518300-LLP-2011-IT-COMENIUS-CNW

Students' Motivation to Learn Chemistry in Spain

Lifelong Learning Programme

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Students' Motivation to Learn Chemistry in Spain

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Abstract

In recent years, we have observed students´ low motivation towards science subjects, while we have been proving the need for scientific literacy in our society. This is reflected in the reduced number of students enrolled in science and the negative view they have on this issue. The solutions provided by experts and teachers include an increasing number of contextualization of science subjects through experimentation and inclusion of ICT in teaching and learning processes. Please provide the abstract of the report.
We are going to make a review of the decreasing number of science students and their negative attitude towards science subjects like Chemistry, and we show some solutions proposed by some Science Education authors and experts. Some of the most evident solutions ask for deep changes in Science curricula and in teaching methodology to achieve a contextual and co-operative science. These solutions include the use of daily Chemistry and ICTs resources in our schools.
In the last few years, scientific and technological developments are changing our society in many and varied ways. We are immersed in knowledge and mass media era and the need for a scientific and technological literacy is increasingly required. Citizens are witnesses of a huge amount of troubles related to Science and Technology that requires responsible decisions and whose repercussions affect us global and individually [7].
As a consequence, we need to change curricula contents to make the relationships between scientific and daily knowledge prevail among students. Therefore, we should bear in mind that scientists´ work can be known by our students [10]. Moreover, to guarantee that this happens, methodology needs to be changed; we may take into account aspects such as competence development, critical thought, analysis information, and people's motivation through values and the adaption of Science learning to 21st century needs [13].
However, at present, we find students' increasing lack of interest towards Science which is reflected in the decreasing number of students, especially girls, who choose Physics, Chemistry or Mathematics degrees [15]. As a consequence, we need to take urgent measures, at institutional level, which can be clearly observed in daily teaching.

1. Introduction to the National Situation

Nowadays, our society is experiencing a very quick change in technology and science. Development in technology, materials or genetics requires a continuous update of teachers on science contents. At the same time, we live in a society based on knowledge acquisition that needs changes in the way we teach.

Moreover, some EU researches like "Rocard report: Science Education Now: A New Pedagogy for the Future of Europe" show a decreasing interest of young people on science. Due to this situation, a change in science-teaching methodology is urgent, in a moment in which we have to solve the need for scientific literacy in our society.

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1.1 Student's attitudes towards Science.

Chemistry public image in the second half of the 19th and the beginning of the 20th centuries does not correspond to a science from which humankind benefits. Generally speaking,
Chemistry is associated to dangerous products, pollution, and environment catastrophes. This vision could be different if we highlighted Science's contributions in the fields of foods, medicines, or new materials [6].
Student´s opinion on Physics and Chemistry is very similar. They attribute negative aspects such as pollution or weaponry development to Science, and they are unaware of its positive points, such as the building of human knowledge or its commitment to environment [16]. This negative attitude towards certain school Science aspects becomes more evident as students grow up. Indeed, this is more remarkable – at the beginning of Compulsory Secondary Education and it mostly affects girls [18]. Students consider scientific subjects as difficult, very theoretical, useless, and excessively conceptual. Besides, they claim that they do not have enough laboratory practice [11].
The aforementioned ideas together with the fact that daily teaching routine excludes contents like STS contents, or Science History make Physics and Chemistry less interesting subjects for student. They do not feel attracted towards scientists´ work and they are not aware of women´s role in Science development.

1.2.Curriculum and scientific literacy situation in Spain.

