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ORIGINAL ARTICLE

Indigenous and peasant undergraduate students in Brazil's Midwest region constructing entomological knowledge based on their prior knowledge

Conhecimento prévio e construção do conhecimento entomológico por estudantes de graduação indígenas e camponeses da região centro-oeste do Brasil

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Abstract: This study presents findings from research conducted with indigenous and peasant students (n = 53) in their first year of the Rural Education Degree (Countryside Education) program at a public university in the Brazilian Midwest. We investigated previous knowledge and methods for developing entomological knowledge using structured questionnaires with open, closed, and multiple-choice questions. As a result, we discovered 24 distinct types of animals known as insects. Indigenous peoples conceptualized insects using ecological principles, whereas peasants approached the subject from health and emotional perspectives. Our findings revealed that indigenous students' prior entomological knowledge was primarily developed within their families, while peasant students developed it at school. This study provides important insights into pre-existing knowledge and the development of entomological understanding in an intercultural setting. It encourages reflection on the interactions of traditions, folk knowledge, and scientific understanding.

Keywords: Education in the countryside; Indigenous education; Ethnoentomology; Folk knowledge.

Resumo: Este estudo apresenta os resultados de uma pesquisa realizada com estudantes indígenas e camponeses (n = 53) do primeiro ano do curso de Licenciatura em Educação do Campo em uma universidade pública do Centro-Oeste brasileiro. Examinamos, por meio de questionários estruturados com perguntas abertas, fechadas e de múltipla escolha, o conhecimento prévio e as formas de construção do conhecimento entomológico. Como resultado, encontramos 24 tipos de animais citados como insetos. Os indígenas conceituam insetos com base em conceitos ecológicos e os camponeses com base em aspectos de saúde e emocionais. Descobrimos que o conhecimento entomológico prévio desses estudantes foi criado dentro do núcleo familiar, no caso dos indígenas, e na escola, no caso dos camponeses. Esta pesquisa traz informações legítimas sobre o conhecimento prévio e a construção do conhecimento entomológico, numa perspectiva intercultural, a fim de promover uma reflexão sobre o diálogo entre tradições, conhecimento popular e científico.

Palavras-chave: Educação no campo; Educação indígena; Etnoentomologia; Conhecimento popular.

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Introduction

Throughout human history, insects have played a consistently significant role in the socio-cultural lives of various ethnic groups (Costa-Neto, 1998; Costa-Neto; Magalhães, 2007; Hongbin; Runzhi, 2001; Posey, 1981; Romero; Yucra, 2017). This connection stems from the fact that insects are highly abundant and widely distributed on our planet, maintaining close interactions with people in their respective communities. As a result, insects feature prominently in community and personal life across diverse situations, shaping experiences that influence knowledge, perception, and attitudes toward these organisms (Dzerefos; Witkowski; Toms, 2013; Gurung, 2003; Oliveira-Lima *et al*., 2016).

This interaction leads individuals to form relationships with the organisms in their surroundings, giving rise to conceptions and perceptions about the natural world. Consequently, cultural elements play a pivotal role in determining how people and communities conceptualize and perceive specific terms. In the case of insects, negative associations with harm and disgust are often prevalent (Costa-Neto, 2000; Santos-Fita; Costa-Neto; Schiavetti, 2011).

In the past, the development of conceptions and perceptions about insects relied primarily on personal and communal experiences within people's local environments. However, in today's world, there has been a noticeable decline in such community experiences, creating a significant disconnect between humans and insects due to the substantial influence of alternative knowledge sources, such as mainstream media (Costa-Neto; Pacheco, 2003; Uehara; Yoshida, 2016).

Conversely, when considering formal education, it is crucial to recognize that every student brings a set of knowledge rooted in their initial culture, derived from their socio-cultural environment (Cobern, 1996). This body of knowledge, referred to as prior knowledge, encompasses all culturally constructed assumptions and beliefs based on individual worldviews (Lemke, 2001).

In the realm of science education, it is worth noting that the importance of acknowledging and incorporating students' cultural knowledge into the learning process has gained increased attention over the past two decades (Bang; Medin, 2010; Carlone; Johnson, 2012; Gondwe; Longnecker, 2015; Lemke, 2001; Schroevers; Fleer, 2019; Snively; Corsiglia, 2001).

According to Bang and Medin (2010), there exist relationships, whether in terms of similarities or differences, between students' prior knowledge and the scientific knowledge that is the subject of teaching. This is because students may come from cultural backgrounds where scientific activities exert a strong influence on their daily lives, or from environments where Western science plays a minimal role, as is often the case in traditional communities, including indigenous, farming, riverside, and peasant communities.

In this paper, we present and discuss the findings of a study that aimed to document the prior knowledge and the development of entomological knowledge among indigenous and peasant college students enrolled in the Rural Education Degree program at a public university in the Midwest of Brazil. Our goal is to highlight potential implications for the acquisition of scientific concepts and to propose teaching strategies that foster science education through intercultural dialogue. We hope that the data presented here will enable science educators to reflect on their pedagogical practices and refine them, promoting a continuous dialogue between classroom knowledge and the local and traditional knowledge embedded in the daily lives of their students.

