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Dark Skies Rangers: a flagship to bridge the gap between schools and communities

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Abstract. A large network of European schools is currently being created in the framework of the Open Schools for Open Societies (OSOS) H2020 project. The main goals of OSOS are to enable schools to become hubs for science communication in their local communities, to be incubators of exploration and invention, to be accelerators of innovation and to promote open schooling. Dark Skies Rangers (DSR), one of the flagships of OSOS, is a project focused on fighting the light pollution and giving back starry skies to the worldwide populations. It tries to create awareness for the impact of light pollution in our economy, in security, in ecosystems and in human health, thus meeting the goal of protecting dark and quiet skies of the IAU Strategic Plan for the 2020-2030 decade. DSR is being used as an accelerator for OSOS, *i.e.*, an idea that facilitates the transition from a traditional teaching system to an open schooling model, where students identify problems within their local communities and carry out scientific projects with the aim of solving them. In this paper we will present OSOS and will focus on DSR, describing several examples of how communication efforts being implemented in Portuguese schools are affecting the behaviour of local communities, authorities and policy makers towards the creation of awareness for the problematic of light pollution, and designing innovative solutions.

Keywords. OSOS, open schooling, education, community, light pollution, dark skies.

1. Introduction

Studies publish during the last ten years, such as UNESCO ICT CFT (2011), Rocard et al. (2007), and Kearney (2015) have demonstrated the importance of teachers in the improvement and renewal of science education, and present them as the key players in this process. Science, and in particular high quality scientific education, contribute to a sustained growth of economies and general development of countries, by fuelling innovation, research and technological development (RTD or R&D), productivity and competitiveness. It is fundamental to invest in human capital, and to provide populations in general of scientific and technical skills that will help everybody to succeed in a digital era characterised by a society increasingly dependent on the use of knowledge at a global level. Improving the education system both at the teacher and student levels is a slow and ongoing process, that has to be continuously supported by the education policy makers (Gomes et al., 2018).

Acknowledging that isolation is one of the greatest barriers to educational innovation, Europe has been testing the open schooling model in several pilot countries, in which schools become reference centres for science and technology. These *Open Schooling Hubs* bring people from all sectors of the society together, increasing the opportunities for teachers and students to interact with other stakeholders.

2. Open Schools for Open Societies

The Open Schools for Open Societies (OSOS, fig. 1) is a Horizon 2020 project that tries to include the local community in the learning process. It aims at building and growing a framework of open schools, where students develop projects that meet real needs in the community outside the school, thus drawing upon local expertise and experience, and where they present the results of their research publicly.

The main aim of OSOS is to facilitate the transformation of schools from traditional ones to open schools, *i.e.*, innovative ecosystems where students, teachers and local community work together in order to solve common problems. Open schools are science hubs that foster responsible citizenship and the independence of students through collaboration, mentoring and by providing opportunities for learners to understand and interrogate their place in the world (Sotiriou & Cherouvis, 2017).

Figure 1. The OSOS logo.

3. OSOS projects

Students projects developed within the framework of OSOS must be multidisciplinary, and based on active learning. They are student-centred, and parents play a key role in the learning process.

OSOS projects must comprise four phases — *Feel*, *Imagine*, *Create* and *Share* — which are built upon the typical steps of *Design Thinking*. Students start by identifying problems and needs in their local communities (the **Feel** phase), then they think about possible solutions for the identified problems (the **Imagine** phase), after which they create and implement those solutions (the **Create** phase), and finally they present their results to the community (the **Share** phase). All these phases have to follow an RRI (Responsible Research & Innovation) approach. During the Feel phase, learners are introduced to several stakeholders in addition to their parents, such as universities and research institutes, other teachers, colleagues and school staff, local community (industry, companies, associations and municipality), museums and science centres, just to name a few (fig. 2). In order to boost their involvement, teachers use techniques such as collaborative workshops, public conferences, participatory debates, media, and local visits. Students are encouraged to engage those stakeholders or others throughout the development of their projects.

