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Development of CLIL activities for Primary Education: Energy and Matter

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'One language sets you in a corridor for life. Two languages open every door along the way' Frank Smith

Resumen

En la sociedad actual, donde la demanda de un sistema educativo plurilingüe y multicultural es cada vez mayor, el enfoque AICLE -Aprendizaje Integrado de Contenidos y Lenguas Extranjeras- se ha abierto paso. Se presenta como una metodología innovadora en la que la adquisición de la segunda lengua se da de forma natural. Debido a su gran capacidad educativa, cada vez son más los centros que apuestan por implementarlo en sus aulas, contribuyendo así a un cambio significativo en la enseñanza del inglés. En este trabajo se analizan los antecedentes y los cinco pilares fundamentales en los que se basa. Finalmente, se plantea un ejemplo de Unidad Didáctica para impartir Ciencias Naturales en el tercer curso de Educación Primaria.

Palabras clave: AICLE (Aprendizaje Integrado de Contenidos y Lenguas Extranjeras); bilingüismo, 4Cs; tríptico del lenguaje; Ciencias Naturales.

Abstract

In today's society, where the demand for a multilingual and multicultural educational system is increasing, the CLIL approach -Content and Language Integrated Learning- has made its way. It is presented as an innovative methodology in which the acquisition of the second language occurs naturally. Due to its great educational capacity, more centres are encouraged to implement it in their classrooms, thus contributing to a significant change in the teaching of English language. This essay analyses the antecedents and the five fundamental pillars on which it is based. Finally, it presents an example of a Didactic Unit to teach Natural Science in the third year of Primary Education.

Keywords: CLIL (Content and Language Integrated Learning); bilingualism; 4Cs; language triptych; Natural Science.

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INTRODUCTION

1. JUSTIFICACIÓN DEL TEMA

El presente trabajo de fin de grado *Elaboración de actividades CLIL para Educación Primaria: Energía y Materia*, tal y como su título indica, tiene como centro de atención el diseño y creación de actividades *CLIL* para la asignatura de *Natural Science* en Educación Primaria.

La principal motivación que impulsa la elección de este tema reside en el hecho de haber cursado la Mención en Lengua Extranjera (Inglés), cuyas asignaturas me han dado a conocer un enfoque distinto sobre la enseñanza de las lenguas extranjeras, en especial de la lengua inglesa. Así pues, he decidido adentrarme en el estudio del *CLIL* para compaginar lo que yo pueda aportar de mi humilde experiencia educativa vivida durante el *Practicum II*, utilizando la metodología CLIL, con lo que investigadores y expertos han estudiado acerca de la enseñanza de las lenguas extranjeras a través de este enfoque.

2. ANTECEDENTS

2.1. Bilingual education within the framework of European language policies

In the last 10 years, Europe has broken down its borders and has added many more member states. According to The European Symposium on the Changing European Classroom – *The Potential of Plurilingual Education*, held in March 2005 in cooperation with the Luxemburg Presidency, about 450 million people coming out of various nations, communities, social and cultural backgrounds and from different language groups live and work in the European Union today.

The influx of refugees and immigrants has changed the typical European classroom into a multinational environment consisting of students with plurilingual abilities (Attard Montalto, Walter, Theodorou, and Chrysanthou, 2016). This new reality, where mobility and trans-border migration are now commonplace and in which English has become a democratized and universalized *lingua franca* for international communication (Jenkins, 2007), implies a need to seek new methods and strategies to implement the teaching of a second language, in this case of English, in an effective and meaningful way.

Thus, given the need to meet the expectations of the globalized world, European government policies gave a decisive boost to multilingualism (Morrow, 2004). To overcome the limitations of a monolingual ideology and promote linguistic diversity in multicultural societies, the EU[1] Commission adopted, in the Framework Strategy on Multilingualism (2005), the long-term objective of increasing

[1] EU stands for European Union.

multilingual students so that everyone acquires practical skills in two or more languages in addition to his or her mother tongue. In other words, pupils should master at least two foreign languages at the end of compulsory schooling, as one of the prerequisites for successful participation in the Member States of the EU.

Consequently, in the 1970s, there was a translation of this new global aspiration to the educational system that found response in bilingual school programs (Morrow, 2004). This fact explains the currently growing need for bilingual programmes in Spain, considered a European leader in the implementation of bilingual programs (Coyle, 2010, p.8). Since the 80's, Spain has coexisted with co-official languages such as Basque, Catalan, Galician and Valencian in compulsory schooling. This practice has gradually created a bilingual mentality that has led to transferring the experience to this new situation in which the language of the bilingual programs is usually English.

These bilingual programs include the training of teachers in both linguistic and methodological aspects from the Education Departments of the different Autonomous Communities. The most relevant initiatives are collected and documented in detail in the first part of CLIL in Spain (Lasagabaster & Ruiz de Zarobe, 2010) and in CLIL across education levels: opportunities for all (Dafouz & Guerrini, 2009).

2.2. Methodology of bilingual teaching

Before engaging in bilingual education, it is necessary to understand what bilingualism is and what to be a bilingual person means. Traditionally, it was understood that a bilingual person is one capable of making a native use of two or more languages. In 1984, Cooper, R. defined bilingualism as the 'regular use of two or more languages' Cooper, R. (1984).

In the same way, authors like Bloomfield assumed that bilingualism implies a 'native-like control of two languages' (1933, p. 56). Nevertheless, his definition was not realistic as he established a very high goal. The reality reflects that this idea about bilingualism is practically unattainable because it does not correspond to the functionality that a person assigns to the languages he/she uses. Normally, an individual who has competencies in two or more languages develops them in specific contexts and for very specific purposes of his or her daily life. For instance, 'one may use Spanish at home with family and friends and English at work with colleagues and other contacts' (Li Wei, 2000, p.5).

In the early 80's, there was a reconceptualization of bilingualism when Jim Cummins discovered that although two or more languages used by an individual are apparently different on the surface, they function trough the same central cognitive system. In 1978, the expert in bilingual and

second language education, proposed the linguistic interdependence hypothesis whereby he compared an iceberg to a person who learns a language. This theory is commonly known as the 'Dual Iceberg' and explains, as we will see later, the way in which the brains of bilingual learners use two languages to make sense of their world.

Currently, various studies have shown that the concept of bilingualism is not unambiguous, rather it is subject to different nuances and its interpretation depends on different variables. Consequently, there are different typologies that show the representations and forms that bilingualism can adopt depending on the context in which an individual develops their linguistic abilities, their level of competence, and the use or functionality that gives to each of them. In fact, Li Wei (2000) distinguishes up to more than twelve variety of bilinguals: 'additive bilingual[2], coordinate bilingual[3], early bilingual[4], recessive bilingual[5]…' (p.6).

The above discussion of the causes of language contact and types of bilingual people has troubled linguistics for decades. To respond to this complexity, the researchers have developed different models of bilingual education. Even though there are many methodologies for bilingual education, we cannot ensure which one is the best because an effective methodology must be based on a combination of didactic practices that emerge from the analysis of several factors: learning pace, socio-cultural level, the educational project of the centre... and that is adapted to the students to whom the instruction is directed.

However, among all available innovative methods and approaches to teach foreign languages, the most widespread and discussed one is the Content and Language Integrated Learning, henceforth CLIL. Some authors point out the great impact CLIL has had on European classrooms in recent years (Baïdak, Balcon and Motiejunaite, 2017).

3. WHAT IS CLIL?

As we have mentioned previously, the process of European integration and the pressing globalization trends have made the English language gain the status of today's lingua franca, not only in the European Union but also around the world. Consequently, the concern and need to learn English has led to changes in the educational framework.

[2] *Additive bilingual*: someone whose two languages combine in a complementary and enriching fashion.
[3] *Coordinate bilingual*: someone whose two languages are learnt in distinctively separate contexts.
[4] *Early bilingual*: someone who has acquired two languages early in childhood.
[5] *Recessive bilingual*: someone who begins to feel some difficulty in either understanding or expressing him or herself with ease, due to lack of use.

In recent years, the methodology of the second language has evolved, going from a traditional approach, FLT (Foreign Language Teaching) in which the language itself was exclusively studied, to a communicative approach in which the learning of the language is intended through the delivery of the contents, using that second language as a vehicle for teaching the contents of certain subjects.

This change was supported by the Council of Europe, which established the main objective of promoting multilingualism, and the consequent realization of an integrating language curriculum that facilitates their educational practice in an efficient way. So, in the search for a common system that would meet the strategic objectives of the European educational bodies for the promotion of foreign language teaching, emerged, in 1994, an innovative methodological approach called CLIL.

Nikula, Dalton-Puffer, Llinares & Lorenzo (2016) explain that this educational policy, concerned with promoting economic, social, and cultural well-being, has spread specially in Europe since mid-1990s and draws on earlier models of bilingual education such as immersion and content-based instruction. In the same way, this form of education supports effective learning of two or more languages, and, since 1995, has explicitly supported CLIL as a curricular approach which can achieve this.

The policy of the EU has led to the development of CLIL initiatives in many parts of Europe, at pre-primary, primary, secondary, and tertiary levels. Ioannou-Georgiou and Pavlou (2011) think that these initiatives, in addition to supporting good practice in schools and classrooms, provide training and research opportunities which can guide the effective implementation of CLIL for the future.

3.1. Definition

The acronym CLIL 'Content and Language Integrated Learning', translated into Spanish as AICLE '*Aprendizaje Integrado de Contenidos y Lengua Extranjera*', is not new in methodology. Conversely, the term was adopted in 1994 (Marsh et al., 2001) within the European context to describe and further design good practices that are achieved in different types of school environments where teaching and learning take place in an additional language.

Before going into detail, it is important to know that learning a foreign language is different from the mother tongue because a mother tongue is a huge system that surrounds the child, while the foreign language belongs to people that are far from the pupil's environment and with a different culture. Therefore, the CLIL objective is precisely to make it nearer, to create an environment in which students can communicate in this new language in a natural way, in a more different situation.

To begin, CLIL is an umbrella term for programmes that use a FL (foreign language) as a medium of instruction. There are many authors who agree on this definition. For example, Darn (2007) refers

it as a dual-focused method where curricular content is taught through the medium of a FL, students are learning both, content and language at the same time. Likewise, to Coyle et al., (2010) 'CLIL is a dual-focused educational approach in which an additional language is used for the learning and teaching of both content and language' (p.1). According to this general definition, we have to highlight three essential aspects.

Firstly, CLIL is not a simply language-learning teaching approach. It does not consist of teaching a subject in a second language to improve the linguistic competence of the students, but rather the approach is oriented both to content learning and language learning of the subject studied. Secondly, within the CLIL framework, content and language are learned in an integrated way. Whilst there is no single model for CLIL, all the different variations share this common fundamental principle whereby content and language learning are integrated. In this way, CLIL prepares students for working in a plurilingual world. And finally, considering the definition given, it should be mentioned that in CLIL, language is both a learning medium and a content. In fact, there is a simultaneous teaching and learning of curricular contents and a foreign language, in which this second language becomes, at the same time, an object and vehicle of learning. So, the main idea of CLIL is to use the English language not only as a subject, but also as a vehicle to communicate.

In short, CLIL carries out a different methodological treatment of the language, focusing on students learning a new language through the teaching of content of curricular subjects such as Mathematics, History, Sciences, Arts, and Craft, etc. This allows learning a foreign language without reducing the teaching time of other curricular subjects. Based on foregoing, CLIL constitutes an enormous educational impact tool with extraordinary potential to increase language skills while developing cognitive abilities.

3.2. CLIL objectives and principles

CLIL, or any form of multilingualism, is a meaning-focused learning method where language knowledge is not the ultimate aim but rather a vehicle for instruction. Therefore, the aim of CLIL is twofold: to learn a subject matter together with learning a language.

By using CLIL, students learn one or more than one of their school subjects in a target language, often English, but sometimes in another second language. Nevertheless, students are not expected to master or to be proficient in the new language before starting to study, but in the long term, students learn both the content and the new language as well as, if not better than, students who study content and language in separate classes (Montalto et al., 2016).

Professionals, therefore, must consider that CLIL is not simply a disguise for additional language lessons. On the other hand, using CLIL does not mean that content teaching is simply translated into a foreign language, but as Yessengaliyeva (2019) said, 'they learn the language they need for studying at the same time as they learn the subject' (p.281).

As we can see, with CLIL, learning the content and learning the language are equally important. Both are important curriculum subjects for the students, and they are developed and integrated slowly but steadily. From this perspective, as we already said, language is used as a tool through which students acquire the specific knowledge of a subject of study, and during this process, language acquisition occurs simultaneously. This requires a 'comprehensive methodology that transcends the traditional dualism between content and language teaching' (Meyer, 2010, p.26). This methodology is based on 4 main pillars:

- Coyle's so-called 4Cs (2007, based on Mohan's Knowledge Framework 1986).
  - The 5Cs (2010).
- Bloom's Taxonomy (1956).
- Cummins' Quadrants (2000).
  - Vygotsky's Zone of Proximal Development (1920).

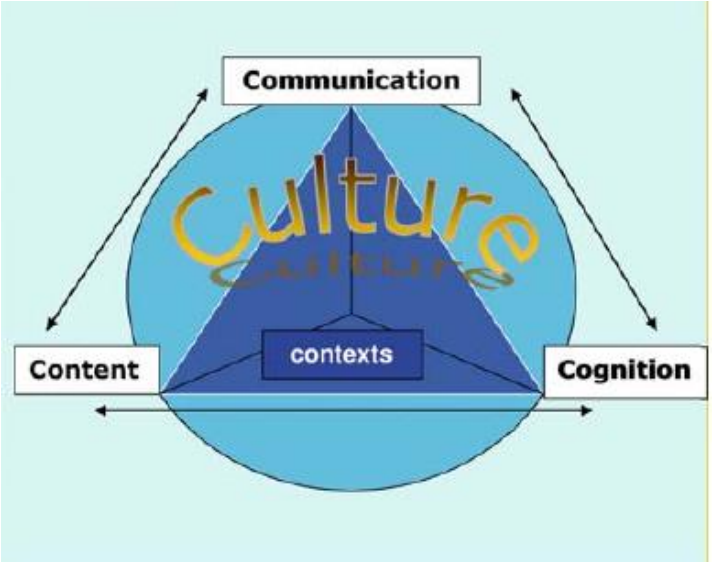
3.2.1. The 4Cs Framework

The 4Cs refer to the theoretical framework based on Mohan's Knowledge Framework (1986) and advocated by Do Coyle (2007), which reveals how content and language are integrated into teaching to obtain balanced bilingualism.

To understand CLIL and how to implement it, we first need to highlight the different components that make up the methodology and how they are related. This influential framework incorporates four blocks elaborated within a context, which serves as equal and balanced curriculum reference points. In turn, these elements that we can see in Figure 1 are characterized by sharing the same initial letter, the C, thus giving the name of the 'The 4Cs Framework': Content, Communication, Cognition, and Culture (Coyle et al., 2010, p.41).

Figure 1

The 4Cs framework for CLIL



Note: Adapted from *The 4Cs conceptual framework for CLIL*, Coyle, 2005, CLIL: Planning tools for teachers.

As we can see in Figure 1, the 4Cs Framework integrates the four contextualized building blocks. It starts with content and focuses on the interrelationship between content (subject matter), communication (language learning and using), cognition (learning and thinking processes), and culture (developing intercultural understanding and global citizenship) (Gierlinger, p.1).

3.2.1.1. Content

The content is the starting point of the planning process as it refers to the subject matter or the CLIL theme. It is fundamental that the content of the topic, project, theme or syllabus leads the way.