Materials and methods

Participants

This study involved 53 participants (men: women = 1:0.9), ranging in age from 17 to 57 years old. These individuals were first-year students enrolled in the Rural Education Degree program at the Intercultural Indigenous College (FAIND), which is affiliated with the Federal University of Grande Dourados (UFGD). This educational institution is situated in the city of Dourados, located in the state of Mato Grosso do Sul, in the central-western region of Brazil. Notably, this program has a substantial representation of indigenous people and farmers, and it has specific public policies tailored to these social groups (Barboza; Rinaldi; Lima, 2018).

The primary objective of the Rural Education Degree program is to prepare educators to work in Basic Education within rural areas, including schools in land reform settlements. This undergraduate program follows the Pedagogy of Alternation, which is grounded in the principles of the pedagogy of movement. It involves a structured alternation between university-based learning (where students attend in-person classes) and community-based learning, during which instructors travel to settlements, small farms, ranches, villages, and traditional communities to conduct classes (Melo; Adams, Nunes, 2020).

The program attracts students from various backgrounds, including peasants, indigenous individuals, and riverside communities, hailing from different settlements, villages, and traditional communities across the Pantanal region, spanning from the north to the southernmost areas of Mato Grosso do Sul state.

We categorized the total number of participants into two distinct groups: (a) peasant students residing in land reform settlements in the state of Mato Grosso do Sul, and (b) indigenous students from the Guarani and Kaiowá ethnic groups living in villages in the southern region of the state.

Data collection and research instrument (data sampling)

The research proposal was presented during the face-to-face classes of the undergraduate course at the university (university time) for three incoming classes. Thus, in March 2018, January 2019, and February 2020, incoming students were invited to participate in the research. The students participated in the study freely and agreed to answer the research instrument.

We used a structured interview, through a questionnaire with open and closed questions, as a tool to obtain data. The questionnaire was offered during the first class of the curricular component *Biology, Biotechnology, and Science Teaching* for all incoming classes in their respective years of admission (from 2018 to 2020).

The questionnaire consisted of (1) Social aspects (skin color/ethnicity, gender, age, place of residence), aiming to establish the profile of these students; (2) Prior knowledge (information regarding classification, biology, and ecology), to verify previous entomological knowledge; and (3) Source of acquisition of entomological knowledge, to understand how entomological knowledge is constructed and transmitted.

Data analysis

For closed-ended questions in the questionnaire, we employed frequency distribution and percentage calculations to quantitatively analyze the data. This involved organizing and tabulating the numbers and percentages of responses within each variable category.

In the case of open-ended questions, we conducted a qualitative content analysis. This entailed a thorough examination of the data to establish categories, define the boundaries of these categories, assign data segments to the appropriate categories, and provide summaries for each topic. Responses from the open-ended questions were transcribed and categorized through a detailed and interpretative analysis of the data using established methods (Altheide, 1987; Bardin, 2006; Hsieh; Shannon, 2005).

To analyze the content of open-ended questions related to the definition of insects, we considered the following categories: (a) ecological, (b) taxonomic, (c) emotional, and (d) healthy, as shown in **figure 1**.

The ecological category encompasses participants' prior knowledge concerning the ecological aspects of insects, such as their roles in pollination, food chains, and dietary habits. The taxonomic category pertains to the external morphology of insects, including features like the presence of wings and exoskeletons.

The emotional category addresses the range of emotions that insects elicit in individuals, including fear, curiosity, and disgust. Lastly, the health category consolidates responses that associate insects with the transmission of diseases and illnesses. Each response was classified into a single category based on its primary focus.

Results

Social aspects

The sample consisted of 53 students, with the indigenous group comprising the majority (60%; n = 32) compared to the peasant group (40%; n = 21). In terms of gender, the participant composition was relatively balanced, with women making up 49% of the sample (n = 26) and men comprising 51% (n = 27). The age range varied from 17 to 57 years. Women were distributed across the entire age range, while men were represented in a slightly narrower age range, spanning from 18 to 51 years. Among indigenous individuals, ages ranged from 18 to 51 years, and among peasants, the range was from 17 to 57.

The students involved in this research hail from nine municipalities in the state of Mato Grosso do Sul, Brazil. Peasants reside in the following municipalities: Corumbá, Nioaque, Ponta Porã, Sidrolândia, and Terenos. Indigenous students live in villages located in the municipalities of Amambai, Dourados, Laguna Carapã, and Tacuru.

Prior knowledge

In total, we obtained 227 citations, with an average of 4.2 insects per student. The highest number of insect citations came from peasants (n = 115; 51%). In terms of prior taxonomic knowledge, the majority of students (n = 49; 92%) classified insects as belonging to the Animalia kingdom.

