



CLIL for STEAM

Project Number: 2019-1-PL01- KA201-065027

Guidelines on CLIL methodology



Developed in the framework of the European project

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1. Introduction to CLIL methodology

CLIL (Content and Language Integrated Learning) (Marsh, 1994) is an innovative methodology focusing on the learning of language whilst simultaneously teaching content from a subject area such as humanistic or scientific area (Coyle et al., 2010). Therefore CLIL means using a foreign or second language as a medium of instruction and learning for primary, secondary and/or vocational-level subjects such as Math, Science, Art or Business. According to Mehisto et al. (2008), some key features are crucial to create an effective, CLIL oriented learning environment, such as:

- Grade-appropriate levels of academic achievement in subjects taught through the CLIL language;
- Grade-appropriate functional proficiency in listening, speaking, reading and writing in the CLIL language;
- Age-appropriate levels of first language competence in listening, speaking, reading and writing;
- An understanding and appreciation of the cultures associated with the CLIL language and the student's first language;
- The cognitive and social skills and habits required for success in an ever-changing world (Mehisto et al. 2008:12).

CLIL methodology is flexible and adjustable to the learners' needs, level of language competence and level of academic achievement.

Among the main CLIL frameworks we can mention Do Coyle's 4 Cs and language triptych.

The 4Cs are the following:

- Content (the topic of the video in the CLIL4STEAM project)
- Communication (the "languaging" as expression of content, thoughts, intentions)
- Culture, which is always behind the scene
- Cognition, which is the kind of cognitive skills activated (according to the Bloom taxonomy: LOTs or HOTs).

The language triptych offers a wider perspective of the use of the language in a CLIL pathway, as follows:



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- **LANGUAGE OF LEARNING** (content), essential vocabulary and grammar associated with the topic for a communicative approach. The language is used in authentic interactive contexts in order to develop communicative skills, rather than focusing exclusively on grammar;
- **LANGUAGE FOR LEARNING** (meta-cognition and grammar system) the kind of language needed to operate in a foreign language environment. Learners need skills for pair work, cooperative group work, asking questions, debating, enquiring, thinking, memorizing, etc.
- **LANGUAGE THROUGH LEARNING** (cognition) new meanings would require new language. It needs to be captured during the learning process, then recycled and developed later.

As far as the language dimension is concerned, seven principles for language practice in CLIL can be identified (Ball et al., 2015):

1. “Mediate” language between the learner and new knowledge
2. Develop subject language awareness
3. Plan with language in mind
4. Carry out a curriculum language audit
5. Make general academic language explicit
6. Create initial talk time
7. Sequence activities from “private” through to “public”.

Therefore the role of the teacher is essential as “language mediators in order to ‘build bridges’ between the learners and the new subject knowledge” (Ball et al., 2015: 71).

CLIL methodology seems to be aimed at building bridges: between language and content; between the learner and the new subject knowledge; between the language teacher and the subject teacher, etc.

As Genesee and Hamayan point out, “more and more parents in communities around the world want their children not just to acquire minimal proficiency in an additional language (often English), but to reach high levels of bilingual proficiency and they are looking for





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innovative educational approaches to achieve this” (Genesee and Hamayan, 2016:3). Among the different features, the CLIL approach is action-oriented, task-based and student-centered. It aims at combining language practice and specific content delivery and fosters foreign language and intercultural competence acquisition.

CLIL methodology takes advantage of a wide range of teaching strategies, which, according to Hattie (2009), can have a huge impact on learning; in particular, Hattie’s top ten teaching strategies are the following:

1. Direct Instruction
2. Note Taking & Other Study Skills
3. Spaced Practice
4. Feedback
5. Teaching Metacognitive Skills
6. Teaching Problem Solving Skills
7. Reciprocal Teaching
8. Mastery Learning
9. Concept Mapping
10. Worked Examples.

These teaching strategies can be effective in terms of students’ learning outcomes and teachers’ innovative practices and are examples of techniques that can all be included in a CLIL approach.

In fact, CLIL is considered by the European Commission as a driver to innovation and as an effective methodology, which can contribute to improve the quality of education all over the member states. The report from Eurydice (2017) *Key data on teaching languages at school in Europe* highlights CLIL provision all over Europe, pointing out that it has expanded considerably in all member states, but only a few of them have adopted it as a national education policy, introducing it at a certain level of education and Italy is among them. In fact, in Italy CLIL has been mandatory in the final year of upper secondary schools since the Reform Law 53/2003, in particular according to DPR 88/89 dated 2010 (Cinganotto, 2016; Cinganotto 2018).



