New Perspectives in Science Education
International Conference
NEW PERSPECTIVES in SCIENCE EDUCATION

CLIL Teaching in Physics: Methodologies and Technological Innovations

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Abstract

CLIL is an acronym invented by David Marsh e Anne Maljers in 1994, it means Content and Language Integrated Learning. It represents a new kind of learning, usually for the student of the secondary high school, which pairs the teaching of non-linguistic subjects in a foreign language, by the using of innovative methodologies. This kind of teaching represents one of the most important elements about modernization of European innovation systems. In fact, in particular for teacher, this approach presupposes an high linguistic level (equal or greater than C2). In this paper, starting from the classical elements which composes a CLIL lesson, we will expose new methodologies about this kind of teaching, taking into account the aim of enhancing students' motivation, to strengthen their knowledge, in particular, about Physics, We will present also new technological approaches by the help of classroom's instrument (digital whiteboard, notebook, tablet, etc) and mobile devices proper of the everyday life of the students. It can be used many online platforms to produce interactive lessons, quizzes, etc. In this way the problem solving approach, cooperative learning tasked based go fundamental, by the using of various learning styles (visual, auditory…). In this way the student becomes the center of the learning process through significant processes. They will be also studied difficulties about this methodology and possible ways to avoid them. Examples about this kind of lessons will be presented.

1. Introduction

The acronym CLIL means “Content and language integrated learning” [2], it was created in 1994 by David Marsh [3]. Another usual and impressive definition for CLIL has been given by the Italian teacher Coonan in [1]:

“CLIL is a kind of educational process, more or less long, characterized by strategic, structural and methodological choices, designed to ensure the integrated learning dual - language and non-language content, by learners who learn through a non-native language”.

CLIL is a methodology similar but distinct from a language immersion and content-based instruction. CLIL is a kind of approach helped by the vehicular using of the foreign language, students can improve the knowledge about language and contents. CLIL becomes not only an extension of the second language L2 [4], but acquires others purposes: education towards diversity, intercultural comprehension, improvement of the proper student's language, enhancement of the interest towards new languages. The paradigm of constructivism and social constructivism brings the student, as it should be, at the center of the learning environment, which must improve this line of methodology [5,6,7]. Scaffolding is another methodological way so useful in a CLIL lesson, is used to move students progressively toward stronger understanding and, ultimately, greater independence in the learning process. The adoption of CLIL methodologies in schools is improving year-by-year, in Table 1 we can see some data about the using of CLIL methodology in Italy in 2010, the growing in the successive years has been very strong with percentage of 70% too.

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Subject Areas	Year 1	Year 2	Year 3	Year 4	Year 5
Italian language & culture	132	132	132	132	132
Latin language & culture	165	165	132	132	132
Ancient Greek language & culture	132	132	99	99	99
Modern foreign language & culture	99	99	99	99	99
History & Geography*	99	99	99	99	99
Philosophy*	0	0	99	99	99
Math*	99	99	66	66	66
Physics*	0	0	66	66	66
Natural Sciences*	66	66	66	66	66
Art History*	0	0	66	66	66
Physical Education	66	66	66	66	66
Religion/Free Time	33	33	33	33	33
TOTAL	891	891	1023	1023	1023

Table 1: Hours of Instruction of CLIL per Year for Subject Areas in Each Year of the Italian Classical Lyceum Curriculum (MIUR, 2010c) [9].

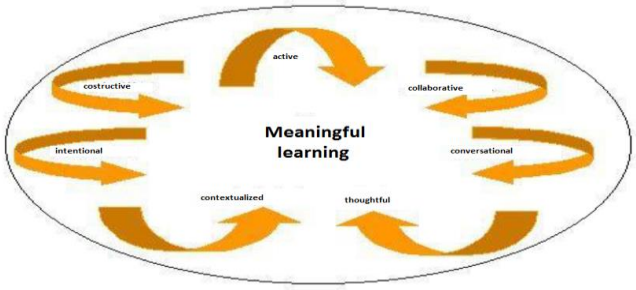
This is the plan of the paper, in Section 2 we will give some ideas about methodologies and technical innovation, in Section 3 an example for a CLIL lesson in Physics, will be presented some final conclusions at the end of the paper.

