Boletim da Sociedade Astronômica Brasileira, **35**, no. 1, 63-65

Education, research and extension at a planetarium

D. A. Pereira[1], K. T. O. Silva[1], & A. D. T. Gomes[1]

[1] Universidade Federal de São João del-Rei, São João del-Rei, Minas Gerais, Brasil
e-mail: andrewss.daisy@gmail.com, kty34@live.com, alessandrogomes@ufsj.edu.br

Abstract. This paper presents the results achieved by an extension program aimed at the dissemination of science and astronomy through a planetarium. The participating public has been 11.250 people since its inauguration in 2016. 583 sessions were held which last, on average, one hour and are based on a dialogical and problematizing approach. Of this total number of sessions, 413 were for students of 35 basic schools of 15 cities in the Campo das Vertentes region, in Minas Gerais state. Partnerships with several programs allow the planetarium, in addition to promoting social inclusion in the region via scientific culture, to contribute to the pre-service and in-service teachers' training of Basic Education teachers in Astronomy. In this way, the results show that this extension program is configured as an articulating entity, supplying teaching and research, composing the three axes of actions that underlie the activities of universities in Brazil.

Resumo. Este artigo apresenta os resultados alcançados por um programa de extensão voltado para a divulgação da ciência e da astronomia por meio de um planetário. O público participante foi de 11.250 pessoas desde a sua inauguração em 2016. Foram realizadas 583 sessões, com duração média de uma hora, baseadas em uma abordagem dialógica e problematizadora. Do total de sessões, 413 foram destinadas a estudantes de 35 escolas de ensino fundamental de 15 cidades na região do Campo das Vertentes, no estado de Minas Gerais. Parcerias com diversos programas permitem que o planetário, além de promover a inclusão social na região por meio da cultura científica, contribua para a formação de professores em serviço e pré-serviço da Educação Básica em Astronomia. Dessa forma, os resultados mostram que este programa de extensão se configura como uma entidade articuladora, suprindo as áreas de ensino e pesquisa, compondo os três eixos de ações que fundamentam as atividades das universidades no Brasil.

Keywords. Teaching of Astronomy

1. Introduction

Despite Astronomy's potential to contribute to the education of Brazilian youth, its reality in national basic education does not match expectations. The reasons for this are analyzed in several articles (Langhi & Nardi 2009; Carvalho et al. 2016).

As the difficulties of teaching Astronomy in Brazil are known, the activities of several non-formal educational spaces such as planetariums, observatories, and science museums stand out in this area. According to Trilla (2003,11), non-formal education "refers to all those institutions, activities, means, areas of education that, although not school-based, were created expressly to satisfy certain educational objectives".

According to Gohn (2006, 32), non-formal education aims to cultivate a citizen similar to that of school education. However, due to its characteristics, it facilitates the pursuit of other specific objectives, including (i) education for citizenship; (ii) education for social justice; (iii) education for equality; (iv) education for democracy; (v) education against discrimination; and (vi) education through cultural expression, fostering the appreciation of cultural differences.

Such spaces present themselves as welcoming environments, suitable for disseminating scientific knowledge as a cultural asset, through innovative methodologies, interactivity, motivation, and engagement—fundamental elements in the teaching and learning processes. Extension activities for projects or programs linked to various universities across the country occur in most of these spaces.

The inseparability between teaching, research, and extension is a concept that emphasizes the interconnection and mutual reinforcement of these three central functions in higher education institutions in Brazil. University extension can be understood as the social dimension of the university. It occurs in dialogical and transformative relationships with the community, where knowledge is constructed, shared, and democratized. Costa, Santos & Grinspun (2009) share the conceptions of university extension work, which includes the possibility of building dialogue between pedagogical and intellectual praxis with society. Seen in this way, extension proposals and products maintain and are produced in a dynamic of reflective, mutual, and autonomous learning, through a link between society and university.

University extension programs are also an essential tool that connects teaching and research, providing future educators with practical experience in real-world scenarios. This experience cultivates a stronger commitment to social issues, shaping them into more dedicated professionals.

Planetariums are examples of these spaces in which various extension activities are developed. They cater to a wide range of audiences, including school groups, families, enthusiasts, and the general public. They offer educational programs tailored to different age groups and levels of understanding, accommodating diverse learning styles and interests.

A planetarium consists of a projector in the center of the dome where software and audiovisual content are projected. The simulation program enables spectators to travel both forward and backward in time and change their observation point to any celestial body within the solar system. This feature allows for the visualization of phenomena like eclipses and meteor showers from different perspectives, enhancing the understanding of these events."The combination of a virtual environment and full-dome technologies result in a unique opportunity for astronomy instruction that is not possible in any other milieu" (Yu 2005, 6).

People, especially children, learn through their interactions with the environment, which is a preponderant factor in learning. The more immersive, thought-provoking, and challenging the medium, the greater the potential for learning. "Those who

defined immersive environments as learning places, characterize the experience as dominating the viewer's senses, focusing the viewer's attention on the stimuli, provoking the senses, and causing the viewer to become absorbed by the story and characters. Immersive environments have been described as an enhancement to traditional learning experiences because they offer a simulated experience with place-based information in the context of other types of science learning" (Fraser et al. 2012, 182).

Planetarium visits complement formal education by providing practical, visual demonstrations of theoretical concepts learned in classrooms. They reinforce classroom teachings and offer a deeper understanding of complex scientific ideas. Through planetarium shows and demonstrations, visitors experience the practical applications of astronomical principles, fostering a better understanding of the universe. This hands-on experience aids in the retention and comprehension of scientific concepts.

