THE CLIL4STEAM PROJECT: FULL STEAM AHEAD TOWARDS LEARNING SCIENCE AND LANGUAGES

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Abstract

The article is based on the CLIL4STEAM project (Erasmus+ Programme - 2019-1-PL01- KA201-065027), which is being implemented by EuroEd Foundation Iasi, Romania and other oganisations, institutions and high schools from Italy, Ireland, Lithuania and Poland, which is the project's coodinator. The ideas of the project stem from the importance of science and language learning in education nowadays. The project stimulates the creation of a community of practice where teachers and educators work together to promote scientific and language knowledge and competences in school education through Content and Language Integrated Learning (CLIL). The CLIL method has proved to be an effective strategy for motivating students to improve their science and language knowledge and methodology.
The benefits of CLIL may be seen in terms of cultural awareness, language competence, preparation for both study and working life, and increased motivation. The project aims to provide secondary school teachers with the necessary knowledge and skills to create CLIL based teaching materials focusing on STEAM curricula. The article presents the project's objectives, methodology, its main outputs and their impact on the teachers participating in the project. The partnership identified twenty most relevant topics in science which were illustrated by short videos in English with subtitles in partners' languages. Research focused on finding the most relevant and useful teaching resources on the internet. These resources were accompanied by tips and concrete explanations as to how to integrate them into engaging and meaningful lessons. In addition to this, interactive online activities enabled students to further practice the language and consolidate the content (matching, crosswords, quizzes, word search, etc). The products were tested on 50 teachers, who evaluated the CLIL method used in the project and the project's platform.

Key words: science, languages, CLIL, teachers, learning

Since the '90s radical changes brought about by the European Union such as mobility, the internalization of education, the advance of technology have challenged education. Young people should be prepared for the multilingual and multicultural requirements of Europe. Students need new skills and competences, where foreign languages and sciences play an important role. The CLIL approach meets these needs by fostering the integrated learning of languages and other areas of the curriculum. CLIL offers opportunities for students to use languages effectively while learning. All subjects can be taught through foreign languages: mathematics, physics, chemistry, civic education, physical education, biology, geography, art or history.

Romania has been interested in developing different approaches to language teaching and learning. The CLIL method has proved to be an effective strategy motivating students to improve their science and language knowledge. The benefits of CLIL may be seen in terms of cultural awareness, language competence, preparation for both study and working life, and increased

motivation. CLIL has been used in a wide variety of initiatives and in different contexts. However, there is a significant shortage of teachers with training in the CLIL methodology because there are hardly any training courses in CLIL. VET students also need foreign languages: to communicate with their peers from other countries in exchanges, competitions, conferences or simply to read scientific articles in their field. They would benefit from a CLIL approach because so far their textbooks have been concentrating on teaching the language for a general course. VET teachers have repeatedly stated that finding teaching materials related to CLIL, although necessary, is not easy. Such materials not only have to be available in the target language but also have to cover subjects in the national curriculum.Looking for, adjusting and preparing appropriate materials in the target languages means additional work for the teachers involved.

The CLIL4STEAM project fills some important gaps: the creation of CLIL materials and resources, guidelines on how to use them and the creation of a community of practice where teachers

and educators can share their CLIL materials and tips for teaching STEAM in a foreign language. The CLIL4STEAM project aims at combining the study of STEAM subjects and English as a second language. The project's outputs include a video library, a guideline for teachers, a database of teaching resources and a collection of lesson plans.

MATERIAL AND METHOD

The CLIL4STEAM project promotes the CLIL (Content and Language Integrated Learning) method, which involves teaching the content of a subject (biology, physics, chemistry, mathematics, technology) through the medium of a language other than the student's mother tongue (Coyle D., 2006). Thus students acquire knowledge and understanding about scientific concepts while at the same time improving their language competences related to this content. This also means that language teaching/ learning does not follow the traditional course from simple to complex; rather, language elements are introduced whenever they are related to the content. CLIL balances content and language learning in such a way that the second language is learnt in meaningful situations just as the first language is (Coyle D., 2006). Student empowerment is encouraged by engaging them in their own learning process; students are involved in experiences which are applicable in the real world and are stimulated to use technology meaningfully. Learning is also consolidated through sharing communication and student knowledge construction.

The project also makes use of digital tools, which students can benefit from. Online learning is known to offer flexibility of access to the material (presented in our case as short videos) from anywhere at any time. In addition, students can access it at their pace and use it as many times as they want. With short videos, the students are able to control the pace, pause, rewind, explore and return to the content, giving them full control over their own learning. Repeated recall of items previously taught improved retention. The short videos illustrating scientific concepts are associated with multiple–choice quizzes or tests with automatic responses (Norvig P., 2012). Such quizzes provide formative assessment but also an opportunity for retrieval learning, which enhance learning (Agarwal P.K. et al., 2012). Every time we retrieve knowledge, that knowledge is filtered through our mind, altered and reconstructed, which strengthens the ability to reconstruct and recall that knowledge again in the future. Recent studies have shown retrieval practice to also enhance meaningful learning (producing organised, coherent, and integrated mental models that allow people to make inferences and apply knowledge) (Karpicke J.D. and Roediger H.L., 2008).