OSOS projects can be of any nature and, thus, can be drawn upon in any school subject. In particular, STEM projects are encouraged to follow the Inquiry-based Learning (IBL) methodology, a particular branch of active learning that acknowledges the importance of the scientific method in unravelling the mysteries of Nature.

4. Inspiring projects: Dark Skies Rangers

OSOS is supporting schools with inspiring projects, which act as accelerators for the introduction of the open schooling approach and, thus, facilitate the transformation of a traditional school to an open one. One of those accelerators is Dark Skies Rangers (DSR).

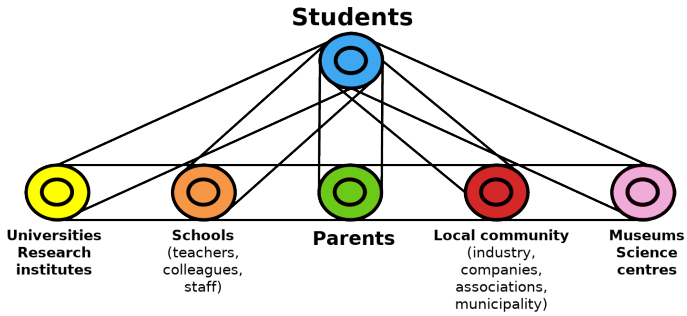

Figure 2. Several stakeholders can interact with students during the learning process (adapted from Sotiriou & Cherouvis (2017)).

DSR is an international project which was born in 2009, during the International Year of Astronomy (IYA2009). It aims at fighting the problem of light pollution in all its aspects, by raising awareness among the educational community and local authorities to its impact in the economy, in security, in wildlife and in human health. In practice, the major goal of DSR is to change the lighting systems of our communities and to preserve the night sky.

Within the framework of OSOS, students have been implementing several creative ideas to fight light pollution. One of the most popular is audits to streets, schools, and public buildings, in which students perform measurements of distances and intensity of lights, identify luminaries and try to understand their purpose (fig. 3). Frequently, they have to combine skills and knowledge from different subjects, such as Mathematics, Physics and Geography.

Figure 3. Examples of audits carried out by the students at streets, public buildings and schools. Parents and educators participated in the activities. The names of the students are indicated within the photos.

In the Share phase, students come up with various creative ways to engage the commu-

nity in the learning process and to disseminate their results and conclusions. For example, one of the students, Ins Prola from Porto (Portugal), had the brilliant idea of making the disclosure about light pollution by asking people from the Internet to join her showing the world they want to see the stars (fig. 4).

Figure 4. Ins Prola (*left*) took a picture at Estdio do Drago, in Porto, and published that picture in social media, asking people to take similar photos and show everybody they also want to be able to see the night sky. An example of such a photo, taken in New York, is shown on the right (names of the people unknown).

In another city of the North of Portugal, Francisco Pires, a student from the second grade, after performing an audit to his street, he sent a one-minute video to the mayor of Vila Real asking him to replace the street lamps, because they produced way too much light pollution and, therefore, he could not become a poet – and poets need the stars to feel inspired... As a result, the mayor did change the street lamps of Francisco's street, and his city became the first in Portugal to adopt strict measures to prevent and fight light pollution (fig. 5).

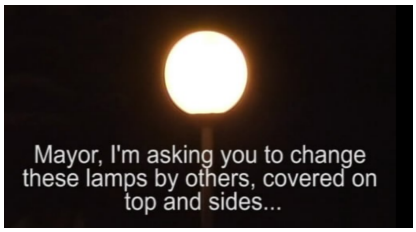

Figure 5. A frame from the one-minute video that Francisco Pires (seven years old) recorded of his street in 2014 and sent to the Mayor of Vila Real (Portugal).

5. Conclusions

The OSOS project is successfully implementing the open schooling model in Europe, where students identify real problems of their communities and develop projects to tackle them. DSR is one of those projects with proved value, that since 2009 has created awareness to the problematic of light pollution around the world, and has significantly helped students and their communities to fight light pollution.

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Discussion

Unidentified teacher from France: I'm wondering if your activities can be used in other countries than Portugal...

Gomes: Indeed, our activities are all translated in English, and since they were not specifically designed for a particular school, they can be adapted and carried out in any part of the world.