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Examining indigenous knowledge among primary school learners through informal learning environment visit: A zoological garden case

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ABSTRACT

This study was conducted under the guidance of the Westernized Indigenous Ecological Knowledge (WIEK) framework and included 35 learners from seven primary schools. The research examined the influence of informal learning settings, specifically zoos, on the educational experiences of primary school learners**.** Data collected via semi-structured interviews and observations revealed that 85% of the learners demonstrated an increased awareness and appreciation for the natural world, linking their observations to traditional ecological principles. Additionally, 90% of the participants reported a strengthened sense of social structures and moral values, deeply rooted in African traditions, such as respect for authority and social accountability. The findings suggest that integrating Indigenous knowledge into education through informal settings may not only enhance cultural pride but also promote environmental responsibility and a more inclusive understanding of the world among learners. These results highlight the significance of experiential learning in reinforcing traditional knowledge and its potential role in safeguarding Indigenous wisdom across various cultural contexts. Further investigation is needed to explore the long-term effects of these educational interventions.

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INTRODUCTION

Indigenous knowledge encompasses the wisdom, skills, and customs that have been passed down through generations within Indigenous communities (Gumbo, 2020; Photo & McKnight, 2024). This understanding is closely linked to the environment itself. It is often transmitted orally from elders to younger generations, covering a broad spectrum of topics, including traditional healthcare, agriculture, storytelling, and spiritual beliefs (Gupta, 2015). Indigenous knowledge systems are inherently integrated, acknowledging the mutual dependence between humans, animals, plants, and the environment (Nelson & Shilling, 2018). By incorporating these systems into modern practices, we gain respected perceptions of sustainability, conservation, and community well-being, which are essential for discussing global issues such as changing climates and biodiversity decline (Adade Williams et al., 2020).

Incorporating Indigenous knowledge into the formal education system is vital for its preservation and sustainability (Aithal & Ramanathan, 2024). Educating learners about the diverse traditions, ceremonies, and skills of Indigenous cultures promotes greater awareness and appreciation of these rich epistemologies (Jaber et al., 2024). This approach not only benefits Indigenous communities by fostering cultural pride but also enhances the educational experience of all learners by offering a more comprehensive and diverse perspective on the world (Baskin, 2022). Integrating Indigenous knowledge into traditional classrooms can challenge prevailing narratives that have historically excluded these cultures, promoting a more balanced and inclusive understanding of the world (Asare-Kumi, 2020; Awoniyi, 2015). This inclusion can foster empathy, respect, and collaboration across cultures, contributing to a more cohesive society (Snively & Corsiglia, 2001).

Informal learning environments, such as zoos, play a crucial role in integrating Indigenous knowledge into education (Mack et al., 2012). These settings provide opportunities for learners to engage with various perspectives, challenge personal biases, and learn from Indigenous wisdom (Chinn, 2007). By incorporating Indigenous knowledge into non-formal educational contexts, we can create more inclusive and equitable learning experiences that recognize the richness and diversity of human experiences (Jaber et al., 2024). These environments not only enrich the educational journey but also break down barriers and foster intercultural understanding, ultimately contributing to social equity and cooperation among diverse communities (Photo, 2022).

This research aimed to investigate the influence of zoo visits on primary school learners' understanding and appreciation of Indigenous knowledge. Guided by the Westernized Indigenous Ecological Knowledge (WIEK) framework (Bowers & Richmond, 2023), the study examines how these informal learning experiences influence learners' perceptions of social structures, moral values, and environmental responsibility. The structure of the paper is as follows: after this introduction, the theoretical framework underpinning the study is presented, followed by a detailed description of the methodology. The results and discussion sections analyze the findings, highlighting key themes such as social structure, moral values, and the use of nature. The paper concludes with the implications of the findings for educational policy and practice, as well as suggestions for future research.