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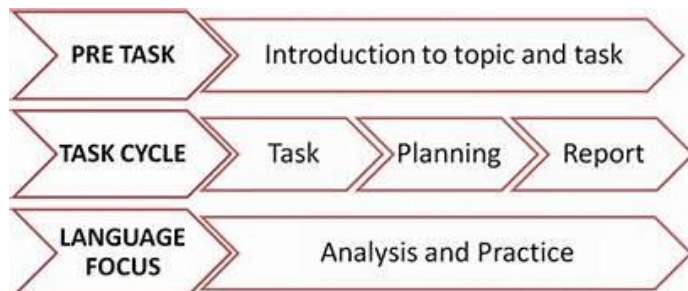


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2. Task-Based Learning in CLIL

Among the different strategies, Task-Based Approach (Nunan, 2004) is one of the most effective and commonly adopted by CLIL teachers, as it allows to have students work on the production of authentic outputs requiring the use of the foreign language for meaningful purposes.



The Task-Based learning (TBL) approach is grounded on learners' experiences with the target language personalised and relevant to them. Each lesson follows a specific structure based on five stages as detailed in the picture above. TBL is used in communicative language teaching where "a task is an activity where the target language is used by the learner for a communicative purpose (goal) in order to achieve an outcome" (Willis, 2002, p.27-36). In a task-based approach the content and the task to perform play a crucial role and the language is related to what happens as the students complete it. Learners are encouraged to use all their language resources during the various stages of the task rather than practising pre-selected items such as grammar, adjectives, if-clauses etc.: this is a very important switch from grammar-based methods to task-based ones.

CLIL activities should be designed to allow a great variety of learning styles or a combination of learning techniques to provide significant experiences for the individual learner.

What follows are possible guidelines and instructions for a task-based CLIL pathway.

Stage 1: Pre-task

- The teacher introduces the topic and gives the students clear instructions on what they will have to do and indicate what kind of support they will receive
- Then the teacher discusses the topic or theme with the students and suggests group or pair-work during the task
- Students pair up or make up groups and assign roles for carrying out the task
- Students plan for the preparation and the materials needed for the task.

Stage 2: Task

- Students engage with the task while the teacher monitors, encourages, comments and helps if necessary



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- Students complete a task in pairs or groups, using the language available while the teacher monitors the tasks and offers scaffolding

Stage 3: Planning

- Students will plan and decide on the kind of output they may choose (a ppt, an audio or video presentation, a written report etc.) to be presented to the whole class.
- Students will prepare rationale for their content, and process of production
- Students will prepare a short oral or written report for the class and can ask the facilitator for advice.

Stage 4: Report

- Students will report back to the class orally or provide an audio, video or written report.
- The teacher will choose the order of the different presentations and will give feedback on the content.

Stage 5: Language Focus Analysis

- During the reflection phase the teacher will highlight relevant parts from the presentation to comment on, encouraging self and peer evaluation, with “focus on form”.
- 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. Students learn / practise language structures as they come across them in the text. The teacher should identify useful language in the text and categorise it according to function. Students may need to use the language of explaining, classifying, comparing and contrasting, making predictions, expressing consequences, evaluating points of view, describing or sequencing a process, etc. as well as adverb phrases or prepositional phrases.

Practice

- The teacher will select language areas to practise, according to the needs of the students as emerged during the presentations.
- The students will be involved in hands-on activities entailing the correct use of the language areas discussed during the language focus analysis.
- The teacher can use substitution tables based on language functions to facilitate students' language learning. A substitution table comprises a table providing model sentences and a range of choices so that students can choose from. Students may find it a reliable and



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useful scaffolding support not only to scaffold the development of a grammar structure but also to scaffold speaking and writing.

Examples:

Comparing and contrasting

X	is similar to works like acts like is like	Y
X	differs from Y in that is better (any comparative) than Y is not nearly as good as Y. is nowhere near as big as Y. is not as important as Y.	

Expressing consequences

The air pollution is rising at an alarming rate.	Therefore, So, Thus, Hence, Consequently, Because of this, For this reason, As a consequence, As a result,	The number of those suffering from stroke, heart disease, lung cancer, and chronic and acute respiratory diseases, including asthma, increases.
The air pollution rising at an alarming rate	results in leads to produces causes is the cause of gives rise to brings about	An increase in the number of those suffering from stroke, heart disease, lung cancer, and chronic and acute respiratory diseases, including asthma.



