

Discovering Light. The 5th Science Fair Hands-on Science

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Abstract. Inscribed in the celebrations of the International Year of Light, IYL2015, in Portugal, the Hands-on Science Network Association together with the Portuguese Society of Optics and Photonics¹⁵, SPOF, and with the support of the European Physical Society, organised the 5th Science Fair Hands-on Science this year under the main theme "DISCOVERING LIGHT".

The competition was open to students and groups of students, but also teachers and educators of all levels of education, from pre-primary to higher education and to anyone interested on science and science education. Over hundred contributions were considered of all kinds, from hands-on experiments to experimental demonstrations, posters and lectures but also dance and drama performances as well as other artistic expressions such as drawings, poems, and even songs... all vivid expression of a fertile imagination creativity and ingenuity with a true and sound interest of the participants on science and specially on light optics and its applications.

Themes were the most varied, not only related to the physical properties of light and its multiple applications or to the different and extraordinary optical phenomena or optical instruments that make our lives easier and more interesting and which are so important for the development of our societies, but also those in the fields of dream and "magic" ... connecting in fact all dimensions of the human being in most interesting and pleasant ways.

The science fair held in Viana do Castelo, northwest of Portugal, May 25, 2015, enrolled over five hundred participants and a few hundred visitors in an exciting and most lively and enjoyable day that surely contributed significantly to raise the awareness of the importance and appeal of Optics and Photonics.

Keywords. IYL2015, Light, Optics, Science Fair, Hands-on Science

1. Introduction

Science fairs are currently recognized as important activities in science education by numerous skills that they can develop in students because they should behave as investigators/researchers when developing their project. Students should define and understand the nature of the problem that they have to solve [1]. Students will gain the ability to solve problems, since they need to make decisions and create alternative hypotheses. On the other hand they develop creativity and imagination [1].

The informal environment of a science fair competition process allow the students to develop skills that make possible to them to establish a relationship between cognitive, affective and social knowledge [2].

The active involvement of students in their learning process through this kind of hands-on activities is one of the most effective methods to engage students on science learning [3].

Previous editions of the "Hands-on Science" science fair showed the enthusiasm and commitment of the students and illustrated the aforementioned benefits of science fair for the students, their teachers and schools [4,5,6].

2015 was designated by UNESCO "The International Year of Light " in recognition of the importance of light and technologies related to light in promoting sustainable development and the search for solutions to global societal challenges in the fields of energy, education, agriculture and health, and in all fields of industry an human life. Being optics one of the key development enabling domains of science it was decided

to set light as the main theme of the 5th edition of the HSCI science fair.

2. Organization

The Hands-on Science science fair already in the fifth edition set a well established reputation among schools and educational institutions in Portugal. This year it was set as a special edition dedicated to IYL2015, the International Year of light, and was organized together with the Portuguese Society of Optics and Photonics, SPOF, and endorsed by the European Physical Society.

As in previous years advertising the initiative was done through the web pages created for this purpose (www.optica.pt/iyl2015) and through e-mailing sent to former participants and to schools all over the country. It was also extensively advertised among to the members of HSCI and SPOF and by the European Physical Society and through the website of the International Year of Light (www.light2015.org). Several Portuguese universities (the universities of Minho, Porto, Aveiro, Beira Interior, Madeira and Algarve) and the Erentay Egitim Danismanlik (<http://www.erentayegitim.com/>) were also actively involved in the process.

This good dissemination the remarkable attraction to this subject but also an extension of the age range open to participation (in previous years it was only open to the participation of students aged between 10 and 18 years old but in this edition it was open from 4 year olds to adults) led to an increase on the number of participants surpassing five hundred.

The event was announced at the beginning of the school year in September. Participants had until the beginning of the month of April to sign up. To participate the teams (group, individual or institutional) had to fill a form with some relevant information about their project and team. With this information the organizing committee divided the projects by categories and began preparing the competition. The projects that were not directly related with the main theme of fair, the light, but who respected the general rules of the science fair were accepted 5th edition to specific categories set as regular science fair.

At the beginning of the month of May, each group had to confirm their participation and upload to the competition website (www.optica.pt/iyl2015) and abstract and all relevant material concerning the work to be presented at the science fair to be held in the premises of the Colégio do Minho school in Viana do Castelo, May 25, 2015. All submitted material remains accessible on the website for consultation. Other important information such as arrival time, water and electric current need, number of tables necessary to their presentation, multimedia, poster stands, etc... Given the particular theme of this year's science fair, light, a main concern was the availability of darkened spaces for the presentations.