THEORETICAL FRAMEWORK

Indigenous Knowledge (IK) encompasses knowledge generated by Indigenous communities, but it possesses distinct features that differentiate it from Western systems of knowledge, particularly Western Modern Science (WMS) (Aikenhead & Ogawa, 2007). IKS typically rejects the widespread tendency in WMS to generalize and simplify to the benefit of more specific and comprehensive understandings (Aikenhead & Ogawa, 2007; Zidny et al., 2020). The emphasis on specific geographic locations in the acquisition of knowledge gives IKS a level of depth and sensitivity that is often absent in the more universal WMS tradition (Bowers & Richmond, 2023). In addition, conducting extended and detailed monitoring and analysis of local environments is an essential component of many IKS (Photo & McKnight, 2024). This practice can uncover long-term trends in the natural world, such as the cyclical shifts between wet and dry periods lasting several decades, which have been observed in the American Southwest (Bowers & Richmond, 2023). IK, similar to WMS, is part of a larger framework of spiritual and cultural beliefs. However, when IK is disseminated by non-indigenous groups to audiences outside of Indigenous communities, many of its

comprehensive elements, including Indigenous cosmologies and perspectives, are frequently omitted or weakened to cater to an audience of settler colonialists (Zidny et al., 2020). Therefore, this study was guided by the "Westernized Indigenous ecological knowledge" (WIEK) framework by Bowers and Richmond (2023).

The WIEK framework (Figure 1) highlights the various facets of IK (interconnectedness and knowledge) of ecosystems that can be communicated in an informal science learning setting, for example, a zoo. The base of the framework illustrates a "holistic IK" which presents a comprehensive understanding of IK by explaining the integration of environmental knowledge with indigenous cultures and worldviews (Bowers & Richmond, 2023). From this holistic base, Westerners can categorize IK into two primary domains: "indigenous philosophical and cultural knowledge" (IPCK) and "traditional ecological knowledge" (TEK). It is essential to acknowledge that although IPCK and TEK are presented as distinct branches, they are inherently closely connected and mutually reinforce each other. IPCK encompasses the extensive anthropological concepts of "culture" and encompasses the diverse morals and traditions, doctrines, universes, and worldviews that Indigenous communities employ to comprehend the world and humanity's connection to nature (Abdul Ghani Azmi, 2017). It also encompasses the artistic expression of these knowledge systems.

IPCK can be conveyed through the distribution of ethical narratives, worldviews, societal structures of indigenous civilizations, and indigenous art. Although IPCK can exist independently, it frequently intersects with and influences indigenous perspectives on ecological knowledge (Kim et al., 2017; Magallanes, 2015). An illustrative instance would be a moral story depicting a young woman who marries a wealthy crow, only to discover that her new spouse is a detritivore (Bowers & Richmond, 2023). This narrative effectively conveys both ecological knowledge and cultural beliefs.

Meanwhile, TEK focuses on aspects of IK related to natural ecosystems that align more closely with Western concepts of ecology. TEK refers to the comprehensive knowledge that an Indigenous community has acquired regarding their specific local environment (Lowan, 2012). When IK from natural ecosystems is incorporated into Western scientific frameworks, it is frequently separated from its cultural context and IPCK (Kim et al., 2017; Zidny et al., 2020). As a result, some scholars propose using the term TEK to refer to this merging of IK and Western scientific approaches (Kim et al., 2017; Zidny et al., 2020). The examination of TEK can be categorized into four aspects: the physical characteristics of organisms, the traditional use of nature by indigenous communities, the understanding of biotic interactions, and knowledge of climate (Bowers & Richmond, 2023). In our paper, the term "Habitus" pertains to how students depict the physiological and behavioural characteristics of a species. Furthermore, it elucidates how students engage with various organisms within their surroundings. The term "Indigenous use of nature" refers to the way in which students engage with local plants, animals, and other elements of the environment (Bowers & Richmond, 2023). Biotic interactions refer to the interactions among various creatures within a living system and how students react to them indigenously. Ultimately, "climate knowledge" pertains to the indigenous comprehension of weather patterns, changes in the seasons, and more extensive climate tendencies (Zidny et al., 2020).

