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"A look inside your cells": a didactic proposal through PBL and CLIL for Biology and Geology.

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ABSTRACT

The decrease in students who continue with studies related to the scientific field, as well as the reduction in the degree of interest and motivation on the part of the students, is largely caused by the traditional teaching practice of transmission-reception where overloaded rote learning is carried out in which the student acquires a passive role in learning.

Likewise, on the other hand, the importance of knowing a foreign language such as English, in today's globalized world, where it is essential as a means of communication and understanding both in personal and professional life between different cultures, we come across with the reality of the existing level in the classroom with such negative results, even adopting the terminology "delivery gap" between foreign language curricula and language achievement. That is, the difference between what the curriculum shows and the real language skills of the population.

All this is the reason for the development of a didactic proposal, in this Master's thesis, in which motivation and effective learning are achieved.

The didactic proposal is aimed at the development of block 1 of contents "The evolution of life" of 4th year of ESO (Compulsory Secondary Education) Biology and Geology, in which a Project-Based Learning (PBL) is proposed in combination with CLIL methodology.

Keywords: Project-Based Learning (PBL), Content and Foreign Language Integrated Learning (CLIL), motivation, meaningful learning.

RESUMEN

La disminución de alumnos que continua con estudios relacionados con el ámbito científico, así como la reducción del grado de interés y motivación por parte del alumnado, viene ocasionado en gran medida por la práctica docente tradicional de transmisión-recepción donde se realiza un aprendizaje memorístico sobrecargado en el que el alumno adquiere un papel pasivo en el aprendizaje.

Así mismo, por otro lado, la importancia del conocimiento de una lengua extranjera como es el inglés, en un mundo actual tan globalizado, donde es imprescindible como medio de comunicación y entendimiento tanto en la vida personal como profesional entre las distintas culturas, nos topamos con la realidad del nivel existente en el aula con unos resultados tan negativos adoptando incluso la terminología “delivery gap” entre los currículos de idiomas extranjeros y el logro del idioma. Es decir, la diferencia entre lo que muestra el currículo a las habilidades lingüísticas reales de la población.

Todo ello es motivo del desarrollo de una propuesta didáctica, en este Trabajo Fin de Máster, en el que se consiga un aprendizaje capaz de motivar e incentivar a los alumnos.

La propuesta didáctica va dirigida al desarrollo del bloque 1 de contenidos “La evolución de la vida” de 4º de la ESO (Educación Secundaria Obligatoria) de Biología y Geología, en el que se propone un Aprendizaje Basado en Proyectos (ABP) en combinación con metodología AICLE.

Palabras Clave: Aprendizaje Basado en Proyectos (ABP), Aprendizaje Integrado de Contenidos y Lenguas Extranjeras (AICLE), motivación, aprendizaje significativo.

1. INTRODUCTION

In the following Master's thesis proposal, it is intended to develop a motivational and innovative didactic project, in which a Project-based learning (PBL) is applied, in combination with an Integrated Learning methodology of Contents and Foreign Languages (CLIL). This proposal will be aimed at learning content block 1 (The evolution of life) in the subject of Biology and Geology in the 4th ESO, whose ultimate goal is to increase the interest and motivation of students, through PBL, as well as such as the development and learning of a foreign language, in this case English, through the application of a CLIL methodology. It should be noted the great importance that English has today, in work and personal life, as a consequence of the globalizing effect exerted mainly by the development of new technologies in recent times, as well as being the universal language in the field of sciences.

However, as teachers, one of the main objectives that we set ourselves beyond the development of knowledge through different methodologies, is the training of young people in the personal sphere, both from the point of view of cultural awareness, as well as such as respect among society, recognizing and challenging cultural biases and stereotypes, and facilitating harmonious coexistence in multicultural environments. These challenges are encompassed in what is called Global Competence, which is basically a multidimensional construction that encompasses both knowledge, skills and attitudes, which allow us to face global problems and situations that affect the entire population (Engel et al., 2019).

This Global Competence is learned throughout life with one's own experience, however, through teaching it can be guided and shaped in a positive direction for the student. The Global Competence includes preparation for professional world, the use of inherently interconnected digital spaces and the commitment to address social, political, economic and environmental problems, based on the Sustainable Development Goals (SDGs).

This proposal aims to develop a project that encompasses the set of contents of block 1, where different practices and activities of various kinds will be developed, among which are: laboratory practices, models, guest speakers,

debates and activities. of research, on the contents of the cell cycle of cells, mitosis and meiosis, as well as the diseases derived from these processes and their biotechnological applications, which will finally be specified and collected in a "scientific poster", and will be exhibited and presented in the VII Scientific Conference organized at school. Likewise, the CLIL approach that has been given to this project will allow the simultaneous learning of a foreign language (English) and the development of linguistic and communication skills, in parallel to the acquisition of skills, abilities and knowledge.

Therefore, in this work, in the first place, the theoretical framework on which it is based will be developed, highlighting the differences between the traditional model that has prevailed in the educational system until today where the constructivist model is being erected, deepening, in this case, on the characteristics of PBL and CLIL, dissecting their methodologies and therefore advantages, as well as their limitations. Subsequently, the curriculum on which this work is based will be developed, following the current legislation that regulates the educational system in the Community of Andalusia. Besides, the development of the didactic proposal will be planned. And finally, the conclusions of the work will be exposed, without forgetting of course, a last section with the references on which this work has been based.

2. THEORETICAL FRAMEWORK

Throughout this section it will be explained what PBL consists of, as well as the benefits of this didactic proposal compared to a traditional approach. Likewise, the philosophy of a CLIL methodology will be deepened, as a tool for language learning through the development of content. But above all, it will be emphasized, based on the studies of certain authors, as between the CLIL and PBL methodologies, there is a symbiosis of positive feedback, which encourages and enhances the learning of the contents in combination with a substantial and significant improvement of competence. student communication.

2.1. Traditional education model

It is notable, according to certain studies, the decrease in the number of students who continue with studies related to the scientific field (Solbes, 2011; Solbes, Montserrat, and More, 2007), they even state that students have adopted a negative position with respect to these areas. This is largely related to the teaching practice carried out, where in many cases rote learning is abused, fundamentally supported by a traditional methodology overloaded with theoretical content, focusing on a transmission-reception method (Morales and Landa, 2004). In most cases, this type of learning is carried out without meaning or sense, far from its application to real situations where they are capable of interpreting and transforming that learning with their own criteria, thus preventing a transversality of knowledge between different disciplines (Diaz, 2003).

One of the most characteristic points of this traditional methodology is the active role that the teacher adopts, in charge of the transmission of information and knowledge, while the student adopts a passive role of receiver of information, through a process of attention, retention and memorization of content, preventing the possibility of a process of interpretation and construction of new knowledge by the student (Klingler and Vadillo, 2000).

Therefore, this rote learning is based mainly on the performance of theoretical exams and tests where the knowledge acquired is evaluated away from a varied evaluation system, and, therefore, on the development of skills and competences that allow them to face situations and problems. of the real world, similarly distorting creativity and talent (Robindosn et al., 2009).

To all this we must add that this type of rote learning generates frustration, stress and disinterest in the student, where in many cases most of the knowledge acquired is forgotten over time.

Faced with this educational challenge, an alternative to the traditional educational model is proposed, whose main objective is to generate interest and motivation in students, whose methodology provides a set of skills and aptitudes, beyond theoretical knowledge, capable of solving real problems, working and live with work groups, face difficulties, developing new knowledge

through intellectual efforts. And this alternative is found in the constructivist model (García, 2013).

2.2. Constructivist model

The constructivist model is mainly based on the fact that the student adopts an active role, protagonist and main responsible for his learning, building his own knowledge through an intellectual effort of reasoning and understanding, where he must associate and relate previous knowledge. While the teacher adopts a more secondary role, becoming a mediator and facilitator in the student's learning (Grossmann, 2017).

In this type of educational model, the student carries out significant learning, in which knowledge is acquired through practice and contextualization of the contents in real scenarios, facing different situations and problems, endowing them with meaning. This in turn allows an approach to the reality of theoretical knowledge showing its applicability, and, therefore, making it more attractive and interesting for the student (Cohen, 2002).

This type of model promotes intellectual maturity and the development of skills and abilities that allow them to put them into practice in real life situations.

In terms of competence, it favours the development of the "Learning to learn" competence, giving the student greater autonomy and the ability to self-regulate the learning process and methodology, favouring an adaptation to different situations and enhancing the skills and outstanding capacities of each individual.

All this is in tune with the thinking of some authors, who consider that for the generation of knowledge it is necessary to combine previous and new knowledge, fostering in the student a cognitive conflict typical of learning through the constructivist model. This cognitive conflict is achieved through activities and tasks, as mentioned, in which the student has to apply theoretical knowledge to real situations and problems, where a cognitive imbalance is caused, generating a broader knowledge adjusted to reality. , finally reaching a cognitive balance. This, therefore, favours a process of metacognition, defined

as defined as the perception one has of one's own knowledge, useful for regulating one's own learning activity and adopting a habit of reflecting on one's own knowledge. This allows the student to be aware of their own learning and to progress in it, favouring significant learning (Swan, 2005).

