GRID Project Case Study:
A Web Portal for Chemistry
ITIS E. Majorana
Grugliasco (Turin), Italy

I- Context of the school

The school ITIS E. Majorana – Grugliasco (Turin) is a pole of excellence for new technologies, leading to the professional qualification as industrial technical expert with a wide range of technical and organisational competences. Other study courses are electronics, telecomunications, and informatics. The courses have a duration of 5 years and give access to university. From 2001 the institute is part of the ENIS (European Network of Innovative Schools) network of excellence and indicated as a "best practice" by the European Schoolnet. In 2002 and 2003 the network of the school is awarded the price of "best practrice" by the tecnological observatory of MIUR (Italian Ministry of Education).

In the frame of the Dschola project of innovation in ICT for schools in the Piemont region, the ITIS Majorana has been selected as centre of excellence for services, animation and experimentation (CSAS) for the other schools of the western province of Turin. The activities of the centre foresee training for other schools, ICT support to other schools of the territory, workshops on ICT as well as experimentation and research activities in the field of new technologies applied to didactics.

The school ITIS E. Majorana – Grugliasco (Turin) has distinguished itself, during these last years, by innovations introduced in the field of ICT reaching a position in the forefront of national and European schools.

The institute is equipped with 18 multimedia laboratories with Internet connection, which are among the most advanced available in the Piemont region, considering technology and ergonomy. The use of laboratories, in contrast to other schools, is foreseen with 12-13 obligatory hours in the school curriculum, and the laboratories are also open in the afternoon for specific activities , i.e the "Afterschool in the web" project which involves students in the design and administration of the school web site and the realisation of contents. The computer network of the school links together almost 400 computer posts, and is animated by 4 web servers, 1 administrative server and 12 laboratory and department servers. It is linked to the Joint Network of Regional Public Administration (RUPAR) and to Internet by broadband connections with protection from potentially harmful contents for youngsters. It is run by innovative open source software developped by the institute in collaboration with Dschola (NetControl). The institute is also equipped with a wireless campus which covers the whole building and is accessible for all users of the school. It allows students and teachers equipped with a laptop to connect to the web from every place in the school. Such a wireless network has been the first in Italy to be certified by the Regional Environment Agency (ARPA) with regard to the respect of limits of electromagnetic emissions.

The computer supported cooperative learning environment used by the school ITIS E. Majorana – Grugliasco (Turin) is unique in Italy; the experimentation with cooperative web sites has been carried out thanks to the collaboration with the Dschola network and the funding of the CRT Foundation and the Piemont region.

Description of the school policy

In the ITIS Majorana school a very active group of science education teachers has brought into life a wide range of various activities in the science field both at regional and national level. Between these the projects "Didactic cooperation in three types of schools for science education" and "A web portal for chemistry and science education" have been recognised in 2002 and 2003 by the Eschola Organisation among the 100 best practices at European level. In September 2003 the school has initiated the project "The school, the territory and the network in science education" which assembles, coordinates and valorises the different didactic initiatives promoted by the ITIS Maxwell school. The common idea is that of contributing to the improvement of basic scientific culture and of developing active learning communities, so that students together with teachers can interpret correctly the events and facts which are heavily affected by science and technology.

Apart from the web portal for chemistry and science education, the other science initiatives of the ITIS Majorana school are the following:

a) MIUR (Italian Ministry of Education) pilot project of science literacy at national level "The words of science", in the frame of which the ITIS Majorana is the regional reference point, and provides tutors for experimental activities in about 50 classes of primary school;
b) The project "Science education from lower secondary to higher secondary school: IC Sessantasei Martiri, IC King e ITIS Majorana", a cooperation of the science education group of the ITIS Majorana school with mathematics and science teachers of other schools of the territory;
c) Participation in the "Micron 2004 – the didactics of microscopy" project, with a group of 30 students and some teachers of the school: the stages are organised by the historical scientific and technological archive of the University of Turin and by the Turin Science Center;
d) Involvement of the ITIS Majorana school as a school-tutor in the project "Science education: words and concepts", presented and approved by another institute of the territory in the field of "A hundred schools competition".