Students mentioned 24 animals that they identified as insects, but six of these animals do not belong to the Insecta class (Hexapoda). The most frequently mentioned animals not scientifically classified as Insecta were spiders (Phylum Arthropoda, Class

Arachnida, Subfamily Araneae) (n = 12, 5%), followed by worms (Phylum Annelida or Phylum Nematoda) (n = 4; 1.7%), mice (Class Mammalia) (n = 3; 1.3%), centipedes (Phylum Arthropoda, Subphylum Myriapoda) (n=1; 0.5%), and toads (Amphibia: Anura) (n = 2; 1%). Spiders, worms, and mice were mentioned by both indigenous and peasant students, while toads and centipedes were only mentioned by peasant students. Detailed data can be found in **table 1**.

The Diptera order (flies and mosquitoes) was the most frequently mentioned among indigenous and peasant participants, accounting for 60% of the total (**table 3**). Additionally, within the Diptera order, we identified three mentions of 'mutuca' (approximately 1.3% of the total mentions) among indigenous students. 'Mutuca' is a common and popular term used to refer to species of flies belonging to the Tabanidae family.

The Hymenoptera and Hemiptera orders exhibited the highest diversity of the mentioned insects, with four species in each category. They were followed by the Diptera order (three insects), Lepidoptera, and Coleoptera orders (two insects each). The Orthoptera, Blattodea, and Mantodea orders each had a single insect mentioned.

Regarding the Coleoptera order, specific citations of beetles in their larval form were observed among indigenous students (11, approximately 4.8% of the total citations), compared to three citations among peasant students (1.3% of the total citations).

Content analysis

Overall, the majority of students (n=30; 56%) defined insects based on conceptions related to their ecological functions. The taxonomic category (n=10; 19%) and the emotional category (n=8; 15%) were the second and third most frequently mentioned, while the health category was the least mentioned (n=5; 10%) (**table 1**).

Table 1 – List of animals cited as insects by indigenous and peasant students

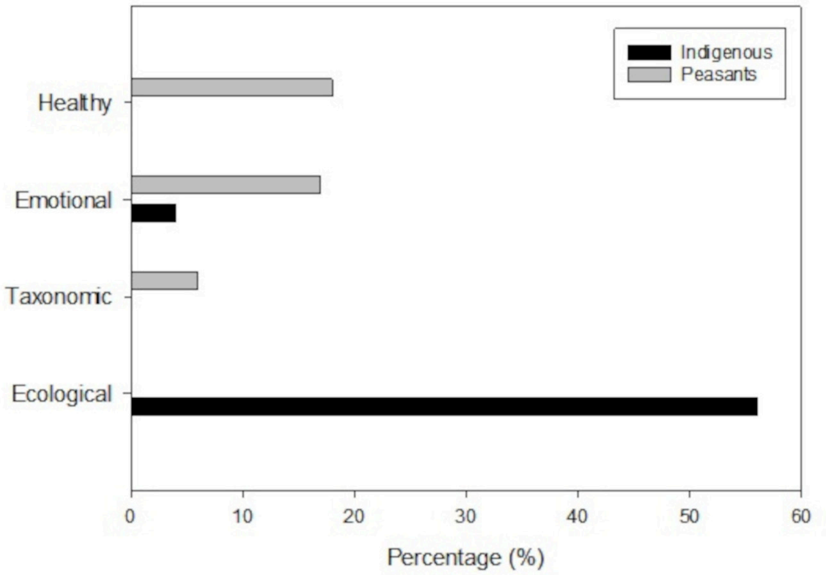
Biological Classification			Number of Citations		
Filo: Subfilo (Class)	***Order***	***Specimen***	***Indigenous***	***Peasants***	***Total***
Filo Arthropoda: Subfilo Hexapoda (Insecta)	Diptera	Fly	19 (8,5%)	28 (12,5%)	89 (39,3%)
		Mosquito	15 (6,5%)	24 (10,5%)	
		Horsefly	3 (1,3%)	0 (0%)	
	Lepidoptera	Butterfly	12 (5,3%)	10 (4,5%)	23 (10,1%)
		Moth	0 (0%)	1 (0,5%)	
	Blattodea	Cockroach	5 (2%)	11 (4,8%)	16 (7%)
	Coleoptera	Beetle larvae	11 (4,8%)	3 (1,3%)	24 (10,5%)
		Beetle	5 (2%)	5 (2%)	
	Hymenoptera	Bee	7 (3%)	5 (2%)	39 (15,5%)
		Bumblebee	6 (2,5%)	0 (0%)	
		Ant	4 (1,7%)	4 (1,7%)	
		Wasp	4 (1,7%)	1 (0,5%)	
	Mantodea	Mantis	5 (2%)	5 (2%)	10 (4,5%)
	Hemiptera	Barber bug	1 (0,5%)	2 (1%)	3 (1,3%)
		Cicada	2 (1%)	1 (0,5%)	3 (1,3%)
		Stinky bug	0 (0%)	2 (1%)	2 (1%)
		Thumbtack bug	1 (0,5%)	0 (0%)	1 (0,5%)
	Orthoptera	Cricket	0 (0%)	1 (0,5%)	1 (0,5%)