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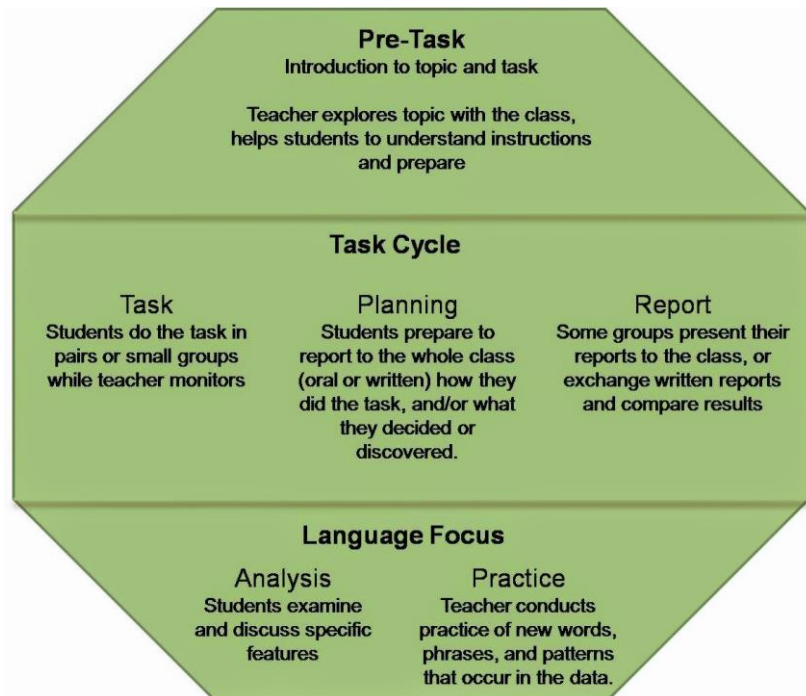
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The picture below summarizes the steps of the TBL previously detailed.



Feedback plays a key role in TBL, as an integrated part of learning and teaching. It can be either formative to help learners improve their work, and summative which is the final information at the end of a module, of a term or of the school year.

Feedback gives students the opportunity to reflect on their performance, identify strengths and weaknesses and find ways for improvement, activating reflection and meta-cognition.

It is important to provide feedback before, during and after a task or assignment. The type of feedback can be a written feedback or a discussion-based, audio or video-based feedback. It can also be a digital feedback using tools such as kaizena (<https://www.kaizena.com/>) or other specific tools. Peer feedback, coming from classmates will elicit reflection on the peers' work.

To learn more about CLIL and TBL: <https://www.youtube.com/watch?v=Ztd8Vtw0v7o>



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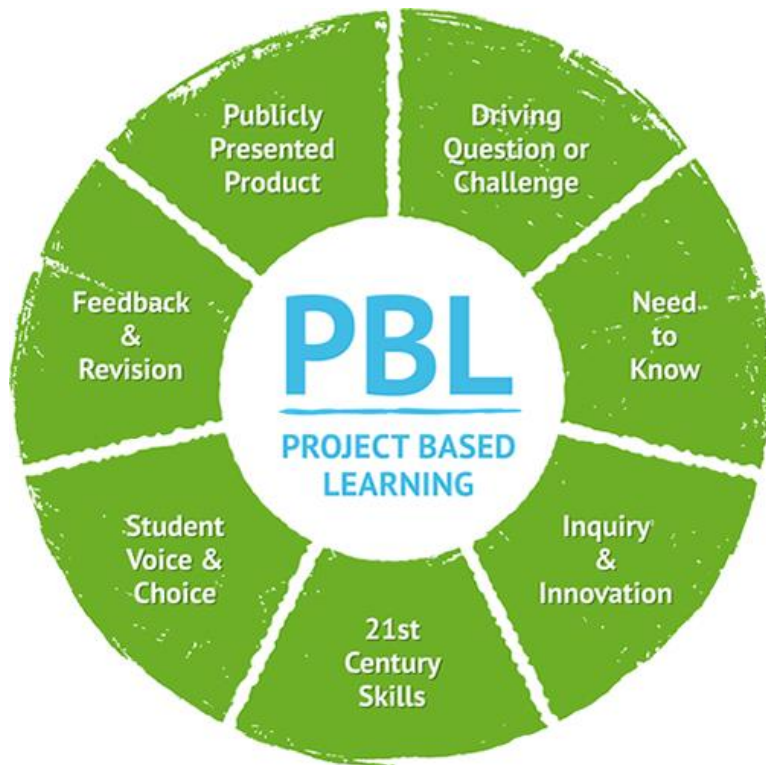
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3. Project-Based Learning in CLIL



Another very popular strategy adopted in CLIL is Project-Based Learning, which allows students to work mainly in peers or groups to create outputs, often digital, such as posters, blogs or other artefacts as final cooperative work to be presented to the teacher and the rest of the class.