The current educational system in Spain is based on LOE (Ley Orgánica de la Educación). In this system, students start Compulsory Secondary Education (ESO) at the age of 12, and at the age of 16 they study Bachillerato (Sixth Form), a non-compulsory education divided into three options: Arts, Science and Technology and Humanities and Social Sciences. Students do not devote a long time to study Physics and Chemistry. In ESO, they study Physics and Chemistry as parts of the same subject in 3rd of ESO (a two-hour-subject) and 4th of ESO (a three-hour-subject), but, in the latter course, it is not considered a mayor subject such Mathematics or Spanish Language. They can choose Physics and Chemistry or a different branch including Music, Drawing or Computing.
At the beginning of non-compulsory education, 1st of Bachillerato, the time spent in Physics and Chemistry is increased up to 4 hours a week, although it is still optional. In 2nd of Bachillerato, Physics and Chemistry are two different subjects and the majority of students must select one of the two, depending on which degree they would like to study in the future (technical sciences versus health sciences oriented Bachillerato). As a consequence, in most cases, students do not acquire enough scientific knowledge in both subjects [1].
As far as the Spanish curricula is concerned, it is not focused on daily life Science, it does not facilitate either debate or students' involvement, and it emphasizes teaching "facts" instead of centering on how scientific knowledge is built [5]. Laboratories practices are not included in official curricula and are not obligatory. The presence of STS contents like Science History is increasing in the last few years, although it is not enough in textbooks and lessons. There are a few points in common with other subjects and we do not devote enough time to research and experimental work. Teaching is still based on fact description and problem solving. Consequently, our students' Science knowledge is lower than that of their standard European counterparts (Pisa 2003).
Some contextual Science teaching projects were carried out aimed at making students achieve an appropriate scientific literacy, (for example "Química Salters"). However, they have not been continued. On the other hand, a specific subject, called "Science for Public Understanding", was included in the curriculum in 1st of Bachillerato. This subject is taught in different European countries and shows an overall and attractive view of Science for students. Nevertheless, a wrong approach to this subject and the forthcoming Education Law seems to point out that this subject will disappear from the curriculum soon. This law will increase the teaching hours offered to Mathematics or Spanish Language, for example, and cut out what they consider "non-fundamental" subjects [2].
Thus, it seems evident that we need to redesign Chemistry curriculum. Experts recommend to a) contextualize the subject using as daily life, social needs, and environmental issues, b) sort contents in the most appropriate way to foster students´ understanding of scientific terms by introducing concepts progressively and c) introduce new teaching strategies. These strategies would take into account ICTs, a new approach to experimental work and real teacher´s involvement to renew curriculum [4].

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1.3 ICTs in science teaching.

ICTs are the ideal tool to transform the classroom into research environments centered on students which foster meaningful learning. The traditional educational system does not facilitate the use of ICTs because of its excessive amount of theoretical contents and the difficulty to spend time in the classroom to develop long-term research. However, teachers and education institutions are aware of the essential role of ICTs in Science teaching. This is so important that some authors claim the need for institutional actions aimed at increasing the presence of ITCs in schools, to evaluate the skills related to new technologies and to enable co-operative teaching settings [17].

In Spain, ICTs have been incorporated to Science teaching in the last years. They have contributed to interaction, dynamism, and three-dimensionality [9] enabling co-operative learning and being an essential part for a methodological change in Science teaching. Learning environments like Syenergia and Moodle have provided teachers with more interesting Chemistry teaching experiences [8].

Spanish Government opted for new technologies thanks to Escuela 2.0 programme starting in 2009. This programme´s goals were to distribute more than 1.500.000 laptops among students, more than 80.000 computers among teachers, and the creation of digital classrooms equipped with smart boards, electronic boards, so as to the required software. That implied a change in methodology in order it to succeed: teachers should be the guide in the teaching-learning process rather than the instructor. The lack of appropriate teachers´ training and the overcrowded classrooms made this change difficult, and it did not help to this programme´s success. Nowadays, due to economic reasons, the new Government has decided to implement a more economical programme based on the creation of virtual teaching environments [12]. Nevertheless, the methodological change is getting complicated due to financial education cuts, the increasing teaching hours, and the increasing number of students per classroom.

On the other hand, due to the fact that there are many available resources on the Internet, teachers must usually invest a lot of time and effort identifying, locating, analyzing and evaluating these resources. The creation of digital libraries and repositories where technology quality resources and supporting materials are at hand are getting more necessary these days [17].