II- Context of the pedagogical project

Description of the whole plan

As nowadays the interest for science subjects is in a constant decline, and there is a crisis of scientific vocations, it is important to become familiar with scientific phenomena since the first years of childhood, with activities able to put an emphasis on their beauty. In this context, following also the cooperative work developed in some classes of the Majorana secondary school, there has been established a working group for the "***Web Portal for Chemistry and Science Education***" with the following web site: http://www.itismajo.it/chimica.

The activity has been started in 2002 and includes the following activities: There are organised ***meetings*** one or two times a week where pupils learn how work with science but in a playful and entertaining way. There are carried out ***simple experiments***, whereas other classmates who are more experienced with data processing and ICT issues, are filming and photographing them, and are afterwards uploading these materials on the ***project web site***. Some of the meetings in the afternoon are dedicated in a particular way to the organisation and preparation of ***science performances called "The Magic of Sciences"***. The web portal is in fact an integral part of the science education project addressing secondary and primary schools of Grugliasco and there exists a close collaboration between the teachers of the Majorana secondary schools and the other schools in the region. Therefore, the veterans of the web portal have conceived a science performance to present in an entertaining way the world of science to those children and youngsters who did not yet have the opportunity to discover it. Within groups of two or three students there are carried out science experiments in front of the public, at the end of which there is nothing left than being amazed.

The web portal for chemistry and science education of the ITIS Majorana school assembles and documents various experiences and activities which have as protagonists the pupils, starting with their individual bents and inclinations. The starting point is the idea that all can have a common space together, with participation as its most important element. The web portal is therefore a concrete (and not only virtual) space of meeting and sharing. Every student has its own account with which he/she can directly add contributions to the portal and modify their layout: by this way all are protagonists and responsible of what has been uploaded online. The more "technical" students have an administrative account but all students and teachers dispose of personal accounts enabling the direct writing on the web site. At the end of the experiences teachers can have a direct look at the web site to see the work carried out and, where necessary, to do possible adjustments.

The peculiarity of this process is that the publication is assisted by the server: every student publishes his/her file (documents, maps, videos, photos, etc.) directly on Internet. The web portal assembles and links the various materials which arrive simultaneously from different wireless computers without asking for any additional assemblage.

The portal by that way changes continuously as it reflects the intense activity of the group: it contains descriptions of experiments, photos, films, reviews and diaries of the activities, but also reflections and interventions, useful resources, links, and documents which are all directly developed by the students. It is obvious that these works have sometimes a more spontaneous and extemporary character, whereas others are more thought out and "scientific".

The learning process

The educational and pedagogical basis of the Science Education Portal is the idea of the teachers involved in the project that educational activities should be organised in tune with a particular historical moment, in connection with the processes that an individual has to face when relating with the world around. In this regard the portal wants to be a place of learning for teachers and students, a place where questions and considerations linked to science can be explored through a plurality of experiences. What counts today, is the capacity to operate with tools which allow persons to face actively rapidly changing situations. Concepts are progressively developed through the project activity. The portal therefore becomes the archive of the various experiences, the historical memory and the showcase of the project group, not intended as simple hypertext but as a process.

The cooperative project portal http://www.itismajo.it/chimica combines cooperative learning, laboratory experiences, wireless, groupware, e-learning and multimedia experiences.

The project group meets in the afternoon one or two times a week, in the chemistry laboratory, in extracurricular hours. It has three wireless PCs connected to Internet, in order to upload directly on the project web site what has been produced in the meetings. With the help of ICT are developed simultaneously different working areas. For example some pupils are developing and documenting a scientific experiment, others are preparing a conceptual map, others are asking questions to experts via mail. In this regard there exists a little community of practice with distributed competences, in which the students are free to specialize in different areas as to their preferences and free to learn and teach things that they like within the selected activities, linking by that way what they learn in class with extracurricular experiences.

