A CLIL PROPOSAL FOR TEACHING-LEARNING OF ELECTROMAGNETIC RADIATION IN THE SUBJECT 'SCIENCES FOR CONTEMPORARY WORLD' AT HIGH SCHOOL

UNA PROPOSTA AICLE PER ENSENYAR I APRENDRE LA RADIACIÓ ELECTROMAGNÈTICA EN L'ASSIGNATURA "CIÈNCIES DEL MÓN CONTEMPORANI" A L'INSTITUT

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1. Point of departure and objective of the experiment

In 2008 a new academic curriculum of post-secondary education (DOGC, 2008) *Batxillerat* (16-17 years old students) started its implementation in Spain and in Catalonia. Since then the new subject "*Ciències per al Món Contemporani*" ("Sciences for Contemporary world") is compulsory in the three modalities of *Batxillerat* (Science and technology, Arts and Humanities-Social Sciences). It is the first time that a science oriented subject is taught to post compulsory, both science and non-science oriented students.

To understand some key content of this subject (e.g. the Universe, or Climate change), a good understanding or electromagnetic radiation is desired. The first year (2009-2010) that the author of this work and teacher of the mentioned subject taught it,

she explained in plenary sessions the key concepts of radiation (wavelength, frequency, energy) and main uses of the different kinds of it, using good simulations and animations of electromagnetic waves, and using a dialogic way with students. But she perceived the classroom sessions as disappointing, students did not show a desirable interest on the topic and the evaluation results were worse than the results in other topics. It is to note that when asking students about the meaning of the word “radiation” students answered relating it to “dangerous” “or “bad thing” or even “bad uses of science”. Moreover they showed a bad predisposition to the topic, expressing that it was very difficult, with formulas and unintelligible figures, very difficult to understand even in their own language.

It has been established by studies in science education (Sanmartí, 2002), and in the use of CLIL in sciences (Canet, 2010) that the main factor that influences students learning outcomes on a topic is the previous knowledge that learners have on it. Having this in mind, one factor that could contribute to explain such results was the previous idea of radiation that students had. To improve this situation, new teaching material was created, and a new management of the class periods was proposed. In this work the main features of materials and classroom management are explained. Results about learning achievement are expected to be obtained in the future.

2. Context

The action was performed in the subject “Sciences for Contemporary world” of first year of high school (16-17 years old) in INS Ferran Casablancas (Sabadell). It is a large school, it has seven groups of students (30-35 pupils) in the mentioned level, and the action was taken in two groups in 2010-2011. After revising the action and adapting it taking into account the results obtained in the first implementation, it will be put into practice in three groups the present academic year 2011-2012.

This subject is taught using CLIL Methodology. This methodology started in our school with a Multilateral Comenius School partnership 2008-2010 (information available in the website http://sciencemaths-clil.eu/) in which a community of practice of CLIL was established with expert teachers and novice (our school) ones; part of the teaching and student materials used in this action were created in the partnership.

3. **Development, teaching strategies and materials created or used**

The action was performed as a part of the activities in the topic about “The Universe”, and in the topic “Sustainability”. To understand the current cosmological theory of the Big Bang and to understand the Earth Climate Change, students need to deal with electromagnetic radiation. Most of students are Catalan and Spanish speakers. Both teaching materials and instructions were in English.

In Fig.1. below the objectives, the activities and the management of the classroom of the whole action are detailed.

Learning Objectives	**Activity**	**Classroom management**
-To relate electromagnetic radiation (ER) with daily experiences of students	-After asking orally the whole group about ER, a different image is given to each student. -Students are asked to write how this relates to daily activities and radiations	-Individual writing activity -Plenary discussion
-To know and to work with variables of ER (frequency, wavelength, speed, energy) -To relate EM with knowledge of the Universe	-Students have to solve a questionnaire on EM They can use information from reliable sources or websites, as NASA (given by the teacher)	- Each student is an expert on an aspect of ER (generalities, variables, EM emitted by celestial bodies, radiation protection) experts worked first individually - Meeting of experts - Each expert contributed to his/her Cooperative group: each group was formed by experts on different aspects of ER.
-To know similarities and differences between the different groups of the electromagnetic spectrum. -To be able to determine if a radiation is ionizing	-Using data on a chart of the EM, determine the energy, wavelength and frequency of each group of radiations in the whole Electromagnetic spectrum	In groups (3-4 students): -Firstly each group of students works on one kind of EM (e.g. microwave, radio waves...) -Each group explains it to the whole class, filling a chart in the board of the class. At the end of

		the session in the board remain the main features of all EM.
-To determine experimentally the velocity of an ER	-Students do the activity at home, using a microwave oven. They take some pictures of their experiences and calculations.	-Homework activity

Fig.1. Main features of the action presented to work electromagnetic radiation using CLIL methodology with students of first year of high-school.

4. Evaluation and conclusions

This experience has been implemented once, students showed a positive attitude to the activity and so were the learning outcomes in the evaluation. Some students' sheets have been improved in order to optimize the activity.

5. Proposals for future

This action will be implemented for second time this academic year (2011-2012). Students will produce written material. This material will be studied to test the evolution of their impressions about electromagnetic radiation pre and post implementation.

6. References

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