Rocard's report pointed out the key role teachers play in the renewal of scientific educational teaching system, and also that the membership of a teacher´s network helps improve their teaching method and motivation [14]. Taking part in projects such "Chemistry is all around Network" facilitates the coordination between teachers and scientists and puts at teachers´ disposal a wide range of resources related to Chemistry all around Europe. These resources will be classified and assessed to find out if they can be used in the classroom to make educational practice easier.

Please briefly describe the national education system focusing in particular on the teaching of scientific subjects.

Please, also describe the Main National Trends: i.e. the current National Situation as education of scientific subjects is concerned.

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2. Setting up of the Network

At least 5 schools in each project country will be involved in the project. All in all the following subjects need to be identified and involved in the project activities:

1. 10 teachers
2. 200 students

2.1) Information on the schools involveD

2.1.1) Jesus Maria Cristo de la Yedra school. GRANADA

-Primary and Lower Secondary School.
-920 students from 3 to 16 years.
-40 students from 14 to 16 years involved in the project.

Lorenza Madrid Villar.
Subject taught: Physics and Chemistry, 4º ESO
Years of experience: 13

Isabel María Morales Yesa.
Subject taught: Physics and Chemistry, 3º ESO
Years of experience: 21

2.1.2) Regina Mundi School. GRANADA.

-Primary , Lower and Upper Secondary School.
-1310 students from 3 to 18 years.
-40 students from 16 to 17 years involved in the project.

Yolanda Tenorio Santana.
Subject taught: Physics and Chemistry, ESO and Bac.
Years of experience: 20

Cristina García Martín.
Subject taught: Physics and Chemistry, ESO and Bac.
Years of experience: 6

2.1.3) San Agustin school, Motril, Granada.

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-Primary and Secondary School.
-920 students from 3 to 16 years.
-40 students involved in the project.

Antonio Guardia Cabrera.
Subject taught: Physics and Chemistry, 3º ESO
Years of experience: 2

Magüi Viñas Armada.
Subject taught: Physics and Chemistry, 4º ESO
Years of experience: 3

2.1.4) Seminario Menor Agustiniano, Guadalajara.

-Upper Secondary School.
-200 students from 16 to 18 years.
-40 students from 16 to 18 years involved in the project.

Enrique Santana Sánchez.
Subject taught: Physics and Chemistry, Thecnology.
Years of experience: 13

Maria Jesús Garrido Bermejo.
Subject taught: Maths and Chemistry.
Years of experience: 20

2.1.5) Santo Tomas de Villanueva, Granada.

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-Upper Secondary School.
-200 students from 16 to 18 years.
-40 students from 16 to 18 years involved in the project.

Antonio Jesús Torres Gil. ***Subject taught: Physics and Chemistry. 4º ESO, Bach.*** ***Years of experience: 14***	
José Ángel Ruiz García. ***Subject taught: Maths and Chemistry.*** ***Years of experience: 10***	

2.2) Information on experts involved

2.2.1*)* Manuel Fernández González
He is the author of various general chemistry textbooks, which have been the manuals followed in the majority of secondary schools throughout Spain. He has also given various teacher training courses in Spain as well as in other countries. This has naturally led to a reflection on science teaching and epistemology that has materialized in articles in national and international journals and conference papers.
For more information see the following URL: http://www.ugr.es/local/mfgfaber

2.2.2) Fernando Hernández Mateo
Fernando Hernandez-Mateo is currently Full Professor in Organic Chemistry at the University of Granada where he obtained his BSc (1982) and PhD (1986) degrees in Chemistry. After a Post-doctoral sojourn at the University of Ottawa (Canada, 1987-88) with Professor H.H. Baer, he returned to the research group named CarboUGR (carbougr.ugr.es) headed by at the Professor Santoyo González at the University of Granada where he also initiated his professional career in teaching. Professor Hernandez-Mateo has a long-standing experience in the area of Organic Chemistry at the different university levels (graduate and post-graduate)as well as a researcher being the author of more than 50 papers in International Scientific Journals, several reviews and book chapters, and the co-inventor of nine patents.
For more information see the following URL:
http://carbougr.ugr.es/~fhmateo/datos_personales/