2. Methodologies and technological innovation

A CLIL lesson is an heavy charge for a teacher, in fact to prepare this kind of lesson is a complex and long process. They exist many books where a teacher can find prepared lessons, but usually they are simple texts written about a certain topic and in a foreign language, with some questions and quizzes about the topic itself. CLIL is a mixture of different methodologies, interaction with students, using of technological instruments, and in particular about a physics CLIL lesson, laboratory experiments and analysis of the results and of the acquired data. The starting point of the lesson is the most important part, so the teacher must using visual methods, to show relationships inside the topics of the lesson and to present real examples, in particular teacher can use videos, pictures etc. The variations about the work for the student from the state of alone, to that in pairs or in group is another useful strategy.

2.1 Methodologies

Different kinds of learning exist. Student and teacher cooperate in many different ways, with the aim to reach



a full and strong learning, the visual-verbal is the usual way. In CLIL one important methodology is the kinesthetic, by practical interaction the learning becomes much more immediate. We can resume the some ideas for CLIL through the Figure 1, here is a scheme about a style of significant learning.

Figure1: An example of meaningful style learning.

With the aim of acquiring a significant learning, the attention must be focused on techniques, activities and information. Teacher, to gain this result with the students, must prepare them about the new used methodologies, in particular during a CLIL lesson must be taken into account the auditory level about the language, so teacher, which in the most of cases is a non linguistic teacher, must cooperate with others colleagues, in particular from the linguistic area of course, to analyze the best lexical and structural aspects to not create mortification in the student. They must be considered also all the problems about not only the foreign language but also the native language. The greatest goal would be to make the CLIL activity a real part of the curricular teaching, in this way it can be constructed a well structured and monitored route.

2.2 Technological innovation

The starting point to introduce a full innovation is the focusing on methodologies like the problem solving approach and the cooperative tasked based learning. Multimedia supports are fundamental too in this phase, the LIM blackboard is an essential requirement in every classroom. Very useful is the eTwinning platform. Formation about CLIL courses is one of the fundamental activity which this platforms carries on, sharing information and collaboration among people [8]. By the using of technological supports can be done interactive lessons between teacher-student and student-student [10]. There exist many online resources to share information and perform interactive lessons. The Moodle platform is an internet site to exchange material and news with teachers and students in a very practical a quick way. Another simple way to collaborate with people all over the world is Padlet. By the using of Padlet can be created message boards to interact with people. Kahoot is one of the best free sites to prepare game-based lesson, thanks to this platform leaning goes funny for the students, on this platform they can be found many subject, in many languages, for any kind of device, and for all ages. In particular, about Science, and more in particular about physics, there are many other online resources:

1. iKIDS is a website where students and teachers can learn through the invention and their creativity by preparing interactive materials;
2. the BBC has created the iPlayer website where student can find many interactive resources, in particular here can be found many resources and materials for technological experiences;
3. The NASA sites has dedicated a full part about physics problems about the field of electricity and connected elements;
4. Last but not the least the YouTube channel is full of very interesting videos about technology and science, here teacher can find ideas to prepare experiments and quizzes about many topic.

The previous are only some sites concerning technological ideas to prepare interactive lessons for CLIL, but teachers by them can produce the interest of the student showing that their mobile devices can be used in many ways that are not the so much used social networks or similar. We give some web links of useful technological tools:

1. for resources/ideas: edtechteacher.org, edutopia.org;
2. for quizzes/assessment: nearpod.com, plickers.com;
3. for collaboration: edmodo.com, padlet.com;
4. for presenting/creation: prezi.com, zaption.com, easel.ly.