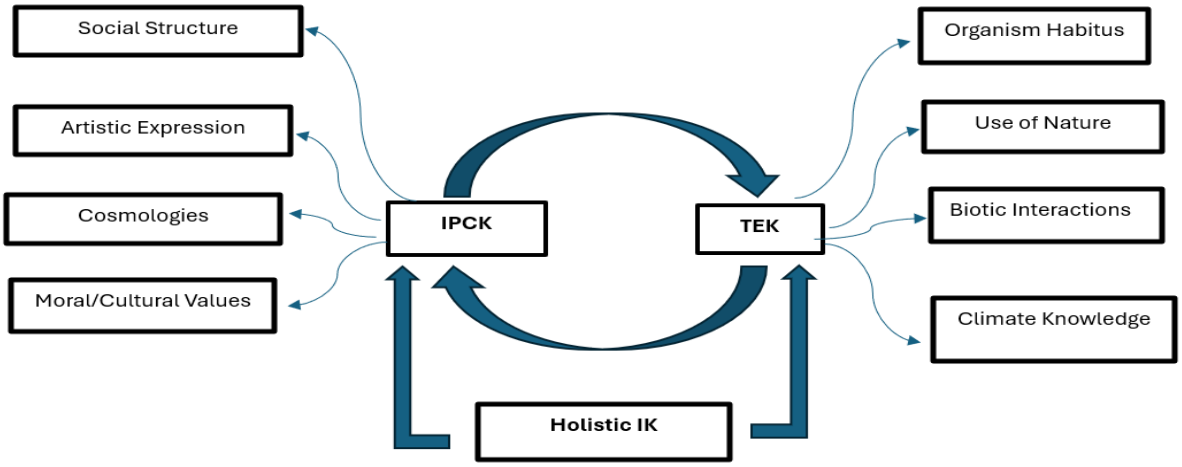

Figure 1: Westernized Indigenous ecological knowledge framework (Adapted from Bowers & Richmond, 2023).

The Two-Eyed Seeing framework (Martin, 2012) promotes the integration of Western and Indigenous knowledge, while the Multiple Evidence-based approach (Tengö et al., 2014) aims to achieve equality between different knowledge systems in environmental domination. These frameworks were considered as alternatives. However, these frameworks were viewed as less suitable for the specific focus of this study on informal educational settings. In contrast, the WIEK framework's emphasis on integrating ecological and cultural knowledge provides a more precise and applicable approach. The WIEK framework's capacity to situate Indigenous knowledge inside a Westernized educational setting while preserving its cultural importance renders it the most suitable option for directing this research (Bowers & Richmond, 2023).

MATERIALS AND METHODS

This qualitative and exploratory study aimed to investigate the influence of zoo visits on the understanding and appreciation of Indigenous knowledge among primary school learners. Qualitative research is a method that explores deeply phenomena by employing non-numerical data, such as interviews and observations, to acquire a better understanding of participants' viewpoints (Maree, 2016). The study utilized purposive sampling, which means that participants were selected based on specific criteria relevant to the study. In this case, 35 learners from seven primary schools located in townships were chosen. These schools were visiting the zoological garden at the time of data collection. From each school, five learners aged between 9 and 12 years were selected for interviews and observations at the zoo. All participants were Black and resided in informal settlements. This research sought to encompass a varied spectrum of perspectives within this demographic to understand broader implications for similar communities.

Data collection

The data collection process was broad, employing semi-structured interview guides that allowed for flexible yet focused discussions. Semi-structured interviews include open-ended questions to enable participants to freely articulate their thoughts, while also allowing the researcher to investigate further for additional information (Creswell, 2013). This method facilitated an in-depth exploration of the zoo's influence on learners' appreciation of Indigenous knowledge (Maree, 2016). Interviews were conducted individually in the learners' school environment before and after the zoo visit, each lasting approximately 30 minutes to ensure a comfortable and familiar setting for the participants. All interviews were audio-taped and transcribed verbatim to maintain the authenticity of the responses (Creswell, 2013). Additionally, researchers conducted systematic observations of the learners during their zoo visit to gather contextual data and observe interactions and engagement in real-time.

To enhance the robustness of data collection, the study also incorporated field notes taken during the observations (Maree, 2016), which provided additional context and insights that were not captured in the interviews. By employing multiple methods, we were able to gain a more comprehensive and detailed understanding of the learners' experiences and perspectives (Creswell, 2013; Makhubele, 2016).