In the scientific field, the constructivist model has been of great importance. Since to achieve the knowledge that it be has today is because throughout history great thinkers and scientists have raised the why of things, and have questioned the knowledge that already existed. Hence the importance of generating that critical attitude in the student, especially in learning science, encouraging questioning of knowledge to generate doubts that require confirmation and raise awareness that there are no "absolute truths" to ensure continuous evolution.

Regardless of whether the student is going to continue with a scientific career or not, it is important to transmit basic concepts and knowledge that allow them, as members of society, to adopt their own criteria for decision-making, and that they can judge and filter the information offered. Likewise, studies such as, Siarova et al., 2019, suggest that the exponential development of telecommunications generates new emerging threats with the spread of disinformation and pseudoscience. Hence the importance of promoting scientific literacy to provide tools to navigate and critically address the different public debates that arise.

2.3. Project Based Learning (PBL)

One of the educational proposals that are within the constructivist model, is the PBL where the student develops a combination of activities, practices, research tasks, debate, interviews, problem solving, etc., that promote the participation and protagonist of the student., allowing significant learning while acquiring the ability to reflect and apply knowledge reasonably. This provides them with the ability and skills to face and adapt to different situations and difficulties (Pozo and Gómez, 1998).

Likewise, according to numerous studies, this type of methodology specifically favours the development of disciplines related to the scientific field, coinciding with the discipline proposed in this work (Trasobares and Gilaberte, 2007).

The first publication where a project is described as a didactic tool, was developed by the author Kilpatrick in 1918 where he proposed the following theory: *"Learning occurs in a better way when it is a consequence of significant experiences, since this allows the student to be a co-participant in planning, producing, and understanding an experience"* (Kilpatrick, 1918). Other subsequent publications, in which a group of authors have joined, propose their particular definition that is summarized in that PBL is a teaching model that uses realistic projects very close to professional practice, in which the student performs active learning. facing a set of tasks and problems that favour their motivation and autonomy, allowing them to acquire skills, abilities and attitudes, beyond the knowledge learned. In addition, since it generally works in a group and cooperatively, it favours interaction between peers, improving their social skills.

More recent authors such as (Graaf and Kolmos, 2003) proposed that the development of educational projects favours the analysis of problems, the integration of knowledge, collaboration and teamwork, observing a greater degree of participation as well as a higher level of complex understanding. Despite this, they raised a possible inconvenience such as the risk of the lack of development of certain concepts and knowledge in certain specific contents, however, they suggest that in order to correct it in some way, greater responsibility for their own learning process should be promoted.

2.3.1. Properties on which PBL is based

The sum of numerous contributions from a large number of authors, among which it is worth highlighting (Graaf and Kolmos, 2003) allows us to establish a compendium of the bases and foundations on which Project-Based Learning is based, which are specified below :

-Authenticity could be determined as the flagship feature of PBL, in terms of the transmission of knowledge that is framed in a real context, where students face problems of daily and/or professional life. Likewise, this methodology is focused on the interests, knowledge, context and expectations of the students.

-The active role that students adopt in the construction of knowledge is one of the fundamental pillars of this methodology. Demonstrating that for students to have a deep knowledge they must be protagonists of learning, adopting an active role and ensuring that this knowledge is lasting over time (Sawyer, 2005).

-In many cases, this type of methodology allows situated learning, which consists of the student having the opportunity to learn directly in a professional exercise together with an expert who may have been invited or made a visit.

-Through PBL, motivation and interest are assured since the students are presented with a final objective, a challenge, generating concern in the students, being more attractive and encouraging initiative in learning.

-The social interaction resulting from PBL, both among peers, with the teacher or external people, favours the development of skills and a more complete learning (Blumenfeld, Marx, Soloway, and Krajcik, 1996).

-Another of the most transcendental benefits of PBL is the attention to diversity, since it allows the development of a wide range of activities and evaluation methods, which allow a more personified attention, enhancing the virtues of each of the students.

-The leading role that students adopt in PBL allows the development of autonomy, creativity as well as the development of social skills and teamwork (Stefanou et al., 2013).

2.3.2. Advantages and disadvantages of PBL

As has been seen, PBL is one of the methodologies where students are motivated and interested, as well as significant learning that lasts over time.

However, like all its teaching methodology, it has its advantages but it also has its limitations. Thus, through a more exhaustive investigation of the work of different authors, it will be tried to summarize the possible advantages and disadvantages that can be found in the application of PBL in the following table (Table 1).

Advantages (Akinoglu, 2008; Hidalgo, Gallegos, Sandoval and Sempértegui, 2008; Ravitz, 2008; Engel et al., 2019)	Disadvantages (Poot-Delgado, 2013; Sáez, 2012; Valero, 2012):
An important motivation of the students is achieved, as a consequence of the practical application that is observed of the theoretical knowledge.	This type of methodology requires greater effort, involvement and commitment both from the student due to their main role and from the teacher who requires greater preparation.
The main and active role of the students increases autonomy, creativity, self-esteem and the ability to be decisive, as well as the ability to learn to learn.	This methodology requires dedication and time, being a limited resource that could affect other content and methodologies. Even so, it would be important to analyze interdisciplinary content to avoid duplication.
Development of social and communication skills, critical thinking and teamwork.	This type of methodology can generate confusion and loss of the common thread of the class, since it is a change of roles. Therefore, a period of adaptation and trivialization of the methodology is required.
It facilitates their media and information literacy. It is very versatile. It allows structuring open activities on any topic. It allows developing respect among peers, facing multicultural challenges and stereotypes. Facilitates the approach of social, political, economic and environmental problems	

Table 1. Advantages and disadvantages of PBL. (Akinoglu, 2008; Hidalgo, Gallegos, Sandoval, and Sempértegui, 2008; Ravitz, 2008; Engel et al., 2019; Poot-Delgado, 2013; Sáez, 2012; Valero, 2012).

2.4. Content and Language Integrated Learning (CLIL)

2.4.1. Origin and foundations of CLIL

The origins of Content and Language Integrated Learning (CLIL) date back to 1990, when it emerged as a proposed solution to the problem that exists in Europe in the learning of foreign languages. Already at that time, Europe established that citizens should master at least 2 languages apart from their mother tongue. In all these claims were involved the very negative results in terms of foreign languages, existing what they called "*delivery gap*" between

the foreign language curricula and the achievement of the language. That is to say, this expression has been coined with the intention of reflecting the difference that exists between the results shown in the curriculum and the reality of the classroom, that in general the students have not acquired the necessary linguistic and communicative skills and abilities, nor chords at the corresponding educational level. Fact that affects students when they have to face real situations and problems.

It will be in 1994 when CLIL begins to acquire its greatest relevance and establish itself as an alternative to existing models, which essentially consists of teaching content and language at the same time, in an integrated way, so that the language is used with the aim of learning content. and vice versa, defined by (David Marsh, 1994) as follows: *“CLIL refers to situations in which subjects, or parts of subjects, are taught through a foreign language with dual focus objectives, namely, content learning, and simultaneous learning of a foreign language"*

The CLIL approach has similarities to other bilingual immersion and language teaching approaches, such as content-based language teaching (CBLT), but the difference is that in the case of CBLT, the content is worked on in the foreign language class. target (L2) and the emphasis is actually on the language even though it is content based. In contrast, the CLIL approach implies that language and content are taught at the same time and in the content class, sharing the emphasis on both language and content. This implies the need to use a methodology that favours said dual learning. As for the difference with bilingual immersion programs, the alternation of the code stands out, that is, in CLIL the mother tongue or L1 is also used, so that L1 and L2 alternate at certain moments of learning.

Therefore, it implies a "two for one" approach, determining its distinctive character with respect to other bilingual teaching initiatives, it is its innovative and ground-breaking character, in which a planned pedagogical integration of contextualized content, cognition, communication and culture in the practice of teaching and learning.

This is what Coyle (2007) refers to as the 4 C's framework: content (topic), communication (language learning and use), cognition (learning and thinking processes), and culture (interculturality). understanding and global citizenship.

These **4 principles** are defined by Meyer (2010) as follows:

-**Content**: the author considers that the content is not just about acquiring knowledge and skills, but that students are able to structure their own knowledge and understanding and develop skills, through personalized learning. For this, it is transcendental to link the theoretical contents to daily life, giving it meaning in their lives.

-Cognition: there is a relationship between learning content and reasoning or thinking about it (cognition). It is therefore the development of cognitive skills that relate the formation of knowledge and language. According to Bloom's taxonomy (1956), which was created by Benjamin, there are six cognitive levels: knowledge, comprehension, application, analysis, synthesis and evaluation are classified depending on the cognitive effort required. If it requires more effort, they will be HOT (Higher-order thinking) and LOT (lower-order thinking), if they require less effort.