2.2.3) Andrés Parra
He has a Ph.D. in Chemistry from the University of Granada (Spain), in the area of Organic Chemistry. During the decade of 1980-1990 he taught physics and chemistry in secondary school and in the baccalaureate degree. For the last 20 years, He has been an associate professor and researcher in the Department of Organic Chemistry of the University of Granada (Spain). He has taught Organic Chemistry at several levels of the university education, in different masters in Science, and in various educational projects. His main research field is “Biotechnology and Chemistry of Natural Products”,

and he has published about 60 scientific papers, directed several doctoral theses, and participated in numerous scientific national and international congresses.
For more information see the following URL:

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http://directorio.ugr.es/static/Personal/*/aparra@ugr.es

2.2.4) José Antonio Martín-Lagos Martínez.
Degree in Pharmacy at the University of Granada, Spain. Subsequently, he gained an MSc in nutrition and food science and a PhD in Pharmacy from the same university. He started in 2005 as Research at the Department of Paediatrics in the School of Medicine at the University of Granada. His research has focused on topics such as functional foods, infant feeding, obesity, nutrition policies and consumer attitudes. He was involved in the EARNEST Project (6th EU Framework Programme) and in the NUTRIMENTHE project (7th EU Framework Programme). He has published 3 articles, 1 chapter books, 10 international and 3 national communications to congresses, symposiums and workshops.

3.2.5) Ana Martín Lasanta
BS degree in Chemistry in 2008 and was awared by the Spanish Educational Ministry FPU-felowship to conduct her PHD tesis in 2009. Her tesis was focus on molecular electronics and organometallic methodology. 2011 she worked in Professor Furstner group at the Max-Planck Institut. peer reviewed publications:
1. " Ti-catalysed transannular cyclization of epoxygenmocrolides. Symthesis of antifungal + tuberiferine and dehydrobranchylaenolide" Tetraedron 2008, 64, 11938-119452. "Titanium/Palladium-Mediated regioselective propargylation of keytones using propargylic carbonates as pronucleophiles" advanced synthesis & catalysis 2011, 353,73,783. "organic - based molecular switches for molecular electronics". Nonoscale 2011, 3, 4003 - 40144. "Influence of the number of Anchoring group on the electronic and mechanical properties of benzene-anthrocene and pentacene based molecular devices " chemphyschem 2012, 13 (3), 860-868
For more information see the following URL:

http://investigacion.ugr.es/ugrinvestiga/static/Buscador/*/investigadores/ficha/264632

2.2.6) Ignacio Pérez-Victoria.
He has a PhD in Organic and Pharmaceutical Chemistry. His thesis was carried out at a biotechnology company. After that he has worked at foreign academic institutions in Netherlands (U. Twente and MESA+ Institute for Nanotechnology) and UK (U. Oxford). Currently he is the Principal Scientist of the Chemistry Department at Foundation MEDINA.
For more information see the following URL:
http://www.medinaandalucia.es/es/index.html

2.2.7) Antonio Parody Morreale**.**
He has been professor in Physical Chemistry at the University of Granada for 25 years. Along that time he has taught both theoretical courses in the different topics of his field (Quantum Chemistry, Thermodynamics, Kinetics, Spectroscopy) and laboratory courses. He has done research work in the development of thermo chemical instrumentation and in the energetic characterization of biomolecular interactions.
As a Chemical educator he has authored three papers in the Journal of Chemical Education.

2.3) Transnational Discussion.
The teachers involved will participate in the transnational discussion that will take place on the "Chemistry is All around Network" Portal:

- Each teacher will post at least 2 comments per year on the ICT based teaching resources, the non national papers and the reviews of non national articles available on the project portal
- The teachers will participate with the scientific experts in the face to face workshops in order to discuss and assess the material available on the project portal
- A spoke person for the teachers will participate in the online meetings where the results of the workshops will be presented and discussed

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2.4) Evaluation

The teachers involved at national level will evaluate the “Chemistry is All Around Network” portal.