Data analysis

Thematic analysis was employed for data analysis which involved coding the transcribed interviews and observation notes to identify recurring themes and patterns (Braun & Clarke, 2006). This process was undertaken rigorously to ensure the trustworthiness, confirmability, and credibility of the findings. Multiple coders were involved in the analysis to cross-verify the themes and enhance reliability (Maree, 2016). Regular meetings between the researchers were held to discuss and refine the coding scheme, ensuring consistency and depth in the analysis (Braun & Clarke, 2006). The thematic approach aligned with a deductive method where the themes emerged from the study's theoretical framework (Maree, 2016).

The study also adhered to strict ethical standards. The participants' rights to confidentiality and privacy were maintained throughout the study, with names and other identifying information omitted from direct quotations (Creswell, 2013). Informed consent was obtained from both the participants and their caregivers, given that the learners were under 18 years old. Comprehensive information regarding the study's objectives, methodologies, and possible threats were given to guarantee informed participation. Ethical approvals were secured from the relevant institutional review committee, highlighting the commitment to ethical research practices. Figure 2 below gives an outline of the research process of this study.

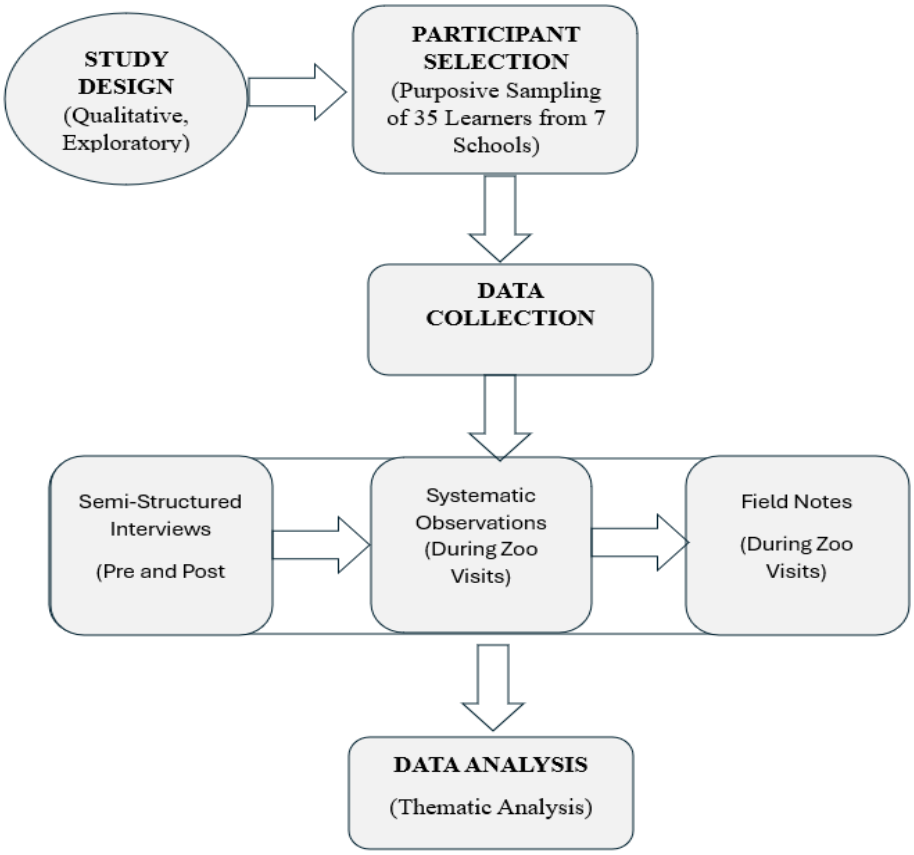

Figure 2: Overview of this Study's Research Process

RESULTS AND DISCUSSION

Social structure

The study revealed that the zoo visits played a significant role in reinforcing the social structures deeply embedded in African traditions among the learners. 85% of the participants reported connecting their experiences at the zoo with stories and knowledge passed down in their communities, highlighting the importance of kinship and oral traditions in their social structure. For example, learners frequently mentioned understanding animal behaviours in ways that aligned with teachings from elders, which reinforces the role of elders in transmitting knowledge and maintaining social norms and values related to nature. This was revealed when learners stated the following:

Learner C from School A noted: "*I learned that some creatures are fun just like monkeys*"
Learner I from School B: "*Learning about animals at the zoo reminded me of traditional stories and teachings about animal behaviors and habitats*."
Learner N from School B: "*My class has a lot of prefects, so I think they'll be in charge of the younger students.*"
Learner F from School C: "*The teachers will want us to behave and not make noise, throw things, or litter*."
Learner B (School A): "*To listen to our zoo guide and not make too much noise*."

