

“CATCH THE STARS IN THE NET!”

Eight Years of Experience in Communicating Astronomy via New Technologies

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ABSTRACT

The authors describe their work and experience gathered in the field of Public Outreach Education (POE) and Information in Astronomy over the last 8 years, mainly but not only, through the web. “Catch the stars in the Net!” is a long term project made up of many initiatives for nearly all types of possible users: young, students, amateurs, general public or the merely curious. All the initiatives are developed within a focus group on the framework for the particular field and then, after this experimental phase, are published and managed on the web. There are more than 33 astronomica independent websites in Italian on the project webserver; all of them are reachable from one “Web door” with the name “*Prendi le Stelle nella Rete!*” (Catch the Stars in the Net) at the url: www.lestelle.net. We have called it a “Web door” because it is neither a simple Home Page nor a Web Portal, but presents all the related websites in a well structured way to facilitate their use by the different types of user for different purposes. Half of the 33 websites are in English, and they are all reachable from the url: www.astro2000.org. The project was born from and has developed in parallel with emerging technologies: from the first website in 1997, to the weekly news bulletin in streaming audio/video in 2000, to the last project with wireless technology for an astrophysical mobile learning programme, supported by industry, undertaken this year at primary and middle schools.

INTRODUCTION

The authors work at the National Institute for Astrophysics, INAF, which was established in July 2000. INAF is the Central Administration Institute that promotes and coordinates research activities in astrophysics in Italy through its network of 12 Italian Astronomical Observatories and 3 research institutes of the Italian National Research Council that joined INAF in January 2004. INAF also manages two National Observing Facilities: the Telescopio Nazionale Galileo Galilei (TNG), La Palma (TF—Spain) and the Large Binocular Telescope (LBT), Mount Graham (Arizona-U.S.). INAF has more than 600 staff researchers and 500 technicians and administrative people on the permanent staff.

By law, INAF must contribute to basic and advanced education at all levels from schools to universities, in other words, function as Public Outreach of Astrophysics and Space Science. As an example we can quote two important acts of INAF in the field of POE: the coordination of a national initiative for the Venus Transit 2004 (www.astro2000.org).

pd.astro.it/thersites/venere/) for the general public, schools and also the press (in collaboration with the European Southern Observatory). The second initiative was related to the inauguration of Large Binocular Telescope for which several products, from a website (www.lbt.it) to a brochure were produced for the press.

INAF is a new research institute, but it is supported by the long-term experience in astrophysics education, information and outreach gained by the astronomical observatories and the other research institutes that constitute it. An INAF Press Office was established in 2003 and is working hard to set up the necessary communication links with the media and with the researchers themselves. Regarding communication with the public, we expect to have full operability before the end of this year.

Among several groups involved in the outreach, education and information activities at INAF, the Astronomical Observatory of Padova (Padua) has acquired a strong and successful track record over the past years. This group is composed of astronomers who have been working in science education, learning and outreach since 1997, both through webstreaming and conventional media (presence at schools, exhibits, newspapers and magazines). The team has a solid background in astrophysics outreach, information and teaching, and is supported by a wealth of technological skills.

The Web door is hosted on the Padova Observatory webserver where there are several other Public Outreach projects. The main bulk of these are made up of more than 33 independent astronomical websites in Italian; all of them are reachable from one “Web door” with the name *“Prendi le Stelle nella Rete!”* (Catch the Stars in the Net!) at the url: www.lestelle.net. We call it a “Web door” because it is neither a simple Home Page, nor a Web Portal, but it presents all the websites in a well structured way to facilitate their use by different kinds of users for different purposes. Half of these 33 websites are in English and they are all reachable from the webpage www.astro2000.org.

Our information activities have an important role and include a daily Astronews bulletin, www.astronews.it, and a weekly audio and video astronomical bulletin, Urania, at the url: www.cieloblu.it. We also host the European Association for Astronomy Education Italian website.

Some statistics: we answer about 1,200 questions per year and there are nearly 5,000 subscribers to our weekly newsletter. We reach more than 100,000 users a year and register thousands of hits per day when a particular astronomical event occurs (such as an eclipse, Venus transit, etc.). Furthermore the group, thanks to

THE “WEB DOOR” CATCH THE STARS IN THE NET!

COMMUNICATION IS A PROCESS OF NEGOTIATION

both new and former connections, manages a very large network of Italian schools (1,014 at the time of writing). Suffice to say that the Web door only represents the “visible” part of a more complex project of didactics and popularisation of our science, astrophysics.