-Communication: the communication process is essential to be able to receive and transmit knowledge. It must be transparent and accessible. This has implications when the learning context operates through a foreign language. Within the CLIL methodology it be found three forms of learning for language through content (Figure 1): **1) The language of learning**: the language necessary to access concepts and skills in a field of knowledge. These linguistic demands of the different disciplines understand much more than vocabulary. **2) The language to learn**: language that allows the student to be functional in a foreign language environment. This includes the language of the classroom, as well as language for academic processes and speech acts. **3) Language Through learning:** the language generated in the learning process. As new meaning is learned, a new language is required and acquired.

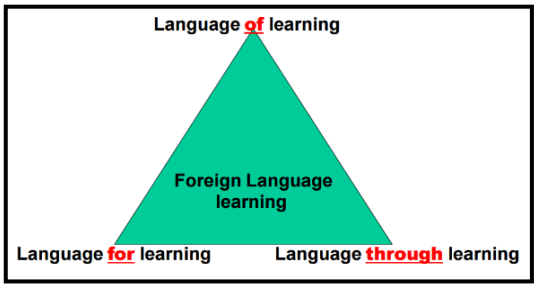

Figure 1. The Language Triptych. (Coyle, Hood, Marsh, 2010)

-Culture: it is important to take into account the relationship between cultures and languages. In this highly globalized society, it is essential to establish relationships between language and the real world, as stated in the Common European Framework of References for language.

Likewise, it be can distinguish two versions of CLIL, on the one hand According to Ikeda (2013:31), the CLIL "hard/strong", where subjects such as geography and science are taught by teachers of non-native content, and the CLIL "soft". /weak" where the teaching is carried out by native or non-native teachers, with greater emphasis on language learning.

2.4.2. Application of CLIL

Through the CLIL methodology, it is not intended that the student learn a battery of vocabulary using the traditional method of grammar and translation of texts, but to do so in a more natural and flexible way through its use. To do this, active and participatory methodologies such as PBL, collaborative learning, gamification... are often used, encouraging the student to interact with their classmates and acquire fluency in oral expression in the new language, in order to develop interactive people. and autonomous.

Therefore, a series of fundamental ideas must be incorporated into daily pedagogical praxis:

- The appropriate selection of content will be necessary, based on the established legal framework, to work on linguistic content integrating all linguistic skills.

-ICT tools will have a transcendental role in designing visual and auditory teaching resources that facilitate learning.

-For the promotion and empowerment of the foreign language through communication, socializing activities should be proposed through cooperative work.

2.4.3. Advantages and disadvantages of CLIL

CLIL is a methodology for language learning through content. Fact that is favoured when facing real situations where language learning has a greater seat in the students' knowledge. However, like any methodology, it has its advantages and disadvantages, which after a compilation of different authors will be shown in the following table (Table 2):

Advantages (Lasagabaster and Sierra, 2009; Llinares and Morton, 2017)	Disadvantages (Lasagabaster and Sierra, 2009; Llinares and Morton, 2017)
It encourages flexibility and construction of meaningful learning based on previous knowledge.	Important changes at the organizational level
Reduces levels of anxiety and nervousness in learning a language by students	Cooperation and understanding between the content teacher and the foreign language teacher
Gradual process in language learning fosters motivation	Poor teacher training and limited support and resources.
Development of intercultural competence and preparation for a global world.	High workload of teachers.
The carefree, dynamic and fun character of the CLIL methodology allows the development of the cognitive, communicative level as well as the development of social skills.	CLIL does not allow the content of a subject to be reduced or lowered due to the fact that it is taught in English, so both teachers and students must make a much greater effort to prepare the classes and update the subject.

Table 2. Advantages and disadvantages of CLIL (Lasagabaster and Sierra, 2009; Llinares and Morton, 2017).

2.5. Symbiosis between Project-Based Learning (PBL) and Content and Language Integrated Learning (CLIL)

Throughout this work, the particular characteristics of each of the PBL and CLIL methodologies have been detailed individually. However, this section will describe the connection that exists between both methodologies, relying on the study of certain authors.

The similarity that exists between the characteristics of these methodologies is remarkable. In both cases, the student is expected to adopt an active, interactive role, as well as to immerse them in activities and practices close to real situations and to develop the ability to face different situations and difficulties of daily and professional life with their own criteria. These similarities, which were already intuited as both teaching strategies have been studied and deepened, have been described in publications such as (Cubero, 2021), whose intuition is reinforced and ratified.

These studies, as is the case of (Cubero, 2021), embark on the investigation and proposal of different methods, models and teaching strategies to help improve teaching practices and thus better understand the factors that come into play. in the dynamics and process of teaching and learning, in this particular case of a language. In this case, a proposal is built around a theoretical reflection in relation to two teaching approaches to improve intercultural communicative competence and implicit linguistic progression in the language or foreign language classroom through the development of a project. These two approaches correspond to CLIL and PBL that meet the necessary conditions to advocate for the best practices of language teaching and learning, the intercultural role and its relevance in learning experiences.

It is argued that the merger between CLIL and PBL can enhance intercultural communicative competence. The theoretical principles of both approaches need to be integrated based on the specific needs of the teaching context, curriculum, population and language level.

Both teaching frameworks place great importance on learner focus, learner autonomy, meaningful and authentic tasks, purposeful communication,

and the need for the use of language in real contexts where language becomes a vehicle to perform, learn and work on the content from which the key.

With which the teaching of both methodologies jointly provides each other with feedback, promoting each other's own virtues and teaching powers. One way to express this feedback in biological terms is through symbiont where the combined development of both methodologies benefits each other.

Diez-Olmedo (2020) highlighted that the combination of PBL and CLIL represents a comprehensive module in fostering various student development issues.

The connections between CLIL and PBL in the context of learning a second or foreign language respond to what modern societies and students need and demand in terms of current times, the technological revolution, key knowledge, skills, competences and professional training.

In PBL, learning outcomes are linked to the creation of a product in collaboration with peers and the educator, which connects directly with social skills, creation and active participation. In CLIL, results are connected to the level of engagement in communication, cognitive thinking, scaffolding, and participation across various learning tasks.

Likewise, these models consider content, culture, context, language and communication as key factors to generate effectiveness in teaching and learning.

2.6. ICTs, fundamental tools in PBL and CLIL

For both PBL and CLIL methodologies, in this combined didactic proposal, ICTs (Information and Communication Technology) deserve to have a specific section in this work as a fundamental didactic resource in the performance of the teaching-learning process. In any educational field, it is very important to approach the digital reality that has permeated both the work and personal worlds in this new society, and that provides a wide range of educational possibilities (Almenara, 2010; Sánchez, 2002).

The TICs are therefore, breaking strongly into the educational process (Sánchez, 2007), very present in methodologies such as PBL and CLIL, in which the autonomous work of the student, frequently in groups, stands out for the development of a project, favoured by the ICT tools allowing access to a huge amount of information on the network, as well as easy communication between the students of the group (Montes and Vallejo, 2016), favouring an efficient exchange of information during the development of collective work, as occurs, for example, in carrying out simultaneous works by different members of a collaborative group through Office 365 (Haro and Yépez, 2020).

The use of ICTs in both PBL and CLIL promotes student motivation, developing digital and communicative skills, abilities and competences, favouring the search for information in different sources, acquiring a critical judgment that allows you to discriminate and select the really relevant information. Thus, some of the positive assessments that students highlight after learning through a project are collaborative learning and group work (Ausín et al., 2016).

3. DIDACTIC PROPOSAL

The contents selected for the development of this didactic proposal correspond to Block 1 of contents "The evolution of life" of the subject of Biology and Geology of 4th ESO in accordance with the legal framework described in the following section 3.1. This didactic proposal is framed within the constructivist model integrating Project-Based Learning (PBL) in combination with CLIL methodology, whose purpose is to increase student learning. motivation and interest, giving students an active and leading role, as well as greater autonomy by bringing theoretical knowledge closer to real application and favouring teamwork. Through these educational practices, it is intended to promote the development of certain abilities and skills that allow them to face possible difficulties and real situations in an effective and resolute manner, as well as the development of linguistic and communicative skills and abilities in a foreign language. For this, a project called "**A look inside your cells**" will be carried out, whose tasks and activities carried out throughout it will result in the

creation of a **Scientific Poster** that will be exhibited at the **VII Scientific Conference** of the school, promoting scientific dissemination.

3.1. Contextualization and legislation

This didactic proposal is aimed at a class of 25 students (including a student with attention deficit hyperactivity disorder (ADHD) and another with reduced mobility) of the Biology and Geology subject in the 4th ESO, in an educational center where Compulsory Secondary Education, Baccalaureate and a Vocational Training module are taught, with a total of 300 students. This center has enough resources to carry out the proposed activities without any problem, and it is located in a town of 3,500 inhabitants in the south of the province of Jaén.

