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New Model of Dome Sessions for the Teaching of Sciences in Planetary

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Abstract

A recent research in Brazil showed that about 85% of the Planetary visitors were Basic School students, led by their teachers, searching for a complement of in-school obtained poor information. In fact, school teachers in Brazil perceive Astronomy as a gap in their education. However Brazil has the largest students' participation in IOAA – International Olympiad on Astronomy and Astrophysics and more than 775,000 students and almost 72,000 teachers attended the Brazilian Olympiad on Astronomy, OBA, 2013. During the XV Encontro da Associação Brasileira de Planetários, Rio de Janeiro, 2010, one of the authors, GMO, interviewed 200 teachers cooperating with OBA, about their perceived role of Planetary among the possible other resources for preparing students for OBA: internet, books, magazines, audio-visuals, TV, movies, radio broadcasts, written media, education units on Astronomy, amateur astronomers, Astronomic Centres or Science Centres. Surprisingly 39% mentioned Planetary and 33% mentioned Astronomic Centres. Consequently interviewed teachers were asked about the relative importance, as a complement to their own education, of their visits to Planetary, Astronomical Centres, Science Centres or attending education units on Astronomy. About 80% mentioned education units; 15% indicated visits to Science Centres and Museums, 5% spoke about visits to Astronomical Centres and none mentioned Planetary. However, most of them mentioned a "dome session" while pre-university students and a Planetary visit during teachers education. These answers eventually point towards default or missing activities in Planetary, designed for meaningful education and not only for disclosing information. It looks as if Planetary uses only astronomic contents, neglecting other sciences supporting it, namely Physics, Mathematics and Chemistry. On the other hand, Planetary hardly run sessions for university students, devoting only to school students and neglecting teachers education. Within the development of educational research inserted in a PhD on Teaching Sciences, branch of teaching Physics, our intention is to design "dome sessions" organized to motivate university students, especially future Physics teacher students, and to search for efficient models and methodologies of complementing the school teaching of Physics using the Planetary scientific tools available outside the school institutions.

Key-words: *Activities in Planetary, Astronomy learning; non-formal education; scientific dissemination*

1. Introduction

There are few scientific investigations on the Planetariums activitie, whether related to Scientific Dissemination, their first vocation, whether related to teaching activities. A brief presentation of this environment (definition, origin, operation, evolution, visitors) will be presented, so one can understand the importance of the discussed problem and what are the main objectives.

The Planetarium is a dome-shaped space, with a vaulted ceiling, ready to receive the projection of a mechanism called planetarium. It is a double term terminology that will be differentiated by writing the first term with the first initial letter in upper case and the second term with the lower initial letter.

The first mechanical optical planetarium emerged at the beginning of the last century, developed by Walther Bauersfeld, by request of Oskar von Miller, founder of the Deutsches Museum [1]. The operation of the first mechanism was a combination of lenses and lights which projected pinholes or shadows, drawn in slides, in a hemispherical screen to simulate the stars. The apparent movement of the stars in the vault occurred by the movement of the mechanism itself that moved through gears adapted to a pivot system.

Since its invention, until the late 1980s, manufacturers of these projectors continuously incorporated new techniques, improving them to increase the realism of the work, although the projection was

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always related to the night sky. The planetarium, up to this period, did not bear any resemblance to cinematographers, and consequently the Planetariums looked nothing like a movie theater.
From the 80's, there was a radical change in the design of these mechanisms. A wide angle lens was adapted to a video projector, giving rise to what was called - for lack of a better name – “digital planetarium”. The projection are images elaborated in a digital format, worked in computer graphics. It should be noted that the new projectors resemble modern cinematographers, and many Planetariums already call themselves "Immersive Cinema".
The aim of this work is related, among other aspects, with a new model of a summit session, to better serve schools, in light of the new technology. Indeed, despite the advances, most Planetariums develop its presentations traditionally.

2. Study motivation

Planetariums are spaces usually visited by first cycle of basic education students, encouraged by professors who teach the contents related to Astronomy. The research work of Oliveira [2], in Brazil, indicates that 76% of the attending public are young students, which is not very different in other countries. These environments are also stimulated when it comes to preparing for the IOAA - International Olympiad on Astronomy and Astrophysics [3]. The participating countries carry out internal screening in order to select the best representative students. In the Brazilian case, the OBA – Olimpíada Brasileira de Astronomia e Astronáutica is organized [4]. In the 2013 edition, as an example, there were over 775,000 students enrolled and almost 72,000 teachers involved [5].