2.5) Tangible results to be produced by each school

- 1 School Presentation Form filled in
- 1 School Participation Letters filled in
- Involvement of 2 teachers and 40 students
- 2 comments per year per teacher on the ICT based teaching resources, on non national papers and on reviews of non national articles available on the project portal.

3. Main obstacles to Students’ Motivation to learn Chemistry

The current system of education in Spain is based on LOE (Fundamental Law of Education). This system consisted of four levels. Pre-school (Educación Infantil, segundo ciclo) - 3 to 6 years old, Primary School (Educación Primaria) six years of schooling - 6 to 12 years old, Compulsory Secondary Education (Educación Secundaria Obligatoria, ESO) four years of schooling - 12 to 16 years old. Post-Compulsory Schooling (Bachillerato) two years of schooling - 16 to 18 years old, a non-compulsory education divided into three options: Arts, Science and Technology, and Humanities and Social Sciences.

Students study Physics and Chemistry as a compulsory subject in 3rd of ESO (2 hours/week), and as an optional subject in 4th of ESO (3 hours/week) and 1st of Bachillerato (4 hours/week). In 2nd of Bachillerato most of science students have to choose between Physics (oriented to Technical Sciences) or Chemistry (oriented to Health Sciences) in a 4 hour-week subject.

In Spain, Physics and Chemistry (as a single subject most of the years) is not considered a basic subject like Mathematics or Spanish Language. Students can study it instead of studying other subjects like Music, Drawing or Computing. Laboratory practises are not always inlcuded in official curriculums and are not compulsory. The presence of STS contents (Science, Technology and Society), like Science History, is increasing in the last years but it is still insufficient. A large proportion of Teachers teach Physics and Chemistry in a very formal and quantitative way, and it is reflected in many textbooks. In this way, the institutional exams, like access to University are oriented in the same formal way. Particularly, chemistry formulation is presented like a terminological language and not as an interpretative language (Solbes, 2007).

These facts make students not to be aware of how important science is. While most of our students consider Physics and Chemistry boring and difficult subjects, they, at the same time, believe them to be very theoretical subjects with little chance of success due to their difficultness. They do not feel attracted to scientific work together with a clear disregard of the role of women in science.

Recent studies show that the number of students in sciences, in particular the number of girls is getting low. Some authors defend the hypothesis that young people think of science subjects like something unattractive and their disinterest in science is higher than in other subjects and them agree that it is a complex phenomenon with multiple causes (Solbes, 2011).

4.1) Reference to publications review:

4.1.1) DECLINE OF ATTITUDES TOWARDS STUDENTS´ SCIENCE: A DISTURBING INDICATOR FOR SCIENCE EDUCATION. Vázquez, A.; Massanero, M.A. (2008) Revista Eureka sobre enseñanza de las Ciencias.

Empirical analysis of the different hypothesis regarding the decline of attitudes towards science subjects in school.

Conclusions:

- -This analysis reveals that attitudes toward science begin in the first years of secondary education and particularly in girls.

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- It seems proved that the altitudinal decline is responsible for the separation of the students from science and technology.
- Authors propose a possible solution changing the way of teaching science in the secondary school (everyday science and focused in generation of curiosity activities).

3.1.2) ROCARD REPORT: "SCIENCE EDUCATION NOW: A NEW PEDAGOGY FOR THE FUTURE OF EUROPE" Rocard, M.; Csermely, P.; Jorde, D. ; Lenzen D. ; Walwerg-Eriksson, H. ; Hemmo, V. (2006) European Commission.
Background analysis-Observations:
A major threat to the future of Europe: science education is far from attracting crowds and in many countries the trend is worsening.
A general consensus on the crucial importance of science education.
The origins of this situation can be found, among other causes, in the way science is taught.