In considering the content, it is useful to think of the subject in two ways: the teaching objectives and the learning outcomes. On the one hand, the teaching aims are what the teacher intends to do, that is, the knowledge, skills and understanding which are intended to be taught and developed. It provides opportunities to study content through different perspectives, which can lead to achieving a deeper understanding of the subject. In accordance with Coyle (2008), content introduced to students must be successful as well as progress in knowledge; this means that students have to acquire new knowledge.

On the other hand, the learning outcomes focus on what students must be able to do and understand at the end of each unit. Using the target language through CLIL may help learners to understand the subject. This focus on content can prepare students for future studies and/or for their

working life. So, at the heart of the learning process lies successful content or thematic learning and the related acquisition of new knowledge, skills, and understanding.

3.2.1.2. Communication

It refers to students using the target language which occurs in interaction and learning in the classroom to communicate their thoughts, opinions, attitudes, and discoveries about the lesson content. So, language is a conduit for communication and for learning.

Coyle (2005) emphasized both speaking and writing as students 'learn to use language and use language to learn' (p. 5). As we can observe, he distinguished between language learning and language using as language learning emphasises on grammatical progression, whereas language using focuses on the communication and learning demands of the moment.

In 2008, Coyle pointed out that communication goes farther than grammar because students use the language not only to learn it, as in the language lessons, but also to communicate. He explained that even if our grammar is faulty, we know very little words or our pronunciation is poor, we can communicate reasonably successful in a language. Therefore, communication involves learners using language in different ways.

Therefore, each language is formed by different types of language use. In CLIL, we also find these differences. For example, Coyle et al., defined in 2010 a three-dimension language framework used in CLIL. As we will explain later, this triptych distinguishes between language of, language for, and language through.

3.2.1.3. Cognition

Acquiring subject knowledge, skills and understanding is related to learning and thinking, that is, cognition. For Kiely, R. (2011), cognition 'reflects the development of learning and thinking in the subject context during the lesson, contributing to the linking new knowledge and skills to existing understanding' (p.28).

Likewise, Coyle (2008) stated that cognition is an important tool that makes CLIL effective, as it creates adequate conditions for developing critical thinking skills, creative thinking skills, and problem-solving skills. In this sense, students develop individual criteria of thought that allow them to understand and build knowledge on their own. Hence, CLIL is not about transforming knowledge, but about allowing individuals to construct their own understandings and be challenged.

We will see later that the Bloom's Taxonomy, serves as a stimulus and guide for planning, discussion and evaluating practice since it explores the relationship between cognitive processing (learning) and knowledge acquisition (of content) particularly relevant to CLIL (Coyle et al., 2010).

3.2.1.4. Culture

The relationship between cultures and languages is complex. When we learn a new language, we are also learning its culture and it requires tolerance and understanding (Coyle, 2008). Nowadays, we have many opportunities to gain competence in intercultural awareness as we are continuously exposed to different perspectives and views.

In education, CLIL plays an important role because it helps to develop intercultural knowledge, awareness and understanding. For instance, in primary schools where there are children from several transmigrant backgrounds, teachers use CLIL to facilitate cultural and linguistic adaptation processes. So, students not only develop intercultural communication skills, but also, they learn about other European countries, regions, or minority groups. That is the reason why culture is another essential building block when dealing with CLIL, because intercultural awareness and learning are fundamental to CLIL. Besides, when we understand ourselves and other cultures, the process of communication with foreign people is more effective. In definitive, as Hall Edward (1959) described culture in the 21st century means 'diversity and dynamism because there is no culture of one as culture is communication and communication is culture' (p.186).

Regarding its implementation, the 4 C's work in synergy to provide students with optimal learning and scaffolding conditions. In doing so, they take account of integrating content learning (content and cognition) and language learning (communication and culture) within specific contexts.On the other hand, in CLIL, the curriculum also presents a synergy of the teacher's plan with the learner's authentic needs. Through balanced and learner-centred CLIL sessions, students have many opportunities to apply knowledge and develop communication skills. However, it should be specifically pointed out that CLIL is not about simply importing 'foreign stuff, foreign ideas, foreign textbooks' as the founder of the term Marsh (Cambridge University Press ELT, 2010, 0m38s) explains, but that the basis for a successful CLIL lesson is rooted in the 4 C's model proposed by Coyle. Thus, the correct methodological application of CLIL contemplate these four aspects illustrated in the diagram of the four C's (Coyle, 1999).

3.2.1.5. The 5Cs in Europe

However, CLIL is not static but it evolves. Many researchers criticized the initial framework established by Do Coyle arguing that the entire CLIL framework was encapsulated within context. In 2014, Gierlinger, used the term 'context-sensitive' (p.70), meaning that communication, content, and cognition already existed in a context. So, he suggested a fifth C. In addition, as the Figure 1 indicates, communication, content and cognition also happen within a cultural environment.

Subsequently, Coyle, Hood and Marsh (2010) modified and transformed the European Framework in 2010. Even though the notion of context was outlined, they did not convert it into the fifth C since, according to Lynch (2015), 'the context encapsulates the original 4C framework' (p.70). Conversely, they proposed the conceptual framework of the Figure 2: 4 Cs + 1, based on Content, Communication, Competence, Cognition and Community, with culture affecting communication, content, and cognition, while all exist simultaneously in a specific context.

Figure 2

The 5Cs in Europe.

Notes: Adapted from *The CLIL guidebook* (p.20), by Montalto, S. A., Walter, L., Theodorou, M., & Chrysanthou, K., 2016, Lifelong Learning Program.

If we compare the 4 C's+1 framework with the initial one, we can observe two different words: community and competence (the added C). Although it may seem that the term 'community' is new, it is not. Some CLIL writers, such as Mehisto et al., (2008), prefer to use the term community rather than culture to reflect the link between classroom learning and the wider social context of learning. For example, Lear (2018) describes the community aspect as 'the ability to communicate for real purposes and spot the differences or similarities with students' own language and culture' (p.82).

Therefore, the added C is the concept of competence, which refers to 'can-do statements' made by the students about the lesson content and skills or about new language once they have internalized a new skill or ability (Montalto et al., 2016, p.21).

3.2.2. Bloom's Taxonomy

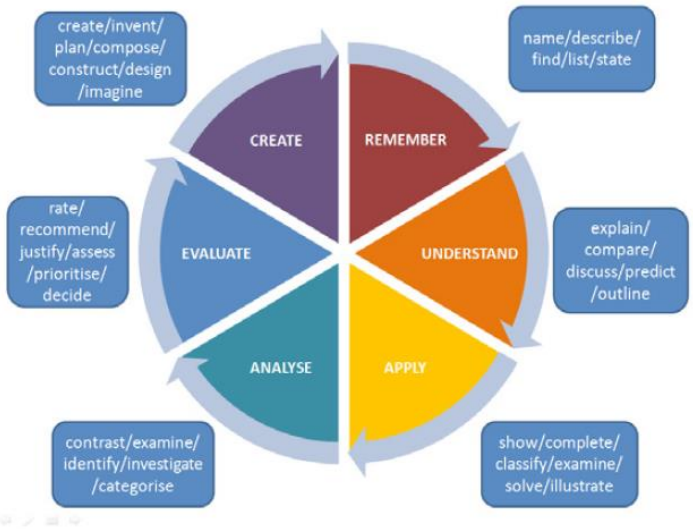
In the 1950s, there was already a need to find a common assessment system that would facilitate the planning process for teachers. Thus, in 1956, the educational psychologist Bloom, who worked at the University of Chicago, developed his taxonomy of Educational Objectives, called Bloom's Taxonomy, which became a key tool to structure and understand the learning process.

The psychologist proposed that the learning process fit within the cognitive domain, which categorizes and orders goals and thinking skills. Regarding the thinking skills, the author categorised them into Higher Order Thinking Skills (HOTS) and Lower Order Thinking Skills (LOTS). Using HOTS encourages students to investigate and evaluate new information and to use it to develop something new, whereas LOTS is about gathering information. Therefore, Bloom's Taxonomy is a 'hierarchy' that follows the learning process and organizes the educational objectives that teachers want their students to learn.

Although Bloom's Taxonomy is often depicted using a triangle, representing the skills like this gives the impression of a hierarchical approach to critical thinking. It seems that the LOTS must be acquired before the HOTS, but this is not necessarily the case. However, as Carolyn Westbrook explains (2014), the different skills can and should be used in a more integrated way. For that reason, it can be helpful to think of Bloom's taxonomy as a wheel (the Bloom's Wheel), with no start or end, and where the skills can be integrated following a logical order (see Figure 3).

Figure 3

Bloom's Wheel



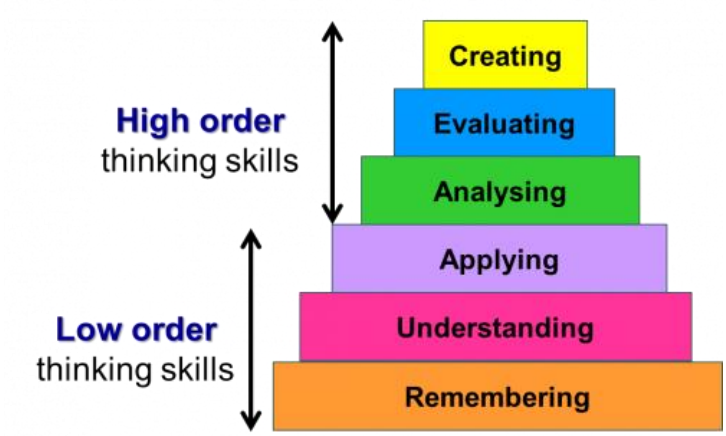
Note: Bloom's Wheel, Adapted from *The CLIL Guidebook,* (p.23), Montalto, S. A., Walter, L., Theodorou, M., & Chrysanthou, K., 2016, http://www.languages.dk.

Briefly, we can see in Figure 3 that the taxonomy is composed of 6 categories (thinking skills) arranged in ascending order, from inferior or lowest order to higher order skills. Both Bloom's Taxonomy of Educational Objectives (Bloom, Englehart, Furst, Hill & Krathwohl, 1956) and later Anderson and Krathwohl's Revised version of Bloom's revised Taxonomy of Educational Objectives (2001) distinguished the following six distinctive categories of cognitive objectives: knowledge, comprehension, application, analysis, synthesis and evaluation. Moreover, as we can see in the diagram, the six skills are associated with a number of verbs that teachers can use as a guide to promote critical thinking skills when they are designing tasks. By using the verbs, we can take any kind of input and create critical thinking tasks around those verbs.

According to the Figure 4, LOTS includes recalling knowledge to identify, label, name or describe things, while HOTS calls on the application, analysis or synthesis of knowledge, needed when learners use new information or a concept in a new situation. Students should go through all these phases, from the basic (lower) to the more complex (higher) order skills. A student must be able to have a knowledge base first (knowledge), to be able to understand (comprehension) it as a whole. In addition, they have to apply it (application) to be able to analyse it (analysis) and, thus, develop a synthesis capacity (synthesis) that will lead them to self-evaluation or self-assessment.

Figure 4

HOTS and LOTS



Note: Adapted from *High Order Thinking Skills and Low Order Thinking Skills, Zamacona, M., 2014,* https://mayolazamacona.wordpress.com/2014/11/02/blooms-taxonomy/

According to Chamot and O'Malley (1994, p. 41-44), in CLIL due to the integration of academic content with language, the development of critical thinking skills is associated with the development of language functions, too. In Bloom's Taxonomy, the higher the slabs are the more complex language and vocabulary it requires, so it is possible that students might not know the specific vocabulary and expressions used. That is why it is necessary to provide a suitable scaffold for the use of language, creating bridges from the language pupils already know and that allow students to modify and adapt what they know to what they should know.

So, the key concepts of CLIL methodology are essentially two:

- Scaffolding: to make language easier for learners.
- Taxonomy: to engage learners with different kinds of tasks.

3.2.3. Cummins' Quadrants

CLIL teachers may wonder why their learners seem to be able to speak English fluently but still have difficulty understanding academic English, for instance when reading a text on vertebrate animals for Natural Science, discussing graphics in Mathematics, or analysing a written experiment for Physics. This is because the language that students need for CLIL is sometimes more varied than the language they would need for general English.

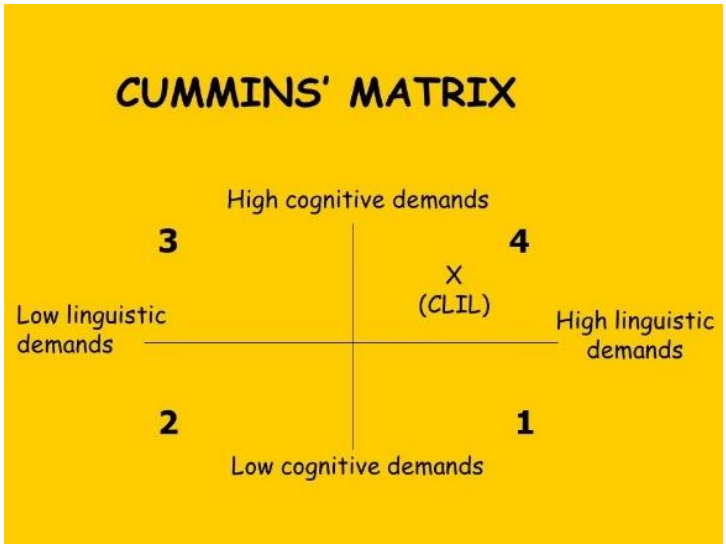
Professor Cummins (1979) distinguishes between two dimensions of language: conventional and academic, commonly known as Basic Interpersonal Conversational Skills (BICS) and Cognitive Academic Language Proficiency (CALP). On the one hand, Basic Communication Skill, is the kind of

language that is frequently taught in standard learning classes and that comprises the skills necessary to function in conversational situations (Bentley, 2010). On the other hand, Cummins defines the Academic Cognitive Linguistic Competence, as 'the extent to which an individual has access to and command of the oral and written academic registers of schooling' (Cummins, 2000, p. 67).

This distinction between BICS and CALP arises from the early work of Cummins (1984) in which he demonstrated his ideas on the development of a second language in a simple matrix called the Cummins' Matrix, composed of four quadrants resulting from the crossing of vertical (cognitive demand at the linguistic level) and horizontal axes the level of contextualization), as we can see in the Figure 5.

Figure 5

The Cummins' Matrix



Note: Adapted from *Cummins' Matrix*, Rose, A., 2021, https://slideplayer.com/slide/9020842/.

If we analyse the Figure 5, in BICS language learning is contextualized, that is, it relies on very specific and close situations (Lorenzo et al., 2011), so that the tasks associated are usually less demanding from a cognitive point of view. Nevertheless, in CALP, the language is more demanding from this perspective, since it corresponds to the register used in the teaching of curricular content, which is more abstract and formal. Consequently, cognitive-academic language expresses and requires higher-level thinking skills (HOTS) such as applying, analysing and creating (Llull, et al., 2016).