The didactic proposal is part of the LOMLOE (Organic Law 3/2020, of December 29, which modifies the Organic Law 2/2006, of May 3. The teaching-learning process will be built around 7 key competences. These competencies are included in the Council Recommendation, of May 22, 2018, on key competencies for lifelong learning (2018/C189/01), which describes a link between the competences, contents, evaluation criteria and evaluable Learning Standards of Compulsory Secondary Education. In turn, the Autonomous Community of Andalusia regulates the basic curriculum of Compulsory Secondary Education and Baccalaureate included in the Order of January 15, 2021. Similarly, the didactic proposal was developed based on the legal framework of bilingual education determined by the Order of June 28, 2011 in Andalusia.

3.2. Objectives

3.2.1. General objectives

In this work, the didactic proposal is developed in which a PBL is combined with the CLIL methodology. For this, a project will be developed, around it through a set of activities and tasks that will conclude in the realization

of a scientific poster. This poster will be exhibited and presented at the VII Scientific Conference organized by the high school.

3.2.2. Subject objectives

-Familiarize yourself with the technical vocabulary of content block 1 "The evolution of life" specified in the Order of January 15, 2021.

-Understand the structure and importance of chromosomes.

-Understand the importance of the cell cycle.

-Recognize the phases of mitosis and meiosis, and their biological importance.

-Know some of the diseases derived from these processes and their biotechnological applications.

3.2.3. Linguistic learning objectives

Enhance the linguistic and communicative skills of a foreign language (English) according to the following points:

-According to the Order of June 28, 2011, which regulates bilingual education in schools in the Autonomous Community of Andalusia, 4th ESO students must reach a B1 level in the foreign language.

-Development of the BICS language (Basic Interpersonal Communication Skills), which corresponds to a social language for a daily environment (Cummins, 2008; Roessingh, 2006), and therefore, aims to acquire skills to communicate in the classroom and perform the task. These skills correspond to the ability to hear, listen, speak, write and interact. In this project numerous groups works, debates, defend of ideas in public, research readings, writing of texts and main ideas and presence in presentations are carried out. To favour fluency in these communicative processes in the study of (Coyle et al., 2010) indicates that it would be interesting to develop vocabulary, expressions and structures that are used in everyday and less specialized communication, as well as idiomatic expressions, phrases facts and words with special difficulty in

pronunciation. On the other hand, the work of the most common verb tenses and modal verbs as well as connecting comparatives, prepositions, etc.

-Language learning CALP (Cognitive command of academic language) focused on a more specific field of the classroom environment (Cummins, 2008; Roessingh, 2006). In this scientific project it is important to promote very specific terms and expressions. In which we highlight on the one hand the development of terms and expressions of an academic nature such as: summarizes, analyses, synthesizes, distinguishes, associates, interprets, reproduces, exposes, clarifies, specifies, contrasts. And on the other hand, the development of a more technical language of the subject, such as: cell division, cell cycle, chromosomes, mitosis, meiosis, mutations, cytokinesis, chromatin, replication, genetic recombination, among others.

3.2.4. 21st Century skills

-Promote an approach of science, and offer a perspective closer to the real application.

-Foster curiosity initiative, creativity, involvement and autonomy.

-Develop social and communication skills through teamwork.

-Develop certain abilities and skills, such as leadership, problem-solving capacity, flexibility that allow facing different situations and changes.

-Apply transversal knowledge.

-Develop their own criteria that allows them to judge current scientific issues.

-Build trust and provide resources for public exposure.

-Promotion of informational, media and technological literacy.

3.3 Key competences

The concept of "competence" was defined by the Organization for Economic Cooperation and Development (DeSeCo, *"Definition and Selection of Competences"*) in 2003 as "the ability to respond to complex demands and carry out diverse tasks adequately, through the acquisition of a combination of

practical skills, knowledge, motivation, ethical values, attitudes, emotions and other social and behavioural components that are mobilized together to achieve effective action". The 7 key competencies included in the Council Recommendation, of May 22, 2018, on key competencies for lifelong learning (2018/C189/01), implicit in the intervention proposal of this work, are the following:

1. Competence in linguistic communication (CLC)
2. Mathematical competence and basic competences in science and technology (MCBC)
3. Competence in Learning to Learn (CLL)
4. Digital Competence (DC)
5. Social and civic competences (SCC)
6. Sense of initiative and entrepreneurial spirit (SIE)
7. Cultural Expressions and Awareness (CEA)

In this intervention proposal, four key competences will be worked on: CLC, MCBC, CLL and DC. The CLC in the development of communicative capacity in a foreign language (English) through, mainly, debates, work teams and public exhibitions, the MCBC, typical of the specialty of Biology and Geology, which frames all those contents that they will work during the development of the proposed project, the AAC favoured by the PBL and CLIL methodology, which offers the student the opportunity to generate their own knowledge with greater autonomy, adopting a leading role; which, in turn, will have as a consequence the development of DC through the search for information itself.

Likewise, both methodologies enhance the SIE competence through the design and organization of the poster, and all the activities and tasks until its completion.

3.4 Contents

The contents that are going to be worked on in this intervention proposal are described below, they are framed in the LOMLOE (Organic Law 3/2020, of December 29, with the modifications of Organic Law 2/2006, of 3 May), (4th of ESO, Biology and Geology, Block 1: The evolution of life), as well as in la Orden of January 15, 2021 of the Autonomous Community of Andalusia.

Contents

-Cell division and its function, both in unicellular and multicellular beings.

-The cell cycle: Stages G1, S, G2, division (mitosis or meiosis) and cytokinesis.

-Identification of nucleic acids (DNA and RNA).

-Mitosis: Prophase, Metaphase, Anaphase, Telophase and Cytokinesis.

-Meiosis, reduction of the number of chromosomes to generate gametes (phases).

-Errors in meiosis (possible diseases).

- Genetic engineering techniques and biotechnology.

Below are the assessment criteria with their respective evaluable learning standards established in Royal Decree 1105/2014 of December 26 and in the Orden of January 15, 2021, of the Autonomous Community of Andalusia, which are expects the students to incorporate through the contents that are proposed for the intervention.

3.5 Assessment Criteria (AC) and Assessable Learning Standards (ALS)

Through the didactic proposal that arises in this work, it is intended to achieve the following assessment criteria and assessable learning standards according to the Order of January 15, 2021:

2. Identify the cell nucleus and its organization according to the phases of the cell cycle through direct or indirect observation (AC).

2.1. Distinguishes the different components of the nucleus and their function according to the different stages of the cell cycle (ALS).

3. Compare the structure of chromosomes and chromatin (AC).

3.1. Recognizes the parts of a chromosome using it to build a karyotype (ALS).

4. Formulate the main processes that take place in mitosis and meiosis and review their meaning and biological importance (AC).

4.1. Recognizes the phases of mitosis and meiosis, differentiating both processes and distinguishing their biological meaning (ALS).

5. Compare the types and composition of nucleic acids, relating them to their function (AC).

5.1. Distinguishes the different nucleic acids and lists their components (ALS)

12. Identify the techniques of Genetic Engineering: recombinant DNA and PCR (AC).

12.1. Difference working techniques in genetic engineering (ALS).

3.6 Methodology

The purpose of this didactic proposal in which Project-Based Learning is combined with the CLIL methodology, is to achieve an increase in motivation and interest on the part of the students through the development of activities that actively involve to students, where they face certain situations and real problems through the development of a project, which induces them to reason, interact and act with their own criteria applying knowledge, and which in turn, through these active methodologies, participatory and dynamic, serve to improve intercultural communicative competence and linguistic progression.

The result of the project will consist of the production and exhibition of a poster with a scientific design, in the VII Scientific Conference organized by the teaching high school, where the different contents of the block worked through various activities and tasks will be collected. Each poster will be made by a group of students (between 2 and 4). The activities and tasks that will be proposed are interactive, dynamic, where the student takes high school stage and is the leader of their learning while the teacher is a mere mediator and guide in the path of student learning. These activities, which are aimed at both the acquisition of knowledge and language, will be carried out in a gradual manner that initially allows us to obtain an **initial assessment**, followed by

formative assessment, ending with a summative assessment that would correspond to the creation, presentation and exhibition of the poster.

Below is shown, in Table 3, the Schedule of the project "**A look inside your cells**" and later the planning of the activities, development and objectives of each of the sessions in which this didactic proposal will be developed.

Project schedule "A look inside your cells"	
Session 1	Presentation and planning of the project. Initial assessment. Specific vocabulary activities.
Session 2	Viewing a video (Mitosis). Development of a laboratory protocol through the scientific method. Laboratory practice.
Session 3	Visualization of a video (Meiosis). Realization of a plasticine model with respective identification of the processes of meiosis
Session 4	Talk and debate with a visiting researcher from the University of Jaén, on mutations derived from meiosis.
Session 5	Research task: Diseases derived from the division and applications of biotechnology.
Session 6	Creation of a poster in scientific format.
Session 7	Exhibition and presentation of the posters in the **VII Scientific Conference** at school.