This finding is particularly significant as it demonstrates how informal learning environments, such as zoos can act as extensions of traditional educational practices, thereby promoting cultural continuity. The ability of these environments to support the socialization processes that occur within Indigenous communities suggests that they could be valuable tools in educational systems that aim to integrate Indigenous knowledge.

Mahuika (2019) emphasizes the importance of kinship and oral traditions in transmitting knowledge within communities, evident in the way learners connected their zoo observations with stories and teachings from their elders. For instance, Learner C's reflection on animal behaviors aligns with knowledge shared by elders, underlining the role of family in reinforcing social norms and values related to nature. Learner I's comments further illustrate how zoo visits evoke traditional stories about animal behaviors and habitats, highlighting the continuity of cultural education. The hierarchical structures within school communities, as noted by Learner N, mirror traditional governance, indicating that zoo experiences can reinforce existing social roles and leadership dynamics. Learners F and B remarks on expected behaviors, such as not littering or making noise, reflect broader community norms and the role of educators in maintaining these standards. These findings highlight how the zoo visits serve not just as educational experiences but also as platforms for reinforcing, reflecting, and linking their education to indigenous knowledge. Research shows that IKS in science education plays a crucial role (Photo &McKnight, 2024; Shabalala & Gumbo, 2023) hence science teachers must use the social structure learners experience at the zoo with science content. Madlela (2023) further states that IKS is beneficial to be included in science content because it provides a context for teaching, encourages variety, and acts as the existing knowledge of learners.

Moral/Cultural values

The results further revealed that the zoo visits significantly reinforced the moral and cultural values deeply rooted in African traditions among the learners. During the interviews, 90% of the participants consistently demonstrated respect for authority and elders, a value strongly emphasized in their cultural upbringing. The learners' responses further reflected the cultural value of discipline. This was evident when some learners stated the following:

Researcher: What will you do when you get to the zoo?
Learner B (School A): "*To listen to our zoo guide and not make too much noise*."
Learner G (School B): "*I will behave myself and listen to my teachers*."
Learner M (School C): "*To be well-behaved, do not throw things and make noise*."
Learner P (School D): "*Listen to my teacher and not run around*."

Learner T (School D): "*I will wait for my teacher to tell me what I should do*."
Learner V (School E): "*It will depend on what our teacher wants us to do*."
Learner CC (School F): "*Our teachers always tell us before going to the zoo what we should be doing, and we listen. The learners who do not listen to risk not going to trips, so we listen*."

Additionally, the value of community and collective responsibility was prominently displayed by the learners. They expressed the importance of staying together and looking out for each other, which is a fundamental aspect of African culture that emphasizes cultural values, unity, and cooperation. This was shown in the following statements.

Learner B from School A: "*Other people showed me animals that my friends and I didn't know. Our zoo teacher hadn't taught us about those animals. It was hard for my friends and me to guess what these animals were called, but our teachers helped us out.*"
Learner E from School A: "*My classmates and I were moving together when checking the animals at the zoo and it was fun*."
Learner K from School C: "*As friends, we all go together to the zoo everywhere and we see the animals together*."

The observation data strongly supported the findings from the interviews, revealing consistent behavior among learners that aligned with the themes of respect, discipline, and community values. During the zoo visits, learners from all schools were observed following the instructions from their teachers and zoo guides without question. Upon arrival, they listened attentively to the zoo guides, who emphasized the importance of not littering and explained the reasons behind it. As they moved around the animal exhibits, learners consistently avoided littering, often running to the nearest bin to dispose of any trash, demonstrating their adherence to instructions and respect for authority. They formed orderly lines as instructed by their teachers, showing discipline and a willingness to follow rules. Learners addressed their teachers and zoo guides respectfully, using formal titles such as 'sir' or 'ma'am' and displaying respect through their body language and tone. During the educational talks given by the zoo guides, learners remained quiet and attentive, refraining from any disruptive behavior, which showcased their discipline. Additionally, learners were observed helping each other identify animals and sharing information they remembered from their elders, lessons, and previous experiences. This behavior highlighted the cultural value of community and collective responsibility, as learners collaborated and supported one another in their learning process. These observations confirm that the learners exhibited significant moral and cultural values during their zoo visits, aligning with the interview findings that emphasized respect for elders, discipline, and a strong sense of togetherness.