In CLIL settings, the transition from BICS to CALP is progressive. Collier found that 'it may take five to seven years for second language learners to become proficient in academic language skills' (Dale, L., Van der Es, W., Tanner, R., & Timmers, S., 2010, p.46). That is why most of the classroom

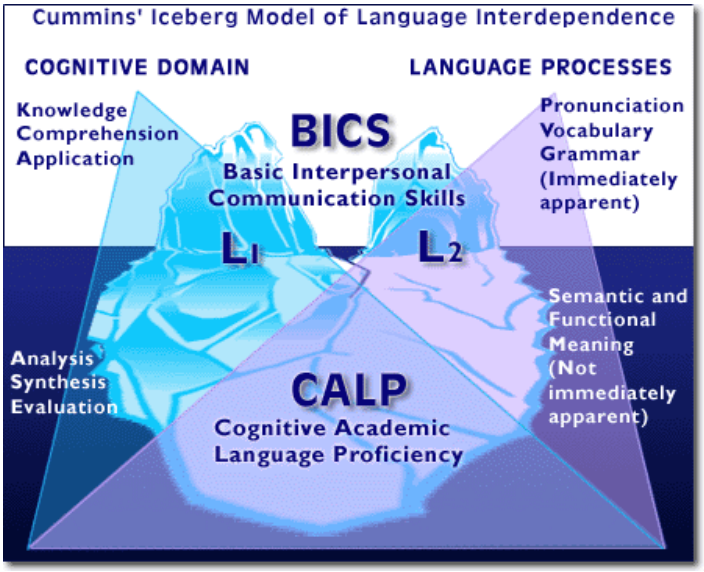
activities are placed on quadrants 2 and 3 of the matrix, as these tasks are accessible in terms of language and cognitive demands. However, in a sequence of CLIL activities, there should be a progression towards quadrant 4, as these tasks require to master the language and are cognitively demanding at the same time. For this reason, teachers should plan the activities carefully and guide students to advance gradually. The development of CALP, in short, is one of the challenges proposed by CLIL so that students can build a solid academic linguistic base that allows them to favour the acquisition of curricular content.

Apart from this, Cummins developed, in 1983, the 'Dual Iceberg' theory to represent the interaction between BICS, CALP, and cognitive processes. By using the image of an iceberg, he described how the bilingual learners' brains use two languages to make sense of their world. For Cummins, an iceberg can be compared to a person who learns a language because an individual who is involved in language learning is like a 'dual-iceberg', with parts of their knowledge invisible, under the waterline, and parts of it visible, above the waterline.

In the next paragraph, especially in Figure 6, we will see a picture that explains the Cummins' Iceberg Model of Language Interdependence.

Figure 6

Cummins' Iceberg Theory



Note: Adapted from *Cummins' Iceberg Model of Language Interdependence,* Serpa, M., 2005, http://ldldproject.net/languages/index.html.

If we look at the Figure 6 more closely, we will observe that both tips of the iceberg contain the two or more languages (L1 and L2) that bilingual learners can use to communicate. Underneath

the waterline, there are the experiences and knowledge of the students, as well as an understanding of how language is used to express their thoughts, which is independent of the language they use. That is why, Cummins (2005), stated that the two or more languages used by an individual, although it may seem they are different on the surface, function through the same central cognitive system, hence the name Common Underlying Proficiency.

As Dale. L, et al., (2010) expose, 'learners already have knowledge and skills in one or more languages' (p.255), therefore, activating CLIL makes them aware of it and transfer everything they know from one language to another. For example, students may know the concept of 'contemporary' and the word 'contemporary', in Spanish. Nevertheless, this knowledge may not be visible in the second language, as they do not know the pronunciation and spelling of the English word /kənˈtɛmpərəri/, where the stress is on a different syllable from Spanish *contemporáneo*. In this case, what students need to add is not the understanding of the concept, just the label (the word contemporary and how to pronounce and spell it). If learners know neither the concept of 'contemporary' nor the language used to describe it, they will need to develop both concept and language at the same time.

Therefore, what differentiates the CUP theory is that it does not separate two areas for different languages, rather bilingual learners store two languages together and the knowledge is linked and can interact; and this way of understanding bilingualism is also known as the 'iceberg analogy'.

3.2.4. Vygotsky's Zone of Proximal Development (ZPD)

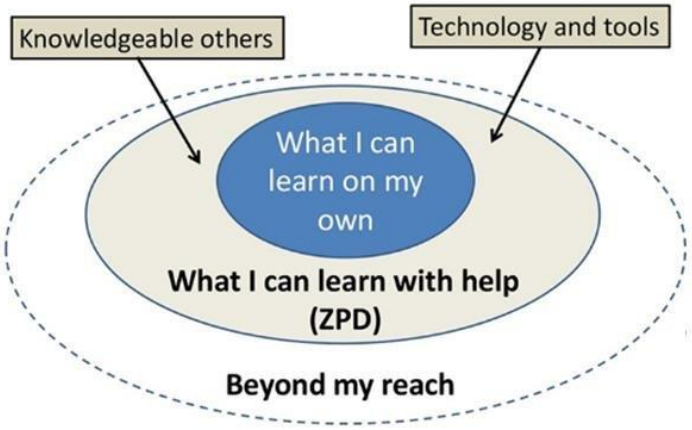
Another important element within this CLIL methodology is Scaffolding (*andamiaje)*, a 'teaching strategy used to move students progressively toward stronger understanding and greater interdependence in the learning process' (Ball, P., Kelly, K., & Clegg, J., 2015, p.306). People who talk about scaffolding say it is like a music teacher guiding a child's arm as they move the violin bow from side to side until the child can make the correct moment alone, or like parents helping their children to ride bicycles; they hold on until the child can keep upright on their own, but even then, they stay close to provide emotional support until the child is truly independent. Although both examples concentrate on teaching children to do things, scaffolding is, perhaps, a good metaphor for supporting students at any age.

In 1920, Vygotsky introduced the concept of Zone of Proximal Development, commonly known by its acronym ZPD, and he wrote (1980) it as 'the distance between the child's actual developmental level as determined by independent problem-solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable

peers' (p.133). The author affirmed that children learn best in the Zone of Proximal Development, when, with help of someone more 'expert' than themselves, they can understand and do new things. So, as we can see in Figure 7, the ZPD is when children are ready for the next bit of learning.

Figure 7

ZPD and Scaffold



Note: Adapted from *Vygotsky-Zone of Proximal Development*, McLeod, 2018, *https://www.researchgate.net/figure/Vygotsky-Zone-of-Proximal-Development-Source-McLeod-2018-7-from-more-knowledgeable_fig1_332342953*.

Many people use this term to describe the role of the teachers, as ´they provide successive levels of temporary support that help students reach higher levels of achievement than they would be able to achieve without assistance. The supportive strategies are gradually removed when they are no longer needed´ (Ball et al., 2015, p.306). That is to say, teachers support students, providing the framework to hang their knowledge on, just as we use scaffolding to support a structure that is being built. However, we must know that there is no single zone for each individual and that students can create a ZPD for any domain of skill. Besides, as Rogoff (1982) explains, there are cultural variations in the competencies that children must acquire by interacting with society. For instance,

> Boys in Micronesia, where sailing a canoe is a fundamental skill, will have a ZPD for the skills of navigation, created in interaction with sailing masters. A girl in the Navajo weaving community will have experiences in a zone not quite like any encountered by the daughters of Philadelphia. Whatever the activity, in the ZPD we find assistance is provided by the teacher, the adult, the expert, the more capable peer. (Tharp and Gallimore, 1998, p. 96)

Finally, Davies (2011) explains that cognition and content are interleaved in the CLIL process being slantingly linked to Vygotsky's Zone of Proximal Development (ZPD)and, thus, accentuating the cognitive processing of language learning suited to each learner's comfort zone. That is why, following the scaffolding strategy allows learning in which there is a progressive evolution and where new knowledge is built from what children already know and master.

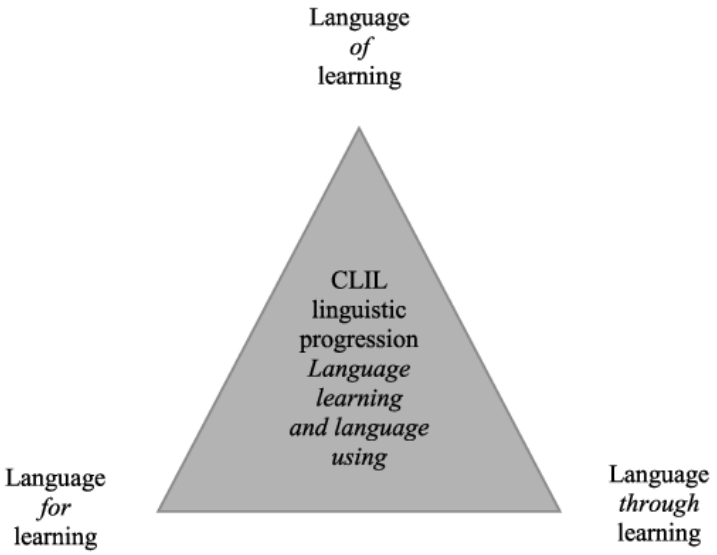
3.2.5. The Language Triptych

CLIL is a pedagogy that takes the integration of subject and language development as central. As described above, through the 4Cs, students construct their own knowledge and skills, and their identity as learners in a context culturally shaped by, at least, two languages and attention to subject knowledge. In this framework, Kiely, R. (2011) points out that the CLIL curriculum maintains a dual focus, where subject and language learning are fostered in an integrated way, and is in alignment with the individual personal, social, and intellectual development of each child as they progress through pre-primary and primary school.

Delving into the section on learning a language through CLIL, it is important to consider the need to integrate cognitively demanding content with the use and learning of that language. For this, Coyle, et al., (2010) designed a linguistic triptych clarifier, the 'Language Triptych' that serves as a support for teachers, since it helps to understand how to interrelate the content objectives with the language learning objectives. We can see it in Figure 8.

Figure 8

The Language Triptych



Note: Adapted from the *Language Triptych*, Coyle et al., 2010, p.36.

The triptych does not replace the grammatical progression, but rather enhances it. It supports the students in the use of the language through the analysis of the vehicular language used in CLIL, from three interrelated perspectives. Therefore, language is a means of communication and learning that can be described as: 'Language learning and language using', in Spanish '*aprender a usar el lenguaje y utilizar el lenguaje para aprender*' (Coyle, D et al., 2010, p.32). Communication in this sense goes beyond the grammatical system. For this purpose, we can clearly recognize the three perspectives of language learning used in the CLIL classroom: language of language for learning and language through learning.

3.2.5.1. Language of learning

It is the language students need to access basic concepts and skills relating to the subject theme or topic, that is, the necessary scientific vocabulary during the unit. It includes nouns, adjectives and verbs. Nevertheless, the selection of these nouns, adjectives and verbs will depend on the content.

In the case of Energy and Matter, for example, the language of learning consists of the key vocabulary and phrases related to energy and matter, changes of state, types of energy, sources of energy and so on. However, it goes beyond a list of key phrases. If the learners are required to define energy, they will need to embed the lexis into 'defining' language. It is not enough to simply identify key words and phrases without considering how learners will need to use them in order to learn. Using this vocabulary for authentic purposes in a CLIL class enables the students to use the language

appropriate to the content in a meaningful way, which can then be further explored for grammatical cohesion in the language class.

Nonetheless, as Coyle et al., (2010) say 'this does not imply that second or additional language lessons should be reduced to grammar lessons, but that a more varied menu can be created to provide a richer diet' (p.37). For the subject teacher, it requires greater explicit awareness of the linguistic demands of the subject or content to take account of literacy and oracy in the vehicular language.

3.2.5.2. Language for learning

It is the language used to operate in a foreign language environment, that is, in real contexts. According to Coyle, learning is the most crucial element for successful CLIL, as it makes transparent the language needed by learners to manage in a learning environment where the medium is not their first language.

Working with energy and matter, the language for learning is linked to the language student will need during lessons to carry out the planned activities effectively. For example, if the students are required to organize, research and present it, then they will need language which will enable them to work successfully in groups, carry out their research and present their work. So, academic functions (describe, explain, establish hypotheses, define...) would be a language for learning because they provide the teacher and the student with speech acts linked to the content.

3.2.5.3. Language through learning

It is the use of language to refer to the new meanings acquired. As new knowledge, skills and understanding develop, new language will emerge through learning, too.

The CLIL classroom demands a level of talk of interaction and dialogic activity which is different that of the traditional language or content classroom. So, if there is no active relationship between language and thought, effective learning cannot take place. Students need language to support each other and be able to advance their thought processes, while acquiring new knowledge, as well as to progress in their language learning (Coyle, et al., 2010).

When learners are encouraged to articulate their understanding, then a deeper level of learning takes place. In CLIL settings, new meanings are likely to require new language. This emerging language needs to be captured, recycled and developed strategically by teachers and learners. Moreover, as language is linked to cognitive processing, it is important to make use of opportunities to advance learning, to encourage learners to articulate their understanding, which in turn advances new learning.

The challenge for teachers is how to capitalize on, recycle and extend new language so that it becomes embedded in the learners' repertoire. Language progression in this sense can be defined as the systematic development of emerging language from specific contexts, supported by structured grammatical awareness, using known language in new ways, accessing unknown language and so on.

In the Energy and matter project, language through learning may emerge if, for example, during the mini-project preparation, students working in groups need language to express a new idea which they have constructed, and which is not in their resources; this might involve dictionary work and teacher support.

3. DESIGN OF THE CLIL TEACHING UNIT

3.1. The school

3.1.1. Contextualization and background

My practices have taken place in a bilingual centre located in Pamplona. Regarding the socio-economic status, most of the students are working families with a lower-middle economic income. Students who attend to this school come from the centre and to a lesser extent from the surrounding neighbourhoods (Milagrosa, San Jorge, or Chantrea). So, we can say that it is a small multicultural school with a wide variety of students from many nationalities: Ecuador, Romania, China, or Abu Dhabi.

3.1.2. The PAI program

Motivated by the need to overcome the limitations of a monolingual ideology and promote linguistic diversity in a multicultural society, this school started to implement the PAI program.

The main idea of PAI is to use the English language not as a subject, but as a vehicle to communicate. Developing foreign language resources and skills occurs through the building of vocabulary and supporting the development of discourse abilities. That is why participation should be the starting point and the target language learning.

3.2. Didactic Unit

In this unit pupils will extend their knowledge of materials and matter, reviewing some of their basic properties and developing the concept that everything is made up of matter. Pupils will observe how matter changes, use different materials to make mixtures and different tools to separate mixtures. On the other hand, students will also explore the essential role that energy plays in our lives

and we will encourage them to think about when, where, and how we use energy every day. In addition, pupils will study renewable and non-renewable energy sources and will become aware of the importance of energy conservation.

Pupils will begin by refreshing what they have learned about common materials and their properties and demonstrate this understanding by means of a picture. Then, they will go on to apply their knowledge of properties while exploring different physical and chemical changes of matter. Likewise, they will realize what they already know about energy and they will be able to extend their knowledge too.

Then, pupils will be introduced to mixtures and learn that almost everything around us contains two or more different materials. This lesson provides plenty of opportunities for pupils to make and separate mixtures with a variety of materials. By its part, student will explore the different types of energy that we find all around us in our daily lives. This followed by an explanation of renewable and non-renewable energy sources, focusing on how each one is obtained and how they produce energy.

Likewise, pupils will practise vocabulary that they have previously learned, as well as develop specific scientific vocabulary about matter, materials, energy, and a variety of processes. As we already know, in CLIL, it is very important to focus on language learning. So, to keep all the new or tricky vocabulary words, connectors and grammatical structures learned, students will complete a Glossary. In this way, they will be able to look the words up when necessary and it will be a useful tool to study. Besides, they will continue to work on important skills including observation, classification, choosing the correct tool for different purposes, and the collection and presentation of data. Regarding the evaluation, both the language and the content are going to be assessed in three different ways, through continuous assessment, formative assessment and an end-of-unit test (*annex 20*).