Link with the curriculum

The initiative is not directly linked to the curriculum. The students of the ITIS Majorana school have chemistry lessons during the first two years of lower secondary school, but after that there is no specialisation in chemistry studies which goes on further. So for pupils of lower secondary school who have curricular chemistry lessons, the project activities can have a decisive impact on their understanding of the subject, due to the practical activities and the hands-on appproch adopted during the extracurricular project

hours. In fact, pupils said that they have improved considerably their performance in chemistry thanks to the participation in this project

III- Concrete case study

a. Introduction

Pedagogical grid

Identification	
Establishment:	ITIS E. Majorana – Grugliasco (Turin)
Teacher's name:	Marco Falasca, Angelo Cimenis, Dario Zucchini (project co-ordinators); Antonella Martini (science teacher participating in the project).
Subject:	Physics; Chemical Sciences; Cross-curricular approaches
Context	
Class: level	Higher Secondary School ITIS "E. MAJORANA" - Grugliasco (TO)
Number of pupils	ca. 20 pupils
Date/Hour	5 April 2006 – 14:30 o'clock
Duration of the observation (when applicable)	ca. 1,5 hours
Learning/teaching objective	
Summary description	The project "**A Web Portal for Chemistry and Science Education**" - www.itismajo.it/chimica - is carried out during extra-curricular hours in the afternoon, in which students, teachers and assistants meet each other to undertake many activities related to chemical sciences, physics and cross curricular subjects, as well as to update and develop the web site. The web portal represents an important place of cohesion and collaborative work, to share the work and the experiences carried out. Of particular importance are also the numerous informal project meetings between project participants which are taking place during the school hours. Usually, the formal meetings begin with an introduction to the "topic of the day". Within this frame objectives are defined and tasks are divided up in single working groups. In accordance with the topics and the objectives, the following activities may be scheduled: a) **Scientific experiments** are carried out, both new and reproduced ones, and are reasoned upon. Students not only carry out the experience by themselves, but also document it on the web site, through pictures and texts. b) **Translations of scientific texts and documents** (usually downloaded from the Internet) which explain phenomena to be understood and reproduced. c) **Construction of conceptual maps** following the methodologies of J. Novak. d) **Experimental problem solving** solutions, procedures, documentations are stored on the web portal using the

	diagram of Gowin (Novak, Gowin, Learning how to learn, SEI 1989) e) **Preparation of science performances** called "The Magic of Sciences" addressing primary and lower secondary school pupils. f) **Didactic materials** for primary and lower secondary schools prepared by the teachers' group are uploaded on the project's web portal.
Description of the sequence	
Intentions of the teacher	The main project's objectives, concerning students, are the following: 1. implement processes of "cultural development and awareness", both collective and individual ones, by making them aware of the attractiveness of sciences as well as of the importance of ICT in the acquisition of knowledge. 2. increase the level of motivation and attraction of students towards science subjects, making them protagonists of the realisation and digital documentation of scientific experiences. 3. improve the students' learning ability, as well as the ability to represent scientific concepts, through conceptual maps and experimental problem solving. The main objectives, concerning teachers, are the following: 1. promote and experiment new forms of active didactical approaches, taking advantage of the Internet and improving the organisation of experimental science teaching. 2. create among teachers of different subjects a cooperative and synergetic working environment, open to new dimensions of cooperation which may better involve and attract students. 3. communicate through the web the initiatives related to the **Web Portal for Chemistry and Science Education** and all the other science education initiatives carried out by the Majorana school group. By this way, the exchange of thoughts among teachers of differents schools has been encouraged and the didactic experiences increased and improved.
Description of the activity stage	In the sequence to be observed, a **science performance called "The Magic of Sciences"** is carried out by students of higher secondary school in front of pupils of primary school, with the objective to foster clear improvements in the attitude of pupils towards science, thanks to the amazement, the surprise and the curiosity generated in the science performance. The following chemical science experiments are part of the science performance addressing primary school pupils: **Greeting poster** (to start the performance) – Both materials are soluble in water; with one has been written the writing on the poster which results invisible because the solution is "colourless", the other one is sprayed upon in a second moment. When both materials come into contact with each other, they interact and form

