MÁSTER UNIVERSITARIO EN LENGUA INGLESA PARA EL AULA BILINGÜE EN EDUCACIÓN SECUNDARIA

TRABAJO FIN DE MÁSTER

APPLYING CLIL TO A PHYSICS AND CHEMISTRY UNIT

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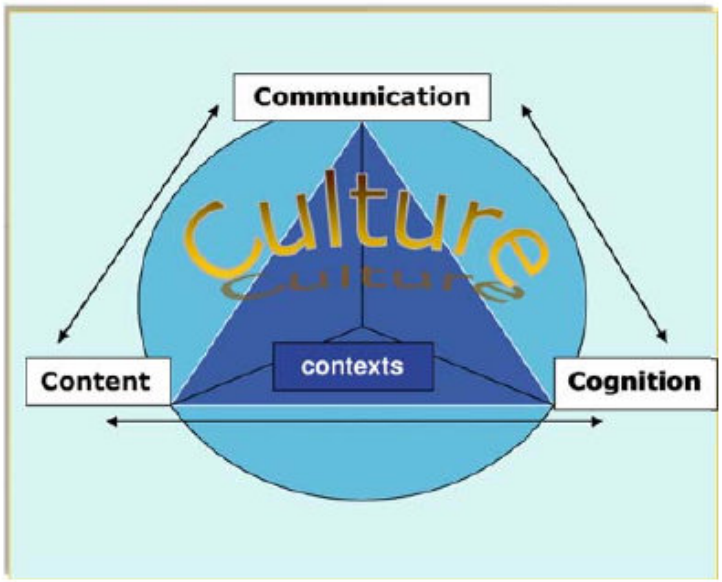
1. WHAT IS CLIL?

Coyle, Hood and Marsh (2010:1) give the following definition of CLIL:

> "Content and Language Integrated Learning (CLIL) is a dual-focused educational approach in which an additional language is used for the learning and teaching of both content and language."

CLIL is a combination of four elements, which are called by those authors the 4C's, Content, Communication, Cognition and Culture (Coyle, Hood and Marsh (2010:41))



The 4Cs framework for CLIL (Coyle, 2005).

- **Content:** it is related to subject matter. It means that students learn the curricular content of the subject using a foreign language to communicate.
- **Communication:** it involves language learning and using, because students learn the language using it as a communication vehicle to learn the content.
- **Cognition:** it is focused on language and thinking processes. That means that students develop their thinking skills, because they have to work harder to learn the content through a foreign language.
- **Culture:** it includes developing intercultural understanding and global citizenship. In CLIL students develop an intercultural awareness and they learn about other cultures.

2. WHY CLIL? THE BENEFITS OF CLIL.

There are many benefits to integrating content and language. These benefits were measured by several research studies carried out in some primary and secondary schools all along the Spanish territory, using CLIL methodology.

Alonso, Grisaleña and Campo (2008) measured the degree of efficiency of the Plurilingual Experience in a secondary school of the Basque Autonomous Community. The general conclusions were the following:

- The improvement in linguistic and communicative competence appears to be substantial.
- The assimilation of the content in the different subject areas taught in English is similar, if not superior, to those groups taught at the same level that did not participate in the experience.
- The application of the experience does not cause any problems in the development of the students' ability to learn in other languages.

Ruiz de Zarobe (2008) carried out a research in a secondary school of the Basque Autonomous Community to compare the speech production outcomes in two groups following two different types of educational programmes: CLIL (CLIL1 and CLIL2) vs. non-CLIL. The non-CLIL group had received 3 hours of English per week, following a conventional English as a Foreign Language (EFL) programme. The CLIL1 group had received instruction in EFL 3 hours per week, and one curricular subject was taught through English for 3 or 4 hours a week. The CLIL2 group had received, apart from the EFL classes 3 to 4 hours a week, two curricular subjects through English.

The conclusions were:

- The CLIL participants have more lexical richness than their non-CLIL counterparts.
- There is a positive relationship between the amount of exposure through English and the linguistic outcomes. This implies that the students with more exposure through English (CLIL2) achieve higher levels of proficiency on the speech production task than students with less exposure through English (CLIL1).

Another research was undertaken in the Basque County by Lagasabaster, (2008). The participants were students of four different schools and all of whom had started to learn

English as a foreign language at the age of 8. The sample was divided into three groups, the non-CLIL SE4 group with students of 4th year of secondary education, the CLIL SE4, formed by students of 4th year of secondary education that had been involved in a CLIL programme for two years, and the CLIL SE3 that included students or 3rd year of secondary education that had participated in CLIL for just one year.

The results were the following:

- The CLIL SE4 achieved a better language performance compared to non-CLIL SE4, so CLIL exerts a positive influence on all the language aspects measured in this study.
- The CLIL SE3 even outscored the non-CLIL SE4 group despite the former being a year younger. Thus, the positive effects of CLIL seem to remain even when the CLIL students are a year younger than the control students.

