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Literacy, a constellation of signifiers

Constellation of astronomical literacy for teaching astronomy

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Abstract. In view of the need for research focused on teaching astronomy to children, we developed a theoretical proposal for scientific literacy in Astronomy Education in non-formal spaces, permeated by Freudian/Lacanian psychoanalytic theory. The research aimed to establish propositions for scientific literacy for children based on psychoanalytic theory articulated with Astronomy Education. It is configured as an explanatory theoretical study with a qualitative approach, whose method of analysis and interpretation dialogued with psychoanalytic theory. From this, the Constellation of Astronomical Literacy was developed in the teaching of astronomy to children in non-formal educational spaces, such as astronomical observatories and planetariums. The constellation mobilizes five concepts that highlight a new perspective on literacy in astronomy: The word, Space, Play, Experience, and Daydreaming. Each concept represents a star in the constellation and is interconnected by the imaginary lines of the transferential relationship that highlight the field of the word, the unconscious, and desire. The point of interest in this metaphor is to understand that, just as in an astronomical constellation, where each star is in a different place, with varying distances and sizes, the Astronomical Literacy Constellation also presents itself in this way, given the complexity reflected in the field of Astronomy Education for children. This astronomical literacy can connect the scientific fields of interpretation and language with the educational field of literacy and astronomy teaching through the signifiers proposed in this constellation.

Resumo. Tendo em vista a necessidade de pesquisas voltadas ao ensino de astronomia para crianças, elaboramos uma proposta teórica para o letramento científico no Ensino de Astronomia em espaços não-formais, permeada pela teoria psicanalítica freudiana/lacaniana. A pesquisa teve como objetivo estabelecer proposições do letramento científico para crianças com base na teoria psicanalítica articulada à Educação em Astronomia. Configura-se como um estudo teórico explicativo de abordagem qualitativa, cujo o método de análise e interpretação dialogou com a teoria psicanalítica. A partir dela, elaborou-se a Constelação do Letramento Astronômico no ensino de Astronomia para crianças em espaços de educação não-formal, como nos observatórios astronômicos e planetários. A constelação mobiliza cinco conceitos que evidenciam um novo olhar para o letramento na astronomia: A palavra; O espaço; O brincar; A experiência e O devaneio. Cada conceito representa uma estrela da constelação e são interligadas pelas linhas imaginárias da relação transferencial que evidencia o campo da palavra, do inconsciente e do desejo. A questão que interessa nessa metáfora é entender que, da mesma forma como em uma constelação astronômica, em que cada estrela está em lugares diferentes, com distâncias e tamanhos variados, a Constelação do Letramento Astronômico também assim se mostra, diante da complexidade refletida no campo do Ensino de Astronomia para crianças. Este letramento astronômico pode conectar os campos científicos, da interpretação, da palavra com o campo educativo, do letramento e do ensino de astronomia por meio dos significantes propostos nesta constelação.

Keywords. Teaching of Astronomy

1. Astronomy, Scientific Literacy, and Psychoanalysis

The discussion on "scientific literacy" in the field of science education is always in the spotlight (Sasseron & Carvalho 2011; Chassot 2016). According to the authors, it is possible to distinguish the current understanding of scientific literacy as the process of "scientific enculturation" of students, that is, promoting the conditions to introduce them to a new culture: the scientific one. In this research, we advocate the terminology astronomical literacy.

For Chassot (2016), it is necessary to approach the language of science from a scientific literacy perspective, as it aids in understanding the world and the relationship between the subject, scientific knowledge, and humanity. The concept of literacy, which originates in education, according to Soares (2014), is the result of learning and teaching the social practices of reading and writing, in this case, more specifically, in astronomy. By appropriating the "writing" and "language" of science in this way, the subject takes them on critically, reworking them as their own, so that, metaphorically, the child does not necessarily know all the meanings of science, but once inclined towards the culture of Astronomy, they will begin to read nature in context, relating it to their social demands in order to propose its transformation.

Astronomical literacy, as advocated here, encompasses both the objective and subjective aspects of learning, valuing desire, language, play, and dreams as integral parts of the educational process, and not merely as means to pedagogical ends. This proposal, which originated from a doctoral thesis (Lima 2024), aims to present a constellation of astronomical literacy in the teaching of astronomy to children and others involved in the process of understanding the significance of astronomy.

To construct this constellation, we mobilize the psychoanalytic theory of the subject of the unconscious and desire – the subject of language (Lima 2024). In science education, Viliani (1999, p 129) points out that children's first reaction to new knowledge is usually rejection. Given this, children need to recognize that it is not possible to know everything, accepting knowledge as something partial and constantly under construction. It is in this recognition that educators can act, not wishing for children, but alongside them. By helping them realize the limitations of their knowledge, teachers enable them to face the challenge of

learning something new and thus open space for a new "scientific discovery."

How can educators work with children to help them deal with uncertainty and thus enable discovery? Astronomical knowledge, like that of the unconscious, needs to be structured into signifiers, transformed into words to produce meaning. It is up to the educator to support this process, helping children to name the cosmos and recognize that this knowledge is always partial, filled only in part by studies, readings, and research. Teaching, in this context, is showing that emptiness and gaps are also part of the subject. Looking at astronomy from a psychoanalytic perspective means dealing with the improbable, teaching children the first meanings of astronomical knowledge.

According to Viliani (1999), science teaching requires mutual involvement between educator and learner; both must be involved in the symbolic exchange of learning. Literacy only occurs when adults recognize the flawed nature of knowledge as something to be constructed with children through language and desire. In this process, teaching is also "putting into signs," as Voltolini (2011) states, which requires intentionality and sensitive listening in the face of disappointments and discoveries.

