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Analysis of children's drawings in non-formal learning environments: an extensive study in astronomical observation activities in Northeastern Brazil

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Abstract. This study examines over 820 children's drawings produced during the Caravana Luar do Sertão outreach project, which offered Astronomy activities in non-formal learning environments in Northeastern Brazil. The analysis considered age, gender, themes, and graphic features, relating them to Piagetian learning theory and developmental stages of drawing. The results show frequent astronomical representations, especially the Sun and Moon, and a predominance of the Schematic (52%) and Realistic (22%) stages. Correlations between age, gender, and graphic patterns indicate that science outreach experiences shape children's symbolic expression in non-formal settings, offering insights for educational assessment and regional comparison.

Resumo. Este estudo examina mais de 820 desenhos infantis produzidos durante o projeto de extensão Caravana Luar do Sertão, que ofereceu atividades de Astronomia em ambientes não formais de aprendizagem no nordeste brasileiro. A análise considerou idade, sexo, temas e características gráficas, relacionando-os à teoria piagetiana da aprendizagem e aos estágios de desenvolvimento do desenho. Os resultados mostram representações astronômicas frequentes, especialmente Sol e Lua, e predominância dos estágios de Esquematismo (52%) e Realismo (22%). As correlações entre idade, sexo e padrões gráficos indicam que experiências de divulgação científica influenciam a expressão simbólica infantil em contextos não formais, oferecendo subsídios para avaliações educacionais e comparações regionais.

Keywords. Astronomy – Non-formal education – Children's drawing – Piagetian theory

1. Introduction

Children's communication, as discussed by Meridieu (2003), is not limited to oral language. Drawing plays a central role in cognitive development, functioning as a bridge for learning and for the symbolic construction of the world. Learning, understood as the result of experiences that promote knowledge, skills, and ways of thinking, may take place in formal environments, such as basic education, but also involves informal processes arising from social interactions and experiences in non-formal learning settings Piletti & Rossato (2011).

Among these settings are those that promote meaningful interactions outside the traditional school structure, such as the Caravana Luar do Sertão project. Carried out in towns throughout the interior of Northeastern Brazil, the project integrates scientific outreach and astronomical observation with educational initiatives designed to dispel misconceptions and broaden inclusive access to knowledge.

Within this context, the "Children's Area" served as a space where children recorded their impressions thought drawings, related or not to astronomical observations. According to Derdyk (2020), drawing possesses a specific nature as a language, integrating gesture, movement, intention, and discovery. Children draw not only to represent but to know, experiment, and appropriate the world around them. Thus, drawing emerges as an instrument of knowledge and inquiry, transforming perceptions into meaning and revealing cognitive, emotional, and social dimensions of child development.

To empirically investigate these manifestations, a database of more than 820 drawings collected during the project's visits to Northeastern towns was compiled. In addition to demographic information such as age, gender, and locality, the database includes objective and subjective characteristics of the graphic productions, enabling a detailed analysis of both their formal features and symbolic content. This analysis is grounded in Jean Piaget's studies on the stages of child development and on the graphic representations commonly associated with each stage. Although the classic terminology used to describe the stages of children's drawings was consolidated by different authors, its application in this study follows the tradition widely adopted in applied Piagetian literature. Within this tradition, the stages: Fig 1 (a) Ordered Scribbling; (b) Unordered Scribbling; (c) Pre-schematism; (d) Schematism; (e) Realism, and (f) Pseudonaturalism, are used to describe the development of graphic representation as a progressive process of symbolic organization, motor refinement, and increasing pursuit of realism.

Figure 1. Examples of drawing types corresponding to each stage of child development proposed by Piaget.

2. Methods

Data collection took place in more than fifty towns across Northeastern Brazilian states: Alagoas, Bahia, Maranhão, Pernambuco, Piauí, and Sergipe. There we designated areas with low tables and EVA floor mats arranged around them. Lighting

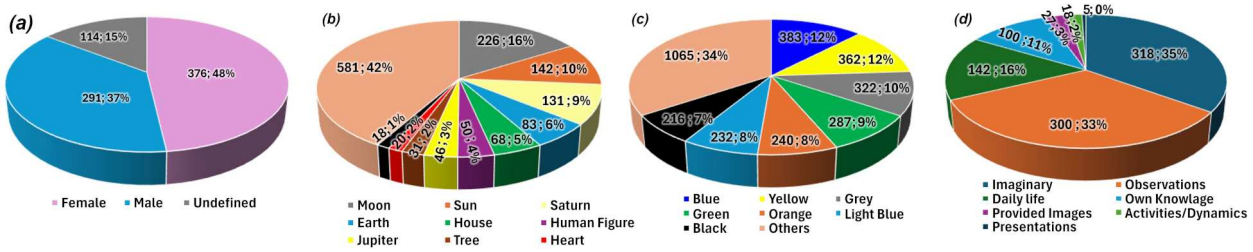

Figure 2. Number and percentage of (a) female, male, and unidentified participants; (b) most frequent elements in the drawings; (c) most commonly used colors; (d) most common sources of inspiration for the drawings.

was provided by public streetlights and indirect projector illumination used in the "Slide Presentations" and "Truths and Myths" areas. The children's space was equipped with a variety of materials, including colored pencils, crayons, pens, and A4 and A5 sheets of paper.

