TEACHING PHYSICS IN A CLIL/BLENDED LEARNING ENVIRONMENT AT PRIMARY SCHOOL

Michele Goffredo, Marco Albanese, Debora Infante, *University of Basilicata*

Giacomo Bozzo, *University of Calabria*

Abstract
In the last few years, many European countries have developed an increasing interest towards CLIL (Content and Language Integrated Learning) which refers to any dual-focused educational context in which an additional language is used to convey a non-language content. Official European documents continuously focus on CLIL, having a contribution to make to the Union's language learning goals and to the promotion of multilingualism and intercultural competence. This paper aims to present a short term model where the teaching of Physics through English to primary school children is developed in a blended learning environment.

1. Introduction

Learning through cross-curricular teaching starting at primary school may represent an instrument that can improve the students' learning process and can be an educational goal to be achieved. Learning through cross-curricular teaching helps students to apply and transfer knowledge from one context to another one and favours the development of a net-like cognitive map. Learning a subject through different languages makes students flexible and aware of the role that each of them may play. Furthermore, concepts, strategies and skills taught in a specific language can be transferred to other content areas. Cross-curricular teaching may also boost the affective dimension since students assign greater value to what they are learning and feel more actively engaged and motivated. A language is a complex communication system with specific semantics and grammar, the acquisition of which is possible through immersion in different contexts. One of these refers to the subject contents which offer a gateway to diverse meanings and languages which can be acquired better when a cross-curricular/interdisciplinary approach is foreseen.

The idea that cross-curricular teaching offers a meaningful way for students to use the knowledge learned in a specific context as a knowledge base in other contexts is one of the paradigms of Content and Language Integrated Learning (CLIL) (Darn, 2006). This relatively new approach, defined as "the teaching of non-language subjects through a foreign language, with both subject matter and language learning as goals" (Nikula, 1997: 5), represents a concrete opportunity for students to improve their proficiency in the foreign language without weakening the content subject. Within a CLIL framework, language and content are learnt together, in an integrated way. This means that CLIL students learn the concepts of the content subject, that are not already shaped by first language linguistic items, through a foreign/second language (Wolff, 2007). This represents a tremendous challenge when adopting CLIL in a school context. Sometimes teachers and parents are worried that learners who are taught content subjects through a foreign language are not able to grasp the key concepts. It seems that this fear is felt more when referring to scientific subjects. Research in this direction shows that this fear is more or less unfounded (Wolff, 2007).

Some researchers who study language in context underline the wide variation in the formal and functional characteristics of language from one context to another (Halliday, 1985). This means that knowing how to use language in one context does not necessarily mean we are able to use it in another one (Geenese, 1994). If the scientific education is considered, it implies taking possession of specific meanings, domains and registers. For instance, some advanced academic domains, such as Mathematics or Physics, also need narrative or argumentative registers in order to be expressed. But, as emphasized by Short (1994), the way language is used in some academic domains, such as Mathematics, is not the same way it is used in other academic domains such as Social Studies. What results from CLIL is not the passage from one academic domain to another, but the passage from a language that is oriented to everyday content, especially at primary school level, to a formal language content.

The model presented in this paper represents the first step in a wider research design which aims to test the potentialities of a CLIL environment where a positive attitude towards scientific subjects, in particular Physics, may be developed starting at primary school, supported by the help of technology. It is our intention to show how the model could be applied to improve pupils' language and scientific awareness The originality of this model lays in the construction of a blended learning environment as a background to all the CLIL activities with a network of teachers and students from the same geographical area (and not from different countries as in most CLIL Italian projects funded by the European Commission in the field of Socrates and the Lifelong Learning Programme) who interact on matters concerning Physics through the use of a foreign language. In this paper, a pre-test resulting from a brief experience carried out in three schools in the South of Italy is presented.

