The role of science communication in popularizing ethnoastronomy

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Article History
Received: 25 March 2025
Revised: 1 April 2025
Accepted: 29 May 2025
Published: 30 June 2025

Keywords
Cultural Communication
Ethnoastronomy
Science Communication
Sociocultural Theory

Abstract
Ethnoastronomy is a scientific field that explores the astronomical knowledge of different cultures through their traditions, offering perspectives distinct from conventional Western astronomy. This study examines the interplay between Science Communication and Ethnoastronomy, using Vygotsky's sociocultural theory as a foundation. A literature review was conducted to identify concepts that validate the interrelation of these areas, highlighting how Science Communication can foster fresh understandings. Moreover, this research delves into indigenous astronomical perspectives, specifically those of the Karajá Xambioá and Tupi-Guarani peoples, and presents an educational game designed for a diverse age group in an informal learning setting. The objective is to investigate how Science Communication, particularly through Cultural Communication, can effectively facilitate the dissemination of astronomical knowledge from various cultural backgrounds, with a focus on Brazil's indigenous peoples, thereby broadening perspectives and understanding. With this, materials were developed that brought indigenous culture closer to science teaching immersed in traditional and Western culture, with the aim of reducing the distances between different cultures.

How to cite: Michelini, F., Queiroz, M., & Acioly, V. (2025). The role of science communication in popularizing ethnoastronomy. *Journal of Environment and Sustainability Education*, *3*(2), 157–161. doi: 10.62672/joease.v3i2.53

1. Introduction

This study incorporates Vygotsky's Sociocultural Theory to support the premise that Science Communication can be an effective tool in enhancing the study of Ethnoastronomy. Science Communication is characterized as a set of approaches aimed at making scientific knowledge accessible to the public (Nielsen, 2013). Additionally, it can be regarded as an initiative to popularize science through diverse methods and platforms (Borin, 2009). Within this domain, distinct terms are employed: scientific dissemination, which is directed toward specialists, and the popularization of science (also known as science vulgarization), which aims at a broader audience (Horizonte, 2024).

However, science communication is not merely about simplifying complex concepts. It requires strategic planning and thoughtful decisions. As Barros (1987) points out, "Communicating science is more than explaining abstract ideas in a simplified way. It is essential to find an appropriate discourse and make deliberate choices: What should be shared?" (Marandino, 2001). Additionally, the author identifies a subcategory within Science Communication known as Cultural Communication, which aims to contextualize science within historical and cultural frameworks, recognizing it as an expression of that broader setting (Marandino, 2001).

Vygotsky's sociocultural theory underscores that an individual's relationship with their surroundings is pivotal in shaping their cognitive processes and perspectives (Zhou, 2024). A particular perception can only take shape if the sociocultural setting provides the necessary experiences. As noted by Marcia Borin:

> "[...] we can assert that certain perceptions only become tangible within specific environments. Without the corresponding experience or exposure, one cannot access a perception simply because it does not exist in relation to that event or phenomenon." (2009, p. 39).

In addition to sociocultural influences, an individual's formal education plays a crucial role in shaping how they perceive and relate to concepts. Their understanding is, therefore, influenced by their unique experiences (Luria, 1990).

Given this perspective, it becomes essential to promote inclusivity within scientific discourse, allowing the development of a decolonial approach that integrates knowledge from diverse cultural traditions. Science Communication plays a crucial role in reshaping the perception of scientific knowledge, as it has the capacity to

doi: 10.62672/joease.v3i2.53

ISSN: 3025-0714

reach a wide audience and encourage the dissemination of these perspectives (Galdames et al., 2024). Through such initiatives, a more inclusive and democratic dialogue about the nature of scientific understanding can emerge.

Scientific communication plays a fundamental role in ethnoastronomy by recording, disseminating, and valuing traditional astronomical knowledge from different cultures, promoting dialogue between modern scientific knowledge and ancestral understandings (Fonseca & Teixeira, 2023). Projects such as "A Céu Aberto" by the Museum of Astronomy and Related Sciences (MAST) demonstrate how exhibitions and publications can disseminate the understanding of the sky by Brazilian indigenous peoples such as the Guarani, Tukano, and Xavante, preserving and sharing this knowledge with the general public.

Moreover, scientific communication facilitates intercultural education, especially when it incorporates ethnoastronomical knowledge into school curricula (Gondwe & Longnecker, 2015). Educational materials developed for indigenous schools that teach Tupi-Guarani constellations, such as the "Ema" and the "Veado," alongside Western constellations, exemplify how this approach can strengthen cultural identities and promote more inclusive scientific learning. Museums and science centers also fulfill this role, such as the Brasília Planetarium, which presents Brazilian indigenous constellations in its educational programming.