Interactions with the children were mediated by the project team, primarily a psychologist (CRP 19/005457). The drawings were systematically recorded in a public database Santana et al. (2025) in Google Spreadsheet, containing: name, age, gender, and city visited, and descriptive characteristics of the productions.

The data analysis was based on Jean Piaget's Learning Theory, using developmental stages of graphic commonly adopted in applied Piagetian research to classify the drawings.

3. Results, discussions and conclusions

There is a predominance of female participants (48%), which simultaneously indicates the project's success in engaging girls in science and reveals a lower male participation (37%), (Fig. 2). This asymmetry was also observed during interactions mediated by the team's psychologist, in which some boys displayed shyness when engaging in the drawing activities. Regarding the most frequent theme we have the Moon (16%), the Sun (10%), Saturn (9%), and Earth (6%) stand out.

Among the colors, blue and yellow appear most often (16% each), followed by gray (10%), green (9%), orange and light blue (8%), and black (7%), (Fig. 2). These choices reflect the experiences lived during the event. Before telescope observations, for instance, the Moon is often drawn in yellow, corresponding to its appearance to the naked eye at sunset or sunrise; after the observations, drawings in gray tones, and craters become more frequent, revealing a perceptual reorganization resulting from observing the satellite through the telescope.

These chromatic and thematic choices not only indicate the direct influence of the non-formal environment on children's graphic production but also illustrate, as Derdyk (2020) argues, that drawing functions as a process of discovery and re-signification: children transform sensory perceptions into graphic symbols, integrating observation, memory, and imagination. This process closely aligns with the mechanisms described by Piaget (2002) of assimilation and accommodation, through which new experiences are integrated into the preexisting cognitive repertoire, that is, the set of knowledge, perceptions, and mental schemas that form the basis for interpreting, modifying, or reorganizing newly acquired content. The classification of drawings based to the stages of child development and the type of representation showed overall consistency between age and drawing type, with a predominance of the Schematic (52%) and Realistic (22%) stages. The low proportion of drawings classified as Pseudonaturalistic (1%), (Tab. 1 and Fig. 3) is explained by the limited participation of children aged 10 to 12, a range in which interest in drawing tends to decrease.

Table 1. Summary of drawing types by scale based on Piaget's scale, number of drawings in each category, percentage, mean age, and standard deviation.

Type of Drawing	Scale	No.	%	Mean Age	Sigma
Ordered Scribbing	1	110	11%	2.7	3.6
Unordered Scribbing	2	54	6%	3.0	3.5
Pre-schematism	3	85	9%	8.8	2.5
Schematism	4	505	52%	8.9	3.2
Realism	5	210	22%	11.3	2.8
Pseudonaturalism	6	9	1%	9.0	0.8

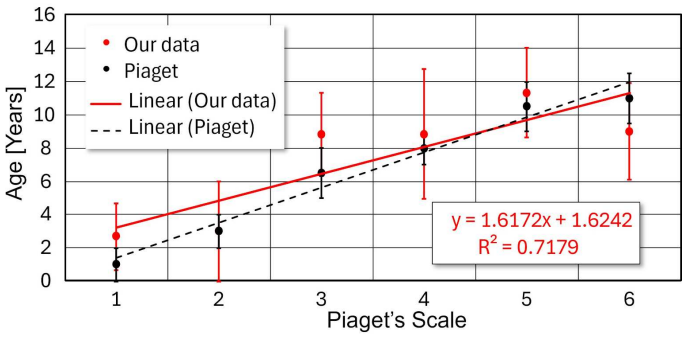

Figure 3. Comparative graph between the recorded age range and the expected age range according to Piaget's scale for the drawing types.

The results of this analysis indicate that participation in science outreach activities in non-formal learning environments not only stimulates children's interest in astronomical phenomena but also promotes the symbolic reorganization of these experiences in graphic form. From a Piagetian perspective, drawing emerges as an epistemic instrument capable of recording, transforming, and re-signifying scientific experience, articulating cognitive, affective, and social dimensions of development.

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References

Derdyk, E. 2020, Formas de pensar o desenho, São Paulo: Ubu Editora
Meridieu, F. 2003, O desenho infantil, Lisboa: Edições 70
Piaget, J. 2002, The Language and Thought of the Child, London: Routledge
Piletti, N. & Rossato, S. M. 2011, Psicologia da aprendizagem: da teoria do condicionamento ao construtivismo, São Paulo: Contexto
Santana, M. D., Scarano Jr., S., & Santos, C. 2025, Google Drive Folder (Accessed Dec 16, 2025), `https://bit.ly/CLdS_Draw22_24`