

Cultural Astronomy: a Mapping of Academic Production in Brazil

Milton Soares dos Santos^a, Roberto Nardi^b

Corresponding author: Milton Soares dos Santos (milton.santos@unesp.br)

^aSão Paulo State University (Unesp), School of Sciences, Postgraduate Program in Science Education, Bauru, São Paulo, Brazil and Federal Institute of Education, Science and Technology (IFAC), Xapuri, Acre, Brasil

^bSão Paulo State University (Unesp), School of Sciences, Education Department, Bauru, São Paulo, Brazil

Keywords: Cultural astronomy, Traditional People, Content analysis

Abstract

Here we present the partial results of a study carried out with the aim of seeking contributions from research in Cultural Astronomy. Firstly, we seek to establish an overview of the existing literature on cultural astronomy in order to answer the following question: how is the topic of cultural astronomy being addressed in scientific publications on Astronomy Education? This research offers a review of publications in the Capes BTDD (Repository of Theses and Dissertations). We then filtered the database for research that addressed elements of Astronomy Education. The data were analyzed according to Bardin's content analysis. We then go through a filter according to year of publication, author, research advisors, name of the postgraduate program, title of work, higher education institution, geographic region and state, keywords, cited references, justification theory, most cited researchers, data collection technique, methodological analysis, thematic focus and specific content of cultural astronomy. This research shows that research in Cultural Astronomy is still in its early stages; few authors work in this area in relation to the growing production in astronomy teaching in general, especially in Brazil.

Introduction

In this research, we gave focus to Cultural Astronomy in a perspective of a panorama of academic production in Brazil. We search through the database of the Brazilian Digital Library of Theses and Dissertations (BDTD) for such productions and with the purpose of extracting data from the research that originated the theses and dissertations.

In this way, we investigate the “state of the art” research as presented in theses and dissertations defended in Brazil and related to Education in Astronomy, with emphasis on cultural Astronomy. We estimated around 605 dissertations and theses on Astronomy Education were already produced in postgraduate programs at higher institutions in Brazil. From this amount, we separated 19 productions of theses and dissertations related to Cultural Astronomy.

Cultural astronomy is the study of humanity and its relationship to the sky. This relationship includes practices such as timing, weather forecasting, seasonal calendars for agricultural activities and navigation; artistic inspiration such as songs, poems, myths, stories, paintings and sculptures; as well as metaphysical beliefs, such as celestial deities, astrology, the

location of the Christian sky, and other religious connections; in addition to the scientific studies of Astronomy, Astrophysics, Space Sciences, Atmospheric Science, Planetary Science, and the study of History.

Given such information, we intend to answer the following guiding research question: How has cultural astronomy been approached in scientific productions in the area of Education in Astronomy?

In this way, an attempt was made to analyse the academic production from 1968 to 2022 in the area of Astronomy Teaching, seeking to highlight Cultural Astronomy as a field of research. In addition, it is intended to identify elements related to Astronomy present in Indigenous and Afro-Brazilian cultures; propose elements for a teacher-training course with an emphasis on cultural astronomy; and contribute to the knowledge within the teaching area of Astronomy.

Cultural Astronomy

Observations of the sky had and still have great importance for many peoples around the world. The analysis of this information has been relevant for a better understanding of sky-earth relationships. The various reports from different peoples reflect knowledge that goes beyond scientific knowledge; they are interpretative currents that mark ethno-cultural territories and times and culminate in discussions and interpretative models systematized by Cultural Astronomy, a field with a strong interdisciplinary character.

Even nowadays, people from different parts of the world with unique cultural references determine a repertoire of possibilities to see, describe and systematize our understanding of the cosmos, developing and using a wide variety of astronomical systems. Despite this variety, there are some traits that are common to these systems, such as the reference to the Sun and/or the Moon to determine the time and/or calendars.

However, when we investigate astronomy in traditional cultures, we need to abandon a common assumption about it, according to which rapid change in academic science is normal, and other sorts of astronomy should be evaluated according to some standard of progress, i.e., referencing science as it develops in universities and research centres. This is because progress is only half of the picture that characterizes science; its aim is not only to expand the domain of what is known, but also to preserve it from error. After all, as McCluskey (2016, p. 21) said, “methods for preserving and transmitting knowledge of the heavens are an important part of the study of astronomy in culture”.

In his 1994 work, Iwaniszewski defined Cultural Astronomy and its domains as: “The study of the relationships between man and astronomical phenomena within the cultural context; it is composed of 4 subdisciplines: archeoastronomy, ethnoastronomy, history of astronomy and socioastronomy” (p. 19, our translation).

We can observe that there is a heterogeneity of ways of interacting and interpreting the world, from which knowledge systems are built, and whose main purpose – whatever the culture or whatever the civilizing state in which a society finds itself – is to provide an explanation (convincing and appealing) for the being and existence of things and of ourselves.