To meet the needs of all participants we organized different spaces: a gym, a place outdoors but protected from the sun, two dark rooms and a large stage, also darkened.

As always the science fair was open for visit and participation of other students the local community and general public. Several schools made the request for the visit and these early appointments facilitated the organization the event and guarantee a smooth development of the fair in spite the over one thousand, enthusiastic participants.

On the science fair day, in order to help in the organization process thirty high school students of the *Colégio do Minho* were enrolled as organization staff. The function of these students was to help in the organization of the space, welcoming and assistance to participants and visitors. Not only their work and efforts were fundamental to the success of the fair as they greatly and proudly enjoy it.

3. Participants

The participants of the 5th Hands-on Science science fair were divided in two main large groups: of projects related with light and projects with other themes (mainly environment related).

The two large groups were also subdivided by categories, based on their ages. Therefore, projects related with light were divided in 5 levels:

Level A – students from pre -school to 1st cycle (4 to 8 years old)

Level B - students from 2nd and 3rd cycles (9 to 14 years old)

Level C - students in secondary schools and vocational education (15 to 18 years old).

Level D - university students, teachers and educators, or other adults.

Level E - Schools, or other institutions.

The distribution of the hundred projects accepted for the “Discovering Light” science fair competition by category is shown on Figure 1. There were projects from all levels. However the stronger group came to basic/primary school level. To notice the not so usual involvement of adults and institutions. More than a typical science fair (and the HSCI’ science fair have a particular twist on the focus given to the investigative hands-on process of the preparation of the projects and the open informal and friendly interactive atmosphere of the fair that we actually called “Festa” – that is “party” in Portuguese...)

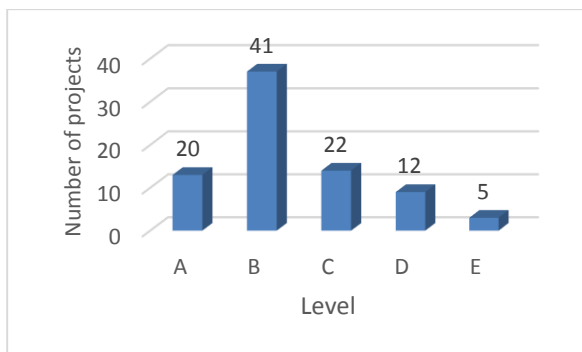


Figure 1-Distribution of projects on the light subject.

A few projects that were accepted did not participate at the “Festa da Luz” essentially due either to lack of time to finish their projects or to the impossibility to travel to Viana do Castelo.

The projects with topics unrelated to light were about 70 including 30 posters brought from Turkey’ project “S.O.S., Saving Our Species”. Since there were in lower number, they were divided in only two groups, as can be seen in Figure 2:

1st level – students from 2nd and 3rd cycles (ages between 10 and 15 years old);

2nd level – students from secondary school or university (15 to 22 years old).

In both cases, the larger participation lied with students from 10 to 18 years old.

The projects could address any area of knowledge and have different forms of presentation. Only on the subject of light we had the participation of younger students and also of teachers and institutions.

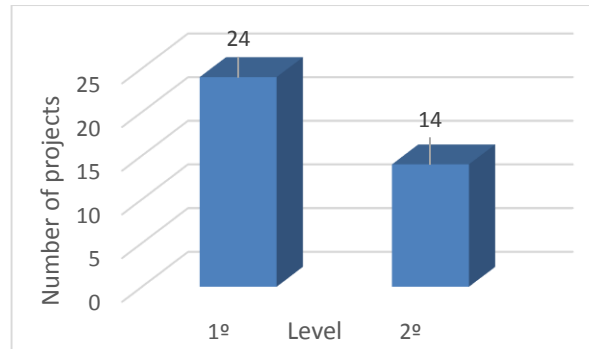


Figure 2 - Number of projects not related with light.

The majority of participants came from Portugal as it was initially intended. However the “Discovering Light” science fair raise interest in other countries. A large delegation of 41 participants from Turkey brought to Viana do Castelo lots of enthusiasm and 37 interesting projects of different types from hands-on demonstrations, exhibitions, boots, posters, as well as music and dance celebrating light with lots of creativity.