A blended learning environment, defined as an integrated combination of traditional learning with web-based online approaches to accomplish an educational goal (Driscoll, 2002), is considered necessary in this context where an integration of language and content is intended to be achieved. It is clear that the usefulness of ICTs in foreign language learning is shown especially when these technologies assist language learning and global communication, so that the learner can show his / her ability to negotiate his / her own pathways (Hamilton, 2005). The use of computers as machines to mediate communication (CMC) seems to offer more opportunities, especially for language learners, to practice the target language "through social interaction both with a tutor and with peers and useful to encourage students to construct their own knowledge" (Hampel and Hauck, 2004: 68). Furthermore, it is generally agreed that collaborative writing improves the teaching/learning process in blended learning courses (Zorko, 2007). In this kind of activity the students are supposed to explore several learning procedures and negotiating skills such as: attention to the "connective" writing process (they are readers and writers, but also editors, reviewers and collaborators) and to the organization of the information (Richardson, 2006).

If this approach is balanced with classroom teaching where a content is conveyed through a foreign language, effects on learning may be meaningful.

2. The research context

CLIL is very widespread in Europe (Eurydice, 2006) and it is gradually gaining success also in Italy (Infante, Benvenuto & Lastrucci, 2008). However, up to now there are no mentions in the literature of experiences in the Italian context where a blended learning environment has been built to let teachers as well as pupils from the primary school interact on their CLIL learning experience.

This original model of teaching Physics through English using a blended approach was tried out on a sample of 72 students entering year five of three different primary schools located in Bitritto (Bari), Matera and Potenza. The amount of hours devoted to this experience was ten, including face-to-face and online activities. Three teachers of English, three of Science and a teacher of Italian were involved in the project. They were trained at the University of Basilicata about the use of the Learning Management System (LMS - provided by the Department of Physics of the University of Udine), the basic concepts of magnetism and the CLIL approach.

As the Internet access among the pupils was not homogeneous, the online section was developed as part of the class activities. The children used one or more PCs in the school laboratory in order to produce the written parts (forum and collaborative writing). They shared the content with the rest of the class, always supported by the teachers, before posting on the LMS, writing one sentence each on the keyboard. The class from the outskirts of Potenza realized the activities at the University of Basilicata due to the lack of the Internet connection.

The teachers were provided with a glossary, seven videos showing six different experiments regarding electromagnetic phenomena (moving a magnet closer to different materials and metals; interaction between magnets, on a table and with a hung magnet; a compass and a magnet; interaction between two magnetic rafts) and a set of handouts describing the experiments. The teachers were also asked to fill in a journal and post it onto the LMS so as it could be shared with the other colleagues, in order to give all the details about how they managed the lessons, the teaching techniques, the pupils' reaction and about their impressions and possible ideas and suggestions.

As regards the collaborative activities, three forums were activated: *presentations*, in which the students were supposed to introduce themselves to their new friends; *impression*, in which the

groups were requested to give their opinions and express their feelings about the videos/experiments; *survey*, dedicated to the teachers, in which they were invited to ask their pupils about their favourite video/experiment and then provide the number of votes or each video/experiment. Then a set of open-ended questions regarding the videos/experiments was arranged in the "scricoll" (collaborative writing) section, aiming to check the overall comprehension of the experiments and the use of the language.

3. Description of the experience

The data have been collected through a continuous analysis of the online environment, especially the following sections: forum, shared materials, collaborative writing ("Scricoll"). We studied the interactions that the teachers created in their classes, the journals they filled and, of course, the pupils' production both in English and in Italian, in order to report their interest and participation. All the teachers from the three schools introduced the project to their pupils and presented the new words during the first lesson both in the oral and in the written forms. They adopted activities typical of the language class such as: repeating words with the correct pronunciation and intonation, using in the case of the teachers from Potenza the International Phonetic Alphabet (IPA) as support; pointing to the objects and guessing the names and memory games.