3. The research universe

In Planetariums, there are at least two summit sessions formats - the sessions intended for the general public and the sessions for schools. The former are generally automated, and more elaborated images, visual and sound effects are used. Sessions for the students, on the other hand, are usually held in real time, replicating the teacher in the school. This format, which no longer produced good results with the previous projection, was deteriorated with the new instruments.
In Brazil, Planetariums are gathered annually in the ABP – Associação Brasileira de Planetários meeting [6]. However, there are a considerable number that are not affiliated in this Organization, including the Planetariums having mobility. During the XV ABP meeting, held in Rio de Janeiro in 2010, a roundtable was organized to raise, present, and discuss the work developed in this follow-up [6]. Oliveira [2], one of the roundtable members, carried out a study with more than 3,000 professors representing the OBA, with the objective to get to know three aspects: the resources used by teachers to prepare students who participate in the OBA; gain insight into students' learning during a visit to a Planetarium and what resources, out-of-school, teachers used during the graduation course, when in contact with Astronomy.

4. Data collection and results

Only 7% of the surveys were returned on time, a sample of 200 teachers was obtained. Of the State of São Paulo, 38.4% of the participations arrived, which is the State with the largest number of schools enrolled in the OBA; 15.4% belonged to the State of Minas Gerais, the third state with the largest participation. Of the State of Paraná, the fourth federative unit with the largest number of representatives, 21% of the surveys arrived and the remaining ones are distributed among several units Rio Grande do Sul, Santa Catarina, Rio de Janeiro, Minas Gerais and Espírito Santo.
Only 35% of the teachers reported to be graduated in Physics and Mathematics, areas closer to Astronomy; 25% were equally distributed among areas of natural sciences such as Chemistry and Biology, and 40% were distributed among professors of Geography, History, Arts, Pedagogy and Informatics, which shows the heterogeneity of areas among the representatives of this competition.
The first part of the survey was related to the resources that those teachers used to prepare students for this competition. The results, shown in Figure 1, were surprising, pointing out to 39% for the planetariums, remaining a significant part for the observatories and the rest distributed by other resources.
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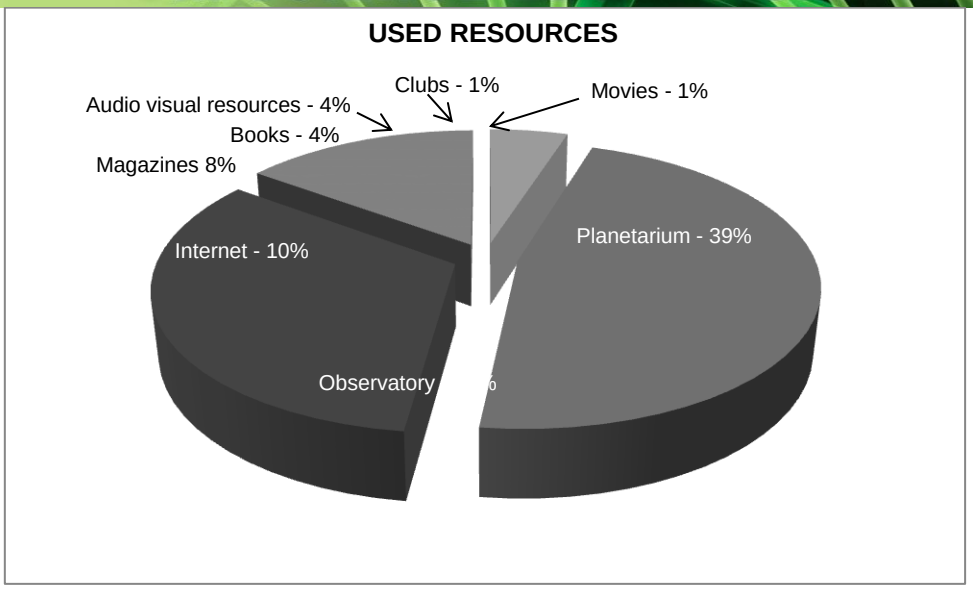

Figure 1. Resources used to prepare students participating in the OBA.

What is observed, taking into account the high percentage of visits to Planetariums and observatories, is that teachers do not only seek theoretical information. It is assumed that a summit session or a night observation can better aid the understanding of the contents.
Another question, formulated on the Likert scale from 1 to 5 (1 = totally disagree; 5 = totally agree) asked how teachers were satisfied with visits to the Planetariums.