Thomas (2000, pp. 3-4) identified five characteristics of Project-Based Learning (PBL):

1. *Centrality*: Project Based Learning type projects are central to the curriculum.
2. *Driving question*: The projects should focus on questions or problems that “drive” students to encounter (and struggle with) the central concepts and principles of a discipline.
3. *Constructive investigations*: The central activities of the project must involve the construction of knowledge by students.
4. *Autonomy*: Projects are student-driven to some significant degree.
5. *Realism*: Projects are realistic or authentic, not school-like.

Thomas (2000) highlights that PBL makes extensive use of student-directed scientific inquiry supported by technology and collaboration. In PBL students are engaged as active participants in the learning process, setting their own learning goals and creating meaningful relations through their experiences, as they investigate real-world issues. The learners have a driving question which initiates a long-term, authentic investigation or design project, then the learning activity produces a tangible and meaningful product or outcome by using any kind of cognitive tool, such as the



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Internet, to support the process of inquiry which requires any kind of collaboration with the learner's community, that may include the peers, teachers, or members of society.

Using PBL with technologies, it is a way to implement CALL (Computer Assisted Language Learning), which is recommended by the European Commission and the Council of Europe for its potential with reference to CLIL and to language learning in general (European Commission: "Improving the effectiveness of language learning: CLIL and Computer-Assisted Language Learning", 2014).

In particular, the following options are mentioned as examples of CALL:

- Authentic foreign language material, such as video clips, flash-animations, web-quests, pod-casts, web-casts, news broadcasts etc.;
- Online environments where learners can communicate with foreign language speakers, through email, text-based computer-mediated communication (synchronous and asynchronous), social media, or voice/video conferencing;
- Language-learning tools (online apps or software), for phonetics, pronunciation, vocabulary, grammar and clause analysis, which may include a text-to-speech function or speech recognition, and often include interactive and guided exercises;
- Online proprietary virtual learning environments, which offer teacher-student and peer-to-peer communication;
- Game-based learning.

Even in the latest "Council Recommendation on a comprehensive approach to language teaching and learning" (May 2019), technologies are mentioned and recommended to improve the quality of language learning/teaching and to make CLIL more effective.

As far as STEM, very interesting projects can be realized in immersive worlds, such as simulations, experiments with physics or chemistry etc.

To learn more about PBL and CLIL in the scientific laboratory:

<https://reunir.unir.net/bitstream/handle/123456789/3613/ALVAREZ%20SANCHEZ%2C%20BEATRIZ.pdf?sequence=1&isAllowed=y>

To learn more about CLIL in TBL and PBL it may be useful to read this article:

<https://www.teachingenglish.org.uk/article/tbl-pbl-two-learner-centred-approaches>

4. Teaching strategies and techniques for CLIL in STEAM

Among the other teaching strategies to be used for CLIL activities debate is becoming more and more popular among schools: it is an effective technique for language learning and CLIL (Cinganotto, 2019). Students are divided into two teams (Proposition Team and Opposition Team)



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and will defend their position in favour or against a motion given by the teacher. In order to do so, they need to find resources, facts and figures as supporting evidence.

In STEAM subjects the topic of the motion launched for a debate could belong to science, maths, physics etc.: it may be an effective way to co-construct and manipulate knowledge to be expressed in the foreign language.

Another useful methodology for CLIL in STEAM is TEAL (Technology Enhanced Active Learning), created by Peter Dourmashkin from MIT (Cinganotto et al., 2015). It is based on the use of technology to activate discussions, research and cooperative learning, as groups of students are supposed to discuss and find a possible solution to a problem, to be shared and discussed with the teacher and the rest of the class.

Websites such as Phet (<https://phet.colorado.edu/it/>), from University of Colorado, can facilitate problem posing and problem solving thanks to the wide range of interactive simulations provided.

Prof. Dourmashkin has recently designed a blended model of learning, based on “learning sequences”, using videos (his own video-lectures) to be delivered in pre-class learning, as exposure to new content and inputs.

The videos produced within the CLIL4STEAM project can also be used according to the TEAL model, as pre-class learning sequence.