Many on-going initiatives in Europe actively contribute to the renewal of science education. Nevertheless, they are often small-scale and do not actively take advantage of European support measures for dissemination and integration.

3.1.3) ROCARD REPORT: "SCIENCE EDUCATION NOW: A NEW PEDAGOGY FOR THE FUTURE OF EUROPE" Rocard, M.; Csermely, P.; Jorde, D. ; Lenzen D. ; Walwerg-Eriksson, H. ; Hemmo, V. (2006) European Commission.

Main findings:
A reversal of school science-teaching pedagogy from mainly deductive to inquiry-based methods provides the means to increase interest in science.
Renewed school´s science teaching pedagogy based on IBSE provides increased opportunities for cooperation between actors in the formal and informal areas.
Teachers are key players in the renewal of science education. Among other methods, being part of a network allows them to improve the quality of their teaching and supports their motivation.
In Europe, these crucial components of renewal of science teaching practices are being promoted by two innovative initiatives, "Pollen" and "Sinus- Transfer", that are proving themselves capable of increasing children's interest and attainments in science. With some adaptation these initiatives could be implemented effectively on a scale that would have the desired impact.

3.1.4) ROCARD REPORT: "SCIENCE EDUCATION NOW: A NEW PEDAGOGY FOR THE FUTURE OF EUROPE" Rocard, M.; Csermely, P.; Jorde, D. ; Lenzen D. ; Walwerg-Eriksson, H. ; Hemmo, V. (2006) European Commission.
Recommendations :

- Because Europe's future is at stake decision-makers must demand action on improving science education from the bodies responsible for implementing change at local, regional, national and European Union level.
- Improvements in science education should be brought about through new forms of pedagogy: the introduction of inquiry-based approaches in schools, actions for teachers training to IBSE, and the development of teachers' networks should be actively promoted and supported.
- Specific attention should be given to raising the participation of girls in key school science subjects and to increasing their self-confidence in science.
- Measures should be introduced to promote the participation of cities and the local community in the renewal of science education in collaborative actions at the European level aimed at accelerating the pace of change through the sharing of know-how.
- The articulation between national activities and those funded at the European level must be improved and the opportunities for enhanced support through the instruments of the

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Framework. Programmer and the programmers in the area of education and culture to initiatives such as Pollen d Sinus-Transfer should be created.

- European Science Education Advisory Board involving representatives of all stakeholders, should be established and supported by the European Commission within the Science in Society framework.

3.1.5) STUDENTS´ DISINTEREST ON LEARNING OF SCIENCES: TEACHING CONSEQUENCES. Solbes, J.; Montserrat, R.; Furió, C.(2007).Didáctica de las ciencias experimentales y sociales.
The numbers of pupils who apply for scientific post-secondary schooling are decreasing. The authors state the following questions:

- Do the pupils a negative image towards the learning of science?
- Do the pupils know anything about the values and the positive contributions of science to the humankind?
- Does the teaching of science subjects take into account the lack of interest of their students?

To answer these questions, authors used several tools:
Analysis of the data from university access tests in order to confirm the drop out of scientific studies.
Questionnaires and interviews made to secondary school pupils.
Analysis of main textbooks and questionnaires addressed to teachers.

3.1.6) STUDENTS´ DISINTEREST ON LEARNING OF SCIENCES: TEACHING CONSEQUENCES. Solbes, J.; Montserrat, R.; Furió, C.(2007).Didáctica de las ciencias experimentales y sociales.
Results:
The results show a decrease in the number of students that choose science subjects.
The students find scientific subjects boring, less useful than other subjects, theoretical and difficult.
Most of textbooks and teachers don´t show STS contents, and do not mention aims and values of science in or its contribution to human needs in their classes.

3.1.7) STUDENTS´ MOTIVATION AND CHEMISTRY TEACHING. A CONTROVERSIAL POINT.Furió, C. (2006).Educación Química.
Problems detected:
An increasing lack of interest regarding the subjects of Chemistry and Physics has been detected.
The students complain of a science teaching des-contextualized from society, quite useless, boring and without teaching methods that improve their participation.
Solutions proposed:
A science which attends to the construction of the scientific knowledge.
An everyday science in the schools.
Inclusion of STS interactions about technological aspects of science.
Change teachers'´ role in teaching of sciences (motivation- feedback).