Table 1. What was the perspective of learning regarding the last visit to a Planetarium

	1. Totally disagree	2. Disagree	3. Neither agree or disagree	4 Agree	5 Totally agree
A. The students approved the visit?				8%	92%
B. The presented contents were as expected?	0%	5%	65%	21%	9%
C. All the proposed objectives were fulfilled?	0%	13%	60%	19%	8%

As the "A" question was answered by the teachers, the perception they gained was that students were satisfied with the visit. In fact, there is no history of people who do not feel overwhelmed by the Planetariums presentations. In this regard, the Planetariums completely achieve their primary role, which is the Scientific Dissemination.
From the results of Table 1, should also be noted that the majority of teachers could not respond, categorically, if the contents presented were as intended, i.e., those contents applied in the classroom. This points to the inadequate format of the summit sessions, which for lack of space and purpose will not be discussed this time; but this statement is consolidated with the question "C" - 60% of teachers do not agree or disagree about whether the proposed objectives were fulfilled.
The second part, shown in Figure 2, was more related to teacher training. One of the questions asked aimed to know whether Planetariums were recalled during the training of professors in the graduation period. As there is a lapse of time between the graduation and the teaching practice, at the time of the survey with the students, the question referred, in the same way, to the continuous training. The Planetariums were not mentioned, constituting, in a certain way, a paradox.

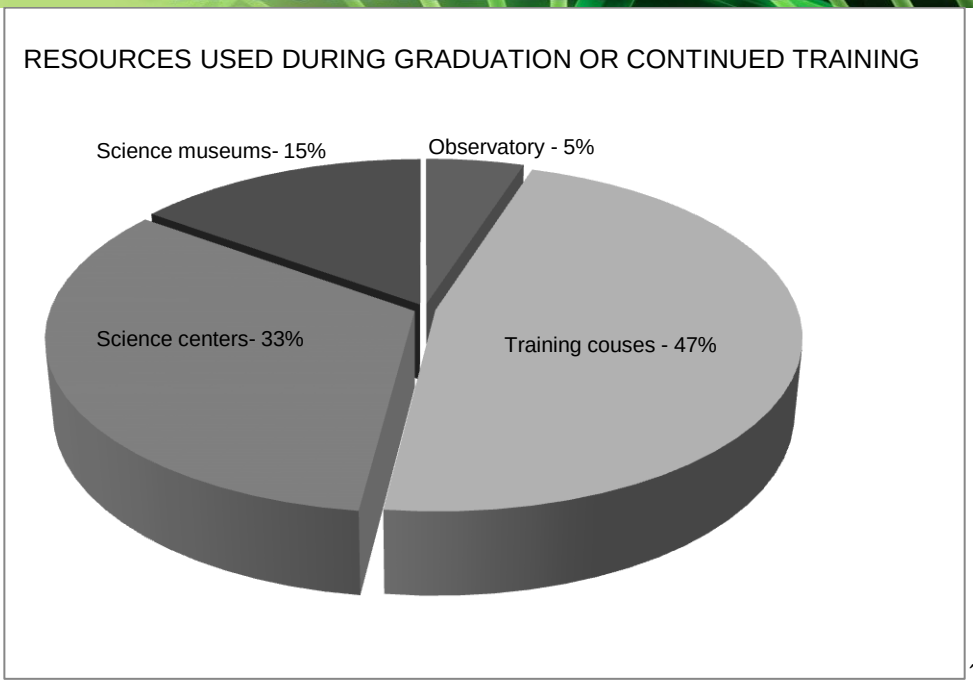

Figure 2. Resources used to prepare students participating in the OBA

5. Conclusions

It is known that Planetariums are not specifically educational environments as the school. They are characterized as spaces of Scientific Dissemination, as well as museums, science centers, science museums, zoos, among other informal or non-formal education spaces. What is taken into account is that the majority of the attending public of Planetariums are young students encouraged by teachers to complement the Astronomy contents educated in the classroom. Therefore, a new session format is required that matches the new reality.

One of the proposals presented in the Doctoral Program in Science Education of the University of Coimbra is the design of sessions to students that can go beyond the Scientific Dissemination and that are closer to the teachers' interests. However, there is a need to create a session model, specific to undergraduate students, because only then they will be able to evaluate the presentations and may contribute to a better harmony between the Planetarium and the school.

It should be clear, though, that what is wanted with this research is to contribute to the operational capacity of Planetariums and their effects, and not question the operators' scientific knowledge or technical capacity.

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