	a solid material of brown colour and therefore visible. **Dry ice on the plate** – Here is the mist of theatre performances. This can be obtained through the condensation of water vapour present in the air because of a fall in temperature due to the sublimation of dry ice. **"Bangs" with rolls of film and dry ice** – It is really funny to see (and hear) the effect of the process of sublimation of dry ice inside rolls of film! The superior capsule of the containers explodes at once and often flies for a number of meters! **Blow up a balloon with dry ice** – There is introduced dry ice in a balloon. The end is closed with a cord. It is observed for a while and suddenly the balloon inflates! If it is then put into hot water, it inflates in a great hurry due to the fact that the water provides much heat and therefore the sublimation becomes very fast… **Oscillating reaction** – In a very complex mix of substances are taking place variations of concentration of these substances which imply variations of the colour to be observed. After a certain while, reaching a stable condition in which the concentrations do not change, the colour remains unchanged. **Writing with fire** – For the writing on a paper there is used a material able to free oxygen which facilitates the combustion of the paper in the expected points. On order to make happen a combustion, the co-presence of three factors is fundamental. **Change of colour due to agitation** – In the present solution is contained an indicator, methylene blue, which exists in two forms: oxidized (blue) and reduced (colourless). The colouring agent is initially present in the reduced form but with the agitation it comes into contact with the atmospheric oxygen which oxidizes it. Keeping immobile the container, the methylene blue is slowly reduced to the colourless form by the present reagents and so on. **Change of colour due to the voice** – Also in this case the experiment is carried out with an indicator which presents a blue coloration in a slightly basic field (pH 9-10). The CO_2 emitted with the breath is an acid substance and therefore neutralizes the basic excess initially present in the solution provoking a colour change of the indicator in the colourless form. **Chemical traffic lights** – The mixture contains substances which, as in the case of the change of colour due to the voice, interacting with the atmospheric oxygen change colour. The agitation favours the contact with the oxygen present in the air, keeping the container stable the initial colour reappears. **Foamy worm** – The presence of a catalyst increases the speed of decomposition of oxidized water with the subsequent development of a remarkable quantity of gas (oxygen); the latter, interacting with liquid soap, provokes the creation of foam. The catalysts are materials which modify the speed of a reaction without being consumed in the process. In this case there has been used an inorganic catalyst but many transformations of metabolism, in

	order to reach temperatures compatible with life, request the presence of biological catalysts, the enzymes, proteins specialised in this function. **Magnesium** - All transformations take place with the transfer of energy, generally in the form of heat, from the system (reagents / products) to the environment or vice versa. In the reaction between magnesium and oxygen, together with the liberation of thermic energy (heat), there is created the most striking luminous energy. **Tin** – Thermic energy produced by a gas burner (Bunsen) provokes the ebullition of water present inside the tin which, evaporating, takes with it also the main part of the air particles. In this way there is created a depression, with the subsequent collapse of the tin when the contact with cold water provokes the condensation of the few water steam particles still present inside it. **Chemical interrupter** – The transformations can take place at very different speeds: some are practically immediate (explosions), others are very slow (the growth of stalactites and stalagmites). In this case the reaction, in which is created iodine, requires some dozens of seconds. The dark blue coloration is due to the soluble starch, a very sensitive indicator, which signals the presence of iodine also in very low concentrations. **Citrus fruits** – In the lemon is injected an indicator which is coloured in red-violet in a basic field, whereas it is colourless in an acid field. The citric acid present in the lemon makes happen the "colour change" and therefore the evident disappearance of the injected coloured liquid. **Coloured capsules** – The explanation of the phenomenon is linked to the structure of the atom. The heat of the flame (thermic energy) stimulates the atoms of some elements to emerge energy in the form of a light of a characteristic colour. This principle is at the base of the production of fireworks. **Chemiluminescent reaction** – One of the solutions contains luminal which, interacting with the other one, is able to develop luminous energy without developing heat. In the animal kingdom luminal is present in the glow-worms. **Coloured cylinders** – In the cylinders are present substances, called indicators, which assume different colourations according to the pH. To change the pH, and therefore to observe different colours, there are taken down small (but heavy) glasses containing dry ice. The dry ice sublimes, the gas is set free (big bubbles of carbon dioxide which, being acid, interact with the indicators)! Here is the "magic": many colours!
Pupils' output	Documention of scientific experiments on the project's web site, through pictures and texts; Translations of scientific texts and documents (usually downloaded from the Internet) which explain phenomena to be understood and reproduced; Preparation of science performances called "The Magic of Sciences" addressing primary and lower secondary school pupils.