3.1.8) TEACHING OF PHYSICS AND CHEMISTRY Education commission ANQUE – National Association of Spanish Chemists. (2005). Revista Eureka sobre enseñanza de las Ciencias.
Manifesto of the National Association of Spanish Chemists in defense of teaching of Physics and Chemistry subjects in our Country.
They analyze Physics and Chemistry teaching problems like decrease of pupils in science subjects and propose solutions like:
Consider Physics and Chemistry as compulsory subjects y in every grade of the secondary schooling.
Increase the number of teaching hours.
Compulsory laboratory practice providing with the necessary resources
Compulsory laboratory teacher lessons.

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3.1.9) WHAT DO STUDENTS SAY ABOUT SCIENCE CLASS? A CROSS STUDY FROM THE PRIMARY SCHOOL TO THE SECONDARY SCHOOL Marbá-Tallada, A.; Márquez, C (2010). Revista Enseñanza de las Ciencias.
This paper reports student's opinions toward their secondary school science education and presents several attitudinal analyses:
Through the schooling.
Through schooling comparing boys and girls.
Comparing the students who want to become scientist with those who do not.
Comparing the students who want to be taught as much science as possible at school with the ones who do not.
Comparing the students who are willing to get a job in technology rather to those students who are not willing to get a job in technology.
3.1.10) WHAT DO STUDENTS SAY ABOUT SCIENCE CLASS? A CROSS STUDY FROM THE PRIMARY SCHOOL TO THE SECONDARY SCHOOL Marbá-Tallada, A.; Márquez, C (2010). Revista Enseñanza de las Ciencias.
Conclusions:
The decrease of their motivation decreases with secondary compulsory education.
The decrease of their motivation is more significant in girls.
Differences between students with negatives or positives attitudes are concerned to the useful of science, but not its difficulty or attractive.
We need to study if science teaching contents are adjusted to student's interests.
The role of the teacher is very important in the students' election of science courses.

4. Analysis of Teaching Resources

4.1 ¡A FORMULAR!

Contents: This is a web application to learn the inorganic formulation recently awarded by the ITE. The application is based on the principles of interactivity, progressive learning and self-evaluation. We can find led theoretical contents and then practical activities divided in five blocks of contents: basic concepts, oxides, and volatile metal hydrides, hydrogen acids and binary salts.

Point of strength:

- Attractive design. -Facility in access and use of the resource.
- -Self-evaluation activities to verify the effectiveness of learning. -A didactical guide for teachers.

Point of weakness:
Only shows binary compounds
Pedagogic value: High, due to their attractive design and evaluation activities.

4.2 CIENCIA EN ACCIÓN

Science in action is the website of an international competition for Spanish-speaking countries and Portuguese. The competition is open to science teachers and science communicators. You can find in this website news about the contest editions, a collection of experiments (all levels and subjects) and videos about every year editions.
Point of strength: A high variety of experiences available in the web.
Point of weakness: Only useful as a database of experiments.
Pedagogic value: It has a high pedagogic value for teachers and students and it´s perfect to design your own practical experiences and science fairs.

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5. Workshop

Spanish workshop was held on September at Santo Tomas de Villanueva School. Ten participants: 4 experts and 6 teachers.
Antonio Jesus Torres Gil was the moderator of the workshop.
Timetable of the workshop: 16.00 – 20.00

1. Project presentation
2. Presentation of teachers' and experts' comments (tool WP3.A) about the papers on student's motivation uploaded by Partners on the Project Portal
3. Presentation of teachers' and experts' comments (tool WP3.A) about the teaching resources uploaded by Partners on the Project Portal