Notions of Philosophy and Sociology also help in equating Cultural Astronomy, as it is found in them heterogeneous and very rich elements to discuss cultural relations.

This characteristic of knowledge systems, called local knowledge, requires the researcher to move between disciplines. In this way, the astronomer moves from specifically astronomical criteria to anthropological or historical ones, and so on.

With regard to the History of Science, the main contribution of Cultural Astronomy is to remove a considerable number of ways of doing science from obscurity and, thus, provide elements that help us to reassess, in global terms, the complexity and heterogeneity of systems of knowledge. Rather, the diversity of ways to systematically and logically interpret and explain the world in which we exist.

However, we have a fundamental question concerning the ways of naming this field of investigation. Let us dwell on Ethnoastronomy and Astronomy in culture. The term Ethnoastronomy was initially used in the 1970s. The problem with this denomination lies precisely with the term “ethno”. Campos (2001) criticizes the term Ethnoastronomy, stating that it discriminates. In this way, he establishes a dichotomy between an astronomy that is not characterized by adjectives (therefore, universal) and one that is characterized by “ethno”, that is, particular. According to him, Ethnoastronomy ends up favouring only one people.

A formal definition of cultural astronomy has been presented by Nicholas Campion (1997, p. 2): “Cultural astronomy is the study of the use of astronomical knowledge, beliefs, or theories to inspire, inform, or influence social forms and ideologies, or any aspect of human behaviour”. Cultural Astronomy also currently includes disciplines of Ethnoastronomy and Archeoastronomy.

Works in Cultural Astronomy

Throughout human history, we can find formulations of observational knowledge of celestial phenomena by people located in various parts of the globe. According to Lima and Figueirôa, research related to cultural astronomy in Brazil is evident since the end of the 20th century.

In the 1990s, the works of D'Olne Campos (2002) emerged, bringing reflections on the research field of ethnoastronomy. In 1992, the American anthropologist Stephen Fabian published the book *Space-Time of the Bororo of Brazil* (1992), the most complete work on ethnoastronomy of a Brazilian ethnic group, the result of his doctoral thesis. And the booklet *The Sky of the Tembê Indians* (CORRÊA et al., 1999), first published in 1999 by the Planetarium of Pará, which brings a didactic view on the astronomy of this ethnic group (Lima & Figueirôa, 2010, p. 297).

Research carried out in the village of Tekohaw, on the region of Alto Rio Guará, in the State of Pará, by the astronomer Germano Bruno Afonso, with the support of the mathematician Osvaldo Barros, was of great importance for Cultural Astronomy in Brazil. This research was adapted for a younger audience by Neves et al (2000), and coordination by Maria do Rocio.

In 2000, the book *The sky of the Tembê Indians* won the Jabuti award in the category of best textbook. This is a very important milestone, as a look at the sky from a cultural perspective

of indigenous peoples began, without the paradigms of a Eurocentric view of Astronomy, and a relevant contribution to the Brazilian nation in plural cultural contexts.

In the first decade of the 21st century, we can observe a greater production and publication of research in Cultural Astronomy. Although still incipient as educational proposals, we have several researchers who have contributed a lot, such as Luiz Jafelice, Germano Afonso, Ana Flávia Pedroza Lima, who have become recurrent among publications related to Ethnoastronomy or Cultural Astronomy.

The contribution of these noble researchers to education in Brazil is significant, since it has continental territorial dimensions and is composed of an ethnic diversity that encompasses not only the peoples of indigenous ethnic groups, but also its geographic location, the genesis of formation of its people, with their habits and customs encompassing various cultural contexts.

Therefore, following such cultural contexts, developing an approach referring to the phenomena of the sky, in a contextualized way, allows the creation of possibilities to exercise interculturality—dialogue between cultures without overlapping them.

Considering, respecting the differences between multiple knowledge systems is a very challenging task. Disentangling oneself from contentist thinking to understand that people are endowed with knowledge arising from their cultural contexts, which are different from one another, and seeking to establish a dialogue between this knowledge and the knowledge of the scientific context is necessary. However, teacher training is not enough, and teachers need to seek support to deal with this reality.

Thus, the contents and concepts related to Astronomy in cultural contexts present in Brazil lead us to the “gateway” to the realization of interculturality.

Researcher Afonso's work (2009) is a very important way to work on interculturality, as his indigenous ethnicity strengthened his scientific production in contexts not addressed in formal education. He travelled from North to South of Brazil, researching, within each reality, the narrative processes corresponding to the most diverse indigenous ethnic groups, such as the Tupinambás, from the Tupi-Guarani family, located in Maranhão; the Tembé, who inhabit the north of Brazil; the Guaranis, from the south of the country.

According to Afonso (2009, p. 4) [Translated by the authors],

“We must emphasize the pedagogical value of teaching indigenous astronomy to elementary school students throughout Brazil, as it is an astronomy based on sensory elements (such as the Pleiades and the Milky Way), and not on geometric and abstract elements, and also for alluding to elements of our nature (especially fauna and flora) and history, promoting self-esteem and valuing ancient knowledge, emphasizing that the different interpretations of the same region of the sky, made by different cultures, help in understanding cultural diversities.”