Intentions of the person/s in charge

The main intentions, concerning students, are the following:

1. implement processes of "cultural development and awareness", both collective and individual ones, by making them aware of the attractiveness of sciences as well as of the importance of ICT in the acquisition of knowledge.
2. increase the level of motivation and attraction of students towards science subjects, making them protagonists of the realisation and digital docu-mentation of scientific experiences.
3. improve the students' learning ability, as well as the ability to represent scientific concepts, through conceptual maps and experimental problem solving.

The main intentions, concerning teachers, are the following:

1. promote and experiment new forms of active didactical approaches, taking advantage of the Internet and improving the organisation of experimental science teaching.
2. create among teachers of different subjects a cooperative and synergetic working environment, open to new dimensions of cooperation which may better involve and attract students.
3. communicate through the web the initiatives related to the ***Web Portal for Chemistry and Science Education*** and all the other science education initiatives carried out by the Majorana school group. By this way, the exchange of thoughts among teachers of differents schools has been encouraged and the didactic experiences increased and improved.

The Scenario

It is important to contextualize the "Magic of sciences" performance which has been observed in the present case study within the frame of the web portal: the organisation of science performances is an integral part of the project which covers different aspects like science documentation, reflection, research and communication.

The following science experiments are part of the science performance called "The Magic of Sciences" addressing primary school pupils and carried out by secondary school pupils:

Dry ice on the plate – Here is the mist of theatre performances. This can be obtained through the condensation of water vapour present in the air because of a fall in temperature due to the sublimation of dry ice.

Please note: For doing experiments with dry ice, special security requirements have to be observed (please see also the specifications listed under point ***c. Open conclusion – Prerequisites for transferability*** of this document).

"Bangs" with rolls of film and dry ice – It is really funny to see (and hear) the effect of the process of sublimation of dry ice inside rolls of film! The superior capsule of the containers explodes at once and often flies for a number of meters!

Blow up a balloon with dry ice – There is introduced dry ice in a balloon. The end is closed with a cord. It is observed for a while and suddenly the balloon inflates! If it is then put into hot water, it inflates in a great hurry due to the fact that the water provides much heat and therefore the sublimation becomes very fast…
How to blow up balloons with dry ice: The dry ice is introduced in the little bottles, on which are put the empty balloons. The dry ice boils, passes over to the gaseous state and blows up progressively the balloons. The mist which is formed under the bottles is due to the low temperature which makes condensate part of the water steam present in the surroundings. The white patina which is formed on the external walls of the bottles is due to the formation of snow (always obtained by the frost of water steam present in the surroundings).

What happens to the blown up balloon if put in dry ice? The balloon shrinks! At these temperatures (-195.8°C), materials behave in a strange way, for example a rubber tube looses its elasticity and becomes fragile like glass. This happens because the bonds which make the rubber so elastic change their configuration.

Chemical traffic lights – The mixture contains substances which, as in the case of the change of colour due to the voice, interacting with the atmospheric oxygen change colour. The agitation favours the contact with the oxygen present in the air, keeping the container stable the initial colour reappears.

Change of colour due to agitation – In the present solution is contained an indicator, methylene blue, which exists in two forms: oxidized (blue) and reduced (colourless). The colouring agent is initially present in the reduced form but with the agitation it comes into contact with the atmospheric oxygen which oxidizes it. Keeping immobile the container, the methylene blue is slowly reduced to the colourless form by the present reagents and so on.

Magnesium - All transformations take place with the transfer of energy, generally in the form of heat, from the system (reagents / products) to the environment or vice versa. In the reaction between magnesium and oxygen, together with the liberation of thermic energy (heat), there is created the most striking luminous energy.