Table 3. Project schedule: "A look inside your cells".

Session 1

Activities: Presentation and planning of the project. Initial assessment. Initial vocabulary scaffolding.

Objectives

In this session, beyond the subject and linguistic objectives set out in the corresponding section (3.2.), the aim is to achieve:

-Generate expectation and enthusiasm with the proposed project, through the videos that show us the final result of a poster.

-Acquire an idea of the current knowledge base of the students.

-Work and establish a linguistic scaffolding to address subsequent activities.

Developing the lesson plan

In the first place, and before addressing the initial evaluation, an explanation of the project "A look inside your cells" will be carried out, where the set of activities and tasks that will take place will be discussed, as well as their timing and locations used. For this explanation, the project schedule developed in Table 3 of this work will be used as a resource. Likewise, to guide and facilitate the realization of the Scientific Poster, the final result of the project, the following examples (https://www.pinterest.com/mara_cuneo/posters-cientificos/) and videos (https://www.youtube.com/watch?v=xDfs3BFK7_k and https://www.youtube.com/watch?v=_WnhoIbfcoM) will be provided.

Subsequently, an initial assessment will be developed in order to assess the current knowledge base of the students, that is, to know the starting point of the knowledge on which we must begin to build learning. For this reason, activities will be used that allow us to assess both the knowledge of the specific vocabulary that we have as well as the knowledge from which we start. These activities consist of filling in the gaps in the part of a chromosome, resolution of simple questions, such as naming the 4 phases of mitosis and some multiple-choice questions that correspond to activity 1, 2 and 3 of Annex 1.

These activities, in turn, will allow us to work on the linguistic scaffolding necessary to address subsequent activities.

Likewise, the initial assessment will serve as a transition from previous knowledge to a new learning program, through activities with greater depth, where the different phases of mitosis must be identified in images and determine which of them corresponds to a plant cell or animal, as well as identify the different arrows in a cell division image, which correspond to activities 4 and 5 of Annex 1.

Justification of the 4Cs of CLIL

The contribution in this session to the CLIL methodology based on the 4 concepts (4Cs); content, communication, cognition and culture is as follows:

Communication: Development of social language (BICS) mainly in the introduction of the project and exchange of impressions in the initial assessment. Through Initial vocabulary scaffolding, academic language (CALP) is encouraged.

Cognition: Through the initial assessment it has been possible to generate a cognitive conflict of the concepts reviewed with possible previous erroneous ideas, inducing analysis and reasoning.

Content: Through the proposed activities, the aim is for the student to establish prior knowledge on which to build new ones.

Culture: Collaboration in raising awareness of a globalized world in which English is the linguistic vehicle in the scientific field.

Session 2

Activities: Visualization of a video of the stages of mitosis (https://www.youtube.com/watch?v=RNwJbMovnVQ), and development of a protocol through the characteristic properties of the **scientific method**, and carrying out a **laboratory practice** for the identification of the different phases of mitosis under the microscope, in garlic root apex cells.

Objectives

The objectives pursued in this session go beyond the subject and linguistic objectives proposed in section 3.2., are:

-Promote learning through activities of a different nature, such as the representation of meiosis through a model.

-Encourage the development of social skills through cooperative and collaborative activities.

-Promote autonomy in learning by developing a protocol framed in the scientific method.

-Use and raise awareness of the enormous potential of ICT tools for learning, through explanatory videos.

Developing the lesson plan

In the first section of this session, a video will be displayed showing the different phases of the mitotic division, so that through these ICT tools, the student can be reached with greater clarity and fluency, trying to distance ourselves from that more abstract concepts.

Subsequently, in groups of 2 to 4 students, they will develop a protocol framed within the scientific method, through the information obtained from the video, textbooks and internet, and supported by the teacher's role as mediator, for the following laboratory practice: visualization of the different phases of mitosis in cells at the apex of garlic roots. To do this, the apex itself is cut, it is crushed with force on a slide to which a dye is added that after a certain time can be observed with the type of microscope that is in the lab school, the different phases of the mitotic division (Annex 2).

It is important that the student make the relevant reports and photographs to later add them in the corresponding section of the scientific section.

Throughout this Session 2, together with Session 3, 4 and 5, a **formative assessment** is carried out, through with the activities and tasks that are shown in each session, where students acquire skills and competencies, through descriptive records, observation, debates, analysis groups and its ability to synthesize, which also allow the assessment of the contents and linguistic skills acquired.

Justification of the 4Cs of CLIL

The contribution in this session to the CLIL methodology based on the 4 concepts (4Cs); content, communication, cognition and culture is as follows:

Communication: introduction of new specific vocabulary, as well as the development of interaction between classmates, favouring the development of social language, and promoting academic language through the writing of a protocol.

Cognition: The approximation to a real experimental situation generates a state of consciousness and reasoning about the theoretical contents and their usefulness in the real world.

Content: In this session, the importance of applying the contents to real situations in the scientific field predominates, causing a better understanding of them.

Culture: In the search for information for the development of the protocol, they can appreciate the different ways of expressing themselves and working in the scientific field between different cultures.

Session 3

Activities: Viewing a **video** (link below) of the different phases of meiosis, emphasizing the explanation of its biological importance, and development of a **plasticine representation** (model) of the meiosis cycle, identifying each process with toothpicks and paper.

Objectives

In addition to the objectives mentioned in the previous sessions related to ICT tools, the development of social skills, facing different problems and promoting activities in a creative and original way, this session aims to:

-Learning of the contents that arise (meiosis and its biological importance).

-Development of skills and abilities for manual activities, enhancing resoluteness and creativity.

Developing the lesson plan

In the first section of this session, video (https://www.youtube.com/watch?v=MNq015d03MU) will be played where the different phases through which the meiotic cycle passes are shown in an interactive and visual way. And in addition, a video (https://www.youtube.com/watch?v=TiIVreGlFhY) will be put on where its importance in the survival and evolution of living beings is reflected, thanks to the genetic variability that is generated.

Later, in the same groups of 2 to 4 students that are made up to carry out the project, they will make a representation of the chromosomes in the different stages of meiosis, similar to a model. Each phase will have to be duly identified, for which posters made with paper and toothpicks can be used. To include this activity in the Scientific Poster, it must be duly documented through photographs.

Once documented, independently, they will be exposed for a week in a section of the center dedicated to the exhibition of works and manual activities.

Justification of the 4Cs of CLIL

The contribution in this session to the CLIL methodology based on the 4 concepts (4Cs); content, communication, cognition and culture is as follows:

Communication: Carrying out a manual activity in a group enhances the development of social and communicative language skills, generating greater fluency.

Cognition: Viewing videos, and observing the continuous flow of information on the internet, can generate an open mind, promoting more autonomous learning.

Content: We could highlight the different ways of working with content, with very diverse activities, which in this case can enhance certain skills that were unknown to them.

Culture: Highlight the important role that meiosis can have in the existence of an intercultural society, since it is during this process that the genetic diversity existing among the population is generated.

Session 4

Activities: **Talk** in English by a **guest researcher** belonging to the Department of Experimental Biology of the University of Jaén, whose research focuses on the meiotic cycle and its derived mutations using the chorus frog (*Pseudacris triseriata*) as a research model. Subsequently, there will be a debate and

questions between the researcher and students. The main ideas of the **talk/debate** must be included in a section of the scientific poster. The items of this activity are shown in the following table (Table 4).

	Very good	Good	Enough	Insufficient
Organization	Arguments are arranged logically around a main idea	Quite a few arguments are arranged logically around a main idea	Few arguments are logically arranged around a main idea	There is no logical order of arguments
Debate	All the pros and cons are argued and have relevance.	Some of the pros and cons are argued and have some relevance.	The pros and cons are scarcely argued and have little relevance.	Proposed pros and cons are not argued.
Information	How and when mutations take place, and their biological importance are debated.	How and when mutations occur is discussed, but the biological significance is not touched upon.	How and when mutations occur is scarcely discussed, but the biological significance is not touched upon.	The contents on which the debate is involved are far from those exposed in the talk.
Presentation and language	Gestures, eye contact, appropriate tone of voice and specific language are used.	Gestures, eye contact, an appropriate tone of voice and a specific language are used, in a less forceful way.	Gestures, eye contact, appropriate tone of voice and specific language are used sparingly.	Gestures, eye contact, appropriate tone of voice and specific language are not used.

Table 4: Items for the development of main ideas in the talk/debate.

Objectives

In this session, in addition to continuing to promote activities that are closer to the real world, generating motivation and interest and promoting the development of language skills, the aim is to:

-Promote the development of understanding skills.