3. An example of lesson

In this section we will give an example of lesson for Physics in CLIL about the Bernoulli's principle, This principle is a basic one in fluid-dynamics [11].
The following can be a plan of the lesson, during it we consider various kind of approach, focusing on the using of technological elements:

1. The starting point of a CLIL lesson must always be some words about what is CLIL, how is born, features, the methodological approach etc.
2. The next step is the division of the class into groups, this is a usual manner to improve the learning level of the student and their interaction.
3. Teacher gives some vocabulary, this is important because usually the vocabulary is very technical so the students reveal problems about comprehension.
4. The teacher proposes some questions about the topics in the form of open answers, multiple choices, true/false questions; scaffolding is the main topic in this moment.
5. Students look at a video about the argument (from YouTube for instance). During the video students write the expressions that they don't understand, so at the end of the vision of the video concept can be expressed by asking to the teacher but also by considerations about the video. A video with music and songs is very useful to impress the concepts.
6. A “domino game” is a funny activity. Students have to couple stripes of paper, in every stripe there are two sentences, students must connect a stripe to another in order to obtain a sentence with sense which starts from a stripe and ends to another. If students have done the right choices the second sentence of the last stripe must be connected with the first sentence of the first stripe.
7. Teacher prepares a quiz game on Kahoot with multiple choice questions, every group of students has a certain time to choose the right answer, so they can acquire a score depending on the time occurred to reply and if they choose the right answer.

A second part of the lesson can be a laboratory test. In [12] can be found more ideas about laboratory activities.

4. Conclusions and future developments

CLIL is a new methodology which includes many educational aspects from different fields of teaching and learning. CLIL includes also many innovative methodologies in particular by the help of technology. In this paper we explained what CLIL is, the features, and we have shown how this methodology involves all the aspects required by the new European schooling guidelines. By the help of technology we have shown how a Physics lesson can become funny and interactive. A further step could be the production, at first, proper of the teacher of an online platform with the aim to exchange didactic material via teacher-student but also student-teacher. Students can work about the proper computer part of the site, in order to improve the site's potential but also their technological skills.

References

[1] Coonan C.M., “Il futuro si chiama CLIL: una ricerca interregionale sull'insegnamento veicolare ”, TRENTO, Editore Provincia Autonoma di Trento, vol. 1, pp. 23-39 (ISBN 9788877021427). (in italian)
[2] British Council BBC Teaching English (http://www.teachingenglish.org.uk/article/clil).
[3] http://www.educlusterfinland.fi/en/contact-us/global-operations/david-marsh.
[4] Balboni, Fare educazione linguistica, ed. cit., 2013, pp. 12-13 (in italian).
[5] Teresa Navés,Carmen Muñoz , Maria Pavesi, Acquisizione della seconda lingua per il CLIL. TIE-CLIL, pag 67-71, 2014. http://www.unifg.it/sites/default/files/allegatiparagrafo/21-01-2014/naves_munoz_and_pavesi_acquisizione_della_seconda_lingua_per_clil.pdf (in italian).
[6] http://www.innovascuola.gov.it/opencms/opencms/innovascuola/didattica_digitale/primo_piano/incontri/content/Jonassen.html (in italian).
[7] http://education.missouri.edu/faculty/SISLT/Jonnassen_David.phpkeepThis=true&TB_iframe=true&height=500&width=900.
[8] V.A., “eTwinning generation”, Central Support Service for eTwinning, 2015, ISBN 9789491440915.
[9] Andrea R. Leone, “Outlooks in Italy: CLIL as Language Education Policy”, Working Papers in Educational Linguistics 30(1): 43–63, 2015 (www.gse.upenn.edu/wpe).
[10] Ulla Fürstenberg, Petra Kletzenbauer, “CLIL: from Online Sources to Learning Resources”, International Conference “ICT for Language Learning”5th edition, 2012.
[11] Landau, L.D.; Lifshitz, E.M. (1987). Fluid Mechanics. Course of Theoretical Physics (2nd ed.). Pergamon Press. ISBN 0-7506-2767-0.
[12] Hogan K., Pressley M., *Scaffolding Student Learning: instructional approaches and issues*, Brookline Books, Cambridge 1997.