However, it should be noted that this researcher organized a bilingual booklet to be used as a didactic resource in indigenous schools, in addition to teaching Ethnoscience courses for indigenous teachers.

The result of the research carried out by Afonso is very valuable within Cultural Astronomy, as it enables the recognition and dissemination of knowledge present in the diversity of

indigenous ethnic groups found in our country. He emphasizes that, in addition to disseminating the material, the ideal is for these Basic Education professionals to have the opportunity to participate in Ethnoscience courses, as well as those offered to indigenous teachers. In addition, when the teacher has access to training and materials, they will be able to present other points of view on the knowledge of Basic Astronomy, in addition to those found in textbooks.

In 1612, the French Catholic missionary and Capuchin friar, Claude d'Abbeville, spent four months with the Tupinambá of Maranhão, near the Equator. In his writings, which became the book *Histoire de la Mission de Pères Capucins en l'Isle de Maragnan et terres circonvoisins*, published in Paris, in 1614, considered one of the most important sources of Tupi ethnography, he recorded the name of about 30 stars and constellations known to the island's Indians. However, he identified only a few of them.

Based on this information, some observers located most of the Tupinambá constellations, only reported by d'Abbeville and several other Brazilian indigenous groups.

However, rescuing Brazilian indigenous astronomy is, above all, rescuing the memory of a people and their relationships with the universe. It is to be able to draw a parallel with the astronomical system of the Tupinambás of Maranhão, Guaranis of the South of Brazil, being able to analyse, also, the knowledge of the constellations of the Brazilian Indigenous, and of other Indigenous of South America and of the Australian aborigines.

In her research, Rodrigues (2015) presented, in the text of her dissertation, a theoretical survey of the concept of culture, multiculturalism, Ethnoastronomy and/or Cultural Astronomy. After conceptually discussing the aforementioned terms, she then chooses the nomenclature Cultural Astronomy to carry out her analyses, using Moreira and Candau (2008)'s concepts of multiculturalism, cultural plurality in the PCNs and Federal Law n. ° 11.645 (BRASIL, 2008).

Considering other research, in his thesis, Soares (2017) analyzed teacher training activities carried out in the *Knowledge Space*: at the Federal University of Minas Gerais (UFMG), in Belo Horizonte, and in the *Explora Park*, in Medellín, non-formal spaces from Brazil and Colombia. He highlighted the importance of cultural astronomy for education, with the possibility of promoting interculturality. Knowledge produced in Ethnoastronomy was worked on, emphasizing the Guarani and Tayrona ethnic groups. The author wanted to know how teachers appropriated knowledge related to Ethnoastronomy through indigenous Astronomy. He emphasized that there are convergences and divergences in the form of appropriation of knowledge by teachers, as well as in their pedagogical practices.

We also have Mello's research, which addresses, among other topics, the importance and relevance of training teachers in indigenous schools and presents the Teaching of Astronomy in Natural Sciences, a means of working with different contexts, found in the Pataxó, Hahahãe ethnic groups and Tupinambá. In turn, this research makes us reflect on cultural contexts from the perspective of the diversity in which Brazil is inserted, proposing a look of respect for differences and appreciation of the knowledge built within each culture.

Also within the body of researchers is Jafelice (2010), a retired professor at the Department of Theoretical and Experimental Physics at the University of Rio Grande do Norte. He presented and discussed in his research a dense theoretical study of what cultural astronomy

is. He discusses the use of nomenclatures such as Ethnoastronomy, Archeoastronomy and Astronomy in cultures and their danger when using them. He chose Cultural Astronomy as a nomenclature to designate the knowledge culturally constructed by the Indigenous, *quilombolas*, artisanal farmers and artisanal fishermen, among others. The common origin of the remaining quilombos (quilombolas) is the African ancestry of enslaved black people who fled the cruelty of slavery and took refuge in the forests.

However, Jafelice (2010) suggests that pedagogues, teachers of Geography, Science, Biology and Physics in Basic Education give importance to studies focused on Anthropology, in order to study Astronomy in more depth.

According to the author, it is important to have a vision of the environmental, holistic and disciplinary educational context to address knowledge of peoples of indigenous ethnic groups, indigenous descendants and afro-descendants, both in formal and non-formal education, thus meeting the current legislation of Brazilian Education.

Federal laws speak of the obligation to include knowledge related to Afro-Brazilian and indigenous cultures in the school curricula of Basic Education, whether in public or private schools. Specifically, Laws 10,639, of January 9, 2003, and 11,645 of March 10, 2008. The latter, more complete, amends Law No. 9,394, of December 20, 1996, modified by Law No. 10,639, of January 9, 2003, which establishes the guidelines and bases of national education, to include in the official curriculum of the school system the mandatory theme “Afro-Brazilian and Indigenous History and Culture” (BRASIL, 2008, p. 1).