Biological Classification			Number of Citations		
Filo: Subfilo (Class)	***Order***	***Specimen***	***Indigenous***	***Peasants***	***Total***
Filo Arthropoda: Subfilo Chelicerata (Arachnida)	Araneae	Spider	8 (3,5%)	4 (1,7%)	12 (5%)
	Ixodida	Tick	0 (0%)	2 (1%)	2 (1%)
Filo Arthropoda: Subfilo Myriapoda (Chilopoda)	–	Centipede	0 (0%)	1 (0,5%)	1 (0,5%)
Filo Annelida Clitellata)	–	Worm	3 (1,3%)	1 (0,5%)	4 (1,7%)
Filo Chordata: Subfilo Vertebrata (Mammalia)	–	Mouse	1 (0,5%)	2 (1%)	3 (1,3%)
Filo Chordata: Subfilo Vertebrata (Amphibia)	–	Frog	0 (0%)	2 (1%)	2 (1%)
		Total	112 (49%)	115 (51%)	227 (100%)

Percentages are based on the total number of citations (n = 227)
Source: prepared by the authors.

A majority of indigenous students (n = 30, 56%) defined insects within the ecological category. In contrast, peasant students mainly categorized these animals under the health and emotional categories (n = 9, 18%, in both) (**figure 1**).

Figure 1 – Categories related to prior knowledge of indigenous people and peasants



Percentages are based on the total number of participants (n = 53).
Source: prepared by the authors.

Regarding the content analysis of the open-ended question about the dietary habits of insects, most students (n = 30, 56%) did not know how to respond to the question. Among the students who did respond (n = 232323, 44%), we identified 51 citations divided into five categories: (a) generalists (insects that eat everything), (b) hematophagous (feeding on blood), (c) herbivores (feeding on plants), (d) mycophagous (feeding on fungi), and (e) insectivores (feeding on other insects). The generalist category had the highest number of citations (n = 22, 44%), followed by hematophagous (n = 15, 30%), herbivores (n = 10, 19%), mycophagous (n = 3, 5%), and insectivores (n = 1, 1%).

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Indigenous students provided the most information about insect dietary habits (n = 32, 63%), with the generalist category being the most prominent (n = 17, 33%). Among peasants (n = 19, 37%), the generalist, hematophagous, and herbivorous categories had equal prominence (n = 5, 10% each) (**table 2**).

Table 2 – Insect feeding habits classification, according to indigenous and peasants

Feeding habits	Indigenous	Peasants	Total
Generalist	17 (32%)	5 (10%)	22 (42%)
Hematophagous	10 (20%)	5 (10%)	15 (30%)
Herbivore	5 (10%)	5 (10%)	10 (20%)
Mycophagous	0 (0%)	3 (6%)	3 (6%)
Insectivore	0 (0%)	1 (2%)	1 (2%)
Total	32 (62%)	19 (38%)	51 (100%)

Percentages are based on the total number of participants (n = 51).
Source: prepared by the authors.

Regarding health aspects, particularly the potential of insects to transmit diseases, we found that almost all students (n = 50, 94%) (except for three who chose not to respond) considered insects as potential disease vectors. Students cited five representatives of the Insecta class as examples of disease-transmitting insects (n = 84 citations): mosquitoes (n = 28, 33%), flies (n = 22, 26%), cockroaches (n = 10, 11%), bedbugs (n = 4, 5%), and crickets (n = 1, 1%). Worms (n = 8, 10%) and ticks (n = 11, 14%) were also mentioned as disease vectors.

Among indigenous students, flies were the most frequently cited as disease vectors, while among peasant students, mosquitoes were identified as the primary disease transmitters (**table 3**).

Table 3 – Animals cited as disease-transmitting insects by indigenous people and peasants

Animals	Indigenous	Peasants	Total
Mosquito (Insecta: Diptera)	10 (12%)	18 (22%)	28 (34%)
Fly (Insecta: Diptera)	12 (14%)	10 (12%)	22 (26%)
Tick (Arachnida: Ixodida)	8 (9%)	3 (4%)	11 (13%)
Cockroach (Insecta: Blattodea)	6 (7%)	4 (5%)	10 (12%)
Worm	0 (0%)	8 (9%)	8 (9%)
Barber (Insecta: Hemiptera)	0 (0%)	4 (5%)	4 (5%)
Cricket (Insecta: Orthoptera)	0 (0%)	1 (1%)	1 (1%)
Total			84 (100%)

Percentages are based on the total number of participants (n = 84).
Source: prepared by the authors.

Sources of the construction of entomological knowledge

To investigate the acquisition and transmission of entomological knowledge, we asked the participants to select their primary source of information about insects from a list of options, including school, books, television, the internet, daily life (everyday experiences), and family. Additionally, participants could specify other sources in an open-ended space.

Overall, the majority of students (n = 21, 40%) indicated school as their primary source of insect-related knowledge. Family (n = 19, 36%) emerged as the second most significant source for acquiring entomological knowledge, followed by daily life experiences (n = 6, 12%). Television ranked fourth (n = 3, 6%), while the internet and books (n = 2, 4% each) were the least frequently mentioned as sources of entomological knowledge (**table 4**).

