"Physics: Exhibitionist by Nature": Science Communication Meets the World of School

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Introduction

Science education and science communication have much to learn from one another.
On the one hand, some innovative teaching methods can be useful for scientific journalists and science writers. We can take as an example the stories, cartoons, videos and multimedia materials dealing with physics, biology and chemistry that are produced for students in primary and secondary education [1]. By the same token, teachers can derive benefits from the public communication of science. For example, articles dealing with science taken from newspapers and magazines can be used to make scientific subjects more accessible to all students [2] – even those who are not interested in mathematics or geology, or those who would not choose a scientific discipline at university. Despite this (apparent lack of interest), it is probable that these students are interested in the social, political and ethical effects of science that are often cited by the media: an indispensable element for members of modern democratic society.
Furthermore, many informal communication activities aimed at school-age students and above all those that take place in science centres represent a key contribution for the development of scientific awareness and of the "Public Understanding of Science and Technology" [3].
It is not a coincidence that, in recent years, education research has widened to encompass themes that have traditionally been dealt with in research into science communication. Informal science education that takes place during extra-curricular activities, or the relationship between scientific knowledge acquired at school and the promotion of responsible citizenship, are very much a part of the agenda of many science education scholars [4].
The formation and training of science communicators who deal with a school-age public is one of the themes that can be found among the aforementioned fields of research. This is a crucial aspect for generating synergy in interactions between educational systems, public science communication activities and research and promotion of scientific awareness. There is still much work to be done in this regard, if not only for the fact that training for science communicators is, as yet, not fully developed.
With this in mind, a group of students from the "Master in Science Communication" (MCS) from the SISSA (International School for Advanced Studies) developed a project entitled "Physics: exhibitionist by nature" as part of the initiatives for the World Year of Physics 2005.
The aim of the course was to create a public science communication product which would have the following characteristics:

- to address, in the first instance, students of secondary school age, but also with the possibility of being of interest to a more generic adult audience

- to put forward an image of physics that is based on knowledge-building processes and on open themes rather than, for example, on iconic-epic representations of scientists
- to give importance to artistic expression
- to promote aspects directed towards dialogue between science and society

The course and the project

The International School for Advanced Studies (SISSA), founded in 1978, is a centre for research and postgraduate studies leading to a PhD degree. Initially concentrated around the so-called "hard sciences", SISSA's Sectors have expanded to explore groundbreaking interfaces between science and the humanities. One of the outcomes of this work is the foundation of the Interdisciplinary Laboratory of Advanced Studies, set up in 1986. Among the activities of the Laboratory, special mention goes to the Master in Science Communication (MCS), a two-year part-time course aimed at providing specialized training in different fields of science communication, such as written, television and on-line journalism, institutional and business communication, traditional publishing and multimedia and museology.
Graduates from any discipline can follow the Master course. The courses themselves are distributed across three areas: one regards theory and communication techniques, one relating to scientific teaching in diverse fields and a third that is more directed towards social studies of science.
One of the fields of teaching regards physics communication. The course is held by a scientist and a public science communication expert and is directed at those who have not necessarily followed studies in physics or mathematics, but who are training to become science communication experts and will therefore deal with these subjects.
The problem of what type of training to give a class with the aforementioned characteristics is, in some aspects, similar to the situation that faces many primary and secondary school teachers that are dealing with scientific subjects. It is enough to mention the vast difference between the learning of concepts and the problems related to science and the speed at which scientific research takes place. The former is much slower than the latter, with consequences that are certainly relevant for education but also for science communication.
The Master course is subdivided into eight lessons, each one lasting four hours. Every lesson centres on a different theme in physics, dealt with both on a scientific and a communicative level. The choice of topics depends largely on the teachers holding the lesson, but also changes according to public relevance, on the social effects and therefore on the communicative ‘spendability’ of the theme in question.
The chosen topics were as follows:

- natural constants
- entropy
- asintotic behaviour
- Higgs’ boson
- geometry, relativity, gravity
- multibodies
- dark matter
- *supernovae*
- strings

As far as the communicative output is concerned, during the first lesson it was decided to present outcomes on display boards of 60x120cm. The reasons for these decisions were based on the consideration that, given the limited time and resources available, the display boards were the best way of meeting the objectives of the project.
From one month to the next, the students' task was to produce texts and images inspired by the topics discussed during the lesson. The task was designated after having established a homogenous layout for all the boards. At the end, twelve boards were created, symbolising the 12 months of the World Year of Physics.

Examples

The following gives two examples of the work produced by the students. One dealing with natural constants (panel 1) and the other looks at entropy (panel 2).
The headline in each panel (the English text is in the captions) deals with the relationship between physics and nature. It is important to mention that this link is intended in a metaphorical sense: the intention is not to explain or inform. As well as this, where the body copy contains information, it is very bare and the combination of text and images has the aim of evoking a sensation through an aesthetic presentation.
In the first example (panel 1) the image is of a metaphorical identity card belonging to the universe, with natural constants as its distinguishing features. Entropy (panel 2) has been represented by an overturned glass of milk. These everyday images were used in a context whose aim is not to simplify, render more banal or indeed more spectacular. Rather we hoped to arouse greater interest in an audience that already has questions or ideas regarding the topics in question – we believe that such characteristics can be found among secondary school students.

Panel 1. Headline: Physics: constant by nature **Body copy**: The building blocks of physics: *h bar*, turnkey of quantum mechanics, *c*, speed of light G, constant of universal gravitation. All the measurable quantities of the Universe, the microcosmos and the macrocosmos, can be expressed by these constants. **Text on the identity card:** *Name:*UNIVERSE; *Born:* 14 BILLION YEARS AGO; *State* IN EXPANSION; *distinguishing features*: h bar c G; *Signature of holder:* infinity

Panel 2. Headline: Physics: messy by nature **Body copy**: Entropy: everything becomes more and more disordered. There is no turning back: time travels one way only. The Universe's entropy continues to grow.

Conclusions

The aforementioned experience can be useful for those dealing with the teaching of scientific subjects. The "Physics: exhibitionist by nature" project is an example of how people that do not have a specifically scientific background can come up with communication products that deal with the more difficult aspects of physics. If the product's aim is not that of explanation, even students with less technical preparation can be successful in creating communicative solutions. Indeed, motivated in this way, it is possible that the students will produce images and syntheses that are closer to the reality of those that are interested in physics or would like to know more about it, but who have a kind of reverential fear that prevents them from exploring the subject further.

A similar experience, remodelled for secondary school students, still following the two-part model with one scientific and one dealing with techniques of communication, can be useful for describing scientific research as a process and not (as is too often seen in scientific manuals) as a series of discoveries without context. Apart from the aesthetic judgement that one may give to the panels, the project also demonstrates how science can be communicated through research into artistic expression. We maintain, therefore, that teachers and students, through public science communication projects such as the one described, can be increasingly motivated to think about how to display science in a social context.

The major limitations to the initiative reside in the fact that as yet, no evaluation methods have been developed in order to assess what type of effect the displaying of the panels could have on those that look at them – in particular secondary school students at whom the product was specifically aimed. Another aspect, which merits further study in a possible future project, regards the relationship between the themes dealt with and the notions that students learn from textbooks. A study of this relationship could make both the choice of themes and the realisation of the communication product more useful.

References

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