Tin – Thermic energy produced by a gas burner (Bunsen) provokes the ebullition of water present inside the tin which, evaporating, takes with it also the main part of the air particles. In this way there is created a depression, with the subsequent collapse of the tin when the contact with cold water provokes the condensation of the few water steam particles still present inside it.

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Chemiluminescent reaction – One of the solutions contains luminal which, interacting with the other one, is able to develop luminous energy without developing heat. In the animal kingdom luminal is present in the glow-worms.

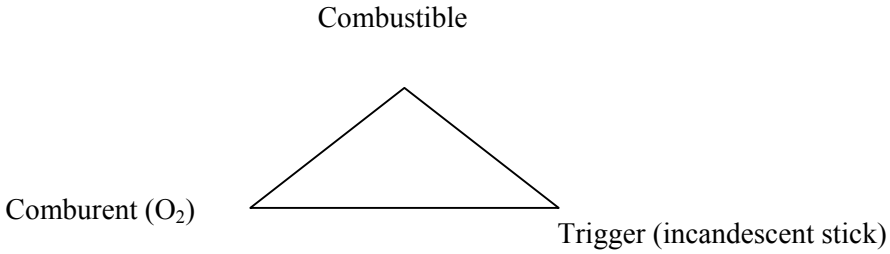
Foamy worm – The presence of a catalyst increases the speed of decomposition of oxidized water with the subsequent development of a remarkable quantity of gas (oxygen); the latter, interacting with liquid soap, provokes the creation of foam. The catalysts are materials which modify the speed of a reaction without being consumed in the process. In this case there has been used an inorganic catalyst but many transformations of metabolism, in order to reach temperatures compatible with life, request the presence of biological catalysts, the enzymes, proteins specialised in this function.

Citrus fruits – In the lemon is injected an indicator which is coloured in red-violet in a basic field, whereas it is colourless in an acid field. The citric acid present in the lemon makes happen the "colour change" and therefore the evident disappearance of the injected coloured liquid.

Oscillating reaction – In a very complex mix of substances are taking place variations of concentration of these substances which imply variations of the colour to be observed. After a certain while, reaching a stable condition in which the concentrations do not change, the colour remains unchanged.

Coloured cylinders – In the cylinders are present substances, called indicators, which assume different colourations according to the pH. To change the pH, and therefore to observe different colours, there are taken down small (but heavy) glasses containing dry ice. The dry ice sublimes, the gas is set free (big bubbles of carbon dioxide which, being acid, interact with the indicators)! Here is the "magic": many colours!

Writing with fire – For the writing on a paper there is used a material able to free oxygen which facilitates the combustion of the paper in the expected points. On order to make happen a combustion, the co-presence of three factors is fundamental as described in the triangle below:



Procedure: a cotton bud is soaked with a substance saturated with potassium nitrate (this is the material which frees the oxygen during the reaction) and is then used to write on a porous paper. The writing on the paper must be continuous, with the characters linked between each other. Then it has to get dry; at the moment of the demonstration a match which has been just lighted off is approached close to an earmarked point on the paper. By that is started the reaction which allows to read the writing in the parts in which the paper is burnt.

Greeting poster (to say good-bye) – Both materials are soluble in water; with one has been written the writing on the poster which results invisible because the solution is "colourless", the other one is sprayed upon in a second moment. When both materials come into contact with each other, they interact and form a solid material of brown colour and therefore visible.

b. Real progression of the session(s)

Conditions of the session

The session is not different from the one described in the pedagogocial grid, although the order of the experiments may vary.

Detailed description of the session

The "Magic of Sciences" is a real performance, with presentators, actors, walk-ons, assistents, viedo operators, sound and light technicians, and journalists. As in every performance, it is around the stage that the world revolves around, because without it the perfromance could not take place. There are some who make photographs, some who document the event online, some who are in charge of projecting slides on the wall which serve as background to the stage, some in charge of the lighting, some preparing the experiments, some putting away the objects before a new excperiment takes place, etc. There is to mention that the

different roles including the ones of the presentators, are interchangeable, or better can be covered by different pupils according to the different situations and occasions. All this impressive organisational apparatus is managed with great liveliness and engagement by students and teachers of the chemistry portal, with the precious assistance of the laboratory technician. The performance in fact is a long event rich of objects, materials, experiments wich alternate quite rapidly, and it requires without doubt great organisational efficiency and an excellent understanding within the group.