As regards the videos, the teachers from Potenza and Bari showed them after the introduction of the new words, asking the pupils to describe in English what they had just observed. Then they reproduced the experiments in the classroom. The teachers from Matera, however, decided to follow this procedure only in one case and, for the rest, involve the students in performing the experiments before showing them the videos. In this case, the pupils described through English each phase of the experiments as they were in progress. As a result, the teachers pointed out that the children appreciated more the second option because they felt more collaboratively involved in formulating the hypotheses. As one of the teachers wrote in her journal, all the students "*observed, described, found out similarities and differences, identified cause-effect relations and classified different electromagnetic behaviours*". In particular, while projecting the videos, the pupils from Potenza were stimulated by the teachers to comment and reflect on what they were watching. They were also invited to connect the physical phenomena to daily life experiences, widening their vocabulary and finding out which other materials, apart from those watched in the videos, could behave in the same way.

The pupils also worked online both in the forums and in the collaborative writing sections. Those from Matera and Potenza wrote in English in the forums, while the pupils from Bitritto (BA) wrote in Italian. The answers were negotiated by the students, with the help of the teacher. For this reason, the pupils had to think about what they had written, being responsible for the content of the message itself. This was the first step towards the acquisition of an "interactive competence" (Kol and Schcolnik, 2008), in order to fully promote a more involving language learning process (Warschauer, 2007) and increase individual effectiveness (Kaplan, 2008). The online collaborative writing was not fully achieved due to the short length of the experience and to school resources. The face-to-face activities were aimed at improving listening and speaking; while the online ones were dedicate to enhancing reading and writing. The teachers also provided photos and videos of the children performing the experiments, while they were explaining them in English. According to a survey the teachers carried out in the classes, the pupils appreciated the hung magnet and magnetic rafts videos more than the others.

4. Conclusions

The project, even at its preliminary stage, showed how the methodology chosen for the development of the activities favoured the pupils' development of cross-curricular attitudes in the conscious use of different languages. The teachers performed the role of *coaches* and resources for the pupils and not of knowledge providers. The pupils actively participated during the meetings accepting and rejecting the proposed challenges. Furthermore, they autonomously promoted a kind of game among them in the search for other words in English, respecting the classification of the experiments. In this way, they spontaneously conducted an in-depth reflection, unforeseen in the initial planning. The blended learning environment (face-to-face and online) revealed its

effectiveness, as results from the pupils' observations and impressions (see appendix 1), in favouring collaborative (not competitive), mindful and meta-cognitive learning.

The research and the activities carried out following the various steps of the model (preliminary teacher training, final objective sharing, pupils' involvement in the planning the classroom activities, use of collaborative writing through technology to sum up the results of the experiments) confirmed that language learning is an interactive, dynamic process, in which new knowledge is most fruitfully acquired when learners can explore materials and resources in flexible learning environments, not restricted to the subject, combining new information with previous knowledge and drawing conclusions from this process. According to the *Common European Framework of Reference for Languages* (Council of Europe, 2001) this is defined as *learning and language awareness* that Lund and Rüschoff (2003: 17) refer to as "the linguistic dimension in language learning as consisting of a multiple of strands, including: a reflection upon learning progress, a socio-cultural competence, and functional-notional categories".

5. Appendix

Impressions from Forum 2 (translated from Italian)

A - Bitritto (BA):
• *I liked it because I learnt things that I hadn't done in class up until now. (Antonio)*
• *We worked all together, we enjoyed performing some interesting experiments and since the English language is a bit difficult, learning in this way was easier. (Donato)*
• *In my opinion, it was interesting because it is another way to learn English and Science. After repeating the names of the metals many times, now they are more familiar to me. The subjects taught in a fun way are easier to learn. (Alessia)*
• *I found it very interesting. It is a good way to put into practice what you learn, so the brain sets into motion. (Francesca)*
• *To me watching the videos was boring, but the rest of the lesson was fun because I learnt scientific words in English that I didn't know. (Gennaro)*