Coffee break

4. Definition of resources to be proposed for trial during next school year.
5. Conclusion

The workshop started with a power point presentation of Chemistry is all around network project. A general overview of the project task done and to be done was presented through the project chronogram. Briefly presentation of the project partnership consortium to figure out the map of the institutions, their background and persons involved in the project.
Almost all participants have been navigated in the project portal before the workshop and they knew the comments from other countries experts and teachers about student's motivation.
Following the introduction experts and teachers made their presentation of their comments about papers and review of publications of student´s motivation and teaching resources uploaded by partners on the Project Portal.
Attendances conclusions where:

- Motivation problems on chemistry students are common to most countries in Europe.
- Decreased number of sciences students in all school levels
- Lack of students motivations due to intangible vision of students on sciences
- Decline of attitudes towards science subjects in school.
- It seems proved that the attitude decline is responsible for the separation of the students from science and technology.
- Change teachers' role in teaching of sciences (motivation- feedback).
- Papers about motivation demonstrate that European student's aren´t so different from one country to another.
- Science teaching is base in a very theoretical way all around Europe and it is needs to be adaptate to everyday life in order to catch the attention of students to sciences subjects.
- ICT resources must be included in chemistry teaching.
- Science student's motivation is totally decrease in secondary educational level.
- The motivation decrease is more significant in female gender students.
- Differences between students with negatives or positives attitudes are concerned to the useful of science, but not its difficulty or attractive.
- The necessity of a teacher's review on student's interest.
- Revision of teaching sciences contents at students levels
- The role of the teacher in class it is totally influent on students choice
- The necessity of a new way of approaches from expert to scientific work
- We must look for ways for experts to approach scientific work and contributions of science to our students.

Some initiatives carry out in the University of Granada was mention by the experts. Those initiatives consist to bring scientific work closer to the classroom. Some exemplas are, visit research centres and show the students what they are doing there. Another very good example are the sciences museums, and the way in which they spread science in an attractive and hands-on form.

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The relevance of some articles was mentioned, such as Norman Reid´s "A scientific study about why our student don´t like chemistry, and a number of reports and papers about the use of everyday science like "Chemistry at home" by Salta, Gekos and other Greek authors. It´s a non traditional didactic approach based on the teaching of science in context. Some people made comments about the Rocard Report and asked for the dissemination of this report to secondary school teachers.

During the workshop participants debated about possible solutions regarding the decrease student motivation in chemistry and they reached some interesting conclusions. For example, we discussed how making chemistry understandable for the students is the most direct way to motivate them. In fact, many times an excess of theoretical content taught in our schools (such as formulation) makes understanding the subject difficult and moves to our students away from the science classroom.

Regarding resources, the majority of the workshop participants evaluated the amount of attractive resources that are presented in the project´s portal and some mentioned its great possibilities for teachers teaching in the classroom. Very constructive comments were made about the Portuguese web page "A química das coisas" ("The chemistry of things), the web "Chemistry for life" and all the teaching resources made with JMOL, and we looked at the possibility of applying some national resources in the classroom this coming school year.

Finally, some meeting attendants highlighted that participating in the project and in the meeting had been very beneficial, giving them a chance to exchange ideas among different countries methods of science teaching, it is very enriching because it offers many points of view, stimulates reflection and motivates teachers to look for improvements in the "day to day" of their works.

6. Conclusions

The fact that our society needs scientific literacy is beyond question. However, our students have an opposite opinion of this, as they have not positive attitudes towards school science and, particularly, towards Chemistry. Their science view is negative due to several facts: a teaching method in which we do not pay attention to experimental work, a non-contextualized science teaching, and a very theoretical curriculum which does not motivate students to choose science subjects in their scholar life.

In order to solve these problems, it is necessary to change not only the contents but also the orientation of the curriculum. It has to be connected to reality and focus on students´ needs. Teaching methods must be based on experience and daily science together with more STS and Science History contents. These changes should include ICTs in Science teaching and promote the exchange of experiences between teachers on the Internet. Institutional support to this kind of project show us the way for a new science teaching horizon.

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