The findings from the learners' interviews and observations revealed meaningful moral and cultural values deeply embedded in African traditions, particularly respect for authority and elders, discipline, and community (Asare-Kumi, 2020; Awoniyi, 2015). The respect for authority and elders is evident as learners consistently mentioned the importance of listening to their teachers and guides during the zoo visits. For instance, Learner B from School A emphasized listening to the zoo guide and maintaining quiet, while Learner G from School B and Learner M from School C echoed the importance of behaving well and following instructions. This respect for authority aligns with African cultural values that prioritize hierarchy and respect for elders (Aju & Beddewela, 2020; Koenane, 2018). The value of discipline is highlighted in the learners' responses about expected behaviors during the zoo visits. Learner P from School D and Learner V from School E noted the importance of following their teachers' instructions and not running around, while Learner CC from School F emphasized the consequences of not listening, indicating a cultural emphasis on discipline and adherence to rules (Spooner et al., 2019). Furthermore, the value of community and collective responsibility is prominently displayed by the learners. This is a fundamental aspect of African culture that emphasizes unity and cooperation (Shabalala & Gumbo, 2023). Learner B from School A mentioned how friends helped identify animals, reflecting a sense of communal learning and support. Learner E from School A and Learner K from School C expressed the enjoyment of moving together as a group and exploring the zoo collectively, emphasizing the cultural value of community and shared experiences (Byrne et al., 2023). These findings illustrate how zoo visits reinforce these moral and cultural values among primary school learners.

Use of Nature

The study found that the zoo visits influenced learners' awareness and appreciation of nature, closely linked to Indigenous knowledge and teachings. For instance, during the post-interviews, approximately 80% of the participants reported that their experiences at the zoo reminded them of traditional stories and teachings about animal behaviors and habitats, which were passed down by elders in their communities. Learners expressed a thorough knowledge of the importance of respecting the natural environment, as evidenced by their behaviour during the zoo visits, such as not littering and following guides' instructions. Some of the learners' responses were as follows.

Researcher: What did you learn from the zoo and did that remind you of something?

Learner I (School B, spoke in Zulu): "*Ngafunda ngezilwane e-zoo futhi lokho kwangikhumbuza izindaba zendabuko nezimfundiso mayelana nokuziphatha kwezilwane nezindawo zokuhlala*". [I learned about animals at the zoo and that reminded me of traditional stories and teachings about animal behaviors and habitats].

Learner A (School A): "*I learned that some animals are funny just like monkeys, and this reminded me of my granny when she says monkeys are like us*".

Learner E (School A): "*Seeing my favourite animal, the tiger eating meat. I learned that it eats meat and not grass like a giraffe*".

Learner O (School C): "*I do not remember what I learned. But I wanted to see dolphins because I heard many stories about dolphins helping people when they are drowning*".

Learner M (School C): "*I learned about giraffes, and it was tall. It reminded me of my grandmother who likes to say, I am tall like a giraffe, and it eats fresh leaves which are on top of a tree*". [This learner laughed after saying this].

Learner X (School E): "*We learned about the African National symbols, and this showed me that Africa is rich*".

Learner U (School E): "*I learned that elephants would remember what you do to them and get back at you one day. My dad likes to say I have the brain of an elephant*". [This learner smiled after saying this].

Learner H (School B, spoke in Zulu): "*Ngiye ngafunda ukuthi ibhubesi liyisilwane esiyingozi kakhulu ngakho lihlala kude nezinye izilwane*". [I heard that lions are very dangerous and are kept away from other animals because of this.].