3.2.1. Key competences

Regarding the competences, we distinguish seven categories:

- C1 LIN: competence in linguistic communication.
- C2 MST: competence in mathematics, science and technology.
- C3 DIG: digital competences, that is, competence in the use of new technologies.
- C4 LTL: competence in learning to learn.
- C5 SOC: competence in social awareness and citizenship.
- C6 AUT: competence in autonomous learning and personal initiative.
- C7 CUL: competence in artistic and cultural awareness.

3.2.2. Session distribution and activities

Table 1.

Objectives of the 1st session

MATTER: FIRST SESSION		
CONTENT		
Teaching objectives	Learning outcomes	
To recognize that matter is the material that everything is made of. To observe and classify materials according to their properties: solids, liquids and gases.	The pupils will compare different objects to see that everything in our planet is made up of matter. They will identify the properties of common materials.	
COGNITION		
Teaching objectives	Learning outcomes	
To provide the pupils with opportunities for defining the concept of matter, comparing common materials and contrasting the properties of matter.	The pupils will infer the concept of matter from practice.	
CULTURE		
Teaching objectives	Learning outcomes	
To use strategies to help their own learnings, as well as asking for help and information.	The pupils will learn to demonstrate a positive attitude towards learning.	
COMMUNICATION		
Language of learning	Language for learning	Language through learning
-Lexical items Subject-related lexical items: matter, material, gas, liquid, solid, glass, plastic, paper, metal, wood, fabric, waterproof, absorbent,	-Questions words: who, which, how many… -To describe: there is/are	-Language through activities and questions during the session: A book is made of… A chair can be made of…

smooth, rough, rigid, flexible, shape, volume, definite. -General English words: balloon, party, music, vacuum cleaner, recycling, container. -Verbs: fill, change, occupy, present, have-do not have/ has-does not have -Phrasal verbs: change into. -Grammatical tense: Present simple Present continuous	-Prepositions of place: in, on, under, next to, above, below, on the left, on the right, in front of, behind, opposite, between… -Quantifiers: a lot of, many.

Table 2

States of matter

MATTER: States of matter	
Session 1	Length: 45 minutes

Materials:

- Interactive Whiteboard (IWB)
- The textbook: *ByME Natural Science Learn Together (2019).*

Place: the ordinary classroom

Procedure: the aim of the first session is to develop our pupils' observation skills and find out what they already know about the topic of the unit. Before introducing the topic, we will give them and explain that they will have to complete the Glossary with the vocabulary bank.

Activities	*Description*	*Interaction*	*Timing*
Activity 1 'Look at me!'	To activate the previous knowledge, we are going to use the picture we find on the cover of the unit 5 (McLoughlin et al., 2019), and use it to elicit vocabulary related to matter and energy, as well as action verbs to describe what is going on in the scene and adjectives to describe the various characters and elements (*annex 1*). For that, we will project the image on the interactive whiteboard (henceforth IWB), focus only on the picture of the scene of the block of flats, not the questions, and let them describe what is happening in the different flats. We can elicit ideas about what	Class group	10 minutes

	is happening in the picture from the class (there is a lot of people; there is a bin for recycling things, etc.), or ask some guided questions while pointing to the picture. For example: • What people in each flat are doing? • What relationship each person has to the other people in the same flat? • Which of the activities shown they also do in their own homes? Alternatively, we can use the IWB and ask pupils to come up to the board, mark an area of the picture and describe what they can see.		
Activity 2 'Is it matter'?	In the second activity, we will ask pupils to choose three objects from the picture that can also be found in class (for example, a table, the paper bin and a cup), and we will place them in front of the class. We will give students 2 minutes to think about what these objects have in common. After sharing some answers, we will read the unit introduction at the top of the page 'anything we can see, touch, taste or smell is matter' (McLoughlin, Riach & Sadovy, 2019, p.78). Then, we will pick up the three objects and ask if they are made of matter. Afterwards, we will explain that everything on our planet and in the Universe is made up of matter, even we are made up of matter. So, what they have in common is that they are made of matter. To understand that we can differentiate one object from another, we will say that as well as human	Class group	15 minutes

	beings, matter also has general and specific properties that allow us to name objects. For example, all human beings share general characteristics (we all perform the vital functions, we communicate through language…), but we are able to differentiate ourselves because each one has its own specific characteristics: eye colour, height, weight… And the same happens with matter. It has general and specific properties that allow us to identify and classify objects.		
Activity 3 'The properties of matter'	Once they have understood that objects can be defined by its general and specific properties, we will work on the specific characteristics. Going back to the previous activity, students will have to describe what the above objects are made of. To facilitate the description, we will previously establish the meaning of the six materials in the glossary (glass, plastic, paper, metal, wood and fabric) that we will complement by adding a useful language box. Within the box, they will find two examples of material descriptions that students can use as a guide. As well, students will have the opportunity to use their sense of touch to guess the properties of the three elements. Once they have experienced how it feels like, we will name the properties of materials (waterproof, absorbent, smooth, rough, rigid and flexible) and they will define them in the glossary. By doing it this way, students will relate a sensation to a new word, more technical and precise.	Class group	20 minutes

To ensure they have understood the relationship between daily objects and their technical name, pupils will have to complete the following worksheet (*annex 2*).

Annexes:

- Annex 1
- Annex 2

Table 3

Objectives 2nd session

MATTER: SECOND SESSION	
CONTENT	
Teaching objectives	Learning outcomes
To identify the different states of matter and study its properties.	Pupils will observe the properties of solids, liquids and gases and they will analyse their properties.
COGNITION	
Teaching objectives	Learning outcomes
To provide the pupils with opportunities for identifying the states of matter and comparing changes of matter.	They will investigate through the realization of simple experiences. Pupils will apply the scientific method to a variety of scenarios, for example, to study the changes of state of the matter. They will state their hypothesis, select the necessary material, draw conclusions, and communicate their results, manifesting

	competence in each of the phases, as well as in the knowledge of the basic laws that govern the studied phenomena.	
CULTURE		
Teaching objectives	Learning outcomes	
To use strategies to help their own learnings, as well as asking for help and information.	Students will learn to work proactively and develop strategies for working in a group.	
COMMUNICATION		
Language of learning	Language for learning	Language through learning
-Lexical items Subject-related lexical items: matter, material, gas, liquid, solid, shape, volume, definite, indefinite. -General English words: space, amount, container. -Verbs: fill, change, occupy, present, have-do not have/ has-does not have -Phrasal verbs: to change into. -Grammatical tense: Present simple Present continuous Future simple	-Questions words: who, which, how many… -To give opinion: I think that… I believe that… -To describe: There is/are I can see… I can observe… -To organize ideas: First, then, later, finally… -Language to hypothesize: It will change its shape because it… If we move X to a new container its X is going to…	-Language from the Scientific Method worksheet: hypothesis, prediction, conclusion…

Table 4

Physical and chemical changes

MATTER: Physical and chemical changes	
Session 2	Length:45 minutes

Materials:

- Images of elements in the different states of the matter (gas, liquid and solid).
- The mystery box:
  - 3 empty containers
  - A differently shaped container
  - Oxygen
  - Water
  - Beans

Place: the ordinary classroom

Procedure: In this session, pupils will explore the concept of matter. We will introduce them to its three stages (gas, liquid, solid) and explore the characteristics of each.

Activities	*Description*	*Interaction*	*Timing*
Activity 1 'The 3 states of matter'	Pupils should have a basic understanding of the states of matter, so we will show them some cropped photos with elements in the three states and they will have to describe what they see. Then, we will paste them on the board and write the headings: liquid, solid and gas.	Class group and in pairs	5 minutes

	We will also encourage children to share some examples of each one. Depending on the rhythm and attitude of the class we can do it orally, or as a game, asking children to work in pairs and taking turns to name and give examples of elements in different states of matter. The player with the most correct examples, wins.		
Activity 2 'Does anything change?'	After having identified the three states of matter, we will give students the opportunity and autonomy to delve into the topic on their own. For that, we will present them a hands-on experiment in which students will have to answer how each state of matter will fill each container according to its shape and volume. Like scientists, they will have to record the results, following the steps of the Scientific Method (explained in the S.W 2 and that we will comment in that moment). So, we will start the activity by placing a mystery box which contains the materials for the experiment (three empty containers and elements in a different state: oxygen, water and beans), and we will shake it, so that students can guess what it may contain. Once we have shown the materials, we will take the opportunity to say that scientist must also master the theory to introduce the key concepts: volume and shape. Finally, we will explain them in which will consist of the experiment and we will carry it out.	Class group	35 minutes

	During the experiment, we will move the elements from one container to another with a different shape and students will have to predict and write in their S.W 3 if the volume and shape of the elements will change from one container to another, or, if on the contrary, it will stay the same. To check it, we will make the change and see what happens.		
Activity 3 'Titi'	We will use the last 5 minutes of the class to indirectly introduce the content of the next session: physical and chemical changes. For that, we will bring a new friend called Titi. We will tell them that Titi, which is a green apple, is very ill and urgently needs a surgery. So, we will cut the apple in half and we will leave it rest for two days (until session four). Afterwards, they will have to write down what do they think will happen to Titi and how do they think they will find her. Thus, we will be able to teach and see the oxidation process. (*Annex 5*).	Class group	5 minutes

Scaffolding tips: I have briefly described and explained the steps of the scientific method so that children know what to write in each phase. Besides, I have included some useful language boxes with the main structures to facilitate their English expression.

Class assessment: the advantage of doing hands-on experiments is that children receive instant feedback, that is, they can test by their own whether their hypothesis was correct or not. They

like watching the results and often enjoy seeing something that does not change that they thought would do.

Annexes:

- Annex 3
- Annex 4
- Annex 5

Table 5

Objectives of the 3rd session

MATTER: THIRD SESSION	
CONTENT	
Teaching objectives	Learning outcomes
To identify the basic principles of certain physical changes: change of state and change of shape. To identify the basic principles of certain chemical changes: combustion and oxidation.	Pupils will understand certain physical and chemical changes in matter.
COGNITION	
Teaching objectives	Learning outcomes
With help, to plan and carry out simple experiments to study chemical changes in common materials.	They will remember the steps of the scientific method. Pupils will orally reproduce the experiments taking into account the discourse markers to make the speech more polite.

	They will discuss in buzz groups about the experiment, bearing in mind the scientific vocabulary, the content of the experiment itself and the language (discourse markers).

CULTURE

Teaching objectives	Learning outcomes
To respect the rules of use, safety and maintenance of instruments and work materials in the classroom and in the centre.	Students will learn to make proper use of available materials.

COMMUNICATION

Language of learning	Language for learning	Language through learning
-Lexical items Subject-related lexical items: physical change, chemical change, change of state, change of shape, state, shape, size, matter, properties, liquid, solid, gas, combustion, oxidation, wood, ash, bend, fold, rip, shred, wrinkle, metal, rust, stretch, twist, let go, reversible change, non-reversible change. -General English words: elements, brown, apple. -Grammatical tense: Present simple and present continuous.	-When clauses (not with future meaning): When you… / If you…/ You can… -To describe: there is/are -Prepositions of place: in, on, under, next to, above, below, on the left, on the right, in front of, behind, opposite, between… -The discourse markers: Adding: and, also, as well as, moreover… Sequencing: first, second, third… Cause and effect: like, in the same way…	-Language from manipulating the white sheet. -Language through buzz groups. -Language through guided questions.

Table 6

Physical and chemical changes 2

MATTER: Physical and chemical changes	
Session 3	Length: 45 minutes

Materials:

- White sheets
- Lighter
- A pan with water

Place: the ordinary classroom

Procedure: in this session, students will learn about how matter changes. Pupils will study ways that the properties of matter can change including changes in shape, size, and state. Then pupils will go on to explore two types of physical changes: change of state (that we will see in the next session) and shape and two types of chemical changes: combustion and oxidation.

Activities	*Description*	*Interaction*	*Timing*
Activity 1 'Origami'	In this activity, we are going to introduce the change of shape by a guided experiment. As in the rest of the experiments carried out in this Didactic Unit, we will also follow the steps of the scientific method, but this time we will do it orally to promote linguistic ability, pronunciation and listening. Origami consists of making as many changes to a white sheet as possible and after it, analyse and compare its shape and colour with the original sheet,	Class group	15 minutes

	thus explaining the change of shape and the concept of reversible changes. For that, we will give a sheet to each student, so that they can manipulate it and, consequently, experience learning. Children will have to think about how they can make changes to the sheet and do it in their own papers (they can bend it, fold it, rip it, shred it, wrinkle it…). Next, on their place, they will show their transformations. (*Annex 6*). Afterwards, they will compare them with the initial sheet and students will understand, supported by guided questions, that even though we have changed the paper in a variety of ways and its shape and size changes (depending on the change), we still having paper. Finally, we will introduce the term reversible change. So, we will ask children if they are able to undo the change, that is, to return to the same form of the initial sheet. By doing it, they will see that the paper returns to its original shape, fact that we know as reversible change. (*Annex 7*).		
Activity 2 'Burning into pieces'	The second activity will be a continuation of the 'Origami's experiment' which will be useful to introduce the term combustion and non-reversible changes. After changing the paper as they have suggested, we will ask them if there is still anything else that would change the paper. However, this time they will have	Class and buzz groups	20 minutes

one condition: the change cannot be reversible, that is, it must be a non-reversible change.

For this part, we will encourage our students to discuss into buzz groups how they can do it. Once in groups, they will have to reach a consensus on the three best options, and we will note them on the board. We will carry out each idea until we come up with the term combustion. It is possible that we find ideas such as 'we can burn it' or 'we can use fire', so it is up to the teacher to turn these words into a more technical and scientific vocabulary. Nevertheless, it is also possible that any group has thought of an idea related to fire. In this case, we must guide them until they find the keyword and we can do it by playing to the 'Hangman'. The Hangman is a quick and easy game that only requires using a paper/blackboard, a pencil/chalk, and the ability to spell. One player, the 'host' (the teacher), makes up a secret word (combustion), while the other players (the students) try to guess the word by asking what letters it contains. However, every wrong guess brings them one step closer to losing.

Once students are familiar with the term combustion, we will ask if they think that burning the paper will change it. Before trying, it is very important explain to children that they are not allowed to do this at home without adult supervision and that we are going to follow some safety rules. Then, we will show them a pan of water that we will

	use to place the paper in immediately following the task. Finally, we will burn it. Students will see that the paper has changed its size and colour, and what is more, it has been transformed into another material (ashes), thus being a non-reversible change. By asking some questions, we will guide students to discover that two different changes have occurred: a physical and a chemical change. (*Annex 8*).		
Activity 3 'Titi'	In the last 10 minutes, we will visit Titi. Students will see that, as she has been in contact with the air, through the chemical change of oxidation, she has turned brown. Therefore, they will understand that the apple reacts with air, changing it into different matter. It is possible to remove rust from the apple, but we need special chemicals to do this, so it is a non-reversible change. (*Annex 9*).	Class group	10 minutes

Class assessment: this session does not have a specific assessment. The idea here is to give continuous feedback to our students, for example, when they answer the questions and the worksheet. As they are going to comment on all the answers, including the ones on the worksheet, we will be able to correct any mistake and guide the class.