Jiménez and Ojeda (2010) measured the English vocabulary production of sixth grade primary CLIL and non-CLIL learners in La Rioja through a cloze test and a lexical availability task. In the cloze test, the non-CLIL learners performed better than the CLIL learners, the differences in the test being significant. The results obtained in the lexical availability task showed the same results, although the differences in this case were not significant.

With the aim of analyzing the impact of implementing a CLIL programme in terms of language proficiency gains, Victori and Vallbona (2008) gathered data on the productive and receptive skills of two groups of students of third to sixth grade from Catalonian schools. A group that had received one hour a week of CLIL instruction in the subject of natural science was compared with a group of students of the same level that had never received CLIL instruction before. Data were gathered on their productive and receptive skills by means of: an oral test, a listening comprehension test, a dictation, a cloze test, and a written composition in their L1 and in English. Results showed that sixth grade students showed better skills at dictation and fifth grade students outperformed in lexical complexity, fluency and accuracy when their written skills were compared. The questionnaires revealed a generally enthusiastic assessment of the CLIL experience by students and teachers.

Also in Catlonia, Navés and Victori (2010) carried out two studies with CLIL and non-CLIL learners from two primary and three secondary schools. They focused on the

subjects' general language proficiency and learners' writing skills. Students' language proficiency was analysed by means of a listening test, a grammar test and a dictation in English. The writing test consisted of a composition, which was analysed for accuracy, fluency, syntactic and lexical complexity. Results of both studies showed that CLIL learners outperformed non-CLIL learners in most of the tests administered. The first study also found that seventh grade CLIL learners obtained results similar to those of non-CLIL learners one or two grades ahead for each of the measures analysed: dictation, reading comprehension, grammar and listening skills. In the second study, CLIL learners' writing at lower grades was observed to be as good as or even better than that of older learners a few grades ahead. From both studies the authors conclude that when learners are at grades 7 and 9 and have received CLIL instruction they achieve a level equivalent to or even higher than learners a couple of grades ahead in many of the domains of a language.

A study was carried out by Lorenzo et al. (2010) in Andalusia with fourth year primary (aged 9–10) and second year secondary (aged 13–14) students. The only feature which distinguishes the CLIL and non-CLIL groups is that the bilingual learners have had one and a half years of CLIL. The data collection methods used consisted of: questionnaires administered to the teaching body, CLIL learners and their parents. These focused on curricular organization, classroom praxis and levels of satisfaction; structured interviews administered to the Bilingual programme coordinators; and diagnostic tests to assess language competences amongst CLIL and control learners. Lorenzo et al., (2010) state that "when the results of the linguistic evaluation had been compiled, it emerged that the CLIL learners were clearly outperforming their mainstream peers. Global average scores were 62.1 per cent for the bilingual groups in comparison with 38 per cent for the control groups" (p. 9).

San Isidro (2010) presents the results of a CLIL study in Galicia with 287 CLIL and non-CLIL students in the fourth year of secondary education. Results showed that CLIL groups outperformed their non-CLIL counterparts in every test (reading/writing; listening and speaking) and in the overall English competence score. This author concludes that "this study provides empirical evidence that the CLIL approach is successful and helps to improve students' foreign language competence" (p. 75).

These research studies show that CLIL students outperform non-CLIL students in their English language skills, due to the great exposure they have to the language, and the greater the exposure to foreign language is, the faster the students develop these skills. In some cases these results are similar to those obtained by non-CLIL students in higher grades.

The results also show that the contents of the curricular subjects taught through English are not affected by the use of a foreign language.

In conclusion we can say that studying in the bilingual program provides great benefits to students' language acquisition, and the motivation that comes from studying both content and language at the same time and learning content through language and language through content.

Due to this, I think it is interesting to explain how to carry out a CLIL teaching unit.

3. APPLYING CLIL TO A PHYSICS AND CHEMISTRY UNIT.

I'm going to explain how to apply CLIL to a Physics and Chemistry unit of the third year of Secondary Education.

This requires taking into account a change in the methodology used.

This is the first year that students learn Physics and Chemistry and they might not know the specific vocabulary and expressions used, so they might need different explanations for the content or need more time to accomplish tasks. Sometimes L1 might be used to support teacher's explanations.

Teachers must be aware that students need more visual support when learning a subject in a foreign language, which means that it is very useful to use images, videos, diagrams or mind maps.

It is also necessary to provide a suitable scaffold for the use of language. That could be a glossary, sentence structures or the use of a dictionary.

Tasks should be varied and appropriate to assimilate both content and language.

The grouping of students is also important and activities in pairs or groups provide the right environment for communication in a foreign language.

3.1. TEACHING UNIT: SEPARATION OF MIXTURES.

This unit is called "Separation of Mixtures" and it belongs to the regional curriculum: *Decreto 74/2007, de 14 de junio, por el que se regula la ordenación y establece el currículo de la Educación Secundaria Obligatoria en el Principado de Asturias*.

It focuses on the knowledge of the characteristic properties of the substances, those which serve to distinguish substances from each other. It will emphasize the importance of differentiating between homogeneous and heterogeneous mixtures. Different methods of separating substances will also be studied.