The data from the interviews and observations highlights how the zoo visits developed primary school learners' understanding and appreciation of Indigenous knowledge, particularly through the theme of "Use of Nature" as framed by Bowers and Richmond (2023). Learners reported that their experiences at the zoo often reminded them of traditional stories and teachings about animal behaviors and habitats, reinforcing the role of elders in knowledge transmission. For example, Learner I from School B mentioned learning about animals in a way that connected to traditional stories, while Learner E from School A noted the distinction between carnivores and herbivores, linking it to their favourite animal, the tiger. These experiences are consistent with the Indigenous cultural focus on protecting the environment and appreciation for nature, as learners were observed refraining from littering and diligently adhering to the instructions of their guides. Incorporating traditional environmental knowledge into their education enhances their understanding of the natural world and how it works. Furthermore, the learners' curiosity and admiration for animals, such as giraffes and dolphins, frequently reflected narratives and proverbs passed down by their ancestors (Lilomaiava-Doktor, 2020). This serves as further evidence of how visits to the zoo can connect modern educational experiences with Indigenous knowledge and principles. The research conducted by Tsuji and Ho (2002) corroborates these findings, emphasizing the significance of incorporating traditional ecological knowledge into modern education in order to promote environmental responsibility. Moreover, studies by Snively and Corsiglia (2001) emphasize that incorporating Indigenous knowledge in education enriches learners' learning experiences and promotes a more inclusive understanding of science and nature. This integrated approach promotes a deeper appreciation and connection with the natural world among young learners, thereby strengthening the fundamental goals of sustainability education.

Biotic Interaction

The post-interview data revealed perceptions of primary school learners' understanding and appreciation of Indigenous knowledge, particularly focusing on biotic interactions. Biotic interactions encompass the relationships between different organisms in an ecosystem, such as predator-prey dynamics, symbiotic relationships, and competition (Bowers & Richmond, 2023). The learners' observations at the zoo highlighted these interactions, mirroring the ecological teachings of their elders. For example, Learner H linked the biotic interactions by demonstrating the predator-prey relationship and dietary habits of different species. The learner's understanding of why lions are separated, and their carnivorous diet reflects Indigenous knowledge about animal behavior and the food chain. Some learners such as Learners P, R, S, Y, and JJ highlighted a biotic interaction related to habitat preferences and adaptations. These learners stated to have observed monkeys adapting to living in trees, while gorillas primarily occupy the ground, which demonstrates the traditional biological understanding of species-specific habitats and behaviors. Other learners showed curiosity about the evolutionary adaptations of reptiles, a key aspect of biotic interactions (Bowers & Richmond, 2023). The learners sought to understand the reasons behind reptiles possessing scales, which is connected to Indigenous knowledge regarding animal physiology and environmental adaptations (Learners A, T, and CC). Some of these learners' responses were as follows:

Researcher: "What did you learn or observe at the zoo?

Leaner H (School B): "*I now know that lions are kept away from other animals because they are very dangerous. A giraffe, on the other hand, was fed grass, but a lion was only given meat. Our teacher said it's because lions only eat meat.*".

Learner Y (School F): "*While I was there, I saw that some animals, like monkeys, live in trees and gorillas were in a cage. These gorillas were hiding, so it was hard for us to see them. Nevertheless, they were huge when we saw them.*".

Learner R (School D): "*Many animals live in different places such as on trees, inside the water, and some in glasses. Monkeys live on top of the tree, fish and crocodiles in water, and snakes inside glasses*".

Learner T (School E): "*Our zoo teacher told us that reptiles are animals with scales on their bodies. But I was wondering how these animals got scales instead of hairy skin like humans. Our zoo teacher didn't tell us this.*".

Learner J (School B): "*It was fun to look at snakes through their glasses with my group. There were many kinds of snakes, and some people in my group were scared. It was my dream to touch the snakes, especially the big yellow one with a white line through it.*".

The findings from the interview data revealed that the zoo visits enhance primary school learners' understanding and appreciation of Indigenous knowledge, especially regarding biotic interactions. These interactions encompass predator-prey dynamics, habitat adaptations, and evolutionary traits, which are key components of ecological education (Bowers & Richmond, 2023). The learners' observations at the zoo reflected traditional ecological teachings, such as the importance of understanding dietary habits and predator-prey relationships to maintain ecological balance, the recognition of species-specific habitats and behaviors, and curiosity about evolutionary adaptations. These perceptions align with the framework discussed by Bowers and Richmond (2023), which emphasizes the understanding of complex ecological interactions within ecosystems. Tsuji and Ho (2002) support this by highlighting the importance of contextual learning environments in reinforcing ecological knowledge. Snively and Corsiglia (2001) and Madlela (2023) argue that integrating traditional ecological wisdom with modern education enriches learning experiences, fostering a deeper respect and understanding of nature. In addition, Berkes (2012) highlights the significance of traditional ecological knowledge in comprehending complex ecological connections, while Kimmerer (2013) stresses the importance of Indigenous knowledge in advocating for a comprehensive perspective of nature.

