

# Digital resources and low cost of teaching materials for astronomical education

Ludemar Paladino<sup>1</sup> & Marcos Rincon Voelzke<sup>1,2</sup>

<sup>1</sup> Universidade Cruzeiro do Sul, São Paulo. e-mail: ludemarp@yahoo.com.br

<sup>2</sup> Geophysik und Institut für extraterrestrische Physik — Technische Universität Braunschweig, Germany. e-mail: mrvoelzke@hotmail.com

**Abstract.** This work presents the results of the application of two questionnaires about Astronomical concepts in three classes in the first year High School of a public school in the periphery of São Paulo. In the first questionnaire was verified the prior knowledge of students. Then the intervention strategies were carried out: use of digital resources of the school, construction of mock-ups using low cost materials and the use of educational books, such as Couper & Henbest (1997), Horvath (2008). After four months, the second questionnaire was applied to verify the occurrence of meaningful learning.

**Resumo.** Este trabalho apresenta os resultados da aplicação de dois questionários sobre conceitos de Astronomia em três turmas do primeiro ano do Ensino Médio de uma escola pública na periferia de São Paulo. No primeiro questionário foram verificados os conhecimentos prévios dos alunos. Então as estratégias de intervenção foram realizadas: uso de recursos digitais da escola, construção de maquetes usando materiais de baixo custo e a utilização de livros educativos, tais como Couper & Henbest (1997), Horvath (2008). Depois de quatro meses, o segundo questionário foi aplicado para verificar a ocorrência de aprendizagem significativa.

**Keywords.** Teaching of Astronomy

## 1. Introduction

The theory of a meaningful learning is a theory developed to be used in practice inside the classroom, using the students' previous knowledge. In order check the occurrence of that learning in Astronomy classes using the facilities which school provides. The teacher might guide the digital resources at his or her fingertips to improve the Astronomy teachings, and he or she might understand the reality that students belongs of. According with Moran et al. (2002), the biggest challenge to an educator is to help the meaningful information reaches the students. The application of low cost materials in the construction of Solar System mock-ups makes the learning process easy. According to Dickman et al. (2009), the application of low cost materials can encourage teachers to adopt that practice as a learning tool. That research takes up of the use of that facilities like pedagogic methods in the Astronomy learning.

## 2. Objectives

The present work aims to analyse if the use of digital resources combined with the application of low cost materials in the accomplishment of projects and the use of pedagogic books collaborate to the occurrence of a meaningful learning in the Astronomy learning.

## 3. Methodology

It was drafted two questionnaires with 21 questions, therefore 20 closed questions; success rates, Figure 4. And discursive ones; success rates, Figura 5. The first is to check the Astronomy previous knowledge. To stem from the questionnaire analysed it was applied the pedagogic strategies, so the second one was used. Three classes were studied in a amount of 78 students among 14 and 15 years old. The result os success rates of the classes is on the Figures 1, 2 and 3.

## 4. Results and Discussion

After the application of the second questionnaire, the results presented an evolution in right answers to the question, except to class C (question 14 and 20) and class D (question 1 and 10), in closed questions, the rates increased from 16.7% to 49.7%. In the second test, in the open question the result was from 0.0% to 28.2%. And in the second phase just class C did not have evolution in the considered satisfactory results (above from 50.0% of successes in the questionnaire), success rates, Figure 6. Indicated that the strategies have achieved positive results, but they need adjustments to improve the meaningful learning.

## 5. Final Remarks

The teaching of Astronomy serve as boost to achieve a meaningful learning, in a wider context in the Science learning. After the second questionnaire application there was an improvement in the results. And during the application of the strategies the students started to relate each other in a better way, showing socialization and great interest among students in astronomical science.

## References

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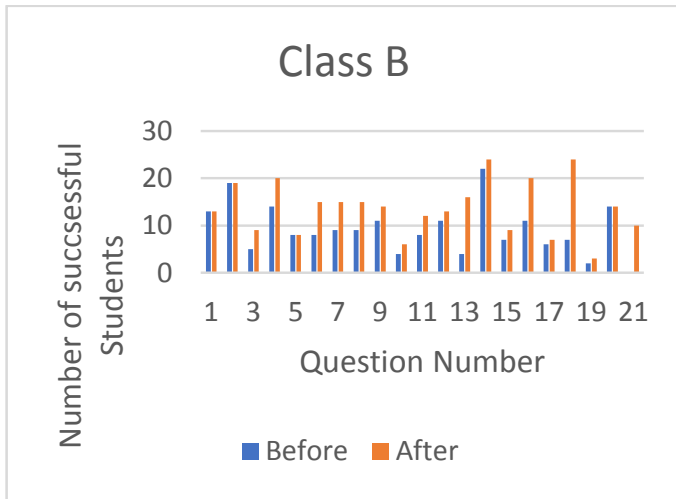


FIGURE 1. Correct answer before and after the questionnaire application.