Annexes:

- Annex 6
- Annex 7
- Annex 8
- Annex 9

Table 7

Objectives of the 4th session

MATTER: FORTH SESSION		
CONTENT		
Teaching objectives	Learning outcomes	
To understand the concept of mixtures and apply different criteria to identify and classify them. To define homogeneous and heterogeneous mixtures.	They will be able to identify the mixtures. Pupils will relate daily meal images with its type of mixtures.	
COGNITION		
Teaching objectives	Learning outcomes	
To make some mixtures, explain their characteristics and identify the best method to separate mixtures.	They will learn to use the tools to separate the mixtures.	
CULTURE		
COMMUNICATION		
Language of learning	Language for learning	Language through learning
-Lexical items Subject-related lexical items: mixture, materials, matter, separate, sieving, filtering, evaporating, dissolve, solid, liquid, homogeneous, heterogeneous, etc. -Grammatical tense: Present simple Present continuous	-To describe a mixture: This mixture contains… I can use X to separate X This method is good because… -To express possibility: I can see…/I can't see… Is possible/is impossible.	-Language of roleplay related to the restaurant and food: food, meal, hot meal, main course, dessert, bill, dish, menu, fixed-price menu, waiter/waitress, costumer, to book a table, to ask for the bill… Specific questions: What are you going to have for your main course? Could we have the bill, please?

Table 8

Mixtures

MATTER: Mixtures

Session 4 | Length: 45 minutes

Materials:

- Personalized menu with homogeneous and heterogeneous mixtures
- Pictures of all the mixtures with the names behind
- Big cards
- Blu-Tack
- 3 real mixtures: salt and water, sand and stones and water and stones
- 3 home methods of separating mixtures: evaporation (a transparent plate), sieving (a sieve), and filtration (a bottle of water and a strainer).

Place: the ordinary classroom

Procedure: in this session, students will learn that almost everything around us is a mixture containing two or more types of matter. Besides, they will observe how in some mixtures they can see these different types of matter, and how in others, they cannot. Finally, we will also focus on the three key methods to separate these different kinds of matter.

Activities	*Description*	*Interaction*	*Timing*
Activity 1 'The restaurant'	To encourage children to participate and learn in a fun way we will design a roleplay. For that, we will simulate a scenario transforming the class into a restaurant, the pupils into the customers and the teacher(s) into the waiter/waitress.	Class group (4 big tables)	35 minutes

The restaurant will be divided into four large tables, so pupils should sit in groups. As well as in real life, students will have to order their meal from the menu that includes a wide selection of dishes, specially designed to work on the concept of homogeneous and heterogeneous mixtures (*annex 10*). However, there is a problem; as they have arrived very late there is little food, so they cannot repeat the menu in each table. In this sense, students will work with the greatest number of different mixes and without repetitions.

They will have 5 minutes to agree what they are going to eat. In this part, they will have to work collaboratively, demonstrating that they are able to listen, talk and respect other members. Once they have thought their menu, the waiter/waitress will note them, and he/she will bring their order, which will be colour printed pictures of the food with the names behind. We can complicate the game using, for example, black and white pictures.

So, in groups, they will classify all the menus into homogeneous or heterogeneous mixtures. For that, we will give them cards with the classification names and Blu-Tack. (*Annex 11*).

This game will help the teacher to label how much they know. Before correcting the exercise, we will give them the opportunity to review it and make any change if necessary. Finally, we will display the pictures in colour in the IWB and we will classify

	them into homogeneous or heterogeneous mixtures. During the correction, the teacher will emphasize on the main concepts, and explain the reason why they are in one group or another, thus solving possible doubts. This activity is very interesting because it will allow children to practice the vocabulary bank they have learned in English about food, as well as to use the common structures used at the restaurant. Likewise, it is a practical exercise to improve the speaking ability and to correct the pronunciation.		
Activity 2 'Separating mixtures'	Taking advantage of the fact that they are in groups, we will give them three real mixes. One of salt and water, another of sand and stones and the last one of stones and water. Students will have to identify the materials and think how they could separate them. After that, we will give them three different tools (easy to find at home or at school) and they will have to decide which the corresponding method to separate each mixture is. Finally, they will learn that evaporation separates a solid dissolved in a liquid, sieving separates big solids from smaller solids, and filtration separates solids from liquids.	Class group (4 big tables)	10 minutes

Annexes:

- Annex 10
- Annex 11

Table 9

Objectives of the 5th session

ENERGY: FIFTH SESSION		
CONTENT		
Teaching objectives	Learning outcomes	
To define the concept of energy. To recognise the sources of energy and the machines used to obtain the energy.	Pupils will identify and explain the different types of energy and their characteristics.	
COGNITION		
Teaching objectives	Learning outcomes	
To provide the pupils with opportunities for creating a mural, collecting information from different sources and presenting work orally and clearly in an organised fashion.	They will approach to cooperative learning, showing autonomy in the planning of activities and tasks.	
CULTURE		
Teaching objectives	Learning outcomes	
To define the concept of energy in our immediate surroundings, using specific examples.	Students will explain with concrete examples the importance and use of energy in daily life.	
COMMUNICATION		
Language of learning	Language for learning	Language through learning
-Lexical items Subject-related lexical items: energy, thermal, kinetic, electrical, sound, electricity	-When clauses (not with future meaning) -Pronouns: we/our/us	-Language to work in jigsaw groups: experts and teachers. -The spider diagram.

-Grammatical tense: Present simple Present continuous	-To describe: If thermal energy…, it becomes… This process is called…

Table 10

Types of energy

ENERGY: Types of energy	
Session 5	Length: 45 minutes

Materials:

- Glue
- Carboards
- A template of a spider diagram

Place: the ordinary classroom

Procedure: in this session, students will learn about different types of energy that we find around us in our daily lives, and the effect these have on matter. We will start refreshing their prior knowledge about energy, as a general concept, with a concrete example; we will tell children that every morning we have a healthy breakfast because it gives us energy for our day. Then, pupils will have to imagine how they would feel if they had not had breakfast.

Activities	*Description*	*Interaction*	*Timing*

Activity 1 'Colacao or Nesquik'	In this session, students are going to work in jigsaw groups to learn about different types of energy. Jigsaw is a cooperative learning strategy that enables pupils of a 'home' group to specialize in one different task (*annex 12*). After reading it at least twice and become familiar with it, the home group students join the students assigned with the same task, thus forming temporary 'expert groups'. After mastering the segment, they return to their home groups and share the information. So, the class will be divided into 4 home groups. Each member will be assigned one extract from their textbook (*annex 13*) and they will have time to read it. They do not have to memorize it, just understand the meaning and vocabulary. Once they are familiar with their extracts, they will join their experts groups. By doing this, students will have the opportunity to share and discuss the point and even expand their knowledge. Before returning to their home group, students will have to summarize the extract, so that then, they can explain it clearly. Lastly, each expert will explain his/her extract to the rest of their home group, so that all the members master the topic. Finally, each home group will organize the content in a spider diagram that will be presented in an A0 cardboard (*annex 14*). First, they will have to present a draft paper, writing the word Energy in the middle and drawing around as many smaller circles as they consider necessary to classify all the types of energy.	Jigsaw groups	45 minutes

We will suggest them to look at the headlines and its colour as it determines the main groups and the subgroups. After correcting the draft, they could transfer it to the cardboard and decorate it as they want.

Scaffolding tips: to avoid students presenting inaccurate or misleading information, the teacher will go through the groups asking questions about the content. For the spider diagram, we will only show them a template as we want them to organise information, summarize it and classify it on their own.

Class assessment: the teacher will give students checklist (*annex 15*) to review their draft spider diagram. Once they have corrected all the mistakes, with the teacher's supervision, they will be able to pass the content to the cardboard.

Annexes:

- Annex 12
- Annex 13
- Annex 14
- Annex 15

Table 11

Objectives of the 6th session

ENERGY: SIXTH SESSION		
CONTENT		
Teaching objectives	Learning outcomes	
To recognize and distinguish common sources of energy (renewable and non-renewable energy) and the machines used to obtain the energy.	Pupils will understand common sources of energy.	
COGNITION		
Teaching objectives	Learning outcomes	
To use ICTs to help search for information and/or for presenting results.	Students will obtain relevant information about specific phenomena, integrate information and communicate the results.	
CULTURE		
Teaching objectives	Learning outcomes	
To demonstrate a positive attitude towards using energy responsibly.	They will understand the importance of a responsible use of energy, both individually and collectively.	
COMMUNICATION		
Language of learning	Language for learning	Language through learning
-Lexical items Subject-related lexical items: oil, gas, coal, solar energy, wind energy, water energy, renewable, non-renewable, thermal energy, electrical energy, kinetic energy, wind farm, reservoir, hydroelectric power station. -Phrasal verbs: run out, come	-To express opinion: It is better to use… I think it's better because… -To describe: X comes from X We extract it using… -Infinitive to show purpose: People use/burn it to	-Language through activities and questions during the session. -Language from the 'matching trios'.

from, turn into…	produce…
-Grammatical tense: Present simple Present continuous.	

Table 12

Sources of energy

ENERGY: Sources of energy	
Session 6	Length: 45 minutes

Materials:

- Chormebooks

Place: the ordinary classroom

Procedure: in this session, pupils will learn about where energy comes from and which sources of energy can be classified as renewable and non-renewable. They will also learn about the impact of renewable sources of energy on the environment.

Activities	*Description*	*Interaction*	*Timing*
Activity 1 'Sunny-Sun'	We will begin the class drawing The Sun on the board, or if the day is sunny, we can also start asking them the weather of that day. Then, we will ask what the function of The Sun is. It produces thermal and light energy, in other words, we get heat and light from The Sun. We will also explain that The Sun is a natural source of energy and that all energy on	Class group and individually	30 minutes

	our planet comes from natural sources. Likewise, we will make them think about the duration of The Sun, for example, if we will also have light and heat tomorrow. The Sun is always there. Its energy never runs out. It is renewable. However, there are other sources of energy that one day will run out and cannot be replaced, such as oil, natural gas, or coal. These other sources that come from the ground and the seabed are called non-renewable sources. Once students knew the difference between renewable and non-renewable sources of energy, we will display a video, so that they can expand the information (*annex 16*). During the video, they will have to fill in the gaps *S.W7* related to the sources of energy, its use and machines. We will display it again, but this time, they can solve the gaps in pairs. Finally, the teacher will read carefully the transcript, solving doubts and translating the text if necessary.		
Activity 2 'Matching trios''	The last activity will consist of completing this worksheet *S.W8* in which students have to match the corresponding square of each of the three sets. In this case, the set 1 will contain the key concepts, the set 2 the definitions and the set 3 some pictures. Therefore, students will have to match the key concept with its definition and picture(s).	Individually	15 minutes
Extra activity 3	This will be the last activity of the unit. As we are working with the renewable energy, I think it would be interesting to investigate about the solar panels	Individually or in groups	Indefinite

'Solar panels'	of their school, placed in the roof and that can be seen from the schoolyard. For the investigation, we will use the school Chromebooks available for all the students. Students will have to complete a template *S.W9* that will be uploaded in the Google Classroom. So, they just have to download it and complete it with contrasted and reliable information. The template will have different sections/questions that they must answer. During this activity, students will have to use the ICTs (Google, Google Classroom, and Word Office) to search for information, as well as to select, organise and summarize the main ideas. Finally, pupils will have to upload their worksheets to Google Classroom, so that the teacher can correct them at home. They will see the feedback as soon as possible.

Scaffolding tips: for the activity 3, we can give them some websites to facilitate the searching process in Internet.

Class assessment: the solar panel's worksheet will be evaluated individually. Students will have a mark from 1-10 and they will be able to see it in their mails.

Annexes:

- Annex 16
- Annex 17
- Annex 18
- Annex 19

CONCLUSION

Durante el desarrollo de este trabajo de fin de grado, he estudiado y comprobado, de primera mano, el gran potencial de la metodología *CLIL*, que está ganando popularidad tanto en Europa como a nivel internacional.

Tras analizar exhaustivamente sus principales características y principios y tras plantear una serie de actividades y recursos enfocados a la enseñanza de las Ciencias Naturales, he tenido la oportunidad de llevar a cabo mi propia Unidad Didáctica en el centro de prácticas, un colegio bilingüe. Cuando se utiliza CLIL en un programa bilingüe, el contenido del programa de estudios y la adquisición de la lengua inglesa están integrados. Por ello, en este TFG, los temas, el lenguaje y las habilidades de pensamiento crítico se enseñan simultáneamente.

En cuanto a la puesta en práctica, estoy muy satisfecha con los resultados obtenidos. A pesar de tener un alumnado con un bajo nivel de inglés, he conseguido despertar su interés por la energía y la materia. De esta forma, mediante la combinación de actividades prácticas y teóricas, y haciendo especial hincapié en el uso de la lengua, todos los estudiantes han podido acceder al conocimiento sin importar su condición. Por todo ello, considero que el *CLIL* no es un salto hacia lo desconocido, es un salto al siglo XXI.

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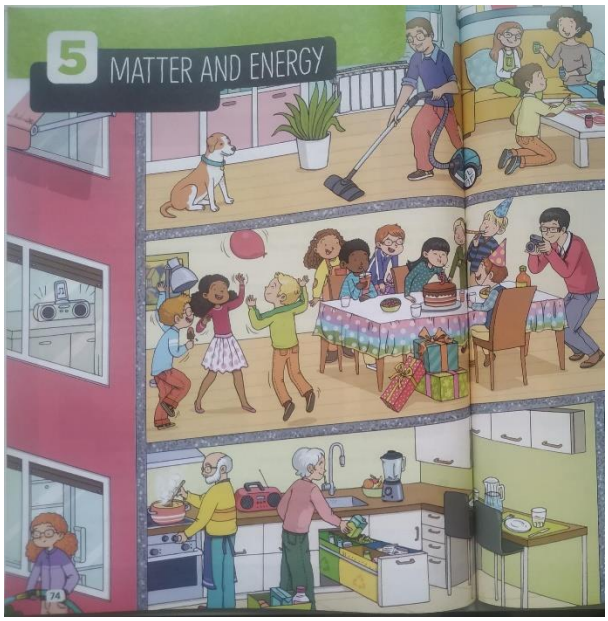
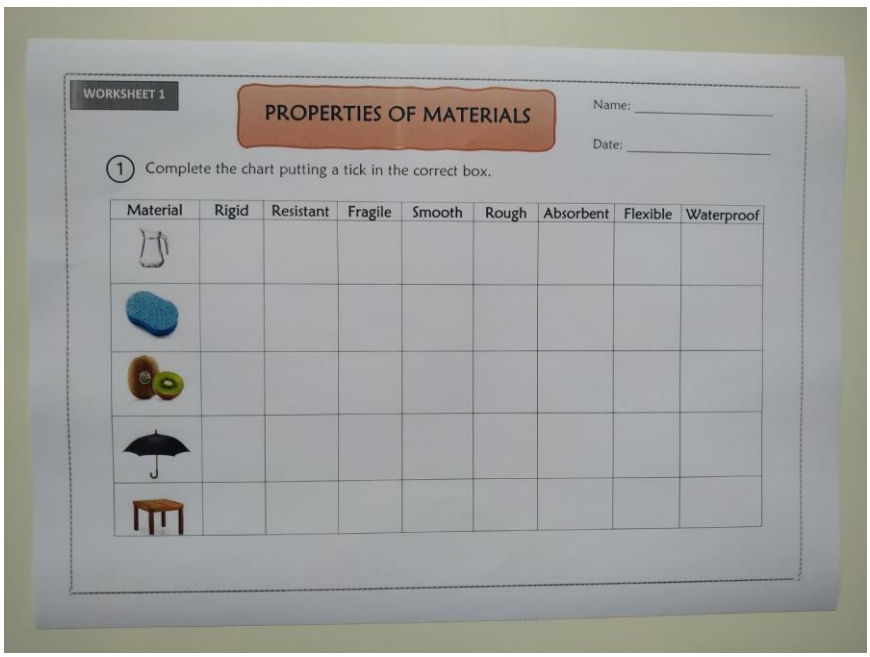
ANNEXES

All the students' worksheets are also available in my Drive folder called *TFG Maite Izu Ventura, Students' Worksheets*. You can access it by clicking on this links: https://drive.google.com/file/d/1cdsBkEhA0_vjuJANOP20ILKyuvArw3Al/view?usp=sharing. To facilitate reading I have also added the links on each individual annex.