The performance is assisted by many children from primary school (4-5 classes) who follow the event with a high level of participation and involvement, contributing at creating a unique atmosphere of fascination and magic. In fact the dailogue betwen students and children is steady and and very lively: the "actors" stimulate and provoke the children with various questions, observations, and bets related to the different chemistry experiments, and the children are reacting with great enthusiasm, supporting the one or the other option, competing in responding to questions or in climbing the stage to be involved with "hands-on".

Every experiment is contextualised in a kind of little scene, carried out by a couple of students who alternate on the stage, and often it is introduced by two presentators who have the task to fill in the little breaks between one experiment and the other, to call to order the children if they are too noisy, and finally to keep together the event. The scenes are well put to the test, but not recited by heart. The magic of science is well alive for all spectators and everybody is aware that it is important to observe attentively the different experiments as they can always reserve some surprises. Since the beginning of the performance there is a good atmosphere, full of complicity, entertainment, and improvisation based on a long and successful working experience together.

Working documents

Please find attached as working documents the PowerPoint slides with the presentation of the different chemical experiments carried out during the "Magic of sciences" performance.

c. Open conclusion

Results obtained

The efficiency of the scientific demonstrations and their impact on the pupils is remarkable, and it has been confirmed both by the responsible teachers of the school classes involved in the project during the last years and by the literature in the field of science education. A recent study, published by the prestigious review "Journal of Chemical Education" in April 2005, with regard to a large sample of initiatives like the "Magic of Sciences" conducted by students of higher secondary school and addressing pupils of primary schools, has demonstrated that clear improvements in the attitude of pupils towards science are produced, thanks to the amazement, the surprise and the curiosity generated in the science performances.

Added value

The pupils of the ITIS Majorana school, which does not offer any specialisation in chemical studies, participate in the project activities not only for scientific reasons but also because of the important social dimension it offers: the portal represents a place for interpersonal relationships and at the same time of opening towards the world which corresponds to their needs of belonging and identity. The project portal represents not a practice for the development of a specific product but a practice of a process in which the multilevel participation is important, which includes both individual and group aspects, both in the field of science education and citizenship.

All pupils have their own space, those who are more interested in science, those interested in ICT issues and in the management of a web community, those interested in photographing, those interested in organising a science performance for primary schools, those who want to document their conceptual map and discuss it with a teacher, those who want to ask questions to a teacher about a scientific problem (sometimes they find the solution by asking together a university expert) and those who are less skilful in school subjects but are interested in minerals or mineralogy and then perhaps become also better in school disciplines, etc.

The motivation which feeds the activity is linked to the incentivation of participation. The centre of attention is assured also by the fact that every student has its own password with which he/she can upload or modify documents on the web portal; everybody assumes his/her own responsabilities, there is the guarantee of cultural expression. One pupil for example has singled out in Internet a book with poems about chemistry and, after having read a number of them together with classmates, he has decided to publish them on the web portal, citing the source and the author. It happens often that a group of students translates the procedures for an experiment from English into Italian and then carries it out, sometimes successfully, and sometimes not, and then it documents it on the portal.

The high level of participation is not only demonstrated by the performance observed, but also by the fact that all felt involved in the observation linked to the present case study, and the interview with the teachers has been transfomed in a meeting and an exchange of ideas with the whole project group, concluding with a counter-interview on the GRID project carried out by one of the students.

Obstacles

One of the main obstacles, as usual, is made up by the scarcity of financial means and time, made available for extracurricular activities in the school. An initiative like this has important management costs, not only concerning technological prerequisites but also for the purchase of necessary materials for the experiments and performances.

