

Expanding Horizons of the "Planetário de Pobre" in Astronomy Teaching

L. Lanza¹, D. M. Rodrigues², e R. Teixeira²

¹ Universidade de São Paulo, IF, São Paulo, Brasil

² Universidade de São Paulo, IAG, São Paulo, Brasil

Abstract. The elegant activity *Planetário de Pobre*, proposed by Brazilian physicist Rodolpho Caniato, allows us to introduce a series of astronomical concepts in a practical and highly educational manner. In this activity it is possible to incorporate the apparent movement of stars and planets, including the Sun, as seen from anywhere on Earth at any moment of the year. It materializes observations done by human beings from a remote past that at the same time instigated and enabled them to conceive different models of the Universe throughout time. In our work, we are trying to broaden the array of basic concepts addressed by the introduction of two elements that were not present on the original proposal of this activity. As presented below, introducing the zenith and local meridian allow us to talk about, in an equally concrete manner, concepts like the rotation of the Earth and apparent and mean solar day.

Resumo. A elegante oficina *Planetário de Pobre*, proposta pelo físico Rodolpho Caniato, permite a introdução de uma série de conceitos astronômicos de forma prática e altamente didática. Nessa oficina é possível incorporar os movimentos aparentes dos astros, inclusive do Sol, como vistos de qualquer lugar da Terra e em qualquer época do ano. Ela materializa as observações realizadas pelos seres humanos desde um passado bastante remoto e que ao mesmo tempo os instigaram e permitiram que concebessem modelos de Universo ao longo do tempo. Em nosso trabalho, buscamos ampliar o leque de conceitos básicos abordados através da introdução de dois elementos não presentes na oficina originalmente proposta. Como apresentado a seguir, a introdução do zênite e do meridiano local permitem abordar, de forma igualmente concreta, conceitos como rotação da Terra e dia solar verdadeiro e médio. Buscamos assim, trazer à luz a potencialidade da oficina como instrumento didático para o ensino de conceitos básicos de Astronomia tão presentes na vida escolar como na mídia em geral, com ênfase para a associação do que observamos com o que aprendemos e ensinamos.

Keywords. Teaching of Astronomy – Earth movements – Celestial sphere

1. Introduction

In its initial concept the "Planetário de Pobre" (Caniato 1993) has as a starting idea using a glass balloon, as shown in Figure 1 below, to represent the celestial sphere, seen from an outsider perspective. The bottleneck materializes the rotation axis of the celestial sphere and can be easily handled to depict the sky at different latitudes. We can also represent the horizon with the liquid surface, celestial poles and equator and the ecliptic by outlining the balloon, which can easily be decorated with stars from both hemispheres of the Earth.

With this collection of elements, the activity acts as a powerful tool to give a concrete explanation about phenomena such as the daily movement of stars, the apparent movements, daily and annual, of the Sun, the seasons of the year and some coordinates that determine the position of these objects.

Its application is an alternative way to learn these concepts and can, at many times, be more elucidative than traditional approaches.

By adding new elements such as the zenith and local meridian, we seek enhancing discussions brought by the original activity and go a few steps further. These new elements will allow to discuss other concepts also, related to the rotational and orbital movement of the Earth such as the non uniformity of the Apparent Solar Time.

2. Development

The increased reach of this activity, "Planetário de Pobre", comes from the incorporation of the two new elements: the zenith and local meridian. However, as these elements must be

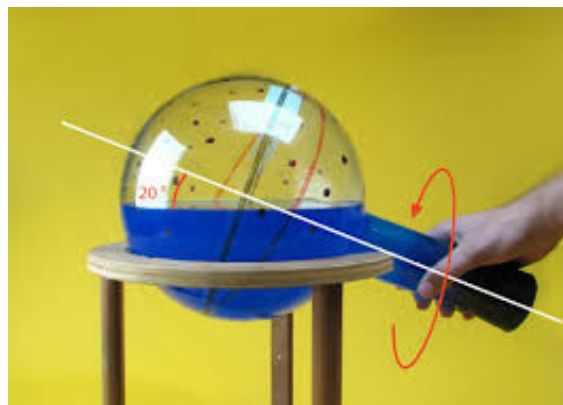


FIGURE 1. Overview on the original arrangement of the "Planetário de Pobre" activity (Lucas Assis — PONTOCIENCIA).

used as references in our proposal, they needed to be fixed, which means that they can not perform the daily movements as other stars. Therefore, they can not be signed on the glass balloon with the other elements already mentioned.

The solution we found at first was to incorporate an arching-like wire that is steady right over the balloon, adding a small twine tied to its highest point, representing both the local meridian and zenith respectively, which does not allow them to participate in the rotation of the celestial sphere.

This way we are able to discuss concepts associated to the rotation of the Earth, as the culmination of celestial bodies and, for example, the difference between time intervals of two consecutive culminations of a star and of the Sun. We can go even further

and discuss about the non-uniformity of a time scale based on the Sun (Apparent Solar Time), the measure of solar time and the concept of the Mean Solar Time that is the civil used approach, as well as many others concepts.

3. Final considerations

By expanding the possibilities of exploring this activity it becomes simple, for example, to understand that the period of rotation of the Earth is different from the one associated with the concept of civil day (the one from the calendar). These aspects of astronomical knowledge, as well as many others, though present in our daily lives, are in general barely known, in a way that is practically imposed a misbelief that "a day" corresponds to "a rotation of the Earth".

The positive answer received from students as for the application of the activity provides us with great expectation for future reproductions of it, perfecting the adaptation of the "local meridian and zenith" and deepening into its resources.

References

Caniato, R. 1993, *O Céu*, São Paulo:Ática Book Company