A. Annex 1: Image of the Unit 5



B. Annex 2: S.W 1


WORKSHEET 1

PROPERTIES OF MATERIALS

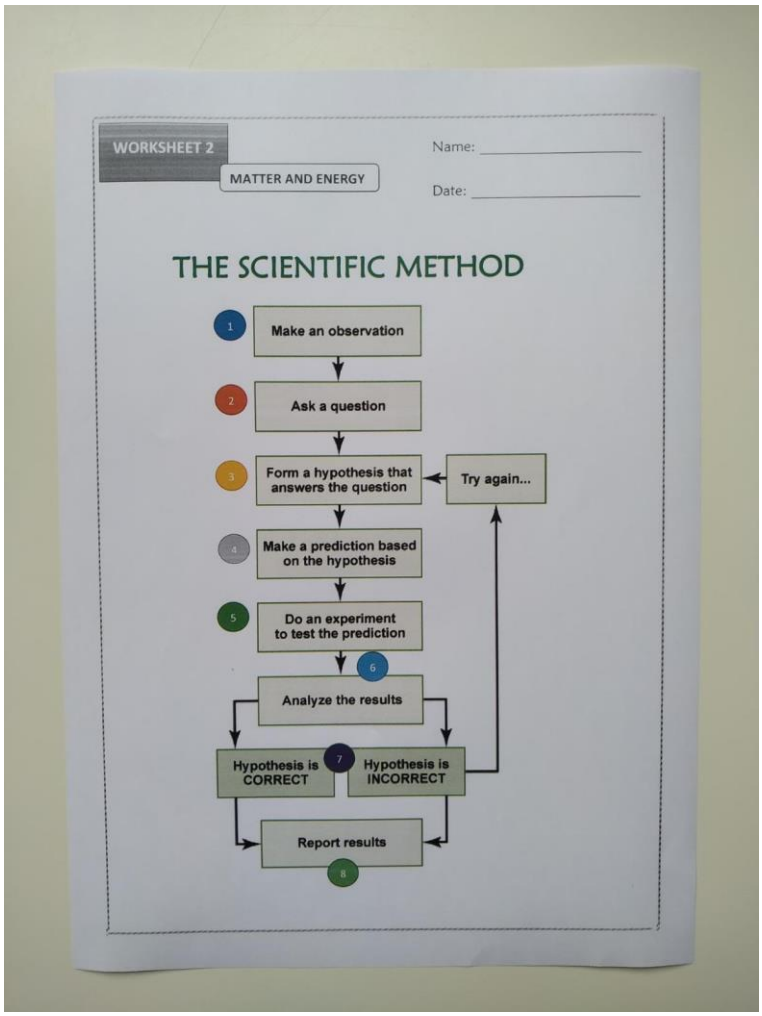
Name: _____

Date: _____

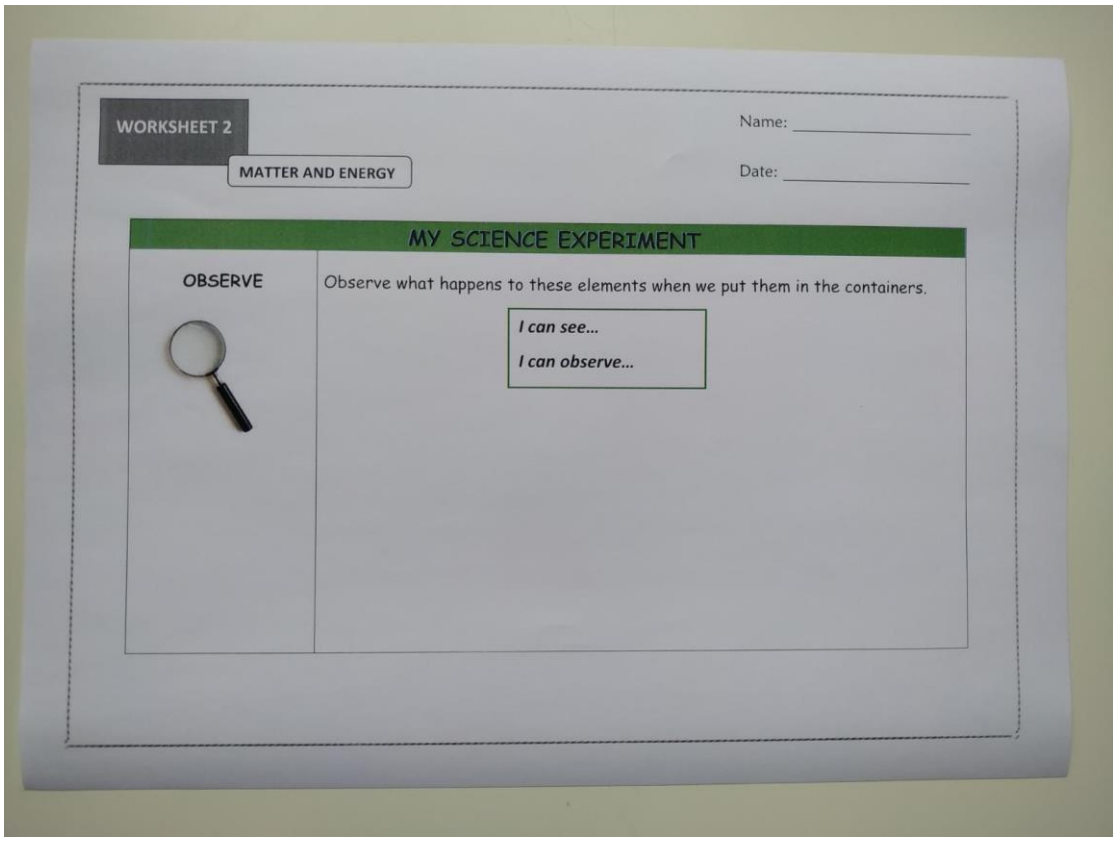
1 Complete the chart putting a tick in the correct box.

Material	Rigid	Resistant	Fragile	Smooth	Rough	Absorbent	Flexible	Waterproof

C. Annex 3: S.W 2


WORKSHEET 2
MATTER AND ENERGY
Name:
Date:
THE SCIENTIFIC METHOD
1
Make an observation
2
Ask a question
3
Form a hypothesis that answers the question
Try again...
4
Make a prediction based on the hypothesis
5
Do an experiment to test the prediction
6
Analyze the results
7
Hypothesis is CORRECT
Hypothesis is INCORRECT
Report results
8

D. Annex 4: S.W 3



WORKSHEET 2

MATTER AND ENERGY

Name: _____

Date: _____

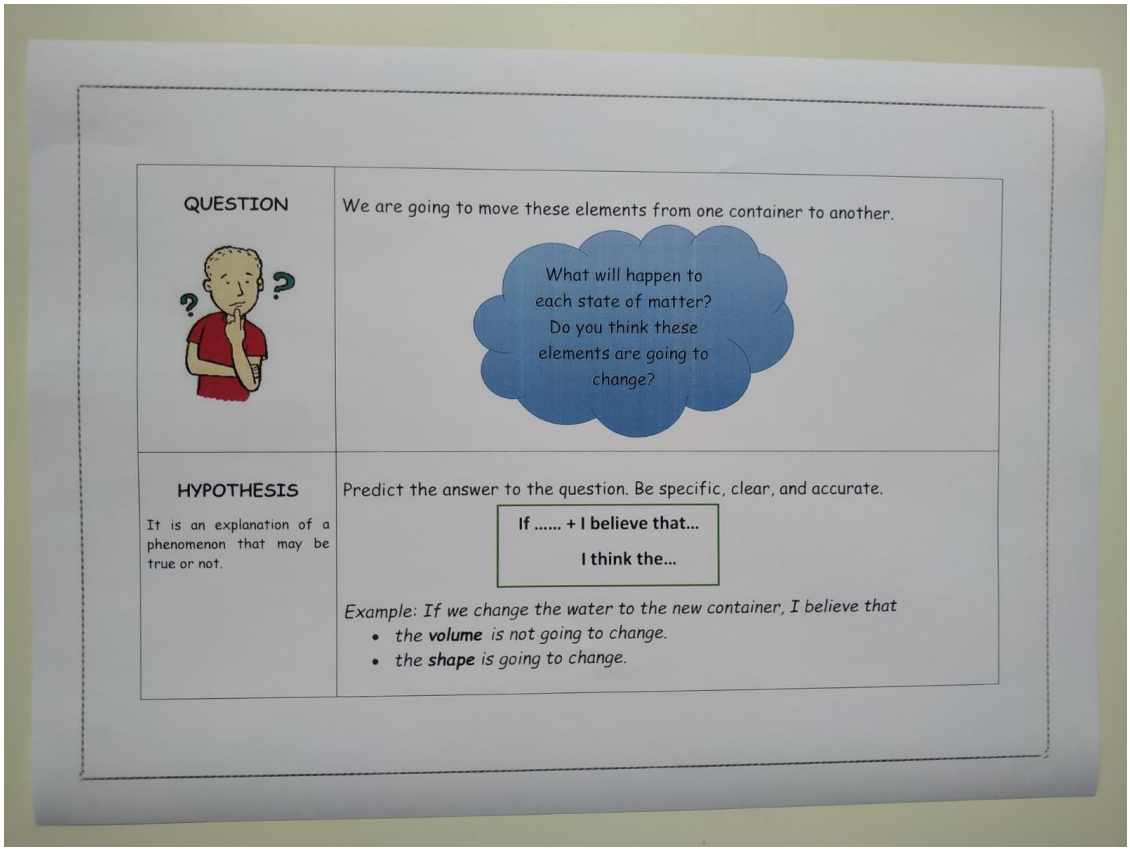
MY SCIENCE EXPERIMENT

OBSERVE

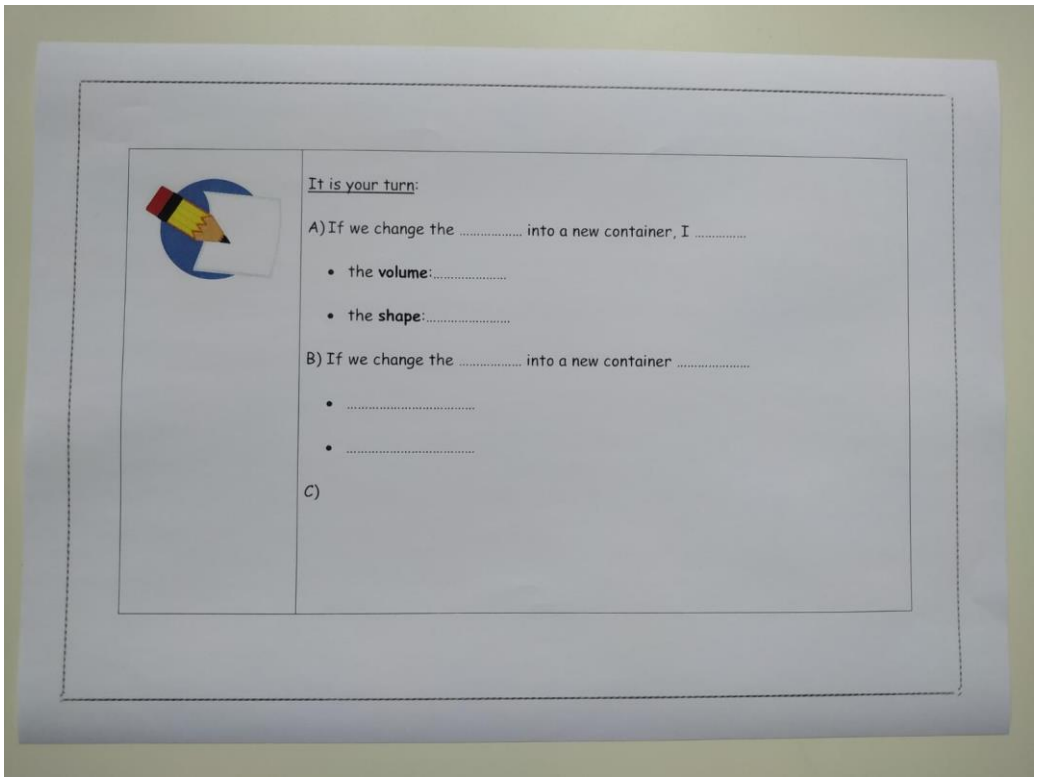
Observe what happens to these elements when we put them in the containers.

I can see...

I can observe...



QUESTION	We are going to move these elements from one container to another.
HYPOTHESIS It is an explanation of a phenomenon that may be true or not.	Predict the answer to the question. Be specific, clear, and accurate. **If ..... + I believe that... I think the...** *Example: If we change the water to the new container, I believe that* • *the **volume** is not going to change.* • *the **shape** is going to change.*



It is your turn:

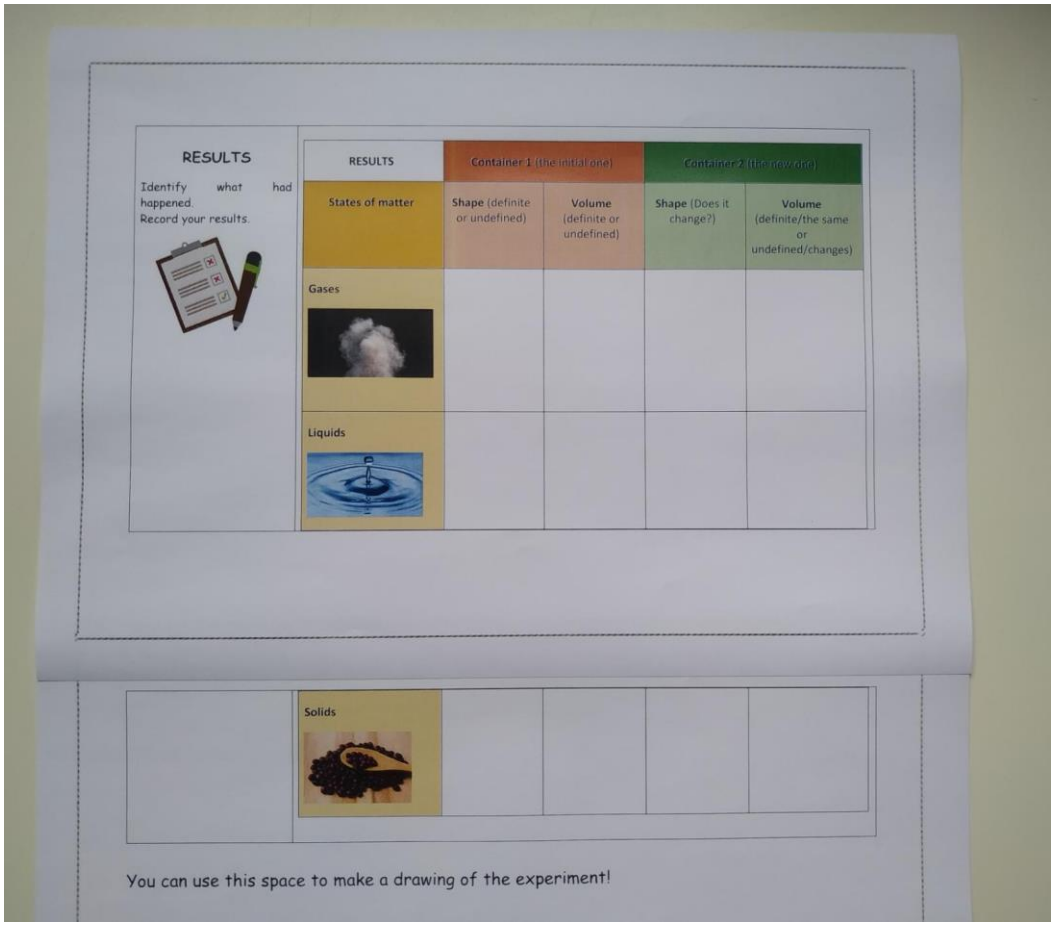
A) If we change the ..... into a new container, I .....

