

Astronomy as a motivational theme in mathematics classes

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Abstract. In this work, we present the results of a research project aimed at identifying the prior knowledge of 9th-grade Elementary School students and 1st-year High School students. Based on the preliminary results, we compared the development of astronomical concepts after implementing interventions conducted during Mathematics classes.

Resumo. Neste trabalho apresentamos os resultados do projeto de pesquisa cujo objetivo era identificar os conhecimentos prévios dos alunos do 9º ano do Ensino Fundamental e dos alunos do 1º ano do Ensino Médio. A partir dos resultados preliminares, comparamos o desenvolvimento dos conceitos astronômicos após a implementação de intervenções realizadas nas aulas de Matemática

Keywords. Teaching of Astronomy

1. Introduction

Since the earliest records of human activity, observing the sky has been a significant practice. Even before it was formally recognized as Astronomy and prior to the development of modern scientific methods, the contemplation of celestial bodies was a part of people's daily lives. Throughout history, this practice has not diminished; instead, it has intensified, leading to advancements such as agricultural calendars.

Today, with the progress of telescopes, space probes, and other space observation tools, Astronomy has become even more fascinating and intriguing. Although Astronomy education is included in the Basic Education curriculum, covering all of Elementary School, it is often neglected compared to other subjects. This may be due to a lack of expertise among Science teachers or time constraints imposed by the curriculum.

In light of this reality, this research aimed to explore the potential of Astronomy education, focusing on meaningful learning as a way to address possible gaps in students' knowledge by the end of the late years of Elementary School. The objectives were to understand students' cognitive structure regarding Astronomy content in Mathematics classes for 9th-grade Elementary School students and 1st-year High School students, to develop an interdisciplinary pedagogical proposal addressing Astronomy concepts, and to critically evaluate the implementation of the pedagogical proposal.

Active methodologies were employed as teaching strategies, aiming to develop the competencies and skills outlined in the National Common Curricular Base.

2. Methodology

The research was conducted at Colégio Monteiro Lobato, located in São Paulo, Brazil, through the application of teaching strategies involving Active Methodologies in Mathematics classes. These strategies incorporated concepts and skills outlined in the National Common Curricular Base, particularly in Geometry and Proportion, based on the theme of Astronomy.

The project was approved by the Research Ethics Committee and had the consent and agreement of the participants. Only the questionnaires of students whose parents authorized the use of the data and who were present on the days the questionnaire was

applying were considered. A total of 17 students from the 9th-grade Elementary School and 24 students from the 1st-year High School met these requirements.

A questionnaire composed of thirteen questions, each with five answer choices, was applied at two different times: once before the interventions (March 2024) and again six months after the interventions (September 2024). This approach aimed to collect data that indicate the prior knowledge of the students and their cognitive structure after the interventions.

The questionnaire was developed based on previous studies conducted, including those by Anastácio (2020) and Barbosa & Voelzke (2016), which focused on student prior knowledge in astronomy. The correct answers were validated by the works of Mourão (1987, 2021), except for the first question, which inquired about each student's perception of their knowledge in astronomy and therefore did not have a correct answer.

Following the first questionnaire, students were asked to create a scientific journal. Each class was divided into four groups, with each group responsible for producing material that included data and information about the planets of the Solar System, some dwarf planets, and the composition of the Solar System. The data investigated included the structure and curiosities of each planet studied. The information should be present in scientific notation and follow the units related to the quantities involved, as well as compare these quantities with data from Earth, the Sun, and the Moon.

The 1st-year High School students presented their work in a seminar conducted in their own classroom, while the 9th-grade Elementary School students presented their seminar to the 3rd-year High School class.

3. Conclusions

After applying an initial questionnaire, we observed that a minority of students understood basic concepts about the composition of the Solar System (34.1%) and how the seasons occur (38.6%). Following the interventions, we found that the pedagogical proposal was effective, with accuracy percentages improving significantly to 81.8% and 59.1%, respectively. Except for question 9, the post-intervention accuracy variation was significant, consistently positive, and exceeded 15.0%, as shown in Table 1, Figure 1 and Figure 2.

TABLE 1. Correct answers (%)

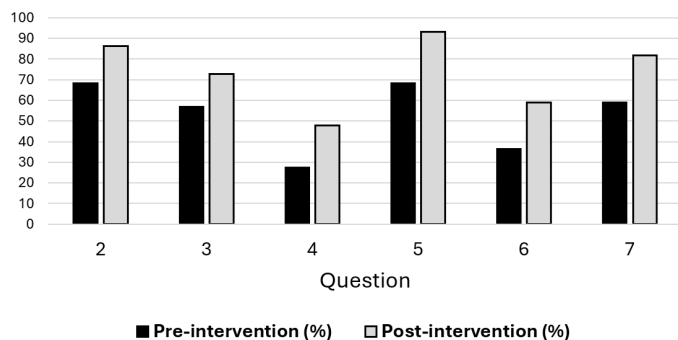
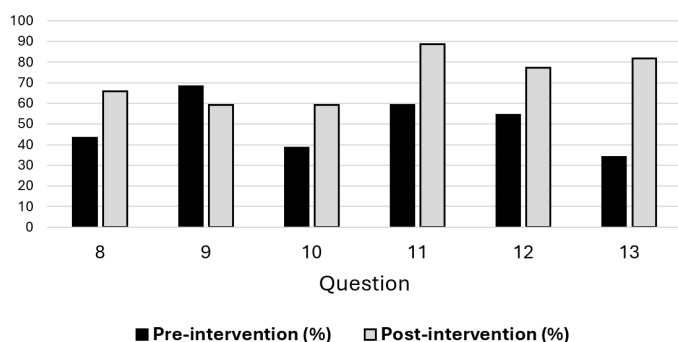
| Question | Pre-intervention | Post-intervention (%) |
|----------|------------------|-----------------------|
| 1 | — | — |
| 2 | 68.2 | 86.4 |
| 3 | 56.8 | 72.7 |
| 4 | 27.3 | 47.8 |
| 5 | 68.2 | 93.2 |
| 6 | 36.4 | 59.1 |
| 7 | 59.1 | 81.8 |
| 8 | 43.2 | 65.9 |
| 9 | 68.2 | 59.1 |
| 10 | 38.6 | 59.1 |
| 11 | 59.1 | 88.6 |
| 12 | 54.5 | 77.3 |
| 13 | 34.1 | 81.8 |

to discuss Astronomy. In many cases, their curiosity about the subject extended beyond the classroom, resulting in students who developed a genuine interest in the topic.

The development of mathematical skills was enhanced during this process, as students sought to connect the two fields of knowledge. This benefit was evident in their mastery of the mathematical concepts applied in their projects and in the application of these concepts to other areas of knowledge.

References

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CORRECT ANSWERS (%)**FIGURE 1.** Correct answers**CORRECT ANSWERS (%)****FIGURE 2.** Correct answers

Using Astronomy as a motivational theme in Mathematics classes provided students with more dynamic lessons, as they sought to associate the content learned in class with knowledge acquired independently. The process also included moments of relaxation and interaction during presentations and Mathematics lessons themselves.

Throughout the process, we noticed that as students researched the topic, they became more confident and excited