-Enhance the ability to formulate different questions with their own criteria.

-Promotes the creativity growth of students, generating a scientific inquiry encouraging students to continue their studies and immerse themselves in the scientific field.

-Know the biological importance of the meiotic cycle and the variability that is generated, in the evolution and development of living beings.

-Awareness about the importance of scientific dissemination

Developing the lesson plan

Reception and presentation to the students of a guest, a genetic researcher from the University of Jaén, summarizing his professional career since his beginnings at school, with the aim of generating a real approach to the students, as well as reflecting an example of the educational and professional path that a student can keep going until you reach your goal. Subsequently, the exhibition and talk will take place on the different related lines of research, in a didactic and entertaining way, to arouse the interest and motivation of the class. Once the talk is over, the students must formulate certain questions of interest and curiosity that give rise to a debate until the end of the session. In this session, beyond the content that can be learned, one of the main objectives is to develop the communicative capacity of the students, and enhance reasoning and judgment with their own criteria. Seeking therefore to improve fluency and clarity in their interventions, as well as trying to ask questions concretely and precisely.

In order for the students not to lose the thread of the debate and to attend to those students with a lower level of English as well as specific knowledge, a margin will be given for the preparation of questions and later some questions will be interspersed with the answers of the researcher in Spanish to promote understanding and fluency in the debate.

Faced with situations of this type in which there may be different levels of mastery of the foreign language, or we simply find ourselves with complex social and cognitive demands, an alternative is postulated, in order to overcome this difficulty, which is translanguage (Lin and He, 2017). This concept refers to the use of more than one language simultaneously in a conversation involving multilingual speakers. This can be developed in various ways, among which, for example, a teacher develops the transmission of information in English (speech L2) but the discussion with the students will be in Spanish (dialogue L1), maximizing the student's bilingual capacity.

Justification of the 4Cs of CLIL

The contribution in this session to the CLIL methodology based on the 4 concepts (4Cs); content, communication, cognition and culture is as follows:

Communication: The talk/debate will allow the development of linguistic skills both when it comes to listening and understanding. how to synthesize ideas and formulate questions. The use of academic language will also be promoted.

Cognition: The very presence of a scientist, who exposes how they apply theoretical knowledge to real experimental situations, can generate a change of perception and motivation, when facing the educational process.

Content: This session is very important because it allows students to associate such specific and abstract content with a real situation.

Culture: Through the researcher's talk, they can observe another way of seeing studies and life. Be aware of the perception that diseases caused by mutations have in different regions, and how they are treated according to the state of development of each country.

Session 5

Activities: Research task; search for information in groups of 2-4, on biotechnological applications and diseases derived from errors in cell division. This information will be included in the Scientific Poster as the last section.

Objectives

In this session, apart from the subject objectives, mainly related to biotechnological applications and mutations, and linguistics, with special emphasis on reading and comprehension, the aim is to achieve:

-Learn to do an efficient information search on the Internet and distinguish and discriminate the different sources.

-Know and manage different search servers for scientific publications.

-Be able to break down and synthesize the massive information obtained on the internet.

-Be aware of the most common diseases found in society as a result of mutations.

Developing the lesson plan

In this last session before creating the Scientific Poster, where the results of the set of activities and tasks carried out in the previous sessions are included, we will go to the computer room where each student will sit at a computer, and between groups of 2-4 that constitute the project, will share a document through Office 365, Padlet, Google docs, among others. The entire session will be dedicated to the search, compilation and structuring of information related to biotechnological applications and diseases derived from errors in cell division. This information will be directly included in one of the sections of the Scientific Poster, that will be held in the next session, with the following minimum content and format:

-Inclusion of 2-3 biotechnological techniques with application in areas such as health and food. To do this, a brief description of the technique and its usefulness in the corresponding field should be made, preferably accompanied by an image.

-Description of 2-3 common diseases caused by a mutation in the cell cycle. For this, the type of mutation and its symptoms in people will be briefly explained. In the event that these mutations generate a characteristic phenotype, it will be convenient to add images that allow the mutation to be associated.

Justification of the 4Cs of CLIL

The contribution in this session to the CLIL methodology based on the 4 concepts (4Cs); content, communication, cognition and culture is as follows:

Communication: in this session, cooperative research work is carried out that requires very close collaboration and communication, promoting language skills. Likewise, writing will be enhanced with a specific vocabulary.

Cognition: As they search for information on the internet, they will realize the number of documents and articles that are found. Hence, there is a need to reason and reflect on the importance of good techniques for searching and discriminating information.

Content: through this activity it will not only be necessary to have the contents, but also to know how to analyze and synthesize them in order to transmit them in a clear and orderly manner.

Culture: Working so closely together encourages interaction between people with different education, values and culture. This will allow knowledge of the different ways of working and promote greater flexibility in decisions and personalities.

Session 6

Activities: Design and creation of the Scientific Poster, on the contents worked through the activities and tasks carried out throughout the sessions that constitute this project.

Objectives

In this session where the creation of the poster takes place and most of the proposed subject objectives are going to be worked on, as well as the linguistic objectives, highlighting the writing, other objectives are proposed to be achieved:

-Develop illustrative skills for a good presentation of the contents.

-Learn to synthesize the information obtained throughout the project.

-Promote linguistic competence, especially writing.

-Develop the ability to prepare a work with a scientific structure.

-Encourage creativity in the preparation and design of the scientific poster.

Developing the lesson plan

In this session, the groups of 2-4 students who have worked throughout the project will collect all the information obtained during the different activities that have been carried out throughout the sessions that have included the project. Subsequently, they will develop a scientific Poster, with the dimensions and requirements detailed later, which will be exposed and presented in the following session.

Requirements and dimensions of the scientific poster

- The poster, for its creation, must include the following sections:

-A title related to the contents worked on.

-The authors who have developed the project.

-A summary/introduction of the project, where the topic of the work is briefly and precisely explained and described. It must have a maximum length of 200 words and may include a related image.

-The objectives, where they express the purposes and expectations of each of the activities and tasks that are incorporated in the poster, as well as a general objective of the project. This should not exceed 200 words in length.

-The results are the most extensive section where each of the activities carried out in the different sessions must be integrated, for which the following contents have been worked on: Mitosis, Meiosis, Mutations and their biological importance, biotechnological tools and diseases derived from mutations. Each of the results should be briefly described using a specific vocabulary, although tables and images should predominate since they facilitate their subsequent presentation, and provide greater clarity and visual richness.

-The conclusions in which a reasoning about the different results obtained is finally collected. With an approximate length of 300 words.

-Finally, the references must be included, which must not exceed 10 for reasons of balance in the distribution of the poster. APA style will be used.

- Regarding the formal aspects, the poster must include:

-The school logo

-Have a size of 1.5 meters in height and 1 meter in width

-Use clear, large and legible font (Arial or Times New Roman)

-Use light backgrounds and dark letters.

-Each table and figure must have a title.

-Respect margins.

In this Session 6 (Creation of the scientific Poster) and Session 7 (Exhibition and presentation of the Poster in the VII Scientific Conference), it will allow us to carry out a **summative assessment**, useful to evaluate the learning of the students, the acquisition of skills and the level of achievement showed in the graded rubric of the poster. In this case, we are interested in knowing if the students have been able to apply the knowledge acquired in real life situations, and therefore, have assimilated the concepts included in the rubric, shown below (Table 5), through whose achievement will be assessed.

	Very good	Good	Enough	Insufficient
Presentation and organization	Clear and precise content. Use of graphs, images and tables. Visually appealing presentation.	Generally clear and precise content. Use of some graphs, images and tables. Presentation quite attractive to the eye.	Unclear and precise content. Use of few graphs, images and tables. Visually unattractive presentation.	Unclear and precise content. No Use of graphs, images and tables.
Structure: **Title** **Authors** **Summary/ Introduction** **Objectives** **Results** **Conclusion**	Includes all sections	Includes most sections	Includes some of the sections	Includes few sections.

References				
Contents: **Mitosis** **Meiosis** **Mutations and their biological importance.** **Biotechnological tools.** **Diseases derived from mutations**	Integrates all the contents worked on	Integrates part of the contents worked	Integrates few of the contents worked.	Does not integrate the contents worked / Does not make the poster
Dimensions: **1,5m tall** **1m width**	Proper size and shape	Size and shape similar to the correct one	Wrong shape and size	No making a poster
Writing, vocabulary and spelling	Correct expression with specific vocabulary without spelling mistakes	Correct expression with lack of some specific vocabulary without spelling mistakes	Poor expression with lack of some specific vocabulary without spelling mistakes	Incorrect expression, non-use of specific vocabulary and spelling mistakes

Table 5. Rubric for the assessment of the scientific poster

Justification of the 4Cs of CLIL

The contribution in this session to the CLIL methodology based on the 4 concepts (4Cs); content, communication, cognition and culture is as follows:

Communication: beyond other linguistic skills, the making of a poster requires good cooperation between colleagues developing social language, as well as correct writing through specific vocabulary.

