Non Formal Education for Schools Under the Dome

Ilídio André Costa¹,², Daniel Folha¹,²,³, Pedro Pedrosa¹,², Paulo Pereira¹,², Filipe Pires¹,², Ricardo Reis¹,²

¹ Planetário do Porto – Centro Ciência Viva
² Instituto de Astrofísica e Ciências do Espaço
³ Instituto Universitário de Ciências da Saúde
⁴ Agrupamento de Escolas de Santa Bárbara

Email: daniel.folha@astro.up.pt

ABSTRACT

In 2016 we started a thorough analysis of the Porto Planetarium educational offer, which revealed the necessity to think more in depth on how to potentiate formal education in our non-formal education setting. As a result, we started producing additional fulldome contents in the specific context of the formal school curricular contents and goals. This paper relates to an educational module made up from a live fulldome presentation, linking its contents to the 10th grade Biology-Geology curriculum and noting how the planetarium presentation is of added value.

I. THE PORTO PLANETARIUM – CIÊNCIA VIVA CENTRE

The Porto Planetarium (hereafter Planetarium) completes 20 years in 2018. It was created in a very specific environment, built from the outset so that the creation of scientific knowledge in astronomy and astrophysics (A&A) lives in close connection to the promotion of scientific culture and the dissemination of knowledge and attitudes, especially to young people. It is still operated within this context, being run by Centre for Astrophysics of the University of Porto (CAUP) on behalf of the University of Porto. CAUP is also the host institution of Instituto de Astrofísica e Ciências do Espaço (IA), the largest Portuguese research centre in A&A, which scientifically supervises the Planetarium activities.

The Planetarium is a member of the Network of Ciência Viva Centres. This is a network of twenty science centres in Portugal, led by Ciência Viva, the National Agency for the promotion of initiatives for the public awareness of science and technology in Portugal (Rede de Centros Ciência Viva 2018). The network mission is to promote an active citizenship based on scientific knowledge.

From June 2014 to June 2015 major overhaul works were carried out under the dome, with the installation of a new dome screen, the implementation of a unidirectional seating plan and the installation of a RSA Cosmos ISS 2C 3K digital projection system running SkyExplorer, bringing the Planetarium into the digital era.

At the reopening, in June 2015, we debuted into the licensed realm of fulldome films with “Life – a cosmic story”, by California Academy of Sciences. This was a move designed to start expanding our education offer beyond A&A, with Biology and Geology in mind and their connection to A&A in the wider context of Astrobiology.

II. SCIENCE COMMUNICATION, OUTEREACH AND TEACHING

Science communication, outreach and teaching are different concepts, worthwhile exploring here.

II.1 Science Communication and Outreach

Science outreach is the dissemination of knowledge and scientific skills for an audience that adheres voluntarily to the dissemination activities (Bueno, 2010; Crato, 2016; Fernandes, 2011). For these authors, science outreach and science communication are separate concepts, with the latter emerging as the dissemination of contents between peers. Such notion is not, however, consensual, as seen in Lewenstein (2003) and in Burns, O’Connor & Stocklmayer (2003).
Science outreach aims at a captivating approach towards the communication of scientific knowledge, giving particular attention to the understanding of concepts and not being limited to conveying scientific facts, always without sacrificing scientific rigour. As such, outreach has a key role in capturing the public interest in science and promoting scientific literacy. It informs the public about actual and important scientific subjects, it reveals sources and promotes taking pleasure in knowledge. It shows science as another human creation which, as such, is part of our everyday lives and of our culture.

Science outreach does not replace science education, however the particular interest of science outreach in simplicity and in provoking a feeling of wonder can become a starting point for moments of science education. In truth, one of the most important causes for educational underachievement resides in the lack of an emotional connection between pupils and curricular contents, leading to a lack of motivation to learn them. Models of science outreach may bring an added value in this regard.

II.2 Teaching and education

While often used indistinctly, the concepts of teaching and education enclose paradigmatic differences that make them even incompatible.

The use of the concept of education in detriment of the concept of teaching, relies on the assumption that one of the school missions is, beyond teaching, educating. The idea that a teacher should only be concerned with the act of teaching is, for some authors, very reductionist. More than delineating didactic sequences for the understanding of knowledge, the school thinks about the mobilization of knowledge and skills developed by pupils, as well as on the system of values.