An interview to prof. Dourmashkin on TEAL: <https://www.youtube.com/watch?v=Cga6n00K38o>

5. Guidelines on CLIL4STEAM materials

The aim of the CLIL4STEAM project is to combine the study of STEM subjects and English as a second language.

The virtual video library consists of a database of video lessons in English on specific scientific topics identified by the teachers of the schools involved in the project.

Each video consists of 3 parts:

- The introduction: the speaker will briefly introduce the topic and pre-teach the new vocabulary which is necessary to understand the video
- The main body: the topic will be presented and discussed in detail
- The conclusion: the topic will be summarized in order to ensure that all the ideas have been communicated clearly.

Videos in CLIL play a crucial role (Cinganotto, Cuccurullo, 2015), as they can simulate learning scenarios in an effective way, enhancing the learning experience with practical “hands-on” activities.



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The videos included in the CLIL4STEAM repositories can be used in different ways, planning and suggesting a wide range of activities, such as the following shown below, with no ambition of being comprehensive and exhaustive:

- **KWL**

The first activity of a CLIL pathway is typically a KWL exercise:

K: What I know

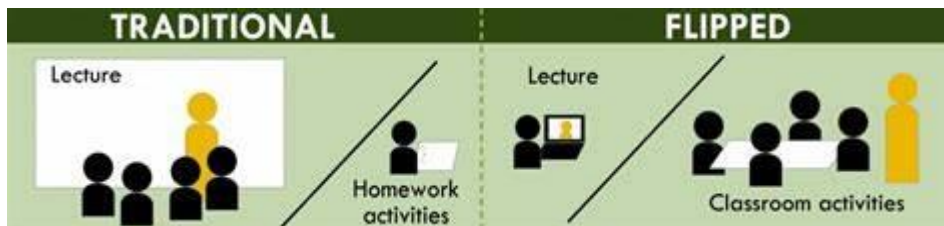
W: What I want to learn

L: What I learnt.

This three-step activity could be facilitated by the videos as the students will be encouraged to reflect on their learning needs and progress.

At the beginning a brainstorming activity on vocabulary combining visual aids and words would be encouraged in order to provide with the lexicon needed for the learning unit: the first part of a CLIL4STEAM video can be used for brainstorming.

Flipped learning



CLIL4STEAM videos can be delivered in class and then discussed with the students, or at home in a flipped learning perspective. Students will then be involved in discussion and in interactive peer or group activities or laboratories focusing on the content of the video.

Flipping the learning means delivering content to the students at home through videos and other content so that they are all exposed to the same inputs before the lesson in class which is mainly devoted to cooperative, peer or group learning activities aimed at co-constructing and negotiating knowledge.

To learn more about flipped learning the following videos may be helpful:

<https://youtu.be/1T3-2zxBu4Y>

<https://youtu.be/zJuCLokyYvE>

In class delivery

In class the following activities can be planned before/during/after the delivery of the video:



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Before the video:

- Asking questions to activate curiosity and motivation, such as:
- What do you think it will be about? What do you know about this topic? Have you ever heard of this?
- Recalling previous knowledge and making it emerges through asking: “what do you already know about...?”

During the video:

- Set moments of pause/waiting
- Support resources (e.g. hints, helper)
- Note-taking, Sketches, mind maps
- Language scaffolding.

After the video:

- Reflection moments
- Reviewing content and language
- Connecting previous and new knowledge
- Cut scenes and recap
- Comments from others
- Debriefing
- Reflective diaries
- Production of artefacts
- Experiments in laboratories taking inputs from the video
- Problem posing starting from the video as a stimulus
- Expressing hypothesis and interpretations of the phenomenon showed into the video.

Manipulating the video:

Videos can be embedded into webtools such as edpuzzle or moocnote allowing you to annotate and comment on certain parts of the video itself or add quizzes or test.

Here is an example: <https://edpuzzle.com/media/5ece7e1de589593f0ae93331>



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Ted-Ed is a very interesting platform allowing you to choose your video from the repository of Ted Talks by famous people; you can also add questions, comments and elicit students' discussion in forum threads.

Using other resources

The other resources included in the CLIL4STEAM repository (pdf, interactive activities etc.) can be delivered to students with different aims:

- Further exercises about the content of a video, after watching it in class or at home
- Language reinforcement focussing on integrated skills, on the same content of the video
- Formative assessment
- Summative assessment
- Gamification of the curricula in order to enhance the students' motivation and participation.
- Further opportunity to place the topic in a context close to the students' daily life and therefore of interest to them.

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