Cognition: Facing the challenge of synthesizing all the results accumulated throughout the project will generate a process of self-management and reasoning to calmly tackle this challenge.

Content: In this session, the ability to analyze, understand and synthesize all the content worked on is fundamentally enhanced, and to be able to project it on a poster in order to transmit it clearly and concisely.

Culture: scientific posters in many cases have a scientific dissemination task, that is, they bring society closer to the different lines of research and advances in a simple and clear way. This is essential to promote the development of a conscious society with its own critical thinking.

Session 7

Activities: Exhibition and presentation of the scientific poster in the **VII Scientific Conference** at school.

Objectives

In this last session, as happened with the previous ones, not only will we try to achieve the proposed subject and linguistic objectives, but the following objectives will also be pursued:

-Get used to defend ideas in public and acquire communication skills, knowing how to express oneself and transmit information.

-Development of social skills, distribution of roles, organization and teamwork.

-To raise awareness and promote the importance of scientific dissemination.

-Enhance the ability to understand, synthesize and transmit knowledge.

-Plan new questions, possibilities and alternatives, for the development of the project from the different opinions, debates and suggestions of the invited public.

Developing the lesson plan

Exhibition of the posters in assembly hall at school, for the development of the VII Scientific Conference, assessing the adequacy and success of the exposed contents, its communication and oral transmission of the contents, the clarity and specificity of the contents reflected in the poster and the distribution of roles among the members of each group, the participation of all and teamwork through the items established in the rubric of Table 5. In the same way, after the exhibition of each one of the groups, a group feedback will be promoted where the teacher will contribute his impressions and contributions to

emphasize both the positive aspects in which the students have stood out as well as those aspects that they can modify and improve for future jobs.

Justification of the 4Cs of CLIL

The contribution in this session to the CLIL methodology based on the 4 concepts (4Cs); content, communication, cognition and culture is as follows:

Communication: This session is mainly developing the ability to transmit knowledge clearly and concisely. For this, it is essential to use a simple but specific language, and in a fluid and concise way.

Cognition: One of the advantages of defending recently learned knowledge, as is the case with the poster, is the importance of having a clear mastery of the content in order to transmit it. This allows the student to reason and be aware of the level of understanding of the project itself, when transmitting it to other people.

Content: in this case, the importance of having a clear and concise knowledge of the content worked on is combined with its relationship with language (from the point of view of expressions, vocabulary, connectors...) that allows you to express and transmit them clearly.

Culture: The exhibitions by groups of the posters will allow a level of awareness of the differences that exist between one and the other, the different ways of working and dealing with different problems and situations, bringing out the cultural differences between the students.

Resources for carrying out the project

-Projector connected to a computer with internet connection.

-Computer room with computers with internet connection.

-Classic or digital whiteboard.

-It requires the provision of a laboratory with benches and 8-10 microscopes with a 40X focus objective, and the components of the lab equipment.

-Assembly hall at school.

-Office 365, Padlet, Google docs platforms.

-Plasticine, leaves and toothpicks.

4. ASSESSMENT

4.1 Assessment of project

The assessment of the project will be carried out continuously throughout the 7 sessions in which the development of the different written activities, attitude, performance, participation and group work will be taken into account. As well as the involvement in the development of the project (scientific poster), problem-solving capacity when facing certain difficulties, acquisition of linguistic and communicative skills in a foreign language (English), and everything that includes the poster and its exhibition.

For this assessment, standardized and objective criteria will be used for the students arranged in the following rubric (Table 6) where each of the sections included in the project are valued and graded.

Rubric for Project assessment				
Indicators	**Outstanding**	**Remarkable**	**Passed**	**Unsatisfactory**
Participation in the initial assessment, and vocabulary activities. **(10%)**	The student is active and cooperative. Complete the activities properly. Participate collectively.	Complete the activities properly. Does not appear active and collaborative	Partially complete the activities. Does not appear active and collaborative	Does not complete activities. Active and collaboratorative attitude are not shown.
Attitude, performance, and group work in the laboratory practice **(10%)**	Shows initiative and interest. It unfolds fluently. Follow the instructions successfully. And work in a group.	Shows interest in the activity. Carry out the activity successfully. and work in a group	Does not attend to instructions, hindering the development of the activity. Finish it and work in group.	Does not collaborate with the group and disregards instructions and practice.

Participation, interest, proposal of ideas, involvement in the development of the project for the making of the poster **(25%)**	The student is active, interested, propose ideas, care about content and design. Complete dedication to the task during the sessions.	The student active, interested, propose ideas, care about content and design. Sometimes gets distracted from homework during sessions	Participates in the development of the project although with little interest and contributes few ideas. The student gets distracted from the task on numerous occasions.	The student shows no interest. The student disengages from the project. Mere spectator in the development of the project.
Resolution capacity in the face of difficulties in the development of the poster. (10%)	The student has a high level of ability to solve the problems he/she faces autonomously.	In most cases, the student is capable of facing and solving problems autonomously.	In many cases, it requires the help of the teacher to face certain problems.	Continuously requests and requires the presence and help of the teacher for any problem or inconvenience.
Linguistic and communicative competence in a foreign language (English) **(25%)**	The student expresses themselves with fluency, clarity, coherence. Participate in conversations. Use specific vocabulary. Understands and writes at a good level.	The student expresses fluently. Participate less in conversations. Use specific vocabulary. Understands and writes at a medium level.	Difficulty in expression. Use part of the vocabulary. Understands and writes at a medium-low level.	The student does not express himself or participate in the dialogues.
Evaluation of the exhibition of the poster. **(15 %)**	Understand and dominate the results you expose. The student is receptive and interested in questions and contributions.	Understand and dominate the results you expose. Less interest in questions and contributions.	It exposes the results, although it does not dominate the content. Not knowing how to answer many of the questions.	It does not make the exhibition.

Project self-assessment **(Questionnaire Section 4.2.)** **(5%)**	The student completes the questionnaire in a reasoned and thoughtful way.	The student completes the questionnaire in a less interested and reasoned way.	The student completes the questionnaire inconsistently.	The student shows complete disinterest and does not fill out the questionnaire

Table 6. Rubric for project assessment.

4.2. Assessment of the didactic proposal by the students and the teacher

In order to try to improve the activities and tasks that comprise the project, to achieve greater motivation and interest on the part of the students, as well as a better dynamic and optimization of the activities, the students will be given an anonymous questionnaire where they raise certain aspects to specify the degree of satisfaction as well as a suggestion section. This will allow a process of feedback and external perspective for the teacher that will allow continuous evolution and self-demand for the development of future projects.

Table 7, below, shows the questionnaire provided to the students:

Complete the survey based on the degree of agreement you have with the following questions	**None**	**Not enough**	**Right**	**Very good**
The project has favored the learning of the contents.				
The project has been very interesting and has generated motivation.				
The timing of the project has been adequate.				
The structure of the project has been adequate.				
The teacher's attitude has favored the development of the				

project with his support and motivation.				
A good and entertaining class atmosphere has been fostered.				
The number of members per group allows for teamwork and everyone's participation.				
The available resources were sufficient for an optimal execution of the project.				
The activities and tasks developed throughout the project have favoured the acquisition of linguistic and communicative skills				
-Fill in the box, with those contributions and suggestions that you consider appropriate and do not appear in the survey:				

Table 7. Questionnaire for assessing the project by the student

This survey about the project completed by the students allows us to obtain a general idea of the qualities and limitations that the students have perceived throughout the development of the project, offering the teacher a different point of view and perspective in order to improve the project. and respond more concisely to the needs of the students, thus generating a feedback process.

In order to evolve and improve as a teacher, as well as improve the didactic proposal, it is important to carry out a reflective self-assessment process on the goals proposed for the project and the outcome of the results obtained. Likewise, it is important to submit to self-criticism to detect those weaknesses and difficulties that can be modified for better teaching performance, as well as to enhance those aspects that have allowed a favourable development of the teaching-learning process.

5. ATTENTION TO DIVERSITY

The principle of attention to diversity, equal opportunities and inclusion, today are very present at all educational levels from infant to adult education. For which inclusive methodologies are applied for attention to diversity, which according to UNESCO (United Nations Organization for Education, Science and Culture) is defined as "Inclusive Education supposes a new paradigm, which tries to eliminate the effects negative effects of segregation (based on difference) and overcome the limitations of the integration of students with special educational needs. In accordance with this, we define Inclusive Education as a permanent process aimed at offering quality education for all, while respecting diversity and the different needs, abilities, characteristics and learning expectations of students and communities, eliminating all forms of discrimination" (Berná and Luque, 2015).

PBL and CLIL are both inclusive methodologies where listening skills, personal initiative, problem solving, positive attitude, reaching agreements, decision making, teamwork in diverse and heterogeneous contexts, interpersonal skills, flexibility are enhanced., etc. Therefore, the use of these methodologies is also favouring the professional orientation of students, which is so necessary from an early age and success in their future.