B - Matera :
• *Physical phenomena were explained in a simple and clear way. Furthermore we learnt English words that we didn't know. (Angelica)*
• *Electromagnetism was presented with experiments. Some of them were very interesting others were less. (Marianna)*
• *Almost all of us were able to answer the questions that our teacher asked us and explain the phenomena. We are great!!!!!!!! (Michele)*
• *I thought the experiments were more interesting and involving. (Giovanni)*
• *Performing the experiments of Physics through the English language allowed us to increase our vocabulary both in English and in Physics. It seems strange, but we understood electromagnetism even if it was explained in English. (Angelo)*

Open-ended questions (collaborative writing)

1 - Can you list what is attracted by a magnet?

A magnet can attract coins, compass, scissors, another magnet, a nail. (Bitritto - BA)
The objects that are attracted by a magnet are: coin, scissor, paper clip, nail, iron, marble, magnet. (Matera)
Steel, coin, nail, iron, scissors, needle, metal, sharpener, magnetic raft. (Potenza)

2 - Can you list what is NOT attracted by a magnet?

A pen, a piece of aluminium, a red plastic ball, a watch, a stainless steel ring are not attracted by a magnet. (Bitritto - BA)
The objects that aren't attracted by a magnet are: plastic ball, aluminium, wood, plastic, rubber, pencil, pen, ruler. (Matera)

Stainless steel, aluminium, tray, marble, bronze, compass, wax, little cube, wire, geomag, cast iron, wood, material, copper, glass, polystyrene. (Potenza)

3 - If you move a magnet closer to a table-tennis ball, is the table-tennis ball attracted or not? Why?

No, it is not attracted because it is not of metal. (Bitritto - BA)
No, the table tennis ball isn't attracted, because it isn't a ferromagnetic metal. (Matera)
No, why not is by metal. (Potenza)
4 - If you move a magnet closer to a pair of steel scissors, is the pair of steel scissors attracted or not? Why?

The pair of steel scissors are attracted by the magnet because they are of metal. (Bitritto - BA)
If I move a magnet to a pair of steel scissors it's attracted because it is a ferromagnetic metal. (Matera)
Yes, perché contiene metal. (Potenza)

5 - Are all metals attracted by a magnet? Can you give any examples of ferromagnetic metals?

No, some metals are not attracted. For example magnet and the needle of the compass. (Bitritto - BA)
No, all metals aren't attracted by a magnet. Some ferromagnetic metal are: iron, marble, paper clip, scissor, nail, coin, compass, geomag, needle. (Matera)
Yes, perché contiene metal, steel, iron, cast iron. (Potenza)

5.1 - Which metals are attracted and which are not?

Iron, steel, stainlees steel are attracted. Aluminium, bronze, brass are not attracted. (Bitritto - BA)
The metal attracted are: iron, nail, coin, scissor, paper clip. The metal that aren't attracted are: alluminium, plastic sfere, wood, copper. (Matera)
Steel, iron, cast iron are attracted. Brass, stainless steel, copper, are not attracted. (Potenza)

6 - Describe the behavior of a magnet moving closer to another magnet.

The opposite poles attract each other. (Bitritto - BA)
If there are same poles, the magnet turns around and they repulse. If there are different pole, the magnet attracts the other magnet. (Matera)

7 - Describe what you see when you move a magnet closer to a hung magnet.

The hung magnet rolls and moves towards the other magnet. (Bitritto - BA)
The magnet can attract or repulse it. (Matera)

7.1. How do you explain it?

Because the opposite poles attract each other. (Bitritto - BA)
The magnet repulse another magnet if there are same poles. If the poles are different the magnet attracts the hunged one. (Matera)

8 - Describe what you see, looking a compass, when you move a magnet closer to it.

The needle of the compass points the magnet. (Bitritto - BA)
If I move closer the magnet to a compass the needle points the magnet. (Matera)

9 - Describe what you see if you put two magnetic rafts in a tray.

The magnetic rafts move closer until they touch each other. (Bitritto - BA)

If I move closer the magnetic

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