Scientific publications, academic events, and collaborative projects are additional ways in which scientific communication contributes to the preservation and appreciation of ethnoastronomy (Cortesi et al., 2023). Conferences such as the Brazilian Ethnoastronomy Meeting (EBE) enable researchers to share methods and results of studies on astronomical knowledge from various cultures. Additionally, collaborative initiatives with indigenous peoples, such as the project developed with the Karajá people to identify constellations used in agriculture and navigation, demonstrate how scientific communication can preserve traditional knowledge and promote the recognition of the intellectual rights of these communities.

Thus, understanding the role of scientific communication in ethnoastronomy is essential not only to preserve traditional knowledge but also to promote the inclusion of diverse perspectives in understanding the cosmos. This article aims to discuss how scientific communication can be a powerful instrument to bridge ancestral knowledge and modern scientific understanding, contributing to a richer and more diverse comprehension of the universe.

Explaining the relevance of this research within the context of modern science and intercultural communication is essential for several reasons. As contemporary science seeks to be more inclusive and representative of diverse perspectives, acknowledging the importance of traditional knowledge systems becomes increasingly important. By recognizing and valuing ethnoastronomical knowledge, science can promote cross-cultural dialogue and contribute to the construction of more comprehensive and equitable scientific paradigms.

Furthermore, making the research problem more explicit is crucial for readers to understand the purpose and scope of this study. This research aims to explore how scientific communication can effectively bridge ancestral knowledge and modern scientific frameworks, particularly in the field of ethnoastronomy. By examining how these different knowledge systems interact, this study seeks to identify strategies that can enhance scientific inclusivity, cultural preservation, and the democratization of knowledge.

2. Method

This research is based on a literature review of academic studies and articles concerning Ethnoastronomy and Science Communication. Concepts and definitions were analyzed to establish correlations between these disciplines and demonstrate how they can be effectively integrated. Ethnoastronomy, often referred to as cultural astronomy, examines the astronomical knowledge possessed by different societies through their customs and traditions (Karaja, 2022).

According to Fares et al. (2004), Ethnoastronomy provides a means of viewing the universe through a culturally diverse lens, emphasizing the social construction of reality and the necessity of respecting varying worldviews. Burke (2018) differentiates between the history of science, a concept rooted in 19th-century Western thought, and the history of knowledge, which encompasses a broader range of expertise, including practical skills (implicit knowledge). Recognizing and appreciating indigenous cultures, particularly in Brazil, is crucial due to their rich and deeply rooted understanding of nature. Brazil's extensive ethnocultural diversity requires the study of indigenous groups separately. As highlighted by Karaja (2022):

> "Brazil is home to vast ethnic diversity, with each group possessing an immense wealth of knowledge transmitted across generations. Regrettably, these knowledge systems have often been undervalued, and with the disappearance of numerous indigenous communities, invaluable ancestral wisdom has also been lost." (Karaja, 2022)

When studying Ethnoastronomy, it is essential to acknowledge that different cultural groups interpret celestial phenomena in unique ways. Employing a strictly Western perspective to understand their views would be inadequate (Cannon, 2021). In general, Brazilian indigenous communities assign significance to celestial bodies based on native fauna, such as jaguars, rheas, and tapirs. These constellations, passed down through generations, play a crucial role in guiding agricultural practices, signaling seasonal changes, and predicting climatic variations (Cannon, 2021).

This research is primarily based on a literature review, which requires careful selection of sources to ensure relevance, credibility, and comprehensiveness. The criteria for selecting sources included peer-reviewed articles, books, conference proceedings, and reports that address ethnoastronomy, scientific communication, and intercultural education. Additionally, sources related to the theoretical framework of Vygotsky's Sociocultural Theory were considered to provide a robust foundation for analyzing how knowledge systems interact.

However, relying solely on a literature review presents certain limitations. The absence of empirical data collection may restrict the scope of findings and reduce the ability to generalize results. To mitigate these limitations, this research employs a critical and comparative analysis of sources, identifying patterns, gaps, and areas for further study. Moreover, acknowledging these limitations serves to refine the scope of the research and highlight areas where additional empirical investigation would be beneficial.

3. Results and Discussion

The literature review conducted in this study highlights the significant role of scientific communication in promoting intercultural dialogue within the field of ethnoastronomy. By examining various sources, it becomes evident that projects such as “A Céu Aberto” by MAST and the educational initiatives integrating Tupi-Guarani constellations into school curricula are valuable efforts toward preserving indigenous knowledge and making it accessible to broader audiences. These findings suggest that scientific communication, when applied thoughtfully, can serve as a powerful tool for bridging ancestral knowledge systems and contemporary scientific frameworks. Such projects not only enrich the public's understanding of astronomy, but also broaden the horizons of science through recognition of the diverse systems of knowledge that have developed in different cultures (Chen & Song, 2017).