Thus, we can reflect and realize that, since the 2000s, some public actions in Brazil promoted the possibility of an education that respects ethnic-cultural differences. But it is necessary to move forward and increase more comprehensive actions of a teacher training nature in non-indigenous schools, going beyond the teaching of systematized knowledge from the point of view of the scientific cultural context. And, in this sense, it is necessary to rethink the curricula of higher education degrees and adapt them to multicultural contexts.

Methodological aspects of the research

In this article, works related to the theme "Astronomy" in publications available in the Brazilian Digital Library of Theses and Dissertations (BDTD), from January 1968 to September 2021, were analysed, leading to conclude this is a bibliographical research. A total of 573 papers were analysed – among dissertations and theses. We simultaneously used the Catalog of Theses and Dissertations on the Capes portal and the Bank of Theses and Dissertations on Education in Astronomy (BTDEA).

In the search process, the keywords “Astronomy”, “Cultural Astronomy” and “Indigenous Astronomy” were used. However, after carrying out several searches, we opted only for the keyword “Astronomy”, since, when using the expressions “Indigenous Astronomy and Cultural Astronomy”, the number of works on Astronomy was limited and, consequently, the subject was restricted. On the data collection period, we chose to analyze all the works present on the BDTD platform from 1968 to 2021. The focus was to have an overview of cultural astronomy. As a result of the search, 573 works were initially found, forming the research corpus.

According to existing bibliographic research, this study fits into the so-called “State of Knowledge”, described by Romanowski and Ens (2006, p. 40) as a study that “approaches only one sector of publications on the subject studied”, that is, dissertations and theses present in the BDTD from January 1968 to September 2021.

That way, we selected works related to Cultural Astronomy, Indigenous Astronomy and/or Ethnoastronomy for a deeper analysis.

Finally, Content Analysis, which is a technique that takes into account words, expressions and ideas used in the responses was used (BARDIN, 2006). However, Content Analysis is made up of phases. The first, which concerns the organization of the analysis, “corresponds to a period of intuitions, but aims to make operational and systematize the initial ideas, in order to lead to a precise scheme for the development of successive operations, in an analysis plan”. In this step, the researcher chooses the documents to be analysed.

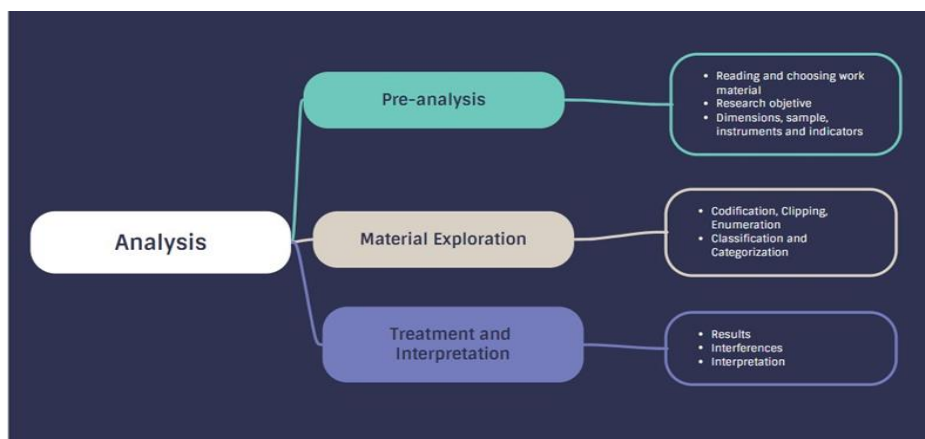
During the first phase, hypotheses were also elaborated, provisional statements that we wanted to verify, through analysis, and the objectives, which correspond to the purpose of the analysis, that is, which question the content analysis intends to answer.

After the first phase of the analysis, when the documents were chosen and skim reading was done, the step of categorization of the components of the analyzed messages may occur. The author states, “this process is not a mandatory step of any Content Analysis” but makes it clear that “most analysis procedures are organized, however, around a categorization process”. For this article, categories were created to better organize the information, thus contributing to the realization of inferences (BARDIN, 2006).

As the last step of Content Analysis, the interpretation of inferences consists of relevant conclusions to the research objectives.

The diagram below was created to clarify the steps of Content Analysis:

Figure 1: Content Analysis steps used in the research



Based on data from the research corpus, the study presents an overview of academic production on the researched topic:

- a) Graduate Degree (Master's or Doctorate) and whether they are Academics or Professionals;
- b) The nature of Educational Institutions (Federal, State or Private);

- c) In which area the Graduate Programs are located (Science and Mathematics Teaching, Physics, Teaching, Education, Vocational Teaching, etc.);
- d) In which Assessment Area they are located (Teaching, Astronomy/Physics, Education, Interdisciplinary, Mathematics, etc.).
- e) Due to the expressive number of Professional Masters, the area in which they are most produced stands out (Physics Teaching – MNPEF; Astronomy Teaching, Physics Teaching, Science Teaching and Mathematics Teaching);
- f) What is the thematic focus;
- g) Most cited references;
- h) What are the methodological approaches?
- i) Themes and contents in Astronomy.