Table 4 – Source of acquisition of entomological knowledge according to indigenous and peasants

Source of acquisition of entomological knowledge	Indigenous	Peasants	Total
School	10 (19%)	11 (20%)	21 (38%)
Family	15 (28%)	4 (8%)	19 (36%)
Day-by-day	4 (8%)	2 (4%)	6 (12%)
Television	1 (2%)	2 (4%)	3 (6%)
Internet	0 (0%)	2 (4%)	2 (4%)
Books	2 (4%)	0 (0%)	2 (4%)
Total	32 (60%)	21 (40%)	53 (100%)

Percentages are based on the total number of participants (n = 53).
Source: prepared by the authors.

An ethnic perspective reveals that indigenous individuals primarily rely on family (n = 15, 28%) as their key source of knowledge acquisition, in contrast to the peasants who selected school (n = 11, 20%) as the most significant institution for building their entomological knowledge. Notably, the internet was not mentioned by any indigenous participants, and books were not cited by any peasant respondents.

Discussion

According to Cobern (1996), every student, upon entering an educational institution, brings with them a set of knowledge derived from their primary culture, i.e., the socio-cultural environment in which they live. The knowledge that students bring with them to the classroom is referred to as prior knowledge. This prior knowledge encompasses a comprehensive array of culturally rooted assumptions and beliefs. Such knowledge originates from a framework of practices and social actions within each context (Lemke, 2001).

In this study, we are analyzing the existing knowledge of first-year students enrolled in the Rural Education Degree program at a public university located in the central-western region of Brazil. Similar to elementary school students, these university students come with pre-existing knowledge of various science topics. Therefore, their university instructors must consider their prior knowledge while teaching them (Fernández-Chamorro; Pamplona; Pérez-Fructuoso, 2020; Lazarowitz; Lieb, 2006).

In the case of the students participating in this study, it is crucial to emphasize that they belong to indigenous (Guarani and Kaiowá ethnicities) and peasant groups, as the specific university program is designed to cater to these social groups. Furthermore, these students will be trained as teachers to work in indigenous and rural schools. Hence, it is essential to consider the cultural aspect when assessing the prior knowledge of these students and future teachers.

The number of types of insects mentioned by the participants in this study closely resembled the findings of a previous study conducted in basic education, which examined the prior knowledge of students in a public school in Northeast Brazil (Costa-Neto; Baptista, 2006).

In this study, the Diptera order obtained the highest number of citations, which may be related to the sanitary aspect of this group of insects, associated with the fact that diseases such as yellow fever, dengue, and leishmaniasis can be transmitted by dipterans, historically affecting the regions where the participants of this study live (Castro et al., 2016; Costa; Cunha; Costa, 2018).

In addition to the sanitary aspect, dipterans are also present in the Kaiowá cosmogony; indigenous students were the only ones to mention horseflies (the common name for individuals of the Tabanidae family). In Kaiowá cosmology, the emergence of this insect is related to Pa'i Kwará (God Sun) when he created the cedar tree, and the insects emerged as part of God's creation (Pedro, 2021).

Similar to horseflies, we observed a significant mention of beetles in their larval form. Previous studies reported the use of larvae of the *Rynchophorus palmarum* species by the Guarani-Kaiowá ethnicity, in the form of oil extracted from the larvae, used for the treatment and healing of skin wounds and respiratory diseases (Vilharva *et al*., 2020).

A noteworthy result from this study is that indigenous students exclusively conceptualize insects based on ecological and emotional concepts. The worldviews of the Guarani and Kaiowá peoples are deeply rooted in the elements of nature and likely contribute to this result. These peoples seek ways to coexist harmoniously with their environment, making the association of insects with their ecological functions an expected outcome (Ioris, 2019).

Similarly, indigenous people confirmed the importance of intergenerational knowledge in shaping their prior entomological knowledge, while peasants identified the school as the most significant factor in the development of this knowledge. In this study, as in similar ones, the results indicate that prior entomological conceptions differ from scientific ones (Costa-Neto; Baptista, 2006); Costa-Neto; Magalhães, 2007; Hermogenes *et al*., 2016; Oliveira-Lima *et al*. 2016).

Concerning the consideration and relevance of students' cultural and ethnic knowledge in science classrooms, it is worth mentioning that there has been a growing body of research in science education over the past two decades emphasizing the importance of this consideration for student learning (Carlone; Johnson, 2012; Fleer; Adams; Gunstone, 2019; Gondwe; Longnecker, 2015; Lemke, 2001; Robles-Piñeros, 2020; Snively; Corsiglia, 2001).