- the **volume**:.....
- the **shape**:.....

B) If we change the ..... into a new container .....

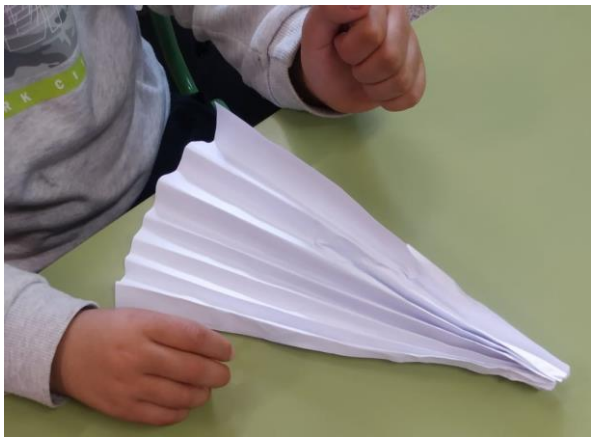
- .....
- .....

C)



E. Annex 5: Titi

F. Annex 6: Manipulating the white sheet



G. Annex 7: Reversible changes

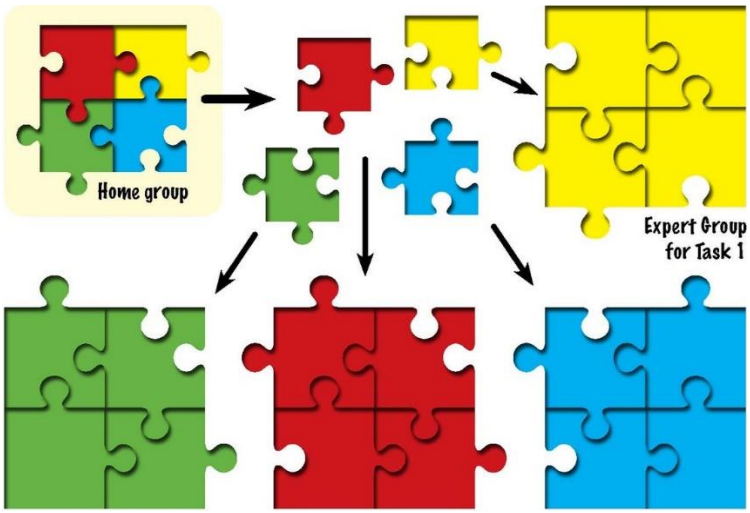
H. Annex 8: Combustion

I. Annex 9: Oxidation

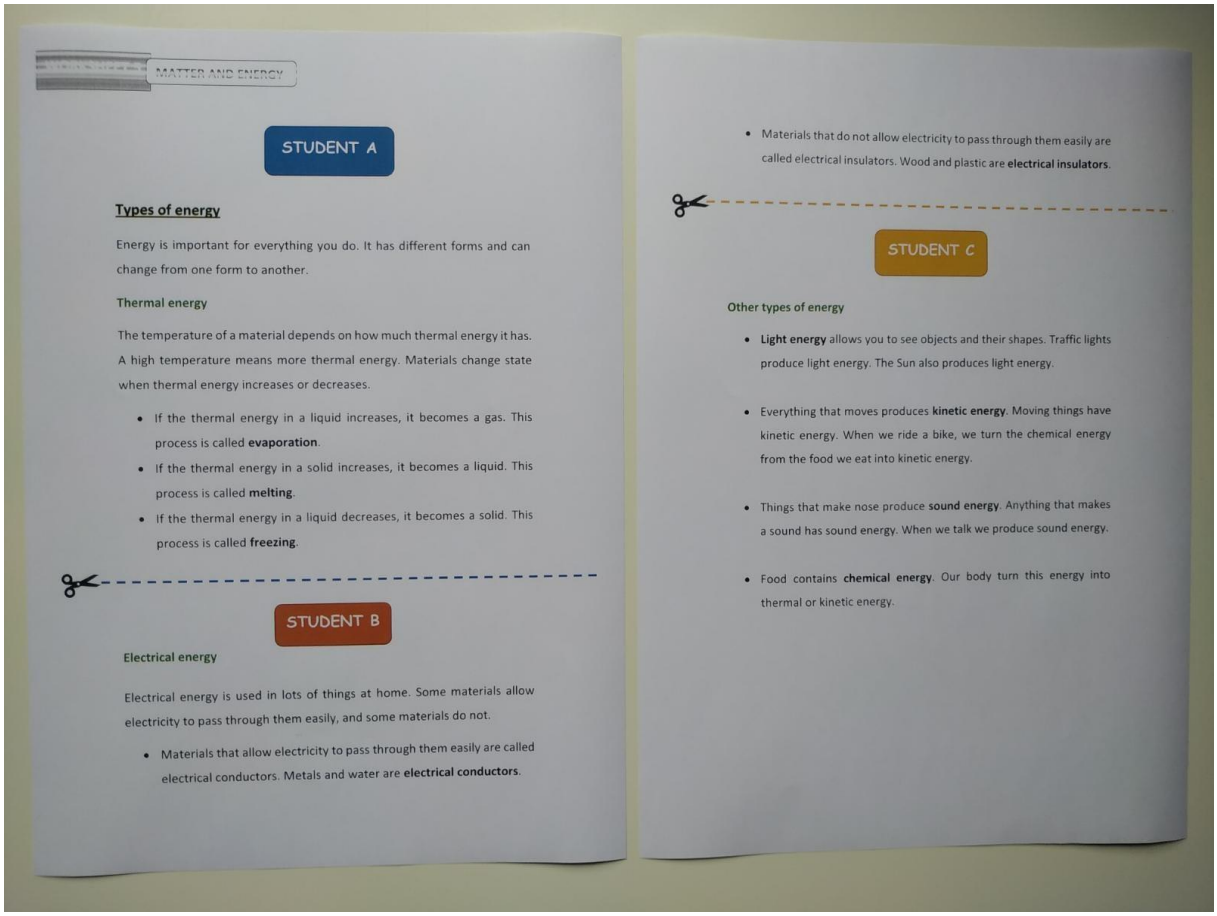
J. Annex 10: S.W 4

K. Annex 11: Homogeneous and heterogeneous mixtures

L. Annex 12: Jigsaw groups (Cooke, n.d.)



M. Annex 13: S.W 5



MATTER AND ENERGY

STUDENT A

Types of energy

Energy is important for everything you do. It has different forms and can change from one form to another.

Thermal energy

The temperature of a material depends on how much thermal energy it has. A high temperature means more thermal energy. Materials change state when thermal energy increases or decreases.

- If the thermal energy in a liquid increases, it becomes a gas. This process is called **evaporation**.
- If the thermal energy in a solid increases, it becomes a liquid. This process is called **melting**.
- If the thermal energy in a liquid decreases, it becomes a solid. This process is called **freezing**.

STUDENT B

Electrical energy

Electrical energy is used in lots of things at home. Some materials allow electricity to pass through them easily, and some materials do not.

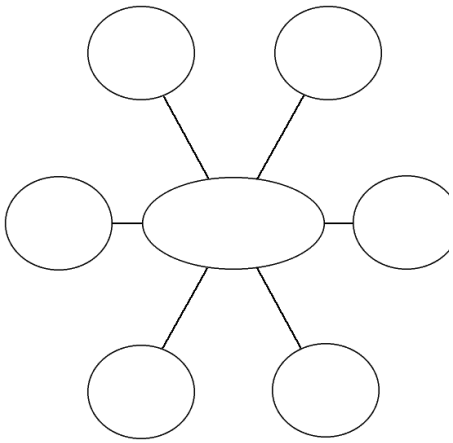
- Materials that allow electricity to pass through them easily are called electrical conductors. Metals and water are **electrical conductors**.
- Materials that do not allow electricity to pass through them easily are called electrical insulators. Wood and plastic are **electrical insulators**.

STUDENT C

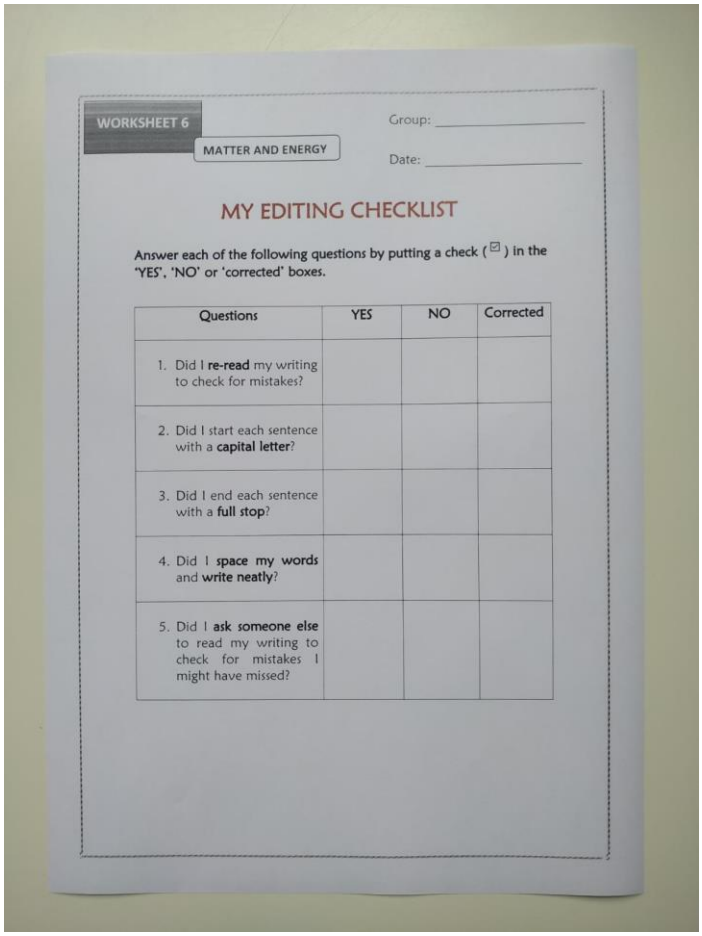
Other types of energy

- **Light energy** allows you to see objects and their shapes. Traffic lights produce light energy. The Sun also produces light energy.
- Everything that moves produces **kinetic energy**. Moving things have kinetic energy. When we ride a bike, we turn the chemical energy from the food we eat into kinetic energy.
- Things that make nose produce **sound energy**. Anything that makes a sound has sound energy. When we talk we produce sound energy.
- Food contains **chemical energy**. Our body turn this energy into thermal or kinetic energy.

N. Annex 14: Spider diagram



Ñ. Annex 15: [S.W 6]



WORKSHEET 6

MATTER AND ENERGY

Group: _____

Date: _____

MY EDITING CHECKLIST

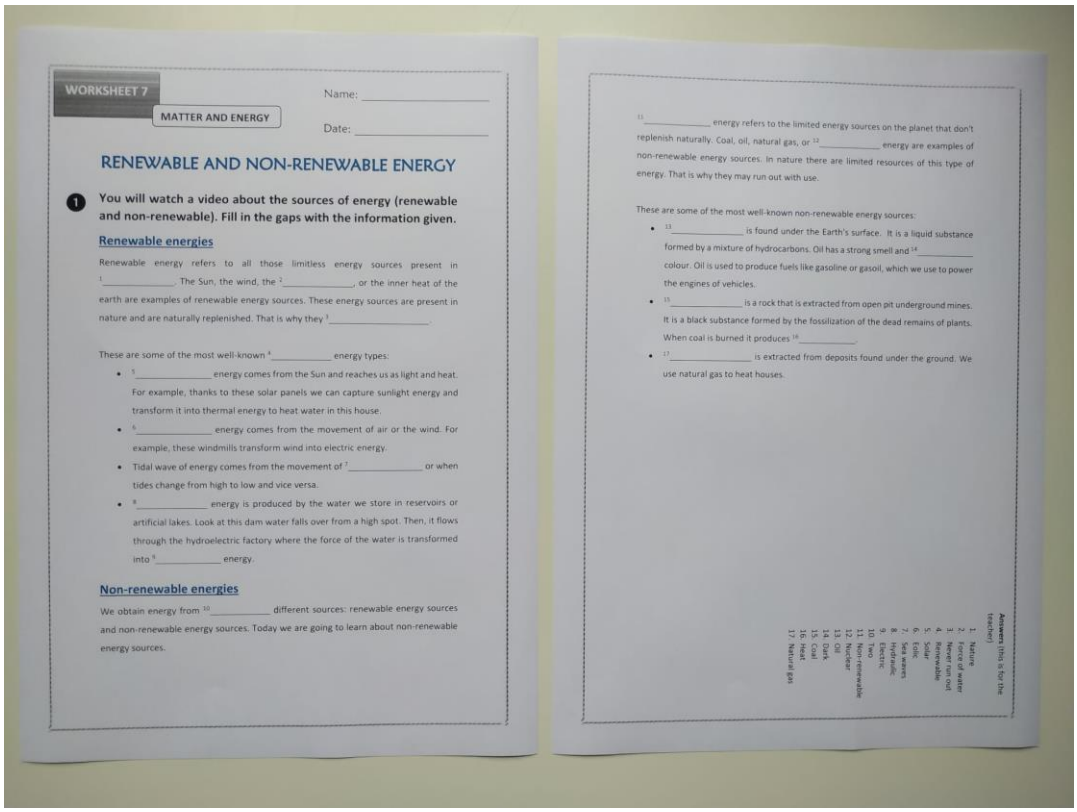
Answer each of the following questions by putting a check (☑) in the 'YES', 'NO' or 'corrected' boxes.

Questions	YES	NO	Corrected
1. Did I **re-read** my writing to check for mistakes?			
2. Did I start each sentence with a **capital letter**?			
3. Did I end each sentence with a **full stop**?			
4. Did I **space my words** and **write neatly**?			
5. Did I **ask someone else** to read my writing to check for mistakes I might have missed?			

O. Annex 16: Renewable and non-renewable energy

(Renewable 3:34-4:47) and Non-renewable (6:17-7:41). To watch the video subtitled we have to click on the bottom left on CC (and the subtitles will appear). We may have to select the English version, which appears next to the CC. As it is a YouTube video, we can also slow it down (settings/speed/0'75) so that students can hear and read it quietly.

P. Annex 17: S.W 7



WORKSHEET 7

MATTER AND ENERGY

Name: _____

Date: _____

RENEWABLE AND NON-RENEWABLE ENERGY

1 **You will watch a video about the sources of energy (renewable and non-renewable). Fill in the gaps with the information given.**

Renewable energies

Renewable energy refers to all those limitless energy sources present in [1]_____. The Sun, the wind, the [2]_____, or the inner heat of the earth are examples of renewable energy sources. These energy sources are present in nature and are naturally replenished. That is why they [3]_____.