4. Brief overview of the projects

It was allowed to submit projects of a wide variety of kinds (www.optica.pt/iyl2015) to be presented in a wide variety of forms: from hands-on experiments and demonstrations, boots, exhibitions, posters or oral presentations, paintings or sculpture, drama and performances including music and dance.

Thus, there was an in fact high diversity of themes and types of presentations.

Some of the projects were presented in an expositive way, through posters, multimedia presentations or models. As an example we have the "Sustainable Eco City" with a model of a city where recycling is favored and renewable energy is used, such as wind power and solar energy, as it can be seen on Figure 3.



Figure 3 - "Eco Sustainable City" - Honorable Mention of the 1st category of projects unrelated to light.

Some projects were more interactive allowing the visitors interact with the projects, as the one in Figure 4.

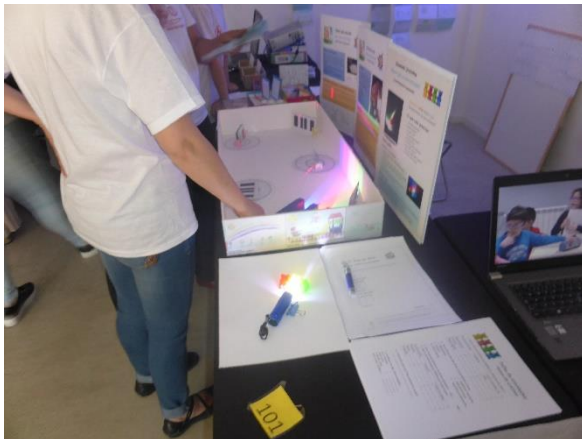


Figure 4 - Visitor experimenting one project related with light.



Figure 5- Project the "Magic and Light"

Other projects have shown to be more artistic, as seen in Figure 5, where a group of five years old students, dance to the sound of

music, accompanied by a robot they built and programmed. Based on the theme of light, the dark stage, the light combinations and the student's clothes performed a show that earned them the 3rd prize in category A.

Younger visitors were in focus several times throughout the afternoon. A moment just for them was provided by the project "A story with Science" (Figure 6) which consisted on a story read to them from which they participated and various everyday situations were explained to them through physical and biological phenomenon related to light.



Figure 6 - "Story with science" for students under 10 years old.

4.1 The "winners"

Of course prizes were a small part of all science fair contest. However the effort of all had to be recognized and lots of very interesting project were presented to the evaluators. Given the large number of projects involved we set up different groups of judges according to the contest level.

To evaluate the projects, some parameters were set to be taken into special account:

- Originality of ideas and projects and their implementation;
- Creativity;
- Innovation;
- Experimental and scientific rigor.
- Broad knowledge of the subject;
- Safety Precautions;

- Scientific-technical or artistic quality and presentation;
- Aesthetic quality of the presentation;
- Interdisciplinary / mainstreaming;
- Involvement of colleagues, family and / or community;
- Interaction with visitors and other participants.

For the task of evaluating, we created groups of juries with 2 or 3 members, where the majority was specialist on the scientific subject of the project. Three groups evaluated one category.

The evaluation process was divided into two parts: the analysis of the projects description that each group submitted when they made the application and its presentation on the science fair day. At the science fair each group of jury members evaluated the presentation of the respective projects in order to give the final classification. Some of the reviews coincided with the previous evaluation performed by the description, but in some cases, oral presentations made the difference.

All students that participated and responsible teachers involved received certificates of participation and a t-shirt of souvenir. At the end of the day, awards and honorable mentions were given in each of the categories.

5. Conclusions

As in previous editions, the 5th Science Fair Hands-on Science "Discovering Light" transpired in a very positive way both to participants visitors and organizers. This year's science fair had a much higher dimension than previous editions which required a larger team for the organization and heavier organizational structure. However the open mind friendly and informal spirit typical of HSCI organizations greatly facilitated the task.

Projects were presented by participants from all ages starting from 4 years old children up to adults, with a wide range of presentations types. Everybody respected and enjoyed each other with a truly *feita* (party) celebration atmosphere.

The celebration of the international year of light seems to have been a great incentive for participation in this kind of activity.

All participants stated they enjoyed to develop and present their projects and everybody could learn a bit (a lot...) more about science wanting to repeat the experience!

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