Number of dissertations and theses on Cultural Astronomy recovered from 2004 to 2019. Table 1.

YEAR	NUMBER OF DISSERTATIONS	NUMBER OF THESIS
2004	1	-
2006	1	-
2007	-	1
2012	-	1
2014	3	-
2015	2	1
2016	1	-
2017	1	1
2018	1	-
2019	1	-
2020	4	-

Publications had a greater concentration in 2020. It is clear that production in Cultural Astronomy is scarce and, as a possibility for further development, it is necessary to explore the forms, structures and choices adopted by teaching materials and proposals in their approaches to the topic.

In this sense, this research proposes to analyze, in a more in-depth way, publications involving Cultural Astronomy with the use of categories (groupings) of analysis – a process of classification or organization of information into categories, which contain common elements or characteristics (FIORENTINI ; LORENZATO, 2006, p.134).

By organizing the work into categories and through a vertical analysis, it was possible to identify the thematic research focuses related to the theme “Cultural Astronomy”:

Table 2: Thematic research focuses related to the theme “Cultural Astronomy”

Finals	Intermediaries	Initials
I. Type, modality, place and consolidation of research.	I. Degree and location of research in Cultural Astronomy II. Configuration of Institutions promoting Research in Cultural	1. Theses
		2. Theses by region of Brazil
		3. Dissertations
		4. Dissertations by region of Brazil
		5. Nature of higher

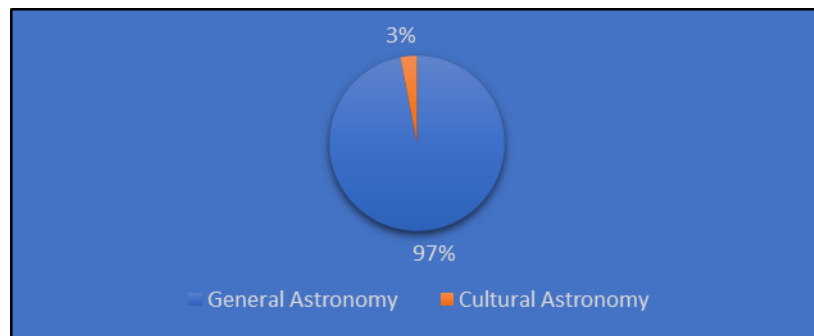
	<p>Astronomy. III. Programs and their respective areas of evaluation IV. Production by Region of the country and their respective States</p>	<p>education institutions 6. Higher education institutions 7. Postgraduate programs – CAPES-base area 8. Assessment area – CAPES-base area 9. Geographic region of Brazil 10. States of Brazil</p>
<p>II. Mechanisms for the production of Research in Cultural Astronomy.</p>	<p>V. Repertoire, emphasis on Astronomy themes and Research development. VI. Theoretical Foundation based on researchers in Cultural Astronomy. VII. Ethnicities present in research in Cultural Astronomy. VIII. Agents producing research in Cultural Astronomy.</p>	<p>11. Thematic focus 12. Themes and content in astronomy 13. Methodological approach 14. Most cited references 15. Most cited researchers 16. Quotes from ancient philosophers 17. Which indigenous people are most mentioned 18. Indigenous peoples in Brazil 19. Afro People - Brazil 20. African Peoples 21. Which indigenous peoples are most cited? 22. Author 23. Gender of the author 24. Advisor 25. Advisor’s gender</p>
<p>III. Relevance of Researchers in Cultural Astronomy and its scope.</p>	<p>IX. Dialogue between researchers, research paths and their relevance based on the abstracts.</p>	<p>26. Theoretical foundation 27. Methodology 28. Keywords</p>

Analysis and discussions

A sample of 573 studies were analyzed, selected according to the academic degree: Masters and Doctorate. The discussion was centered on research on Cultural Astronomy from Figure 2.

General Astronomy – 573 papers – Cultural Astronomy – 19 papers

Figure 2: Surveys focused on Cultural Astronomy published in Brazil (2022)



According to Figure 2, we can see that, out of the 573 surveys in General Astronomy, we found only 19 surveys focused on Cultural Astronomy. The 3% in Cultural Astronomy clearly shows us that there is a wide field to be researched, with many research opportunities.