Thus, astronomical literacy marks the child as a historical subject, driven by the urge to know (Freud 2016). The author highlights this childhood that is enchanted by the beautiful, strange, and unknown. Astronomy, in this sense, awakens a longing for journeys that touch on the wonderful and the terrifying. Given this, it is not a matter of exhausting the senses of childhood, but of making room for listening, for displacement, and for constant re-enchantment with the world.

One of the emergencies of astronomical literacy in childhood is to enable children to talk about the meanings they themselves attribute to things. By repeating signifiers, they transform meanings in a metonymic and metaphorical movement of language (Lacan 2008). The pleasure of repetition in childhood is revealed in stories that need to be told countless times, almost like a ritual. Narrating something already said allows children to shift meanings, reinventing the text and the experience.

The concept of signifier used in the constellation is related to the unconscious structured as a language, in Lacanian theory, in which the subject is the effect of a chain of signifiers. It is in the order of the signifier and language that human beings are constituted, placing themselves in play in this symbolic field (Lacan 2008). In Astronomy Teaching, as the proposed mediations and linkages occur, the subjects involved in the learning process transform their signifiers, in this case, astronomical ones, as their relationships with knowledge and with the Other change. These subjects do not arrive at this process empty of knowledge, nor are they defined by fixed or predetermined knowledge. Therefore, this research focuses on language, signifiers, desire, and the unconscious, because it is in this field, in which humans encounter what they cannot control, that their deepest dimension is revealed: that of desire and the unconscious.

For (Lacan 2008), in the early stages of subject formation, children demand that the story told be always the same, textually identical, which reveals the importance of the signifier as such. The precision of repetition is not about the content itself, but about the symbolic function it assumes. It is by leaving and returning to the same story that new meanings emerge, being re-signified in the games and narratives that the child elaborates about their happy moments, expressions of joy.

Given this, it is worth asking: what signifiers are necessary for astronomical literacy from this theoretical perspective? The research is explanatory in nature, qualitative in approach, and based on Freudian and Lacanian psychoanalysis, articulated with the fields of Psychoanalysis and Education, Science and Astronomy Education, and with contributions from Benjamin and Bachelard.

Figure 1. Astronomical Literacy Constellation (Lima, 2024).

2. The Astronomical Literacy Constellation

Based on this survey, Lima (2024) proposed an image of the constellation of signifiers for astronomical knowledge in Astronomy Education. This connection with the astronomical concept of "Constellations" occurs both through the image created and through the intended conceptual relationships, since constellations are full of diverse histories and cultures, in which different ways of naming and creating allegories arose from each way of looking at the sky. Constellations are regions, parts of the sky that have been divided, analogous to a map, to facilitate observation and recognition of the sky, and include everything in that specific space, including the figure that represents it. Figure 1 below shows the "Constellation of Astronomical Literacy."

In Stellarium, the tool chosen to draw the constellation, the field represented brings together the stars Spica, Rigil, Antares, Vega, and Arcturus. Although they are part of different constellations, here they make up the "Constellation of Astronomical Literacy." The stars (white and red circles) are joined by an imaginary line that shapes the constellation. This line represents the transferential field, a concept traversed by the Other, understood as subject, culture, and otherness, which stitches together discourses and builds bonds (Lima & Langhi 2021).

Each star, in this field intertwined with language and the unconscious, is taken as a concept: Space, Play, Experience, Word, and Daydreaming, developed in depth in Lima (2024), in the context of teaching astronomy to children. As in astronomical constellations, each star has its own magnitude and characteristics, symbolizing the diversity and complexity involved in this educational process. The image of the constellation is, therefore, a symbolic representation. Although they appear to be on the same plane to the observer, these stars make up a vast network of intertwined signifiers. Astronomical literacy, in this metaphor, is the articulation of these symbolic connections, always crossed by the field of the Other.

3. The Astronomical Literacy Constellation and the Teaching of Astronomy

Based on this proposal from the Astronomical Literacy Constellation for teaching astronomy to children and in non-formal educational spaces such as planetariums and astronomical observatories, interconnected by the psychoanalytic framework

that is explored in greater depth in the original research, it is understood that this is an innovative proposal for the field, as it proposes scientific teaching that also focuses on subjective processes, meeting desire and the unconscious, connecting teaching through words, daydreaming, play, experience, and space (Lima, Langhi & Nascimento 2025).

Children are recognized as desiring subjects, not passive recipients. Astronomical knowledge, therefore, must emerge from the interaction between them and educators, in a transferential relationship, where there is symbolic and affective exchange. Thus, scientific literacy is understood as a symbolic construction, which comprises the uniqueness of each subject.

The "Astronomical Literacy Constellation", composed of five signifiers, Word, Play, Daydreaming, Experience, and Space, structures this new way of teaching astronomy. It allows children to enter the world of astronomy not only through reason, but also through enchantment, imagination, and language.

It is worth emphasizing the importance highlighted in the research of not reducing teaching to merely technical and rationalized explanations, but rather making room for the sensitive, the poetic, and the subjective. The desire to know arises from observation, from fascination with the stars, from lived experiences, including those that provoke fear or admiration. Childhood curiosity and desire are the driving forces behind scientific literacy. Thus, astronomy becomes a fertile field for the encounter between knowledge, language, and subjectivity. This work highlights the need to expand theoretical and empirical research that articulates psychoanalysis, science education, and astronomy, with a focus on the subject and its interactions.

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