



## Developing Scientific Knowledge and Language Competences through the Goerudio Project

Anca Colibaba<sup>1</sup>, Elvira Rotundu<sup>2</sup>, Irina Gheorghiu<sup>3</sup>, Stefan Colibaba<sup>4</sup>

<sup>1</sup>Universitatea Gr.T.Popa (Romania), <sup>1,4</sup> Fundatia EuroEd (Romania), <sup>2</sup> Colegiul Costache Negruzzi (Romania), <sup>3</sup> Albert Ludwigs University Freiburg (Germany), <sup>4</sup> Universitatea Al. I. Cuza (Romania)

### Abstract

*The article is based on the Goerudio project (543223-LLP-1-2013-1-LV-KA4- KA4MP), as it is being implemented by EuroEd Foundation Iasi, Romania. The project has analyzed challenges that European educational systems are facing at present: students' lack of motivation when studying scientific related topics and school teachers' inability to find innovative teaching methods in order to stimulate students' interest in science. The project has created a learning community of science teachers and students who have discussed and shared knowledge and experiences in order to make scientific education more involving and appealing. The community has been involved in the development of teaching resources for scientific subjects. Its resulting products- educational models- have been further used in a CLIL program, where students have developed not only their knowledge and understanding of the world but also their language competences. The resources created through the Goerudio project, the methods and online activities and exercises used have enabled students to use language purposefully. The article analyses the way the program has helped students to process information, negotiate meaning, and share knowledge even when their level of the target language varies.*

### 1. The Goerudio project- context and objectives

The Goerudio project (543223-LLP-1-2013-1-LV-KA4- KA4MP) has analysed challenges that European educational systems face in terms of learning and teaching science. Although science and technology have become part of one's future personal development and our society is increasingly dependent on scientific and technological knowledge, skills and devices, students are not motivated and interested in science, while school teachers are unable to find innovative teaching methods. To this end a learning community of science teachers and students has been created across Europe. They have discussed problems and obstacles and shared, uploaded and commented upon knowledge from their experiences or European project initiatives on the project platform. The community has been involved in the development of teaching resources for scientific subjects. The most challenging ones have been the Goerudio educational models.

### 2. Teaching with Goerudio models

A Goerudio model is based on similarities between two items, not unlike an analogy or a simile used in speech. Goerudio models can be useful for teaching and learning because they ask students to identify a common trivial item analogous to a scientific concept. Students have to analyze and find similarities between the two disparate items: a scientific one which has just been introduced and a familiar one which is part of everyday reality. The latter item has to be related to something from their personal everyday experiences. Models compare the two items—one that is less familiar and one that is familiar (e.g. classes of the periodic table to human families/ electric current to the way water flows/ a chemical equation to a recipe/ inertia to everyday routine). They use familiar information to explain unfamiliar information; thus students build knowledge by integrating new information in their previous knowledge base. In this way they also get engaged in experiences promoting inquiry-based, student-centered learning and making full use of constructivist teaching strategies (constructivist learning theory). Goerudio models offer multiple opportunities for the students to work on the new knowledge from different angles by exploring the newly introduced concepts, discovering explanations for the concepts they are learning, and applying their knowledge to new situations. This process requires understanding and makes learning very personal as students have to relate new knowledge to previously learnt one and also integrate it in their own life experience. As students get actively engaged in the learning process by scrutinizing and evaluating each item, they gain a better understanding of the scientific concept and practice critical thinking skills. Goerudio models can make unfamiliar scientific concepts easy to understand, visualize and remember.



### 3. The CLIL program

Furthermore the Goerudio educational models have been used in a CLIL program, where students have developed not only their knowledge and understanding of the world but also their language competences. Content and Language Integrated Learning (CLIL) is a general expression used to refer to any teaching of a non-language subject through the medium of a second or foreign language (L2). CLIL balances content and language learning. The non-language content is developed through the L2 and the L2 is developed through the non-language content. Increasing attention to Content and Language Integrated Learning (CLIL) is due to the European aspirations of providing a multilingual education [1]. The European Union seeks to promote Content and Language Integrated Learning, in the hope that students “might benefit from the experience of content and language integrated learning (CLIL)” [2]. In 1995 the European Commission adopted a document on education called “The White Paper. Teaching and learning. Towards the learning society”. It holds that proficiency in three community languages is a prior objective, and suggests teaching content in a foreign language as a way to contribute to the achievement of this plurilingual objective. The European Commission urges in the White Paper that “secondary school pupils should study certain subjects in the first foreign language learned (...)” [2]. Content and language integrated instruction was influenced by Krashen’s theory of second language acquisition. Krashen argued that acquisition takes place when the second language is learned and developed in a way similar to how native speakers learn their mother tongue where grammatical rules are acquired in meaningful situations. Otherwise, when language skills develop through formal instruction, this conscious knowledge is called learning [3]. Second language instruction has to rely on meaningful material, just as natural language is always learned in meaningful situations. Language is a means of instruction and not an aim in itself. People develop two different kinds of language proficiency: social and academic language. Social language is informal and cognitively less demanding whereas academic language is more formal and cognitively demanding. CLIL instruction seems to promote both sides of the target language simultaneously. By using CLIL, teachers may enable the development of both academic concepts and target language skills [5].