The project focuses on several school subjects: Math, Physics, Biology, Chemistry, Technology and Engineering. Partners negotiated the most relevant topics lying at the foundation of each field where students have difficulties. The research then identified the most meaningful online teaching resources illustrating these topics and their descriptions were made into short videos. Each video is also accompanied by interactive activities centred on the online resources identified by the research and quizzes testing students' scientific and linguistic knowledge.

RESULTS AND DISCUSSION

The partnership identified a number of 20 most relevant topics in Math, Physics, Biology, Chemistry, Nature Science, Technology and Engineering. Then twenty short videos illustrating the topics were made in English by native teachers with subtitles in the other partner languages. The videos are accompanied by the topic description of the video lesson, its subject and language objectives, as well as the difficulties students may encounter (Figure 1).
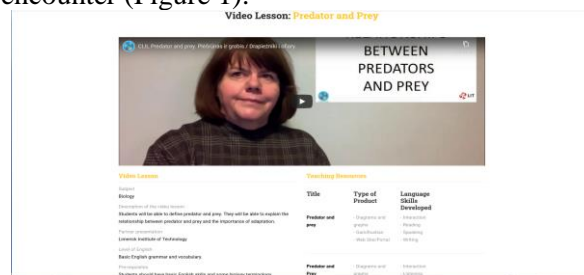

Figure 1. **The video**

Each topic has links to other teaching resources teachers who participated in the project selected from the internet as relevant and useful. Thus, one of the topics selected for biology is Predator and prey. The video is accompanied by important details concerning the main aim of the video, its scientific and linguistic objectives, the age of the target group (16-18+ years old), the level of competence in English (CEFR B1+/B2), the time required to use the resource with the students – 50 minutes, as well as valuable tips about how to integrate it into a lesson (Figure 1). Thus the aim of the video states that the students will be able to perceive how changes in parameters (like birth rate) can affect predator/prey interactions and observe how predator/prey populations change over time. Students will explore these types of relationships while both learning about the competitive exclusion principle, predator-prey cycles and acquiring the basic

English vocabulary connected with the topic (predator/prey interactions). In addition, the students will be able to read English texts with ease, reflect on their reading experience, share it with their peers, get the main ideas from a text and comprehend the topic correctly. Students will develop positive learning habits such as organisational and problem-solving skills.

The section also provides teachers with tips and concrete explanations as to how to make the best use of such materials and integrate them into an engaging and meaningful lesson (Figure 3). Thus, students are set into pairs or groups and they have to use a simulator to observe how changes in parameters (like birth rate) can affect predator / prey – in this lesson rabbit and wolf - interactions. The simulator enables students to observe and explain any changes but also to modify habitat and rabbit/ wolf parameters and run the simulation themselves. On the other hand, the simulator enables teachers to set tasks meant to develop students' critical thinking, problem-solving skills and creativity (i.e. students are asked to achieve a stable population of rabbits and wolves and establish an ecosystem where all of the elements are in "balance"). (Figure 2).
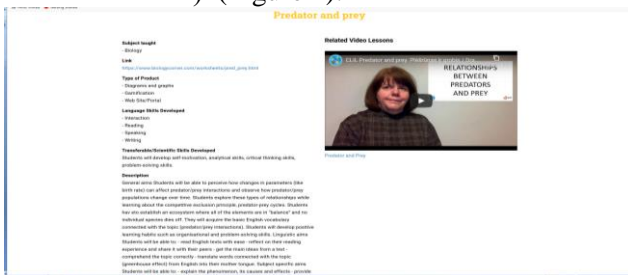