At the present, material for several different groups of people are available: for example, school children from primary to the secondary school level; people with disabilities and people who have a real interest in astrophysics or just want to “know more” about the sky.

We will not catalogue all our projects here as they are all visible on web, but concentrate on just a few of the numerous experiences and projects realized and managed by “Catch the Stars in the Net!” that are strictly related to the key point we wish to stress here. That is: we (people who work for and in an astrophysical research institute) are privileged. We are privileged because we have time to test a variety of new approaches with the public, to test new media, to apply new technologies and, last, but not least, to test new content. Moreover, we share a common knowledge with the main actors of scientific research, and can use emerging technologies before they spread into the community. We also have time to reflect on what kind of content and languages are most appropriate to the presentation of astrophysics to the public.

But what do we mean when we say “to test”? We mean that all our initiatives are first planned and then developed within a focus group, which gives us the proper feedback and then, only after this test phase, are they published and managed on the web. In our opinion testing is fundamental for good communication because we live in rapidly changing times; in particular, as far as science and technology is concerned we have never presumed to know exactly what and how it should be communicated.

To express this idea we would like to use the words of Jane Gregory and Steve Miller:

“[...] key to the relationship between science and the public is trust, and that trust is established through the negotiation of a mutual understanding, rather than through statements of authority or of facts!”

“[...] Models of the public and their understanding have developed from the passive and empty “black box” to an active, discriminating body which should choose information within its own cultural framework. Models of communication too have become more complex as the transmitter-receiver descriptions have failed to account for the variety of interactions observed between communicator and audience.

“[...] The recipient of the communication is a complex human being whose back-

ground, beliefs, and sensibilities play a large part in his reactions to scientific knowledge.

Communication is a process of negotiation: it is one of a mutual getting-to-know. Science communication is a process of generating new, mutually acceptable knowledge, attitudes and practices. It is a dynamic exchange, as disparate groups find a way of sharing a single message. Negotiation is a two way process: if the public needs are to be met, they must be put in the position to articulate what these needs are.” (“A protocol for Science communication for the public understanding of Science” Sept. 2004, University College London)

The group “Catch the Stars in the Net!” has been involved in education and e-learning activities, focussed on young people and schools since 1997. Our experience in education has grown steadily thanks to collaborations with teachers and learning experts. Keeping in mind what we have just said about the way we work on our projects, be they education or information activities, let us proceed with a first example of best practice: the Virtual Planetarium (www.pd.astro.it/education/PlanetV/planetarium/). This is an interactive online astronomy course. The Virtual Planetarium was designed to provide children with a new tool for learning the basics of astronomy. The course is amusing, but at the same time rigorous: it provides teachers with various images, animations and examples to reinforce children’s knowledge. Furthermore it was the first interactive astronomical website in Italian!

The Virtual Planetarium has been tested in several schools during the second part of the school year 1997/98 and during the whole of the school year 1998/99, with the goal of verifying the efficiency of the used methodology and language and to identify possible mistakes and deficiencies. Basic astronomical concepts are introduced progressively, each new level depends on the knowledge acquired in the previous level and the user can access it only after the successful completion of a test about the acquired concepts from the completed level.

The used methodology is the “Karplus cycle” (Atkin & Karplus, 1962; Karplus et al., 1976), which asserts that the correct acquisition of concepts is strictly related to the removal of misconceptions. A list of the most common misconceptions has been prepared, and it can be browsed. They have been used to set the basis for a series of preliminary tests. Responses to targeted questions identify pre-existing misconceptions. In order to remove these misconceptions, observations or lines of reasoning are proposed that lead to a contradiction with the remaining conceptual framework of the student, so that he or she has to revise it.

NEW TECHNOLOGIES FOR EDUCATION

NEW APPROACHES FOR EDUCATION

This multi-level structure is well suited to hypertext and the internet, which was seen as a very revolutionary tool in 1997. At that time the internet and its interactivity were very new both for students and teachers and we have worked very hard to gain their trust. It is well known that trust is hard won and easily lost, especially when dealing with schools. Education has always been a never ending experiment for us. We have continued to develop new educational projects over the past 8 years, always working in strict collaboration with teachers, testing our prototypes and requiring continuous feedback both from students and teachers. We have just described the first example of this.

“Heavens above!” is another example. It is an astronomy and physics course made up of seven modules designed for children aged 6-13. Each module is addressed to children of a given school year. The modules include teaching materials (instruction cards for hands-on activities, examples of discussions, other example sheets, etc.) and materials for students (evaluation cards, cards for instrument construction, etc.).

