2007). *Educação ambiental crítica: contribuições e desafios*. In: MELLO, S.; TRAJBER, R. (Org.). Vamos cuidar do Brasil: conceitos e práticas em educação ambiental. Brasília: MEC/UNESCO.

Marsiglia, A. C. G. , Pina, L. D., Machado, V. O. & Lima, M. (2017). A Base Nacional Comum Curricular: Um novo episódio de esvaziamento da escola no Brasil. *Germinal: Marxismo e Educação em Debate*, v.9, n.1.

MEA, M. E. A. (2005). *Ecosystems and Human Well-Being: wetlands and water synthesis*.

Melo, E. P. D., Simiao-Ferreira, J., Melo, H. P. D., Godoy, B. S., Daud, R. D., Bastos, R. P., & Silva, D. P. (2021). Exotic species are perceived more than native ones in a megadiverse country as Brazil. *Anais da Academia Brasileira de Ciências*, 93, e20191462 https://doi.org/10.1590/0001-3765202120191462

Minayo, M. C.S., Deslandes, S. F., & Gomes, R. (2011). *Pesquisa social: teoria, método e criatividade*. Editora Vozes Limitada.

Mollah, S. (2024). *Using Educational Technologies and Digital Media to Facilitate Environmental Education in Educational Institutions, Curricula, and Practice: The Applications, Benefits, and Challenges*. In Cases on Collaborative Experiential Ecological Literacy for Education (pp. 191-214). IGI Global.

Moraes Scalfi, G. A., & Barata, G. (2019). Fauna brasileira no cotidiano da educação infantil: uma abordagem necessária. *Revista Ciências & Ideias* ISSN: 2176-1477, 31-52. https://doi.org/10.22407/2176-1477/2019.v10i3.1046

Muller, E. S., & Delazeri, F. (2017). Compreensão de estudantes do Ensino Fundamental sobre animais nativos e exóticos. *Revista Acta Ambiental Catarinense*, 14(1/2), 22-38. https://doi.org/10.24021/raac.v14i1/2.4154

Nates, J., Campos, C., & Lindemann-Matthies, P. (2010). Students' perception of plant and animal species: a case study from rural Argentina. *Applied Environmental Education and Communication*, 9(2), 131-141. https://www.tandfonline.com/doi/abs/10.1080/1533015X.2010.482495

Pacheco, R. S., da Rocha, A. L. F., & Maestrelli, S. R. P. (2016). Possíveis efeitos da padronização sobre o conteúdo de mamíferos em livros de ciências e biologia aprovados pelo PNLD. *Revista de Ensino de Biologia da SBEnBio*, Maringá, 9, 663-674.

Prokop, P., & Tunnicliffe, S. D. (2008). "Disgusting" animals: Primary school children's attitudes and myths of bats and spiders. *Eurasia Journal of mathematics, science and technology education*, 4(2), 87-97. https://doi.org/10.12973/ejmste/75309

Razera, J. C. C., Boccardo, L., & Silva, P. S. (2007). Nós, a escola e o planeta dos animais úteis e nocivos. *Ciência & Ensino*, 2(1), 1-6.

Richter, E., Lenz, G., Santo Hermel, E. D. E., & da Costa Güllich, R. I. (2017). Ensino de zoologia: concepções e metodologias na prática docente. *Ensino & Pesquisa*, 15(1). https://doi.org/10.33871/23594381.2017.15.1.1069

Sasseron, L. H., & de Carvalho, A. M. P. (2011). Alfabetização científica: uma revisão bibliográfica. *Investigações em ensino de ciências*, 16(1), 59-77.

Sauvé, L. (2005). Currents in environmental education: Mapping a complex and evolving pedagogical field. *Canadian Journal of Environmental Education* (CJEE), 11-37.

Silva Rodrigues, L. F., Guimarães, S. S. M., & Goldschmidt, A. I. (2024). Qual o entendimento acerca do bioma cerrado que estudantes de ensino médio possuem?. Revista Dynamis, 30(Publicação contínua), e11322-e11322. https://doi.org/10.7867/1982-48662024e11322

Silva, J. F., Prata, J., & Christoffersen, M. L. (2021). Teaching Zoology in Basic Education in Brazil: an analysis of bibliographic publications (2010-2020). *Revista de Ensino de Ciências e Matemática*, 12(4), 1-18. https://doi.org/10.26843/rencima.v12n4a22

Singha, R., & Singha, S. (2024). *Application of experiential, inquiry-based, problem-based, and project-based learning in sustainable education*. In Teaching and learning for a sustainable future: Innovative strategies and best practices (pp. 109-128). IGI Global Scientific Publishing.

Tunnicliffe, S. D., & Reiss, M. J. (1999). Building a model of the environment: How do children see animals?. *Journal of Biological Education*, 33(3), 142-148. https://doi.org/10.1080/00219266.1999.9655654

Twardek, W. M., Peiman, K. S., Gallagher, A. J., & Cooke, S. J. (2017). Fido, Fluffy, and wildlife conservation: The environmental consequences of domesticated animals. *Environmental Reviews*, 25(4), 381-395. https://doi.org/10.1139/er-2016-0111.

Vale, M. M., Vieira, M. V., Grelle, C. E. V., Manes, S., Pires, A. P., Tardin, R. H., ... & Tourinho, L. (2023). Ecosystem services delivered by Brazilian mammals: spatial and taxonomic patterns and comprehensive list of species. *Perspectives in Ecology and Conservation*, 21(4), 302-310. https://doi.org/10.1016/j.pecon.2023.10.003

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