

Astronomical observations: A non-formal and itinerant approach for Physics and Astronomy teaching

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Abstract. Teaching Astronomy is a great challenge, specially in Brazil. On the other hand, astronomical observations can contribute to the dissemination and teaching of Astronomy and Physics, supporting teachers and students. The topic is important and should be instigated both in non-academic scope as well as in the scope of teacher and student training. An itinerant project about Astronomy has been developed since 2011. More than 9,000 people with different levels of scientific knowledge and interest have attended the activities. This work aims to analyze the effectiveness of different non-formal approaches that can be used with a lay audience.

Introduction

The need for survival of primitive civilizations made our ancestors look up at the sky and try to understand space phenomena (1). Nowadays, Brazilian students have to study Astronomy both in elementary and middle school. However, there are many challenges to achieving high levels of quality in teaching and learning astronomical topics. Among the difficulties that impact in a negative way the teaching and learning process are: poor science teacher training; absence of Astronomy contents in initial training courses; teachers that teach disciplines different from those in which they are specialists; diffusion of non-scientific conceptions and conceptual failures, both in students and teachers; historical conceptual errors in textbooks and long working hours that prevent teachers from studying and preparing classes properly (2,3).

On the other hand, researches have shown that Astronomy arouses a great interest and curiosity, both in the classroom and in non-academic spaces (4). In this way, a team from Federal Institute of Minas Gerais – Brazil, created in 2011 a popular project named "The Sky for Everyone", with the main objective of disseminating Astronomy and Physics. It is developed in the region of Ouro Preto, a city considered a cultural heritage site by UNESCO.

Free night astronomical observations are offered to the population. For that, two telescopes are used. The actions are itinerant and happen in squares, schools, soccer fields, rural communities, community centers, train and bus stations and other public spaces.

Results and Discussions

Different methodologies/activities have been used and tested. In this article, we aim to discuss the efficiency of some approaches with a non-specialized audience. The results came from the experience of the project executing team, conversations and interviews with participants.

First, it is extremely important to know in advance what will be possible to observe at the time scheduled for the activity and making this clear to the community. It is recommended to use a software such as Stellarium or Celestia for this purpose. It helps both in the elaboration and execution of the observation.

Interventions well planned and executed have been efficient in attracting people's attention to Science in general and specifically to Astronomy and Physics. Many residents and school principals from Ouro Preto and neighboring cities have regularly requested night observations in their communities or institutions.

The experience gained by the team and a research made with some participants showed that the most appropriate approach for a lay audience in Astronomy is one that combines observation with a scientific conversation between the team and the audience. In the conversations the main features and also curiosities about the observed objects should be presented. That type of

interaction creates a friendly atmosphere that facilitates the interaction. Besides that, astronomical discussions often lead to deeper discussions about Physics, when concepts such as mass, time and distance scales, pressure, density, velocity, temperature, conservation laws, electromagnetic waves, among many others, can be discussed without the characteristic formalism of a traditional class, for example.

The Moon always should be included in observations carried out with a lay audience because it is possible to identify many details: craters, relief, shadows and surface colors. Also, Saturn and Jupiter should be observed when possible. The first attracts people's attention because of its ring system and the latter because of its surface spots and colors. Besides that, it is possible to see their larger natural satellites even with small telescopes. Other Solar System planets could be observed, but it is strongly recommended that an observation includes at least the Moon too.

Observation of nebulae and clusters of stars also works well with a non-specialist audience. Point the telescope at a seemingly dark region of the night sky and show many “invisible” objects has played a considerable role in motivating people, specially children.

In the same way, years of experience of the team and results from research and interviews revealed some activities that are inefficient to be developed with a lay public. The main one is giving a talk about Astronomy because, in general, people associate them to traditional classes and do not care. Another activity that does not work well with a lay audience is the presentation of TV shows about Astronomy. However, both activities could be effective, but only if the participants are previously selected and has minimal knowledge and interest about the subject.

Dark places are better for observations, away from urban centers. However, such they difficult to reach. Thus, for Science dissemination such places are not the best choice because the number of participants is drastically reduced. In the case of a previously selected public with interest and knowledge on Astronomy, dark and remote places would work. However, for the general public, avoid them. A little of lighting is not as bad as an empty activity.

The last point about the activities is that the team must know the location. Buildings, walls and trees, for example, can easily obstruct the view of objects near the horizon and cause a poor impression of the audience regarding the technical and scientific skills of the team.

Finally, a research made with 40 participants showed that they consider the actions to be efficient in relation to: 1) socialize scientific knowledge; 2) supply possible failures in the teaching of Astronomy and Physics in basic education and 3) create scientific interest.

Conclusions

The most efficient activity with a lay audience is through scientific conversations during the observations, when astronomical and physical contents can be discussed. Those in charge of the activities must know the level of knowledge and interest of the audience. It is strongly recommended to include the Moon in all activities. Saturn, Jupiter, nebulae and clusters of stars also work well. In the case of a specialized audience, “less interesting” planets may be included. Finally, some participants interviewed consider that actions are important for the scientific diffusion, to assist in the teaching of Physics and Astronomy and to draw attention to science.

References

- [1] G. Kivelson and C. T. Russell, *Introduction to Space Physics*, Cambridge University Press, Cambridge, 1995.
- [2] R. Langhi and R. Nardi. Astronomy teaching: common conceptual mistakes found in Science textbooks, *Caderno Brasileiro de Ensino de Física* **24** (2007) 87-111.
- [3] S. P. Pinto, O. M. Fonseca, D. M. Vianna, Teachers' Continued Education: strategies for Astronomy teaching in elementary classes, *Caderno Brasileiro de Ensino de Física*, **24** (2007) 71-86.
- [4] J. M. Pasachoff and J. R. Percy, *Teaching and Learning Astronomy: Effective Strategies for Educator Worldwide*, Cambridge University Press, Cambridge, 2005.