A project that could be considered a milestone in our experience with schools is “Altrimondi—Life in the Universe”. This project started in April 2001 as an Italian national programme addressed to schools with the aim of inviting young students to think and know more about the fascinating subject of the search for Life in the Universe. The initiative, addressed to all Italian students, was proposed as an educational project, promoted by EAAE (European Association Astronomy Education) and took advantage of a collaboration with many research institutions, educational associations, astronomical observatories and university departments. A competition called Altrimondi was announced as part of the project. This was open to young students aged between 13 and 18, with financial prizes for the first ten winners. The competition invited the students to investigate and analyse issues pertaining to Bioastronomy in depth.

“Life in the Universe” has been a good example of experimenting with new approaches for students. By using bioastronomy, a new science that investigates the possibility of life in other worlds, and using information and communication technologies as the sole vehicles for the project, we obtained many results as to how best to approach young students and to encourage them to study scientific disciplines.

The starting point and heart of the entire initiative was the website, Altrimondi.net (www.pd.astro.it/othersites/altrimondi/). Altrimondi.net provided the participants with all the tools required to take part in the project and in the competition. A weekly Newsletter gave information and updates. Moreover, the students and their teachers

were put in contact with the experts, i.e. the researchers involved in bioastronomy. Within a short time, a virtual community of young people interested in the subject arose. The many entries submitted to the Altrimondi competition proved to be valid from an educational point of view and considerably enriched the contents of the site. The initiative was expected to be, and in the event, was, very successful, as is clearly shown by the following figures: 600 registrations to the weekly information Newsletter, 200 participant groups to the contest, 3000 young students at the event that marked the end of the competition.

After the success of “Life in the Universe” another project was launched in September 2002: *“Alla Scoperta del Cielo!”* (Discovering the Sky!) (www.scopriticielo.it). The success of this project has been so great that it was repeated for the next two school years 2003-2004 and 2004-2005 with even more impressive participation figures. We have now reached a network of more than 1,000 schools throughout Italy! This initiative develops learning in four stages: four “virtual nights” of observation of the sky in an ideal astronomical observatory during which the main topics of astrophysics are discussed.

As in Altrimondi, information is transferred solely through the net; once a week the students and their teachers receive age-appropriate contributions (four categories of age are provided: 6-8, 9-10, 11-12, 13-14) by email. At the end of every step, a test is administered to check the acquired knowledge. The most active and curious can connect to the dedicated website and find more details, suggestions, games. Participants can also ask astronomers questions directly, participate in guided chats and even contact other students joining the project through the site. Teachers receive separate advance messages containing a full description of every step, auxiliary material and suggestions for additional activities. This project also includes a competition, *“Scopri il Cielo nella tua Città!”* (Discover the Sky in your Town) where students are invited to look for any features related to the sky among the monuments, works of art, engineering works in their own town (buildings, paintings, sundials, etc).

“Altrimondi” and *“Alla Scoperta del Cielo!”* have been, and continue to be, special projects because they experiment with a new educational approach, that starts with the students themselves to reach out into schools. This has been made possible by the fascination of astrophysics itself, by the experience gathered over the past years of work in the field, by the language adopted and, not last, by the technologies employed. They have produced satisfaction, not only to the youngest participants, but also, and especially, to the teachers who have found a firm support to their fundamental and essential role as educators in these projects. (For further details see “A Successful Experimentation in Science Education: the Virtual Community Of Altri-

mondi.net”, Proceedings Of The IADIS International Conference E-Society 2003, Lisbon, Portugal, pp. 19-26).

As we pointed out at the beginning of the present article, we are privileged also because we are able to experiment with an emerging technology before it spreads across the community. This has been the case of “Virtual Planetarium”, but it is also the case of our latest ‘mobile-learning’ project “Learning from Starlight—*Progettare per comprendere*”.

Emerging technologies in the field of wireless communication used in conjunction with mobile devices are leading to the development of new opportunities for the educational environment to improve learning and teaching experience. The emerging mobile learning paradigm tries to implement the vision of ubiquitous and pervasive computing. Within this scenario, the “Learning from Starlight” project aims at mobilising these technologies to improve education and outreach in the field of astrophysics.

Three classrooms of students at three different stages in the Italian education system have been involved in the two phases of this educational project. In the two phases a classroom activity relating to the observation and analysis of astrophysical phenomena is followed by a full day at a research institute to improve knowledge about a particular topic and to allow students to interact directly with astronomers. The projects have benefited from a generous equipment grant by the Hewlett Packard Foundation, that gave us 26 Tablet PCs and 26 Pocket PCs along with other useful devices for the complete planning of an educational activity (for further details see the web-site of project: www.pd.astro.it/hp and the article “The “Learning from Starlight” project: experiencing mobile technologies to improve education and outreach of Astrophysics”, Proceeding of m-ICTE2005, Cáceres, Extremadura, Spain, “Recent Research Developments in Learning Technologies (2005)” A.Méndez-Vilas Editino).