Hence, research in science education highlights the necessity of acknowledging students' prior knowledge in science classes to establish connections between what is taught (school scientific knowledge) and the concepts already present in their cognitive structures. However, not all ideas and worldviews align with Western science, such as the local and traditional knowledge of indigenous peoples and peasants. Therefore, it can be inferred that students' prior knowledge is not always scientific. In the case of students whose prior knowledge does not align with the sciences, teachers can choose content that helps bridge the gap, introducing students to a new culture with an alternative explanatory model, a different language, and a distinct narrative. This approach aims not to replace students' scientific knowledge but to enrich their conceptual repertoire with scientific ideas (Robles-Piñeros, 2020).

Intercultural science education necessitates negotiations between knowledge systems and the tensions that arise between them. Therefore, constructing new concepts does not entail abandoning previous conceptions but becoming aware of the contexts in which these conceptions are applicable (Fleer; Adams; Gunstone, 2019; Robles-Piñeros, 2020).

Students should grasp the pathways of science, actively positioning themselves to make decisions in diverse situations, where science is one of the many voices in society. Consequently, science education contributes to students' critical thinking, cognitive problem-solving abilities, and capacity to make independent decisions, fully exercising their citizenship (Dagher; Erduran, 2017; Pomeroy, 2019).

The same principle holds for students who bring common-sense ideas into the classroom. Common sense refers to the everyday knowledge generated and shared among people in their daily lives. It does not stem from a specific culture but is formed from a blend of various cultures and knowledge systems (artistic, philosophical, religious, cosmological, traditional, etc.). In these cases, teachers can demonstrate how different knowledge systems intertwine in daily life, offering students an epistemological perspective on each one (Godler; Reich, 2017).

Therefore, a science education that aims to incorporate prior knowledge should begin by investigating this knowledge. Cobern (1996), a proponent of contextual constructivism, argues that when science teachers investigate and comprehend the diverse ways in which students perceive nature, it is possible that the structure of science education can bridge the gap between students and science. This is because the construction of students' knowledge requires contexts that provide meaning to that knowledge. This process also involves the affective dimension of these students, their beliefs, values, and prior knowledge (Freire, 1972; Lorsbach; Tobin, 1992).

Conclusion

We conclude that indigenous and peasant students, who are future teachers for indigenous and peasant schools, possess distinct knowledge that has been shaped by their individual and collective experiences, and passed down through generations. When this knowledge is recognized and valued, it enables students to delve deeper into scientific concepts. Scientific knowledge must be held in equal regard alongside traditional, popular, and local knowledge.

To foster this process of appreciation and promote a horizontal dialogue between traditional and popular knowledge and local knowledge, there is a need for more extensive discussions on alternative ontologies, diverse knowledge construction methods, and various theoretical-methodological perspectives within the pedagogical practices of school education.

Furthermore, we emphasize the significance of ongoing education for science teachers through university programs. Such programs serve as a valuable tool for professionals in basic education, facilitating a constructive, equitable, and reflective dialogue on emerging pedagogical paradigms, ultimately leading to the development of more comprehensive, diverse, and inclusive teaching processes.

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References

ALTHEIDE, D. L. Reflections: ethnographic content analysis. *Qualitative Sociology*, New York, v. 10, p. 65-77, 1987.

BANG M.; MEDIN, D. Cultural processes in science education: supporting the navigation of multiple epistemologies. *Science Education*, Hoboken, US, v. 94, n. 6, p. 1008-1026, 2010. DOI: https://doi.org/10.1002/sce.20392.

BARBOZA, E. M.; RINALDI, R. P.; LIMA, F. V. A. O. A formação de professores nas licenciaturas em educação do campo: o que apontam os artigos a partir do Portal de Periódicos Capes. *Colloquium Humanarum*, Presidente Prudente, v. 15, p. 39-44, 2018. DOI: https://doi.org/10.5747/ch.2018.v15.nesp2.001073.

BARDIN, L. *Análise de conteúdo*. Lisboa: Edições 70, 2006.

BRAVO N. R. A conservation ethic in practice: preserving cultural and biodiversity by bridging the generational knowledge base (innovations case discussion: amazon conservation team). *Innovations*: technology, governance, globalization, Halifax, Canada, v. 4, n. 2, p. 27-30, 2009.

CARLONE, H.; JOHNSON, A. Unpacking 'culture' in cultural studies of science education: cultural difference versus cultural production. *Ethnography and Education,* Abingdon, UK, v. 7, n. 2, p. 151-173, 2012.

CASTRO, L. S.; FRANCA, A. D. O.; FERREIRA, E. D. C.; HANS FILHO, G.; HIGA JUNIOR, M. G.; GONTIJO, C. M. F.; DORVAL M. E. M. C. Leishmania infantum as a causative agent of cutaneous leishmaniasis in the state of Mato Grosso do Sul, Brazil. *Revista do Instituto de Medicina Tropical de São Paulo*, São Paulo, v. 58, p. 1-17, 2016. DOI: https://doi.org/10.1590/S1678-9946201658023

COBERN, W. W. Constructivism and non-western science education research. *International Journal of Science Education*, Abingdon, UK, v. 18, n. 3, p. 295-310, 1996. DOI: https://doi.org/10.1080/0950069960180303.