Weak points

The fact that the children have not been provided, during the performance, with real explanations of the phenomena they assisted at, could be considered as a weak point of the initiative. Nevertheless, considering the performance as a part of the chemistry portal activities, it could also be said that this choice has been deliberately. For the students involved in the preparation and the carrying out of the performance, this is one of the activities linked to the chemistry portal project, and therefore does not exclude a priori the detailed study and explanation of chemical phenomena and reactions. Concerning the children from primary school, the spectators, the intention seems to be to offer to them an introduction to chemistry, mainly stimulating their curiosity and interest, offering a playful moment of assistance to a magic performance.

Another weak point could be the negative consequence of the good atmosphere of complicity and participation which has been created during these years in the project. The deep affective ties between youngsters are difficult and delicate to manage in the daily rule of the school, and even more in a context in which are conveyed creativity and expectations, as is the case in this project. For its nature the interclass project group, composed by students of different secondary school classes and age, is something very changeable in time: some are finishing the school and leaving it, others may move and change school, and the affective ties which are underlying the project activities can be broken up. It is therefore necessary to continuously rebuild or rebalance such relations. Yet it is evident that the teachers in charge have this gift of human and communication potential which helps them without doubt to rebuild the group in periods of difficulty due to personal changes.

Prerequisites for transferability

Special security requirements when carrying out experiments with dry ice

- If you are doing experiments with dry ice, do **never** keep it in an hermetically sealed container (for example a bottle with a screw plug). The bottle can explode and provoke damages. Keep it in a polystyrene box, with a joint plug put on it, but free to open itself if the internal pressure becomes to high.
- **What is dry ice?** It is carbon dioxide and its formula is CO_2. It is a gas, colourless, odourless, and denser than the air. Normally it is present in the atmosphere at a level inferior to 1%. It is produced by combustions of materials containing carbon (for example methane, petrol) and also by breathing. The carbon dioxide is neither combustible nor comburent, i.e. it does not burn and is not able to combine itself with combustible materials to allow them to burn; for this reason it is used as an active substance of many extinguishers, from which it comes out, covering the zone of the fire, preventing the combustibles from continuing to be fed by the oxygen of the air and so the fire is interrupted.
- At a normal atmospheric pressure the solid carbon dioxide does not melt to become liquid, but passes directly over to the gaseous state, and therefore is called dry ice. This process is called **sublimation**. The main part of the science performances is linked to this property.
- To handle the dry ice, use glasses, pliers, tablespoons, just to **avoid** to touch it! In fact its temperature is **very** low (-78.5°C).

Technical prerequisites

1. The portal has been developed using the interactive extensions of the Microsoft Sharepoint Team Services and IHMC Cmap Server, necessary for the cooperative and interactive use of the web site.
2. Without server activities it is not possible to use cooperative portals, but there can only be created CD Rom or obsolete web sites (not interactive or scarcely interactive).
3. The portal can perfectly work on an offline PC but requires the preparation of the PC before the transfer of the site. For assistance on the procedure of transfer please contact prof. Dario Zucchini – webmaster@itismajo.it.
4. The technologies used are the following:
    a) Windows 2000 Server with Internet Information Server
    b) Sharepoint Team Services
    c) Microsoft MSDE (database)
    d) IHMC Cmap Server Tools
    e) Microsoft Frontpage XP with Office Service Pack 1 (only for transfer of we bsite)
5. Procedure of publication on offline PC
    a) Install IIS on a Windows 2000 or XP operating system from the control panel
    b) Install Microsoft Sharepoint Team Services (install also MSDE database)
    c) Install IHMC Cmap Server Tools (optional)
    d) Install Frontpage XP and the Service Pack 1 of XP Office
    e) Connect temporarily the computer to Internet
    f) Open the site www.itismajo.it/chimica with Frontpage (there is necessary the administrative password)
    g) Upload the site on the local web server of the computer (http://localhost)
    h) Disconnect the computer from Internet
    i) Surf the portal http://localhost off-line

Suggestions for further development

The portal, being an initiative in process, can be gradually developed in the future, helping students to get involved in wider learning communities, multiplying the access both to human resources and computerized ones. It can become a place for meetings and exchanges with teachers and students of other schools all over Europe.