These are some of the most well-known [4]_____ energy types:

- [5]_____ energy comes from the Sun and reaches us as light and heat. For example, thanks to these solar panels we can capture sunlight energy and transform it into thermal energy to heat water in this house.
- [6]_____ energy comes from the movement of air or the wind. For example, these windmills transform wind into electric energy.
- Tidal wave of energy comes from the movement of [7]_____ or when tides change from high to low and vice versa.
- [8]_____ energy is produced by the water we store in reservoirs or artificial lakes. Look at this dam water falls over from a high spot. Then, it flows through the hydroelectric factory where the force of the water is transformed into [9]_____ energy.

Non-renewable energies

We obtain energy from [10]_____ different sources: renewable energy sources and non-renewable energy sources. Today we are going to learn about non-renewable energy sources.

[11]_____ energy refers to the limited energy sources on the planet that don't replenish naturally. Coal, oil, natural gas, or [12]_____ energy are examples of non-renewable energy sources. In nature there are limited resources of this type of energy. That is why they may run out with use.

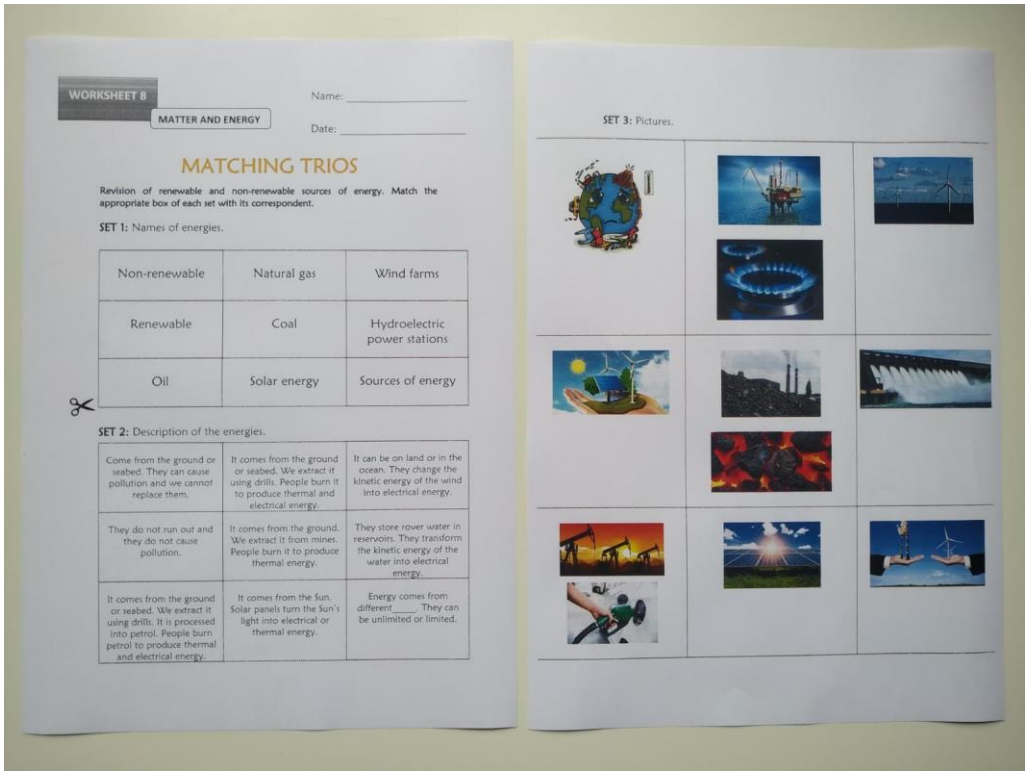
These are some of the most well-known non-renewable energy sources:

- [13]_____ is found under the Earth's surface. It is a liquid substance formed by a mixture of hydrocarbons. Oil has a strong smell and [14]_____ colour. Oil is used to produce fuels like gasoline or gasoil, which we use to power the engines of vehicles.
- [15]_____ is a rock that is extracted from open pit underground mines. It is a black substance formed by the fossilization of the dead remains of plants. When coal is burned it produces [16]_____.
- [17]_____ is extracted from deposits found under the ground. We use natural gas to heat houses.

Answers (this is for the teacher)

1. Nature
2. Force of water
3. Won't run out
4. Renewable
5. Solar
6. Eolic
7. Sea waves
8. Hydroelectric
9. Electric
10. Two
11. Non-renewable
12. Nuclear
13. Oil
14. Dark
15. Coal
16. Heat
17. Natural gas

Q. Annex 18: S.W 8



WORKSHEET 8

MATTER AND ENERGY

Name: _____

Date: _____

MATCHING TRIOS

Revision of renewable and non-renewable sources of energy. Match the appropriate box of each set with its correspondent.

SET 1: Names of energies.

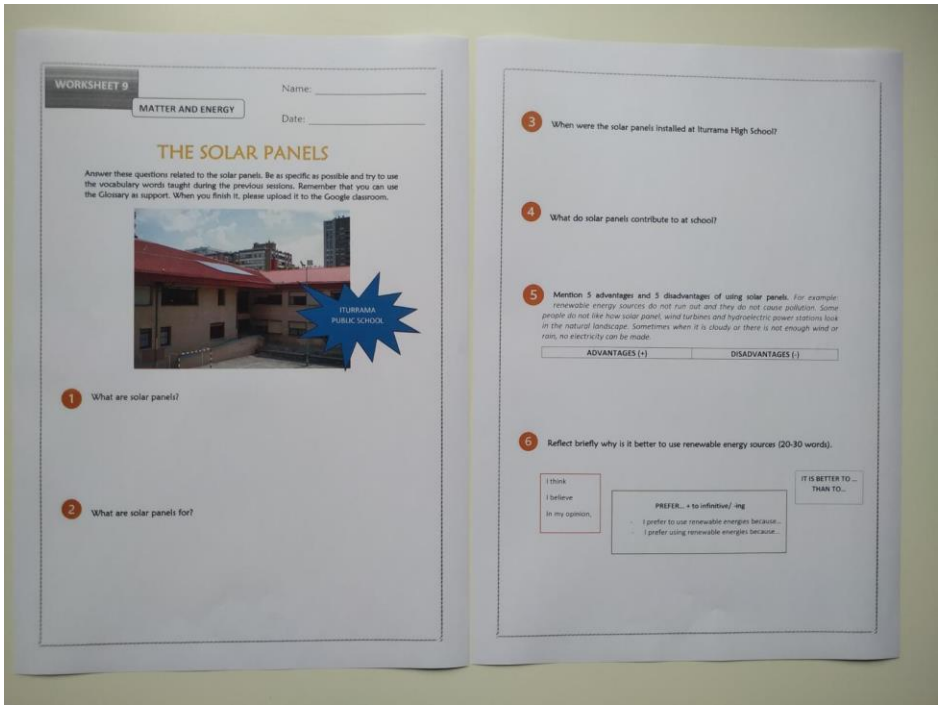
Non-renewable	Natural gas	Wind farms
Renewable	Coal	Hydroelectric power stations
Oil	Solar energy	Sources of energy

SET 2: Description of the energies.

Come from the ground or seabed. They can cause pollution and we cannot replace them.	It comes from the ground or seabed. We extract it using drills. People burn it to produce thermal and electrical energy.	It can be on land or in the ocean. They change the kinetic energy of the wind into electrical energy.
They do not run out and they do not cause pollution.	It comes from the ground. We extract it from mines. People burn it to produce thermal energy.	They store rover water in reservoirs. They transform the kinetic energy of the water into electrical energy.
It comes from the ground or seabed. We extract it using drills. It is processed into petrol. People burn petrol to produce thermal and electrical energy.	It comes from the Sun. Solar panels turn the Sun's light into electrical or thermal energy.	Energy comes from different ____. They can be unlimited or limited.

SET 3: Pictures.

R. Annex 19: S.W 9



WORKSHEET 9

MATTER AND ENERGY

Name: _____

Date: _____

THE SOLAR PANELS

Answer these questions related to the solar panels. Be as specific as possible and try to use the vocabulary words taught during the previous sessions. Remember that you can use the Glossary as support. When you finish it, please upload it to the Google classroom.

ITURRAMA PUBLIC SCHOOL

1. What are solar panels?
2. What are solar panels for?
3. When were the solar panels installed at Iturrama High School?
4. What do solar panels contribute to at school?
5. Mention 5 advantages and 5 disadvantages of using solar panels. *For example: renewable energy sources do not run out and they do not cause pollution. Some people do not like how solar panel, wind turbines and hydroelectric power stations look in the natural landscape. Sometimes when it is cloudy or there is not enough wind or rain, no electricity can be made.*

ADVANTAGES (+)	DISADVANTAGES (-)

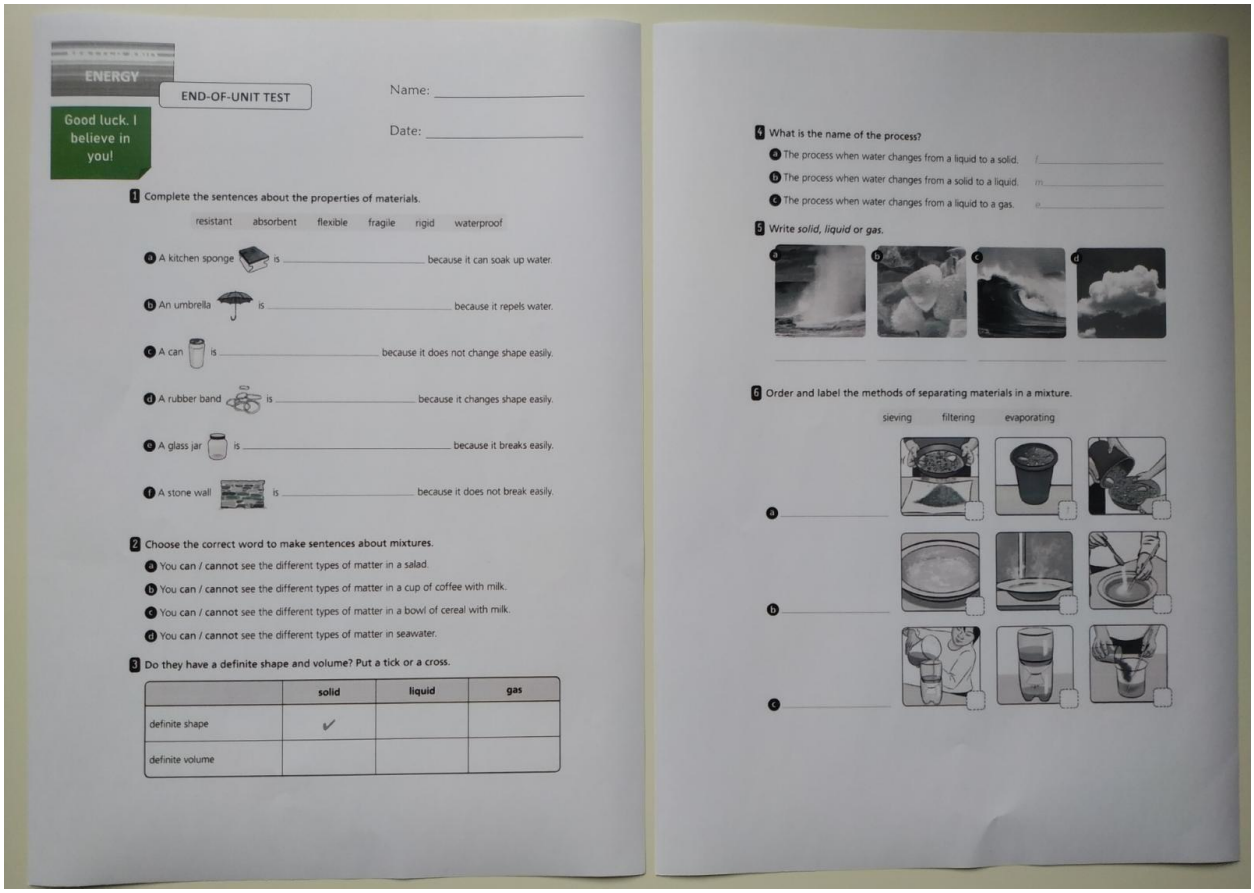
6. Reflect briefly why is it better to use renewable energy sources (20-30 words).

I think
I believe
In my opinion,

PREFER... + to infinitive/ -ing
- I prefer to use renewable energies because...
- I prefer using renewable energies because...

IT IS BETTER TO ... THAN TO...

S. Annex 20: S.W 10



ENERGY

END-OF-UNIT TEST

Good luck. I believe in you!

Name: _____

Date: _____

1 Complete the sentences about the properties of materials.

resistant absorbent flexible fragile rigid waterproof

a A kitchen sponge is _____ because it can soak up water.

b An umbrella is _____ because it repels water.

c A can is _____ because it does not change shape easily.

d A rubber band is _____ because it changes shape easily.

e A glass jar is _____ because it breaks easily.

f A stone wall is _____ because it does not break easily.

2 Choose the correct word to make sentences about mixtures.

a You can / cannot see the different types of matter in a salad.

b You can / cannot see the different types of matter in a cup of coffee with milk.

c You can / cannot see the different types of matter in a bowl of cereal with milk.

d You can / cannot see the different types of matter in seawater.

3 Do they have a definite shape and volume? Put a tick or a cross.

	solid	liquid	gas
definite shape	✓		
definite volume			

4 What is the name of the process?

a The process when water changes from a liquid to a solid. f _____

b The process when water changes from a solid to a liquid. m _____

c The process when water changes from a liquid to a gas. e _____

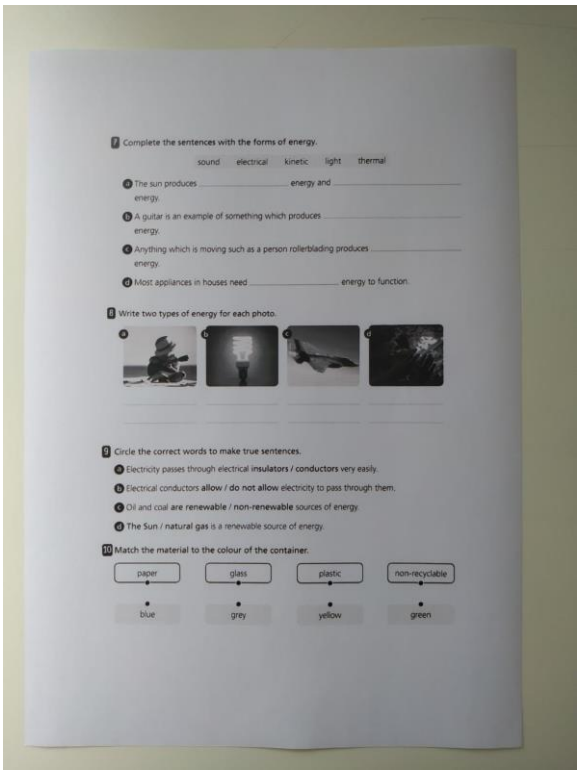
5 Write *solid*, *liquid* or *gas*.

a _____ b _____ c _____ d _____

6 Order and label the methods of separating materials in a mixture.

sieving filtering evaporating

a _____ b _____ c _____



7 Complete the sentences with the forms of energy.

sound electrical kinetic light thermal

a The sun produces _____ energy and _____ energy.

b A guitar is an example of something which produces _____ energy.

c Anything which is moving such as a person rollerblading produces _____ energy.

d Most appliances in houses need _____ energy to function.

8 Write two types of energy for each photo.

a _____ b _____ c _____ d _____

9 Circle the correct words to make true sentences.

a Electricity passes through electrical insulators / conductors very easily.

b Electrical conductors allow / do not allow electricity to pass through them.

c Oil and coal are renewable / non-renewable sources of energy.

d The Sun / natural gas is a renewable source of energy.

10 Match the material to the colour of the container.

paper glass plastic non-recyclable

blue grey yellow green