COSTA, E. M. D. S.; CUNHA, R. V. D.; COSTA, E. A. D. National dengue control program implementation evaluation in two border municipalities in Mato Grosso do Sul State, Brazil, 2016. *Epidemiologia e Serviços de Saúde*, Brasília, DF, v. 27, n. 4, e2017478, p. 1-12, 2018. DOI: https://doi.org/10.5123/S1679-49742018000400007.

COSTA-NETO, E. M. Folk taxonomy and cultural significance of "abeia" (Insecta, Hymenoptera) to the Pankararé, Northeastern Bahia State, Brazil. *Journal of Ethnobiology*, Thousand Oaks, US, v. 18, p. 1-13, 1998.

COSTA-NETO, E. M. The significance of the category "insect" for folk biological classification systems. *Journal of Ecological Anthropology*, Athens, US, v. 4, n. 1, p. 70-75, 2000. DOI: https://doi.org/10.5038/2162-4593.4.1.4.

COSTA-NETO, E. M.; BAPTISTA, G. C. S. A percepção dos estudantes do nível fundamental sobre os insetos: um estudo de caso em uma escola pública de Feira de Santana – Bahia. *In*: CONGRESSO BRASILEIRO DE ENTOMOLOGIA, 21., 2006, Recife. *Resumos* [...]. Recife: Universidade Federal Rural de Pernambuco, 2006.

COSTA-NETO, E. M.; MAGALHÃES, H. F. The ethnocategory "insect" in the conception of the inhabitants of Tapera County, São Gonçalo dos Campos, Bahia, Brazil. *Anais da Academia Brasileira de Ciências*, Rio de Janeiro, v. 79, p. 39-249, 2007.

COSTA-NETO, E. M.; PACHECO, J. M. Uhead of snake, wings of butterfly and body of cicada: impressions of the Lantern-Fly (Hemiptera: Fulgoridae) in the village of Penna Branca Bahia State, Brazil. *Journal of Ethnobiology*, Thousand Oaks, US, v. 23, p. 46-57, 2003.

DAGHER, Z. R.; ERDURAN, S. Abandoning patchwork approaches to nature of science in science education. *Canadian Journal of Science, Mathematics and Technology Education*, Heidelberg, v. 17, p. 46-52, 2017.

DZEREFOS, C. M.; WITKOWSKI, E. T. F.; TOMS, R. Comparative ethnoentomology of edible stinkbugs in southern Africa and sustainable management considerations. *Journal of Ethnobiology and Ethnomedicine*, London, UK, v. 9, p. 20-31, 2013. DOI: https://doi.org/10.1186/1746-4269-9-20.

FERNÁNDEZ-CHAMORRO, V.; PAMPLONA, S.; PÉREZ-FRUCTUOSO, M. J. Assessing prior knowledge of statistics in students attending an online university. *Journal of Computing in Higher Education*, New York, v. 32, p. 182-202, 2020. DOI: https://doi.org/10.1007/s12528-019-09236-9.

FLEER, M.; ADAMS, M.; GUNSTONE, R. Transformative pedagogy: Dinka playgroups as spaces for cultural knowledge productions of Western science. *Cultural Studies of Science Education*, Dordrecht, v. 14, p. 1045-1069, 2019. DOI: https://doi.org/10.1007/s11422-018-9908-7.

FREIRE, P. *Pedagogy of the oppressed*. New York: Continuum, 1972.

GODLER, Y.; REICH, Z. News cultures or "epistemic cultures"? Theoretical considerations and empirical data from 62 countries. *Journalism Studies*, Abingdon, UK, v. 18, p. 666-681, 2017. DOI: https://doi.org/10.1080/1461670X.2016.1266909.

GONDWE, M.; LONGNECKER, N. Scientific and cultural knowledge in intercultural science education: student perceptions of common ground. *Research in Science Education,* Dordrecht, v. 45, p. 117-147, 2015. DOI: https://doi.org/10.1007/s11165-014-9416-z.

GURUNG, A. B. Insects: a mistake in god's creation? Tharu farmers' perception and knowledge of insects: a case study of Gobardiha Village Development Committee, Dang-Deukhuri, Nepal. *Agriculture and Human Values*, Dordrecht, v. 20, p. 337-370, 2003.

HERMOGENES, G. C.; LACERDA, F. G.; CARMASSI, G. R.; RODRIGUES, L. N. Percepção entomológica de graduandos da Universidade Federal do Espírito Santo, ES, Brasil. *Entomo Brasilis*, Vassouras, RJ, v. 9, p. 180-186, 2016.

HSIEH, H. F.; SHANNON, S. E. Three approaches to qualitative content analysis. *Qualitative Health Research*, Thousand Oaks, US, v. 15, n. 9, p. 1277-1288, 2005.

IORIS, A. A. Political agency of indigenous peoples: the Guarani-Kaiowa's fight for survival and recognition. *Vibrant*: virtual Brazilian anthropology, Brasília, DF, v. 16, p. 1-28, 2019.