For those students who have learning difficulties, reinforcement activities will be carried out, simpler activities based on the main ideas and concepts. In some cases, peer tutoring will be used to help each other. On the other hand, the groups will be carried out in a directed way to favour the development of all students.

In this course we have an ADHD student, for whom group activities are very beneficial, such as laboratory practices, making a model and debates, and another with reduced mobility, for whom the school is perfectly adapted without assuming no impediment to the course of teaching practice.

6. CONCLUSIONS

One of the objectives that were raised at the beginning of this work is to detect the possible difficulties and limitations of current educational practice, focusing especially on the scientific field in which this work is framed. It has been seen over the years, the decrease in the number of students who continue with studies related to the scientific field is remarkable (Solbes, 2011; Solbes, Montserrat, and More, 2007), even It is statistically proven the negative conception that students have about this branch of study, which is attributed to a teaching practice that abuses rote learning, fundamentally supported by a traditional methodology overloaded with theoretical content, focusing on a transmission-reception method (Morales and Landa, 2004), to which is added the language used, in many cases promoting a high degree of abstraction, causing a lack of understanding and association of concepts to reality, which has as a consequence: the assimilation of misconceptions, adoption of a passive role , and therefore, being a mere receiver of information, reducing the possibility of interpreting, modifying or generating new knowledge. Likewise, standing out for a learning without a meaning or sense, far from its application to real situations where they are able to interpret and transform that learning with their own criteria, thus preventing a transversality of knowledge between different disciplines (Díaz, 2003).

Likewise, therefore, as published in (Eurydice, 2022), there are performance studies collected by comparative international surveys (TIMSS and PISA), which show how a high percentage of European students have a lack of basic knowledge in science . In this study, a comparison was made with those educational systems that show a high level of performance, highlighting the importance of timely and competent learning support for students who are falling behind. One of the measures successfully proposed is the inclusion of socio-scientific questions in the curricula, increasing the motivation of students and increasing the proportion of students who achieve basic scientific literacy.

Therefore, in this work, in order to increase the motivation of the students and achieve the established linguistic knowledge and skills, a didactic proposal was proposed for the development of a content block in which the PBL and

CLIL were combined, in which we can to conclude that it is a good educational practice, as indicated by some studies (Strobel, 2009), to achieve greater student involvement as it deals with methodologies that bring reality situations closer to the classroom. Likewise, there are surveys carried out on teachers and students where the degree of satisfaction when working with projects increases between 10-20%. Even some teachers reflect, as students, the degree of involvement is such that with their own initiative they contribute new ideas and experiences to the projects.

On the other hand, it can be concluded that this didactic proposal is ideal for the process of attention to diversity, since it allows the development of activities of various kinds, promoting the different virtues and strengths that each of the students may have. Likewise, constant group work favours the support, inclusion and integration of students with more difficulties, generating extra motivation and reinforcing their learning.

Another conclusion that we can highlight is that the presentation of a scientific poster promotes scientific culture. And, moreover, although plant cells have been used for experimental practice, there is an important similarity in their division process with respect to human cells. Then they are able to understand and explain the processes of their own cell cycle, generating and transmitting their own knowledge in assembly hall at school to all the interested public present, in whose scientific dissemination process, linguistic competence is reinforced.

Regarding education in values, it has been seen the important role that these PBL and CLIL methodologies have in the development of civic, responsible and respectful people not only at a social level, but also in political, economic and political spheres, therefore, based on the Sustainable Development Goals (SDGs).

Of course, as in any didactic proposal, a series of difficulties and limitations may arise when designing, timing and managing a proposal, such as the established curriculum itself, so the possible weaknesses of these proposals are shown below:

-Little experience in the development of these methodologies (PBL and CLIL) that affects the design of the times of each session and an increase in the workload.

-Lack of time in the school schedule for the incorporation of collaborative methodologies: the load of content established in the curriculum, in this case the subject of Biology and Geology of 4th ESO, makes it difficult to incorporate as well as, lab experiments that require considerable time, covering in many cases additional hours, which affects the development of other content.

-Some of the inconveniences that can occur when putting this type of proposal into practice is that students can confuse a playful learning environment with a game and trigger a misunderstanding of the activity, resulting in problems of organization and order in the classroom. Hence the importance of making students aware of the type of methodology to work with at the beginning of this proposal. Although, the truth is that in Andalusia, this difficulty is trying to be solved by creating a habit from 1st ESO, by offering an interdisciplinary project in 1th and 3th ESO for the next academic year 2022-23 thanks to Instrucción 1/2022, de 23 de Junio, de la Dirección General de Ordenación y Evaluación Educativa, por la que se establecen aspectos de organización y funcionamiento para los centros que imparten educación secundaria obligatoria para el curso 2022/2023.

-Schedule of each of the sessions: as a result of the author's inexperience, the development of the work causes difficulties when establishing the content or activity appropriate to the time of each of the sessions.

However, to conclude, I would like to emphasize the suitability of this didactic proposal in which PBL and CLIL are combined, beyond its important role in the acquisition of knowledge and linguistic skills, the importance it has in the education that is given to them, as well as, to foster scientific literacy and vocation in students. It offers students values, allowing them continuous social interaction, fostering camaraderie, respect, and collaboration, the management of which by the teacher can be difficult, but its positive results are considerable.

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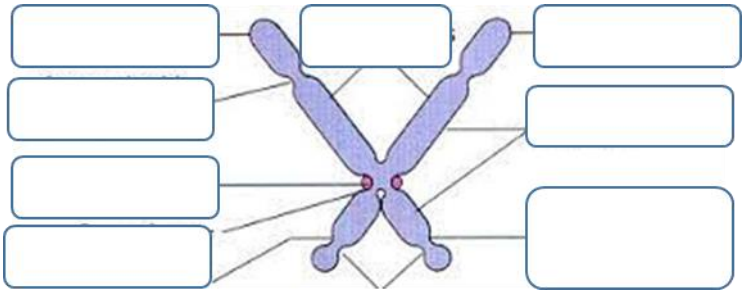
8. ANNEXES

8.1. Annex 1

Activity 1. **Fill in the gaps with the different parts of the chromosome.**



Activity 2. **Which of the following options corresponds to the phases of mitosis?**

a) **Prophase, Metaphase, Anaphase and Telophase**

b) **Prophase, Iconophase, Anaphase and Telophase**

c) **Priphase, Metaphase, Rephase and Telophase**

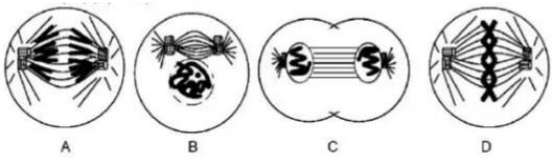
Activity 3. **Fill in the gaps**.

From mitosis or _____, ____ daughter cells _____ are obtained.

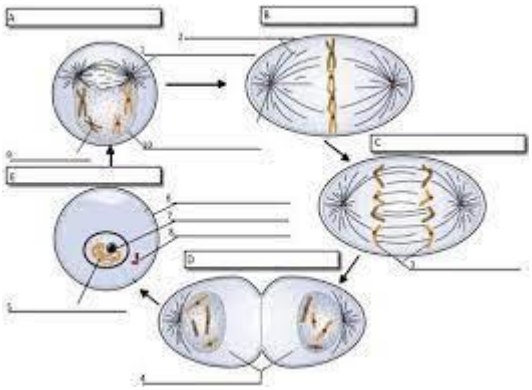
Activity 4**:**

Match the name of each phase with the images.

What type of cell division does the image above represent? And the next?



Activity 5. **Complete this image.**



8.2. Annex 2

Lab Practice: Visualization of Mitosis Phases in Garlic Root Cells (Martinez, 2017).

Introduction

Mitosis is the process by which a mother cell divides into two cells, sharing the genetic material equally, giving rise to two genetically identical daughter cells. In plants this division takes place mainly in the meristems for growth and in the roots and stems. At the apex (end) of the roots is where the division is most abundant due to their growth.

Goal

Visualize the different phases of mitosis; prophase, metaphase, anaphase and telophase in root apex cells under the microscope.

Materials

-Microscope (40X objective)

-Slides and coverslips

-Sterile lancet, tweezers, scissors and glass support.

-Orcein for staining

-Filter paper and water bottle

Methodology

-4-5 roots are distributed to each group of 2-3 students. Deposit them in the glass support where they add the orcein, which will incubate for about 10-15 minutes.

-Remove the orcein and wash the roots with water. Subsequently cut and separate the apex from the rest of the root, depositing it on the slide.

-Macerate (crush) the apex with the opposite end of the lancet and cover it with the coverslip, pressing with the thumb being careful not to break it.

-Observation and identification of the different phases of the mitotic division from a 40X objective.