Figure 3: Education institutions maintainers

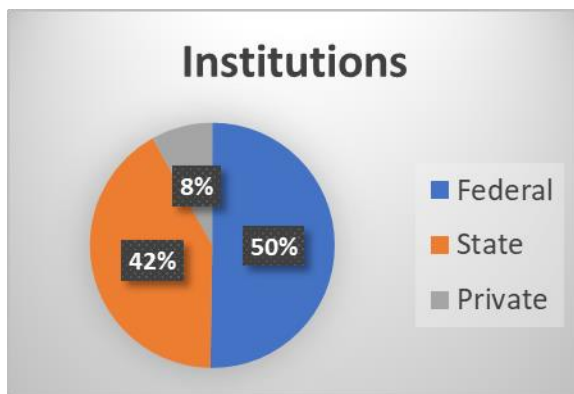
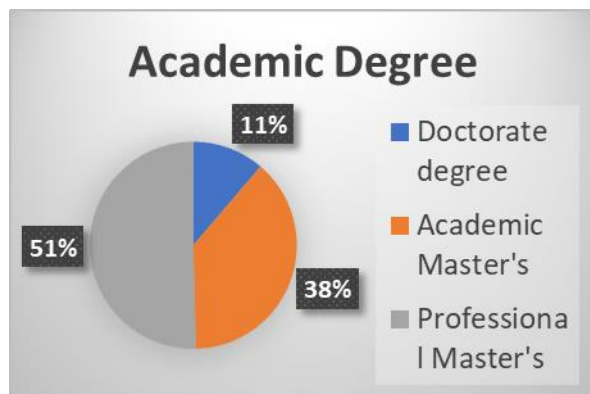


Figure 4: Educational level



The surveys analysed belong to institutions at the public and private levels. As we can see in Figure 3, the institutions maintained by the Federal Government hold 50% of the surveys, while State and Private institutions held 42% and 8%, respectively. These data lead us to reflect that public incentives are very important in the production of research in Astronomy Teaching, while private institutions do not focus on research itself. In Figure 4, we can see that Professional Masters hold 51%, with the largest number of productions in research on Education in Astronomy or Astronomy Teaching. Soon after, we have the Academic Masters with 38% of the productions. At the Doctoral level, we have 11% of research production. It should be noted that the number of Professional and Academic Master's courses is greater than that of Doctorates.

Thematic focus and content in Astronomy

Figure 5: Thematic focuses

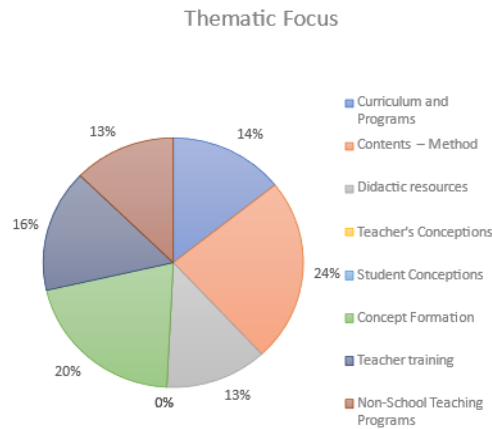
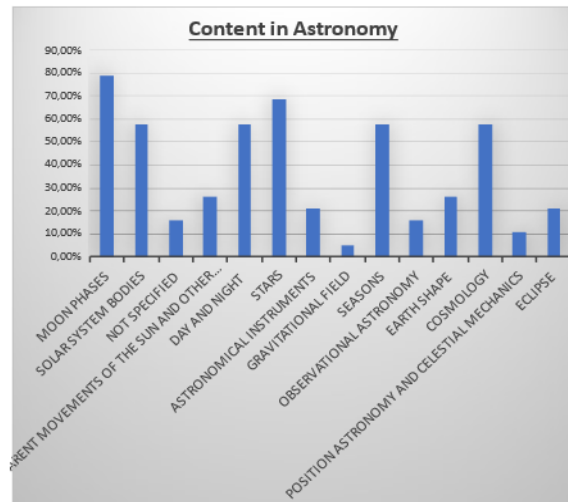


Figure 6: Astronomy contents



In Figure 5, we observe that the thematic focuses of the surveys are varied. Twenty-four percent of the surveys were developed with a focus on content and methods. There are many doubts that teachers have about which method to work on certain subjects. The students' conception of Astronomy stood out by 16%. In fact, many questions and doubts arise in relation to Astronomy in general. In addition, 20% are devoted to the formation of concepts. In this item, the analysis of conceptual errors or superficiality in the level of knowledge on topics in Astronomy prevails. Moreover, there is several research on teacher education and curriculum. In Figure 6, we have the contents most discussed in the surveys. The Phases of the Moon, Solar System, Day and night, Stars, Seasons and Cosmology were the most discussed contents. In fact, they are the contents present in everyday life.

In the 19 searches found, we observed the following terms in the key words:

Searches generally use keywords that are full of meaning. These words make it easier to find the content of searches. In this way, we transcribe the ones that appear most in the research: Education in Astronomy; Teaching Astronomy; Ethnoastronomy; Cultural Astronomy; Indigenous Astronomy; Interculturality; Multiculturalism; Culture; Ethnomathematics; Mythology; interdisciplinarity; These key words invite us to delve deeper into this research.