Science education (Crato, 2016), as all formal teaching, is an organized process, with programs (and/or curricular goals) and with moments of formal evaluation that contribute decisively for obtaining a certification. Given its nature and the amount of time dedicated to it, science education is the largest contributor for scientific literacy amongst pupils.

While outreach is able to choose the themes in which it wants to captivate the public interest, even if only occasionally and in a dispersed fashion, such is not an option for science education. While for outreach to awake for the pleasure in knowledge may be enough, for education the goal is the positive appreciation of an whole program, including the diversity of themes it may include and, most importantly, the mobilization of knowledge and skills.

Using an example from Physics or Chemistry: while for an outreach communicator a set of physics/chemistry “magic” may be enough to fulfill the objectives, for an educator the “magic” is just the beginning of the process.

The most used distinction between formal, informal and non-formal teaching appears with Maarschalk (1988). Formal teaching is highly structured, it takes place at schools and universities, following a predetermined program that is similar for all students of that school level. Non-formal teaching occurs outside the schools, in places like museums, science centres and other institutions that organize training initiatives. This type of teaching is developed according to the wishes of the participants. Finally, informal teaching occurs spontaneously on a daily basis, from non-programmed experiences, such as conversations and other occasional social interactions. Some authors, like Scott (2016), do not distinguish between non-formal and informal teaching, labelling as informal all learning taking place outside of a school context.

III. SCIENCE EDUCATION AT THE PORTO PLANETARIUM

Astronomy is a subject present in the Portuguese formal education from the very early school years.

Curricular guidelines for pre-school education (3 to 5 year old children) allow for Astronomy to be tackled within the “world knowledge” area content. It firstly attains special relevance on the 3rd grade (8 and 9 year old children), by having a dedicated chapter on Celestial Objects within the “Estudo do Meio” (Study of our Surroundings) curricular discipline. From here onwards, while present in the curricula of all grades, it is dispersed through different curricular disciplines, featuring most prominently in the 7th grade (12/13 year olds) “Physical and Chemical Sciences” discipline and in the 8th grade (13/14 year olds) “Natural Sciences” discipline.

School groups represent around 70% of the total number of visitors to the Planetarium. School teachers are the driving force behind those visits, their motivation resulting from the possibility of tackling, at the Planetarium, specific curricular goals that are more difficult to work in the classroom.

Within this framework, during the 2016/2017 school year, we have analysed our educational materials (own and licensed from others) and produced additional fulldome contents in the specific context of the formal school curricular contents and goals. As
a result, the whole Planetarium program for schools was completely reorganized in order to provide a true non formal educational program that complements classroom work carried out at the schools.

We identified an opportunity in the context of the 10th grade Biology and Geology (BG10) curriculum. The Planetarium is licensed to show the fulldome movie “Life - a cosmic story” (produced by the California Academy of Sciences), whose subject is strongly related to that curriculum. To enhance the relevance of a planetarium show specific for the BG10 subject, after “Life” we present a 13 minute long live module, produced with RSA Cosmos’ SkyExplorer 4, with sequences that, despite being associated to astronomy, were chosen due to their relevance for the BG10 curriculum.

![Figure 1: Cutting a slice through the Earth showing a model of its interior.](image1)

![Figure 2: The Orion Nebula star forming region.](image2)

![Figure 3: Returning from the Oort Cloud, to follow a comet to the inner solar system.](image3)

![Figure 4: A comet as seen from near Meteor Crater.](image4)

We start from the northern hemisphere winter sky, focusing our attention on the Orion and Taurus constellations as home to important star and planet formation regions. Lifting off from the Earth, the attention is focused on the Earth/Moon system and from there we move to a general view of the Solar System. We visit the remaining telluric planets, reach out to the asteroid belt
and pay a visit to the giant planets. We proceed to the Kuiper belt and to the Oort cloud. We then start following a comet through the inner Solar System and finally return to Earth to witness a meteor shower and see the result of a significant impact on our planet’s surface.

REFERENCES