Furthermore, the analysis of sources reveals that there is a growing recognition of the need to incorporate indigenous perspectives into mainstream scientific discourse. This recognition is reflected in conferences like the Brazilian Ethnoastronomy Meeting (EBE) and collaborative research projects involving indigenous communities, such as the work with the Karajá people (Santos & Nardi, 2023). The active involvement of researchers and indigenous community leaders in this process shows that cross-cultural collaboration can produce a more holistic and sustainable understanding (Zanotti & Schalscha, 2016). However, it also becomes clear that challenges persist, particularly in terms of ensuring equitable participation of indigenous groups in knowledge production and the validation of their intellectual contributions. Many indigenous communities still face structural barriers such as limited access to higher education, minimal representation in research institutions, and the tendency of modern science to prioritize a positivistic approach. Therefore, it is important for science communicators to not only be disseminators of information, but also facilitators of dialogue that encourage the active participation of indigenous communities in the formulation of shared knowledge (Orthia et al., 2021).

Despite the comprehensive nature of the literature review, it is important to acknowledge the limitations of this approach. Without empirical data collection, the findings rely heavily on existing publications, which may not fully capture the diversity of perspectives present in indigenous communities. Additionally, the lack of direct engagement with indigenous groups limits the study’s ability to assess the practical effectiveness of communication strategies aimed at preserving traditional knowledge. Nonetheless, by identifying these gaps and highlighting successful initiatives, this research provides a foundation for future empirical studies that could further explore the intersections of scientific communication and ethnoastronomy. In addition, the lack of direct engagement with indigenous groups limits this study's ability to practically evaluate the effectiveness of communication strategies aimed at preserving traditional knowledge (Maldonado et al., 2016). Some sources have also not described in depth the internal dynamics of communities in response to science communication processes, leaving room for further exploration.

Nonetheless, by identifying these gaps and highlighting successful initiatives, this research provides a strong foundation for future empirical studies. Future research is expected to further explore the intersection between scientific communication and ethnoastronomy through participatory approaches that involve indigenous peoples as active subjects, rather than just objects of study. In addition, it is also important to consider ethical aspects, cultural sensitivity, and mechanisms for protecting traditional intellectual property rights in designing equitable communication strategies (Gupta, 2024).

Thus, science communication in the context of ethnoastronomy not only functions as a means of information transfer, but also as a cultural bridge that allows an equal encounter between modern science and local wisdom (Wiyanarti & Holilah, 2018). This potential needs to be continuously developed, whether through formal education, digital platforms, or transdisciplinary collaborations, so that traditional knowledge can coexist and contribute to shaping the future.

4. Conclusion

Science Communication serves as a fundamental tool in contextualizing historical and cultural backgrounds, enabling people from diverse age groups and backgrounds to access transformative information. Through these efforts, it becomes possible to challenge deep-seated biases, dismantle misconceptions, and foster appreciation for often-overlooked cultures, such as Brazil's indigenous populations. Their traditions, ancestral wisdom, and unique ways of interpreting the world deserve recognition, not only as historical heritage but also as valuable contributions to modern society.

Fostering initiatives aimed at increasing awareness and respect for these cultures is imperative. This includes developing educational programs and communication strategies that engage diverse audiences. These efforts must be carried out with cultural sensitivity and respect for indigenous rights. By maintaining a sustained and conscientious approach, we can ensure that these cultural perspectives do not merely persist but flourish, offering invaluable insights. Science Communication is not just a means of conveying information it is a transformative tool that plays an essential role in shaping a more equitable and inclusive future for all.

The practical implications of this study suggest that Science Communication can be effectively employed to enhance intercultural understanding, particularly in the field of ethnoastronomy. By acknowledging the legitimacy of indigenous knowledge systems and integrating them into broader scientific discourses, educational programs and collaborative projects can promote inclusivity and mutual respect. This approach not only benefits scientific inquiry but also contributes to cultural preservation and the empowerment of indigenous communities.

Further research is necessary to expand the scope of this study. Empirical investigations involving direct engagement with indigenous groups could provide valuable insights into how communication strategies are perceived and applied within their communities. Additionally, comparative studies examining the integration of indigenous knowledge systems across different cultural contexts could help identify best practices and refine communication models. These future research endeavors will be essential for ensuring that Science Communication continues to evolve as a tool for promoting equity, diversity, and cultural understanding.

Author Contributions

All authors have equal contributions to the paper. All the authors have read and approved the final manuscript.

Funding

No funding support was received.

Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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