#### 3.1 Goerudio models and CLIL program

The resources created through the Goerudio project, the methods and online activities and exercises used have enabled students to use language purposefully and thus to enhance language learning by going beyond classroom language conversations with low or temporary cognitive demands. In a language class students are language and skill-focused. In a CLIL context they need to use the content language. Through CLIL students experience a language rich environment in the classroom through collaborative work. They move linguistically from everyday talk to academic speech. Fisher describes classroom talk as either lower order talk or higher order talk [4]. Lower order talk is used for recall, for checking understanding and for revising learning while higher order talk is used to develop cognitive skills, to express opinions and to stimulate discussions. CLIL programmes offer more opportunities and challenges for learners to hypothesize, analyse and evaluate content. The main demands are vocabulary, instruction verbs or time connectors. In terms of vocabulary there are words specific to the subject the students study and also general academic vocabulary (related to location, structure, type, cause, effect etc). To provide students with vocabulary the teacher may use visuals and explicitly teach the new vocabulary in lessons. As for general academic vocabulary and grammar structures, substitution tables can be used as means of providing support; they support students linguistically providing scaffolding and allowing students to concentrate on the concept. These tables are very useful in enabling learners to make up correct sentences which reflect scientific processes (defining, classifying, predicting, reporting, comparing, making hypotheses or generalising).

#### 3.2. The CLIL experience

A higher secondary school, with students aged 15-19 who learn three foreign languages (French, German and English), has been an associate partner in the Goerudio project. The teachers had the idea of taking advantage of the opportunities offered by the project. They introduced CLIL activities which involved teaching of parts of three science subjects - that is, physics, chemistry and biology - in English. The students’ level of English was B2 and C1. They were interested in taking international exams such as IELTS and CAE. The language teacher and the subject teachers worked together during the lessons. In planning the activities to be done during the CLIL lessons the four C’s identified by Coyle have been very useful:

1. Content (choosing the topic of the lesson);
2. Communication (what science language students need in order to communicate: language of defining items, of comparing and contrasting);
3. Cognition (what thinking skills are necessary: e.g. classifying, evaluating);



#### 4. Culture: the cultural element embedded in the lesson [5].

The topics were chosen following two criteria: reinforcement/ revision of topics dealt with in the mother tongue (Romanian) and development of new topics in the second language (English). Students were familiarized with the topic; they had already studied it in Romanian. Then the Chemistry/ Physics/ Biology and English teachers introduced all the specific words necessary to speak about that particular topic in English. Several activities were carried out to familiarize students with the vocabulary: teachers said the different names and students repeated the names; showed on a transparency the drawings and names of the scientific items and students took notes; gave out a handout with drawings of the items and students wrote down the names; showed on a transparency a list of verbs and expressions to be used. Teachers had to support students linguistically by providing scaffolding and allowing students to concentrate on the concept. The main language functions and their structures were identified and given to the students:

Defining/ explaining:

- X is a process by which.....  
It involves.....
- X is .....
- X can.....
- X is used to.....  
It consists of.....  
It is called.....
- Identifying similarities:  
X is similar to.....because.....  
X works like.....  
It acts like.....  
It is like.....
- Speculating:  
It could be.....  
It looks.....to me.  
It looks like.....  
It looks as if.....
- Expressing opinions and asking for opinions:  
I think/ in my view.....  
As far as I am concerned.....  
What do you think about.....?  
My opinion is that.....What's yours?  
How do you think.....compares with....?  
I wonder what you think of.....?
- Comparing:  
Compared with/ to.....
- Negotiating:  
I really think.....  
I couldn't agree more.....

In CLIL programmes teachers have to provide their students with solid language support for the thinking processes. Students feel safe when being supported by scaffolding devices such as writing or speaking frames.

In the next stage the students were supposed to identify the two items in the analogous pair, prepare the scientific definition and give an explanation for their analogy supported by a drawing. The result was presented to the class and teachers. They discussed their results with the teacher and the rest of the class then answered their questions.

Teachers and students highly appreciated the Goerudio models as exercises in creativity, making thinking visible, learning pleasant and interesting:

"I think that Goerudio models offer plenty of opportunities for students to exercise their creativity." (C. F., teacher of physics)

"Science classes are full of abstract concepts, which are difficult to understand. Goerudio models help students understand them by relating them to their everyday experiences". (M. C. teacher of biology)



## 4. Conclusions

In the CLIL programme the students have been involved in interesting and meaningful activities while using the language. The CLIL programme provided plenty of opportunities for incidental language learning. "I believe teaching science using Goerudio models has changed my teaching. I have noticed how much it has enhanced my students' motivation to learn chemistry. Active learning makes knowledge lasting. It helps students get meaning out of their education." (M.C., teacher of chemistry)

## References

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