LAZAROWITZ, R.; LIEB, C. Formative assessment pre-test to identify college students' prior knowledge, misconceptions and learning difficulties in biology. *International Journal of Science and Mathematics Education*, Dordrecht, v. 4, p. 741-762, 2006. DOI: https://doi.org/10.1007/s10763-005-9024-5.

LEMKE, J. L. Articulating communities: sociocultural perspectives on science education. *Journal of Research in Science Teaching*, Hoboken, US, v. 38, n. 3, p. 296-316, 2001.

LIANG, H-B; ZHANG, R-Z. An introduction to ethnoentomology. *Chinese Journal of Applied Entomology*, Beijing, v. 38, n. 4, p. 314-319, 2001.

LORSBACH, A.; TOBIN, K. Constructivism as a referent for science teaching. *In*: LORENZ, K.; COCHRAN, K.; KRAJCIK, J.; SIMPSON, P. (ed.). *Research matters to the science teacher*. [Manhattan, Kan]: National Association for Research in Science Teaching, 1992.

MELO, R. J.; ADAMS, F. W.; NUNES, S. M. T. Concepções da importância do ensino de ciências na educação básica por licenciandos de um curso de educação do campo. *Revista Brasileira de Educação do Campo*, Tocantinópolis, v. 5, p. 1-20, 2020. DOI: https://doi.org/10.20873/uft.rbec.e7240.

OLIVEIRA-LIMA, D. C.; RAMOS, M, A.; SILVA, H. C. H.; ALVES, A. G. C. Rapid assessment of insect fauna based on local knowledge: comparing ecological and ethnobiological methods. *Journal of Ethnobiology and Ethnomedicine*, London, UK, v. 12, p. 15-26, 2016.

ORTÍZ ROMERO, R.; CATACORA YUCRA, F. Etnoentomología en la cosmovisión andina del altiplano peruano. *Revista Científica Investigación Andina*, Juliaca, Perú, v. 17, n. 1, p. 3-79, 2017.

PEDRO, M, S. *Floresta, animais e insetos*: conhecimentos tradicionais do povo Kaiowá no Tekoha Panambinho. 2021. Dissertação (Mestrado em Entomologia e Conservação da Biodiversidade) – Faculdade de Ciências Biológicas e Ambientais, Universidade Federal da Grande Dourados, Dourados, 2021.

POMEROY, A. Insights from past and present social science literature on the (unequal) development of New Zealand's rural communities. *New Zealand Geographer*, Richmond, VIC, Australia, v. 75, p. 204-215, 2019.

POSEY, D. A. Wasps, warriors and fearless men: ethnoentomology of the Kayapó indians of central Brazil. *Journal of Ethnobiology*, Thousand Oaks, US, v. 1, n. 1, p. 165-174, 1981.

ROBLES-PIÑEROS, J.; LUDWIG, D.; BAPTISTA, G. C. S.; ANDRADE, A. M. Intercultural science education as a trading zone between traditional and academic knowledge. *Studies in History and Philosophy of Biological and Biomedical Sciences*, Oxford, UK, v. 101337, p. 1-10, 2020. DOI: https://doi.org/10.1016/j.shpsc.2020.101337.

SANTOS-FITA, D.; COSTA-NETO, E. M.; SCHIAVETTI, A. Constitution of ethnozoological semantic domains: meaning and inclusiveness of the lexeme "insect" for the inhabitants of the county of Pedra Branca, Bahia State, Brazil. *Anais da Academia Brasileira de Ciências*, Rio de Janeiro, v. 83, n. 2, p. 589-598, 2011. DOI: https://doi.org/10.1590/S0001-37652011000200018.

SCHROEVERS, M. J.; FLEER, J. Why are researchers not interested in studying individual mindfulness-based interventions? *Mindfulness*, New York, 10: 2476-2478, 2019. DOI: https://doi.org/10.1007/s12671-019-01209-4.

SNIVELY, G.; CORSIGLIA, J. Discovering indigenous science: implications for science education. *Science Education*, Dordrecht, v. 85, n. 1, p. 6-34, 2001.

UEHARA, H.; YOSHIDA, K. Acquiring seasonal/agricultural knowledge from social media. *In*: OHWADA, H.; YOSHIDA, K. (ed.). *Knowledge management and acquisition for intelligent systems*: 14th Pacific Rim knowledge acquisition workshop, PKAW 2016, Phuket, Thailand, August 22-23, 2016, Proceedings. Cham: Springer, 2016. p. 129-140.

VILHARVA, K. N.; LEITE, D. F.; SANTOS, H. F.; ANTUNES, K. A.; ROCHA, P. S.; CAMPOS, J. F.; ALMEIDA, C. V.; MACEDO, M. L. R.; SILVA, D. B.; OLIVEIRA, C. F. R.; SANTOS, E. L.; SOUZA, K. P. Rhynchophorus palmarum (Linnaeus, 1758) (Coleoptera - Curculionidae) Guarani-Kaiowá indigenous knowledge and pharmacological activities. *Plos One*, San Francisco, v. 16, n. 4, p. 1-17, 2021.