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Spanish Students Motivation on Sciences.

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Abstract

In this paper, 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.

1. Introduction.

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.

2. 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].



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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.

3. 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].

4. 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



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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 Synergia 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.

5. 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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