Boletim da Sociedade Astronômica Brasileira, **33**, no. 1, 15-26

Low-cost digital planetarium: ten years of application int the teaching and dissemination of astronomy at the Paraná State College

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Abstract. The work reports the application of a low-cost digital planetarium for the purposes of Teaching and Dissemination of Astronomy at Paraná State College, (Colégio Estadual do Paraná-CEP) during the last ten years (2011 to 2021). The survey was based on the number of students attended and the number of presentations made. As this Planetarium belongs to a Basic Education College, all computed sessions comprise Kindergarten, Elementary School and High School. In addition to the CEP's internal public, this space receives visits from schools and colleges from greater Curitiba, in the interior of the state of Paraná, north of the state of Santa Catarina and south of the state of São Paulo. During the ten years of the survey, the total audience was 120,434 in 2,082 given sessions. The number could approach 150,000 people, were it not for the necessary social isolation imposed by the Covid19 Pandemic, which has made it impossible to use the Planetarium since March 2020. In these ten years of operation, only optical cleaning and replacement of the projector lamp were necessary. time, which corroborates the idea of expanding the use of this configuration of equipment by other institutions of Education and Dissemination of Astronomy in Brazil.

Resumo. O trabalho relata a aplicação de um planetário digital de baixo custo para fins de Ensino e Divulgação da Astronomia no Colégio Estadual do Paraná (CEP) durante os últimos dez anos (2011 a 2021). O levantamento baseou-se no número de alunos atendidos e na quantidade de apresentações realizadas. Como esse Planetário pertence a um Colégio de Educação Básica, todas as sessões computadas compreendem a Educação Infantil, o Ensino Fundamental e o Ensino Médio. Além do público interno do CEP, esse espaço recebe visitas de Escolas e Colégios oriundos da grande Curitiba, interior do Estado do Paraná, norte do Estado de Santa Catarina e Sul do Estado de São Paulo. Durante os dez anos do levantamento o total de público foi de 120.434 em 2.082 sessões ministradas. O número poderia se aproximar de 150.000 pessoas, não fosse o necessário isolamento social imposto pela Pandemia do Covid19, que impossibilitou a utilização do Planetário desde março 2020. Nesses dez anos de operação foram necessárias apenas limpezas ópticas e substituição da lâmpada do projetor uma única vez, o que corrobora com a ideia da expansão da utilização dessa configuração de equipamento por outras instituições de Ensino e Divulgação da Astronomia no Brasil.

Keywords. Teaching of Astronomy – Methods: data analysis

1. Introduction

A planetarium is a non-formal educational space of excellence for the Teaching and Dissemination of Astronomy (Martins, 2009).

In 2011, the author linked to the Astronomical Observatory and Planetarium of Paraná State College, (Observatório Astronômico e Planetário do Colégio Estadual do Paraná OACEP) built and installed a low-cost fulldome digital projector, parallel to the main equipment of the Planetarium of Paraná State College, as can be seen in Figure 1.

2. Theoretical Reference

The motivation for building a low-cost digital projector for this space came from the need to offer an alternative, in case of breakage or permanent damage to the main projector, an old Carl Zeiss Planetarium, model ZKP-1, out of line and no spare parts since 2010.

After an extensive search, the article by (Filho et al., 2010), published in the electronic journal of Cornell University, by a group of researchers from the Federal University of Goiás, Campus Jataí, brought the long-awaited contribution, which supported all the work. of construction equipment.

Consisting basically of a multimedia projector and a pair of conventional photographic lenses, and brackets, as can be seen in Figure 2, the equipment is easy and very cheap to maintain compared to other planetarium projectors.

Figure 1. Nebula projection-source-OACEP-2020

3. Results

In addition to the Paraná State College, (Colégio Estadual do Paraná - CEP), which has more than six thousand Basic Education students, the CEP Planetarium serves institutions from all over Paraná, north of Santa Catarina and south of São Paulo, in special pedagogical sessions, according to the students' education range, continuing education for teachers and the community in general.

Figure 3 above shows one of the educational potentials of a digital planetarium: showing, at the same time, the repre-

Figure 2. Projector and lens holder-source-OACEP-2020

Figure 3. OACEP Sessions 2011-2021-source-OACEP-2020

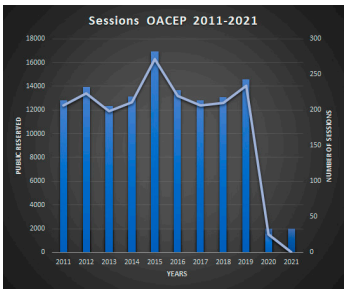

Figure 4. OACEP Sessions 2011-2021-source-OACEP-2020

sentations of all the constellations that are above the horizon with their respective names, which makes it easier, specially for Kindergarten and first grades of the Basic Education, the understanding of these imaginary figures in the firmament.

The Figure 4 shows the panorama of services provided during the survey period.

The maximum points observed above correspond to the years in which there was continuous training of teachers, consequently increasing the number of requests for appointments and the audience served at the Planetarium respectively.

During the last ten years, in which the low-cost digital planetarium has been in operation, the number of sessions and the total audience served during this period, did not compute the sessions held with the Carl Zeiss, ZKP-1 electronic opto-mechanical projector that represented only six percent of the number of sessions, that is, 347 sessions.

Also based on Figure 4, it is possible to observe that between 2011 and 2019 the number always exceeded 200 sessions held with an audience always exceeding 12,000 people attended per year. Were it not for the social isolation imposed by the COVID19 Pandemic, it would be possible to reach the milestone of 150,000 people served in the last ten years.

In common agreement with the requesting institutions and, in cases of a very high number of students and/or transport restrictions to the CEP Planetarium, since 2012, a second low-cost digital projector has been mounted, with an inflatable dome, which serves the region of greater Curitiba. Figure 5 below shows one of these services in February 2020.

Figure 5. Inflatable Planetarium-source-OACEP-2020

Figure 6. Projection during "Moon Night"-source-OACEP-2020

4. Conclusions

From the point of view of Teaching and Dissemination of Astronomy, another great contribution that is brought about by the use of a digital planetarium is the possibility of presenting in the dome, all eight planets and five dwarf planets of the Solar System, the Sun and the Moon. With sizes and details capable of occupying practically the entire projection dome, as can be seen in Figure 5, this, in addition to illustrating the sessions, delights both students, teachers and the general public, further sharpening everyone's interest in Astronomy.

In particular, in the register in Figure 6, using an inflatable dome, this session was given during an event called "Moon Night", in a school in Curitiba. in which parents accompanied their preschool children (aged between five and six years old) in a playful moment about the Earth's natural satellite.

With the low-cost digital planetarium of Paraná State College, throughout these ten years of application, all levels of schooling, from Kindergarten to Graduate, Continuing Teacher Education, as well as the general public, were attended to. The highest incidence of sessions occurred in Elementary School II and High School classes, during approaches to Astronomy themes in the most diverse disciplines, corroborating the Planetarium, as a place of non-formal Education for interdisciplinarity between different areas of knowledge addressed in Teaching.

The potential and modest values of setting up and maintaining a low-cost digital planetarium open up great possibilities for the dissemination of planetariums throughout Brazil, contributing to the intensification of the Teaching and Dissemination of Astronomy.

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