Figure 2. **Online teaching resources**

Interactive and printable activities enable students to further practice the language and consolidate the content (matching, crosswords, quizzes, word search, hangman etc). Feedback is promptly ensured automatically and students can do such exercises at their own pace whenever they want (Figure 3,4).
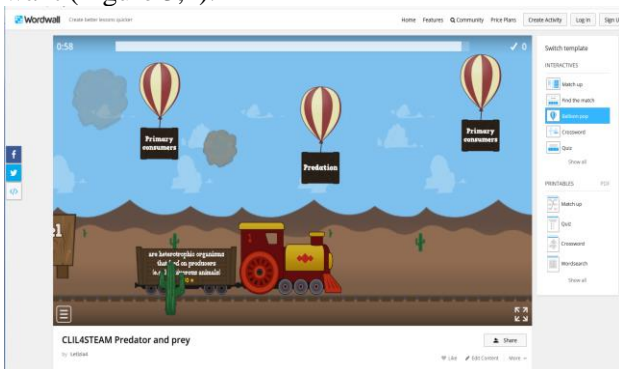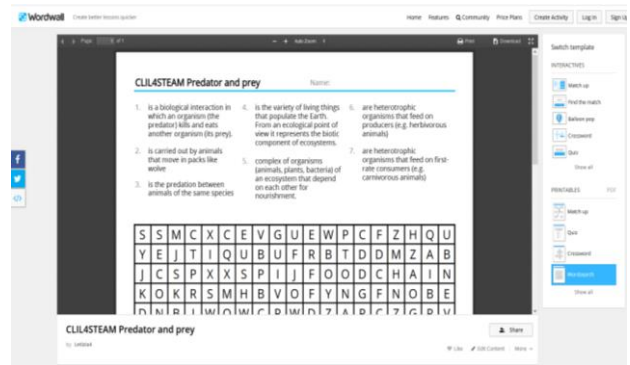

Figure 3. **Online activities: Balloon pop**

Figure 4. **Online activities: word search puzzle**

The products were tested in three high schools in Iasi, Romania (Liceul Vasile Alecsandri, Liceul Miron Costin, Liceul de Informatica) on 50 teachers of Math (14), Chemistry (15), Physics (4), Biology (14), and Technology (3).

The participants were asked to evaluate the CLIL method used in the project and the platform. The average score was 7.9; teachers appreciated its usefulness which got the highest score (8.3), followed by meeting teachers' needs, adaptability to the context and relevance (Figure 5).
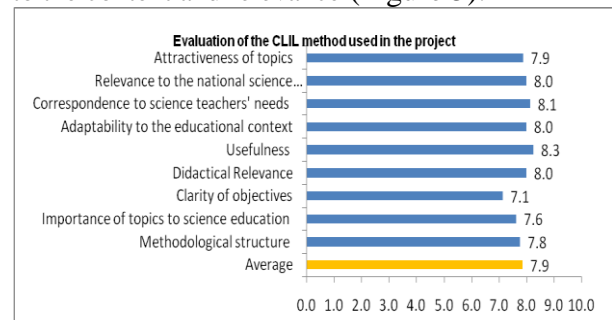

Figure 5. **Evaluation of the CLIL method used in the project**

The participants also evaluated the CLIL4STEAM platform (Figure 6). The average score was 8.1; teachers appreciated its attractivenessness which got the highest score (8.8), followed by their decision to use the platform in the future as it supports their teaching process (8.5), organisation of contents (8.3) and easiness of navigation (8.0).
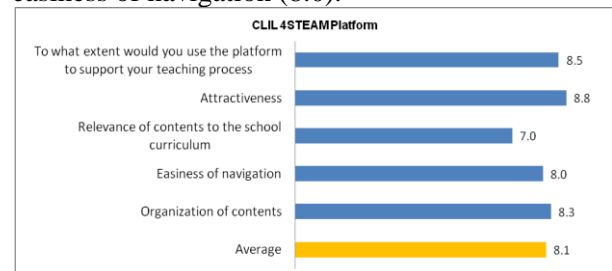

Figure 6. **CLIL4STEAM Platform**

The teachers appreciated the creativity and innovativeness of the methodology and products.

Most of them thought that the products meet their students' needs and when used, the method encourages comprehension and develops students' creativity and critical thinking skills. They were of the opinion that by using videos, online resources and interactive quizzes when studying science, scientific concepts become more accessible and interesting; the CLIL method also stimulates students' motivation to study science. They will definitely use the platform to support students' learning process.

CONCLUSIONS

The project stimulates the creation of a community of practice where teachers and educators work together to promote scientific and language knowledge and competences in school education through Content and Language Integrated Learning (CLIL). The CLIL method has proved to be an effective strategy for motivating students to improve their science and language knowledge.

From the teachers' perspective, the CLIL4STEAM project raises teachers' awareness about the connections existing among different school subjects and how their synergy can augment their contribution to students' overall development. The CLIL4STEAM project also raises teachers' awareness about the role that foreign languages and STEAM school subjects play in education and about the benefits of CLIL. The platform shows a way of improving teaching: the online platform and its digital resources keep students more engaged and motivated. The project provides teachers with accessible resources and ready made materials. Furthermore, the project will enable collaboration and knowledge sharing among teachers and researchers across Europe in science and language teaching.

From the students' perspective, the CLIL4STEAM project motivates students to learn science and languages by using them for real practical purposes; it develops students' tolerance and respect for other cultures; it prepares students for life by offering them better job prospects on the labour market.

ACKNOWLEGMENTS

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