

Dissemination and Teaching of Astronomy and Physics Through Informal Approaches to a Non-Specialist Public

Edio da COSTA JUNIOR, Bruno da Silva FERNANDES

Instituto Federal de Minas Gerais – Campus Ouro Preto, Ouro Preto – MG, Brazil

Astronomical observations can contribute to Science dissemination and teaching of Astronomy and Physics. In addition, they can support teachers and students. In this way, the debate on the topic is important and should be instigated both in non-academic scope as well as in the scope of teacher and student training. Based on this, a popular project about Astronomy has been developed since 2011. More than 7.000 people with different levels of scientific knowledge have attended the activities. This paper aims to analyze the effectiveness of different informal approaches that can be used with a lay audience in Astronomy.

1- Introduction

Observation of the sky comes from antiquity, together with the need for survival of primitive civilizations (1). Nowadays, Astronomy should be taught in Brazil both in elementary and middle school. However, there are many difficulties in achieving high quality teaching of astronomical topics. Among the challenges that negatively impact in the learning process are: poor teacher training or non-science training; lack of Astronomy contents in initial training courses; teachers that teach disciplines different from those in which they were trained; diffusion of non-scientific conceptions and conceptual failures, both in students and teachers, and historical conceptual errors in textbooks (2,3).

On the other hand, researches have shown that Astronomy is a Science that arouses a great interest and curiosity, both in the classroom and in non-academic environments (4). Because of this, a team from Federal Institute of Minas Gerais, Ouro Preto – Brazil, created in 2011 a popular project named "The Sky for Everyone", with the main objective of disseminating Astronomy and Physics in the local community.

Free night astronomical observations are now 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 and other public spaces.

2- Results and Discussions

Many different methodologies and activities have already been used and tested. In this article, we aim to discuss the efficiency of some practices with a non-specialized audience.

First, it is extremely important to know in advance what will be possible to observe at the time scheduled for the activity, besides 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 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 discussions about Physics, when concepts such as mass,

distance, scales, pressure, density, velocity, temperature, conservation laws, electromagnetic waves, among many others, could be discussed without the characteristic formalism of a traditional class, for example.

The Moon always should be included in observations with a lay audience because it is possible to identify many details with regard to craters, relief, shadows and surface colors. Also, Saturn and Jupiter should be observed when possible. Saturn 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 should 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.

In the same way, years of experience showed to the team some activities that are inefficient to be developed with a lay public. The main ones are lectures on Astronomy. In general, people associate lectures with traditional classes and do not care about them. 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 have minimal knowledge and interest on the subject.

For a better observation one must choose dark places, away from urban centers. However, such places are 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.

3- Conclusions

The most efficient Astronomy activity with a lay audience is through scientific conversations during the observations, when astronomical and physics contents can be discussed.

Those in charge of the activities must know the audience. It is strongly recommended that the Moon be included 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, the audience has arguments that actions are important for the scientific fusion, to assist in the teaching of Physics and Astronomy and to draw attention to science

References

- [1] M. G. Kivelson and C. T. Russell, *Introduction to Space Physics*, Cambridge University Press, Cambridge, 1995.
- [2] R. Langhi; 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 Educators Worldwide*, Cambridge University Press, Cambridge, 2005.