We created “The Sky at your Fingertips”, the first astronomy website for blind people (www.pd.astro.it/othersites/stelle/ariveder/ English/) in 2000. “The Sky at your Fingertips” is dedicated to visually impaired users of all ages who wish to set off on a fascinating journey among planets, comets and galaxies and to discover the wonders of the Universe. There is an image that has been converted into a format that can be touched, followed by a piece of text on each page. A Braille printer is needed to print the image on special paper or plasticized paper, while the text can be listened to with a normal vocal synthesizer. In constructing the website we worked directly with a focus group of blind people, who gave us the necessary feedback for

such a difficult task. A book written in Braille describing the website has now been produced.

After this experience we have continued with other projects, in particular for children with cognitive problems (see, for example “Universe for Dyslexia” – 2001 in www.pd.astro.it/othersites/english/handicap.html)

In the last four years we have concentrated on a kind of communication that is separate from outreach and education: the dissemination of information. We have two main products supplying astrophysics information, Astronews (www.astronews.it) and Urania (www.cieloblu.it).

The first simply uses the web; it is very traditional but very effective. It represents a quick and simple way to inform users about the news from astronomical research, space technology and space missions daily. A webpage is updated every week-day with a short summary of the most relevant news from official Space Agencies (NASA, European Space Agency, Japan Aerospace Agency, etc.), press agencies and scientific magazines (Nature, Science, The New Scientist, etc.). Each news feature has a short appealing title and by clicking on it the user can reach the full article from the original source. So, with Astronews the user can be fully informed in just a few seconds. Furthermore the user is assured of the scientific correctness of the news and the reliability of the sources. Astronews is useful not only for professional astronomers but also for amateurs and journalists in search of further information or to verify the reliability of the news they have heard.

The second, Urania, is a weekly Astronomy and Astronautics news bulletin, with an audio version (mp3 for Podcasting), a flash version with images and browsing tools and an html version. There are now more than 30 radio networks broadcasting Urania! Radio is not a new medium but it could be considered a new medium for astrophysical information. Urania is new not only for the different media used, but also for its content and approach. In Urania, information for the general public is directly provided by experts (astronomers), not just by professional journalists. The news is selected for its scientific relevance and not only for “popularity”. Moreover, in Urania, we have chosen to give special emphasis to the consequences of aerospace research on everyday life (telecommunications, environmental monitoring, diagnosis instruments for Medicine, etc.), to the involvement of Europe in astronomical and space research and to the economic and technological aspects of this kind of research.

NEW CONTENT AND “NEW” MEDIA

CONCLUSION

Urania is a simple, modern and flexible way to keep up to date about astronomy and space; the language is direct, simple and at the same time correct, the style is quick to fit in with new communication media, with a strong interaction between text, audio and video. The aim is to inform, entertain and to stimulate people's interest in science that is a common part of everyday life. In particular, both radio and web are well suited for bringing young people closer to science, stimulating interest, discussions and investigations at home or at school. All in all, Urania is a good tool that can be used as a format for information, education and outreach in other sciences and contexts.

We conclude by stressing once again the importance of testing education, information and outreach projects and to make clear a very important lesson learned in this process of negotiation, as communication was called at the beginning of the article. The principal lesson learned in these 8 past years is that the public needs correct scientific information. Outreach and education are also important, but they are capable of reaching fewer people than the total number of people interested in information in general.

But be careful! Information must be presented while respecting the audience. Let us end this article with the words used by H.G. Wells with Julian Huxley while they were writing *The Science of Life* (as referred to by J. Miller in "A protocol for Science communication for the public understanding of Science" – Sept. 2004, University College London):

"The reader for whom you write is just as intelligent as you are but does not possess your store of knowledge, he is not to be offended by a recital in Technical language of things known to him (e.g. telling him the position of the heart and lungs and backbone).

He is not a student preparing for an examination and he does not want to be encumbered with technical terms, his sense of literary form and his sense of humour is probably greater than yours.

Shakespeare, Milton, Plato, Dickens, Meredith, T.H. Huxley, Darwin wrote for him. None of them are known to have talked of putting in "popular stuff" and "treating them to pretty bits" or alluded to matters as being "too complicated to discuss here". If they were, they didn't discuss them there and that was the end of it"