CONCLUSION AND RECOMMENDATION

The study's findings indicate that visits to zoos have a significant influence on primary school learners' comprehension and admiration of Indigenous knowledge. This is achieved through four main themes: social structure, moral and cultural values, utilization of nature, and interaction with living organisms. The learners' experiences at the zoo were enhanced by their capacity to link observations with traditional teachings, strengthening the importance of elders in transmitting knowledge and emphasizing the significance of Indigenous wisdom.

Learners demonstrated respect towards superiors and older individuals, adhering to instructions and showing disciplined conduct, thereby reflecting the traditional systems of authority and community responsibilities (More, 2021). It is crucial to incorporate cultural norms and leadership principles into educational experiences to strengthen social connections and foster respect within the learning environment (Leithwood, 2021). The zoo visits also emphasized important ethical and cultural principles, such as self-control, reverence for the natural world, and shared accountability. The actions of learners, such as refraining from littering and demonstrating respect for animals, mirrored the cultural prioritization of environmental responsibility and social well-being. This demonstrates how educational excursions may provide learners with vital cultural values and ethical conduct, following the principles expressed by Tsuji and Ho (2002) and Kimmerer (2013).

Furthermore, the learners' increased awareness and admiration of nature, often linked with narratives and teachings passed down by their elders, reinforce the value of nature in traditional knowledge systems. The observations made at the zoo regarding how animals behaved, and their habitats served to reinforce these teachings, illustrating how active involvement with nature can improve comprehension and appreciation for the natural world (Bowers & Richmond, 2023). The learners' observations of predator-prey relationships, habitat-specific behaviors, and evolutionary adaptations demonstrated their understanding of traditional ecological knowledge, thereby endorsing the incorporation of hands-on learning experiences, as advocated by Snively and Corsiglia (2001). These instances highlight the value of comprehending complex ecological connections and the interdependence of all organisms, a fundamental element of Indigenous teachings (Berkes, 2012).

The current study acknowledges its limitations and identifies potential areas for future research as follows:

- The study was limited to a specific group of primary school learners from certain schools, which may not be representative of all learners. The findings might differ in other regions or cultural contexts.
- The impact of a single or few zoo visits may not fully capture the long-term understanding and appreciation of Indigenous knowledge among learners. More prolonged exposure and repeated visits could provide deeper insights.
- The presence of researchers and the structured nature of interviews might have influenced the learners' responses, leading to potential bias in the collected data.
- Some responses were translated from indigenous languages, which might have led to subtle nuances being lost or misinterpreted.
- The study focused on specific themes such as social structure, moral/cultural values, use of nature, and biotic interaction, potentially overlooking other relevant themes or aspects of Indigenous knowledge.
- Future researchers may consider conducting long-term studies to assess how sustained exposure to zoo visits and other experiential learning opportunities impacts learners' understanding and appreciation of Indigenous knowledge over time.
- Expand the research to include a diverse range of geographic locations and cultural backgrounds to explore variations in how Indigenous knowledge is understood and appreciated.

IMPLICATIONS OF THE STUDY

The findings of this study have various implications for educational policy and practice. Integrating Indigenous knowledge into the curriculum enhances students' learning experiences and fosters cultural diversity and inclusivity.

Experiential learning opportunities, such as visits to the zoo, offer valuable practical experiences that strengthen theoretical knowledge and traditional teachings. Furthermore, promoting the protection of the environment and demonstrating respect for nature is consistent with the wider educational objectives of sustainability and responsible citizenship. By incorporating these concepts into the educational curriculum, schools may encourage a deeper understanding and admiration for both the environment and the diverse traditions of Indigenous communities (Berkes, 2012; Bowers & Richmond, 2023; Snively & Corsiglia, 2001).

STATEMENTS AND DECLARATION

We have no conflict of interest to disclose.

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