Figure 7 - Distribution of research in Cultural Astronomy across regions and states in Brazil (2022)

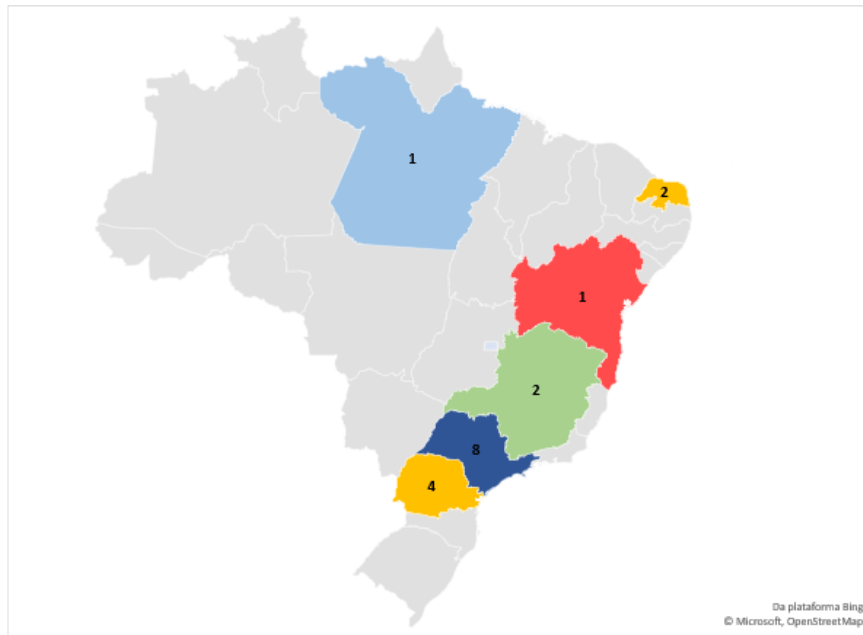
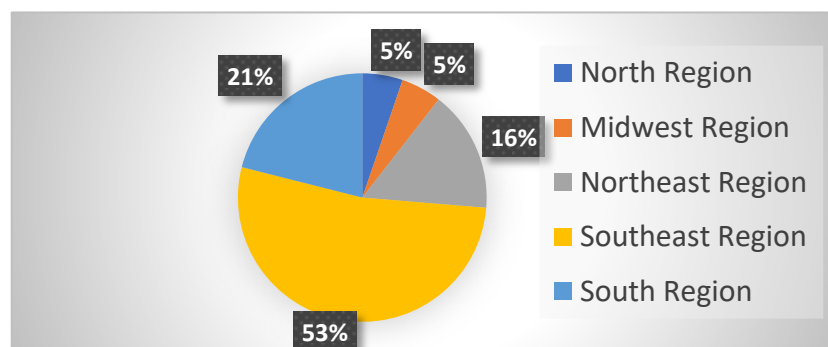


Figure 7 shows the distribution of research in Cultural Astronomy across regions and states. The Southeast and South regions are those that produced the most research. They are also the States with the highest concentration of Universities. Interestingly, the States that have the most Indigenous population do not produce academic productions in cultural Astronomy.

Figure 8

Distribution of researches on Cultural Astronomy by regions



Observing Figure 8, we see that the Southeast region is the one that most generates research in Education in the area of Astronomy. It should be noted that this region contains the largest number of Educational Institutions. The North and Midwest regions are the ones with the least amount of research in this area. However, we must be careful when analyzing the North region, since it contains few educational institutions.

Final remarks

The area of Cultural Astronomy did not follow the growth trend of other areas, such as Science Teaching, Physics and Biology, presenting few works from 2004 to 2020.

The Southeast region still concentrates the largest number of researches. Half of the productions are concentrated in a few Higher education institutions, and public Higher education institutions, especially federal ones, produce the majority of research.

Among the people most cited in the dissertations and theses selected for the study, it was found that the majority were related to indigenous peoples, followed by Africans, Incas and Mayans.

Among the indigenous peoples, The: Temb ; Tik na ethnic group; Guarani Kaiow , Kaingang, Makux , Tenetehara, Yanom mi, Potiguara Xavante, Patax , Sater -Maw , M ra, Tupinamb , Sater -Maw , Xucuru, Bar , Tayrona, Tupi-Guarani, Tukanos Terena, Mby , P l Tavyter  Kaiow , Ach , Kayap ; Yorub s; Inuits; Sioux; Boorongs; Aborigines (Australia); Incas, Mayans.

The survey shows that production in Cultural Astronomy is still incipient; few researchers work in this area, compared to the growing volume of production in Astronomy teaching, particularly in Brazil. From this perspective, we can say that this article is relevant, since the elements identified in Astronomy research, present in indigenous, Afro-Brazilian, Inca, Mayan, African, Asian cultures, etc., are relevant. These multicultural cultures have a lot to offer to teach about intercultural relations and the study of the universe in different cultures.