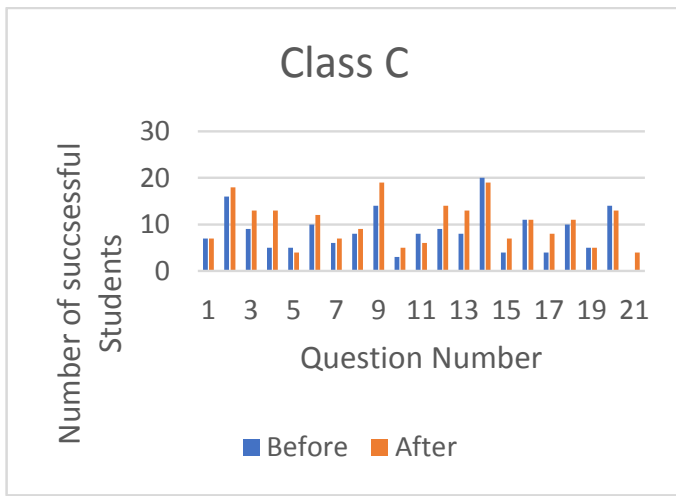


FIGURE 2. Correct answer before and after the questionnaire application.

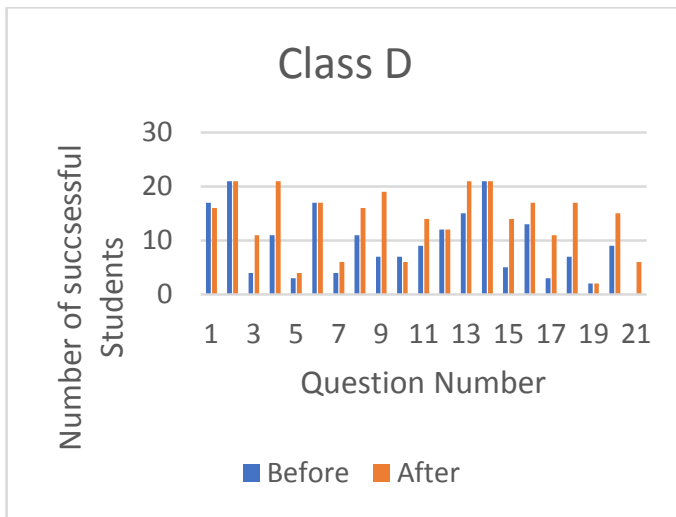


FIGURE 3. Correct answer before and after the questionnaire application.

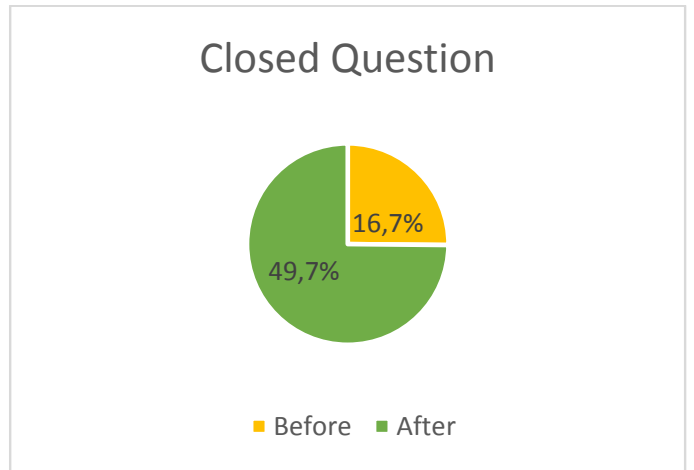


FIGURE 4. Percentage of students answered closed questions, before and after.

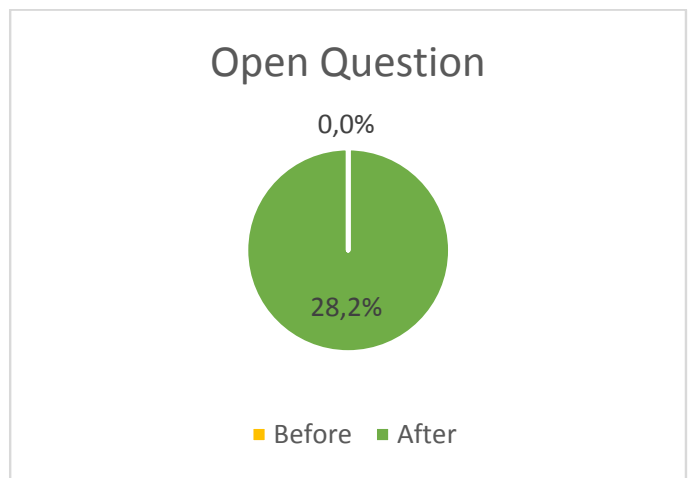


FIGURE 5. Percentage of students answered open questions, before and after.



FIGURE 6. Students whose achieve satisfactory rates in the second phase.