The objective of this work is to present the results so far achieved by the extension program "Planetário da UFSJ" in operation since 2016.

2. The extension program and its results

The program's activities take place in a digital planetarium located on the Dom Bosco campus of Universidade Federal de São João del-Rei (UFSJ), in São João del-Rei - MG, and it offers bi-weekly sessions open to the public in general. Additionally, it welcomes, upon scheduling, school trips from both the public and private sectors in the region.

The program's objectives are (i) To carry out science dissemination activities through Astronomy and interdisciplinary approaches; (ii) To contribute to democratizing access for the general population to scientific and technological knowledge, as well as to equipment, goods, and cultural productions, to foster effective scientific literacy; (iii) To Strength basic education through innovative pedagogical practices and new ways of developing curricular content, diversifying learning situations; (iv) To improve and expand the number of cultural and scientific activities available in the city of São João del-Rei and region.

The sessions take place in a 6-meter diameter and 4.2-meter height digital planetarium. They typically last about an hour and are based on a dialogical and problem-solving approach. According to Santos et al. (2016, 208), "dialogicity is established between the subjects involved in the reality that mediatizes them. Underlying the dialogical and problematizing educational process is the idea of transformation towards a more humanized society", more inclusive, which understands differences and offers learning opportunities to everyone.

During the sessions, which are always adapted to the age range of the visiting audience, the following topics are covered: the history and significance of Astronomy, the apparent movement of the sun, stars and constellations, planets and dwarf planets of the solar system, the moon and its motion, and natural satellites of other planets.

All dome sessions conducted are evaluated by visitors (open sessions) and by teachers (school sessions) using forms prepared by the team.

The visiting public, until July/2023, was approximately 11,250 people, with 583 sessions having been held. Of these, 413 public and private sessions were aimed at basic education schools. Around 8,540 students from 35 schools were able to participate in the activities developed. 130 regular sessions were also held, open to the community, with around 2,060 visitors, and another 40 sessions for 650 people, aimed at internal programs at UFSJ. The program has already received students from 15 cities in Minas Gerais, mostly belonging to the 'Campo das Vertentes' mesoregion. This demonstrates the importance and coverage of the program.

As educational products, the program:

- Contributes to the in-service and pre-service education in astronomy for basic education teachers through activities in Pedagogy and Bachelor's programs in physics, biological sciences, history, and geography;

- Keeps partnerships with institutional programs such as 'PIBID', 'Residência Pedagógica', and other extension programs;

- Contributes to the development of educational materials and lesson plans for teaching astronomy.

As research products, the development of the extension program allowed, so far: -The publication of three articles on astronomy learning published in national journals;

- Two research projects approved by the Research Support Foundation of the State of Minas Gerais (FAPEMIG) in calls related to supporting science dissemination activities and extension projects in connection with research;

- Papers presented at regional and national events.

Finally, in addition to the scientific dissemination sessions, the extension program contributed to making it possible to carry out:

- Lectures and participation in roundtable discussions at scientific events;

- Interviews for local and regional TV and radio stations.

The planetarium activities also provide valuable experiences for scholarship recipients who are students enrolled in Physics course. It is crucial to integrate discussions about teaching and learning processes within non-formal spaces like the planetarium into Natural Sciences degree programs. Such integration contributes significantly to the creation of activities and methodologies that encourage interaction between educational institutions and alternative learning environments.

3. Conclusions

Planetariums are excellent examples of non-formal learning environments that host various extension activities. They offer a unique and immersive setting where individuals can explore and learn about astronomy, space science, and the universe. Additionally, planetariums provide access to astronomy and space science education for people who might not otherwise have exposure to these subjects due to geographical limitations, lack of resources, or other constraints. Furthermore, they ignite curiosity and interest in astronomy and science, motivating visitors to continue learning beyond their visit by exploring additional resources or attending future events.

Based on the results presented, it can be concluded that the extension program is fulfilling the established objectives and contributing to the popularization and dissemination of science. Like other planetariums operating in Brazil, the majority of visitors are basic education students.

It can also be concluded that this extension program serves as a facilitating environment, supplying teaching and research, composing the three axes of actions that underlie the activities of universities in Brazil.

Acknowledgements. We are grateful to UFSJ and PROEX for scholarship extensions. Additionally, we thank the Research Support Foundation of the State of Minas Gerais (FAPEMIG) for their financial support in the development of projects APQ-02650-22 and APQ-03318-22.

References

Carvalho, C. L., Zanitti, M. H. R., Felicidade, B. L., Gomes, A. D. T., Dias, E. W., Coelho, F. O. 2016, Revista Amazônica de Ensino de Ciências, 9, 214.
Costa, P. M. D.; Santos, S. R. M.; Grinspun, M. P. S. Z. 2009, Meta: Avaliação, 1, 3.
Fraser, J. et al. 2012, Museum Management and Curatorship, 27, 2.
Gohn, M. D. G. 2006, Ensaio: avaliação e políticas públicas em educação, 14, 50.
Langhi, R., Nardi, R. 2009, RBEF, 31, 4402.
Santos, A. H. 2016, Revista Teias, 17,44.
Trilla, J. 2003, La educación fuera de la escuela: ámbitos no formales y educación social, Barcelona: Ariel Educación.
Yu, K. C.2005, Planetarian, 34, 6.