Acknowledgments

The authors would like to thank the Coordination for the Improvement of Higher Education Personnel (Capes) and the National Council for Scientific and Technological Development (CNPq) for financial support.

References

- AFONSO, G. B. (2009). *Indigenous Astronomy*. In: SBPC Annual Meeting, 61. 2009, Manaus. Electronic Annals [...]. Manaus: SBPC, p. 1-5. Available in: http://www.sbpnet.org.br/livro/61ra/conferencias/CO_GermanoAfonso.pdf.
- BARDIN, L. (2006). Content analysis. Lisbon: Publisher 70.
- BRASIL. Law # 11.645/08 March 10, 2008. Official Gazette of the Union, Executive Branch, Bras lia.
- CAMPOS, A. P. S. F. M. (2001). *The School Psychologist and Early Childhood Education: a look at the insertion of this professional in schools in Bras lia*. Master's Dissertation, University of Bras lia, Bras lia-DF.
- Campion, N. (1997). "Editorial," *Culture and Cosmos. A Journal of the History of Astrology and Cultural Astronomy*, v. 1, no. 1, p. 1-2.
- CORR EA, I. V.; MAGALH ES, L.; MASCARENHAS, R. (1999). *The sky of the Temb  Indians*. Belem/Par : Eduepa.

- D'ABBEVILLE, C. (1614). *History of the Mission of the Capuchin Fathers on the Island of Maranhão and its Surroundings*. Maranhão.
- D'OLNE CAMPOS, M. (2002). *Ethnoscience or ethnography of knowledge, techniques and practices?* In: AMOROSO, M. C. de; MING, L.C.; SILVA, S. M. P. (Org.). *Data collection and analysis methods in ethnobiology, ethnoecology and related disciplines*. Rio Claro, SP: Unesp/CNPQ, p. 47-91.
- FABIAN, Stephen M. *Space-Time of the Bororo of Brazil*. Gainesville: University Press of Florida, 1992
- FIORENTINI, D.; LORENZATO, S. *Research in mathematics education: theoretical and methodological paths*. Campinas, SP: Associated Authors, 2006.
- JAFELICE, L. C. (2009). *Ethnoastronomy: how many heavens are there?* Revista Ciência Semper, n. 12, p. 27-31.
- JAFELICE, L. C. *CULTURAL ASTRONOMY IN ELEMENTARY AND HIGH SCHOOL*. Latin American Journal of Astronomy Education, v. 19, p. 57-92, 2015.
- LOPES, F. A. D. ; JAFELICE, L. C. . *Education and New Conceptions of Reality, Interaction and Knowledge*. Education and Reality, v. 38, p. 789-811, 2013.
- JAFELICE, L. C. *Ethnoknowledge: why include children and young people?* Intercultural education, memory and intergenerational integration in Carnaúba dos Dantas. Inter-legere (UFRN), v. 10, p. 101-112, 2012.
- JAFELICE, L. C. *Ethnoastronomy: how many heavens are there?* Science Always 12: 26-31, 2009. Journal of FAPERN, Ano 5, abril/junho 2009. Natal: FAPERN, 2009.
- JAFELICE, L. C. *Anthropological Approach: environmental and astronomical education from an intercultural perspective*. In: JAFELICE, L. C. (org.). *Astronomy, Education and Culture: transdisciplinary approaches for various levels of education*. Natal: Editora da UFRN, 2010. P. 213-426.
- IWANISZEWSKI, S. (1994). *From astroarchaeology to cultural astronomy*. Works of Prehistory. Madrid, v. 51. n. 2, p. 5-20.
- MCCLUSKEY, S. (2016). *Looking at other Astronomies as if they were sciences*. In: FAULHABER, P.; BORGES, L. C. (org.). *Ethnographic and historical perspectives on astronomy*. Rio de Janeiro: Museum of Astronomy and Related Sciences, p. 18-34.
- MOREIRA, Antônio Flávio Barbosa; CANDAU, Vera Maria. *Multiculturalism: cultural differences and pedagogical practices*. Petrópolis: Vozes, 2008.
- NEVES, I.; MAGALHÃES, L.; MASCARENHAS, R. *O Céu dos Índios Tembé*. 2ª ed. rev. Belém, Pará: Planetário do Pará/UEPA, 2000. 56p. (Série Etnoastronomia). www.premiojabuti.com.br/jabuti/premiados-por-edicao/premiacao/?ano=2000
- RODRIGUES, M. S. (2015). *The diversity of knowledge about the sky and the teaching of astronomy: didactic proposals and potentialities of cultural astronomy*. 2015. 185 f. Dissertation (Master in Science Teaching) – University of São Paulo, São Paulo.
- SOARES, L. M. (2017). *Ethnoastronomy, interculturality and teacher training in the planetariums of the UFMG knowledge space and Parque Explora Belo Horizonte/MG*, Federal University of Minas Gerais, UFMG, 2017. 153p. Doctoral thesis.