3.2. SCHOOL GRADE AND LINGUISTIC LEVEL.

This unit will be developed during three weeks with students from the third year of compulsory Secondary Education, who are 14 to 15 years old. There are 16 students in the group and most of them have good motivation to study.

Their linguistic competence is A2/B1 from the Common European Framework of Reference for Languages.

3.3. CONTENTS.

This unit is part of blocks 1 and 2 of the regional curriculum, which states the contents students must acquire during this unit.

1. Classification of matter: pure substances and mixtures.
2. Classification of pure substances: elements and compounds.
3. Classification of mixtures: homogeneous and heterogeneous mixtures.
4. Classification of real substances.
5. Separation techniques based on physical properties.
6. Separation of heterogeneous mixtures: magnetic separation, filtration.
7. Separation of homogeneous mixtures: crystallisation, distillation.
8. Writing a lab report.
9. Oral presentation of the lab experiments.

3.4. TEACHING AIMS.

The regional curriculum also states the teaching aims students will be able to achieve by the end of the unit.

The following teaching aims include content and language, according to the principles of CLIL. However, some of them focus on content (C) and others on language (L).

1. Classify matter as pure substances or mixtures. (C)
2. Distinguish between elements and compounds. (C)
3. Distinguish between homogeneous and heterogeneous mixtures. (C)
4. Classify real substances as homogeneous or heterogeneous mixtures. (C)
5. Choose the appropriate technique to separate a mixture. (C)
6. Describe the different techniques of separating mixtures. (L)
7. Separate mixtures in the lab, working with order and security. (C)
8. Write a lab report using specific vocabulary. (L)
9. Explain their lab experiment in front of peers. (L)

3.5. BASIC COMPETENCES.

According to the regional curriculum, a student must have developed basic competences at the end of compulsory secondary education to achieve personal fulfilment and active citizenship, to join adulthood successfully and to be able to develop a lifelong learning. These basic competences agree with the CLIL methodology.

In this unit the basic competencies are going to be used in the following way:

- **Linguistic communication (C1):** speaking, listening and participating in dialogue and debate in an organized and clear manner, using specific vocabulary and explaining their lab experiments in front of the rest of the class.
- **Knowledge and interaction with the physical world (C2):** identifying everyday mixtures and separating them in the lab, describing and explaining the scientific processes.

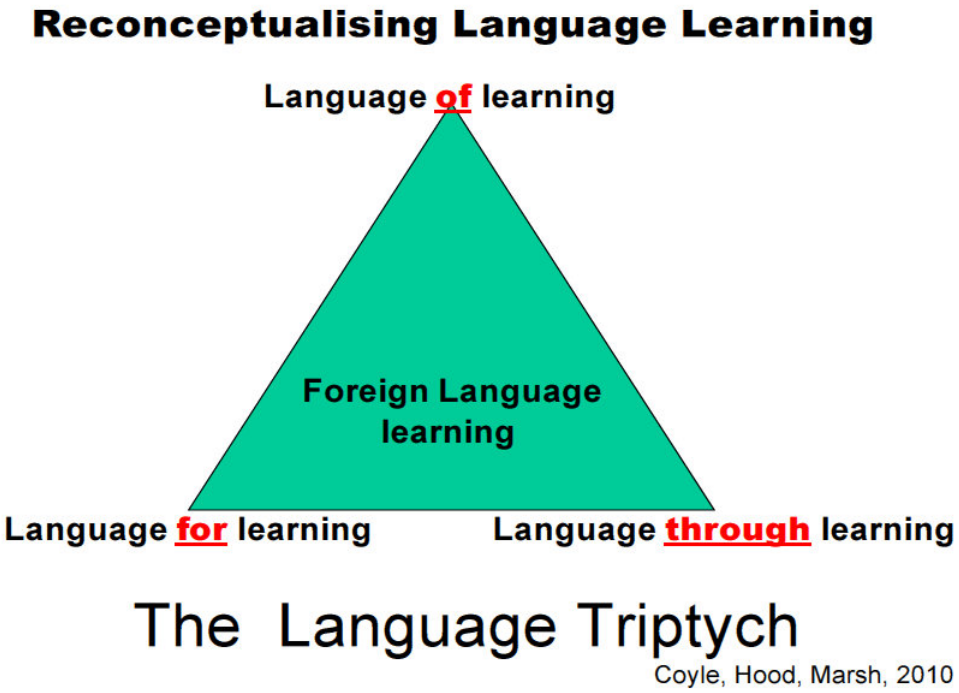
- **Data processing and use of ICT (C3):** collecting data and transferring them to the lab report, using and producing schemes and mind maps.
- **Social skills and citizenship (C4):** working in groups, promoting respectful and tolerant discussion of ideas, making decisions, reaching an agreement.
- **Learning to learn (C5):** the activities are designed to develop skills such as analyse, acquire, process, evaluate, synthesize and organize new knowledge.
- **Autonomy and personal initiative (C6):** analysing situations, evaluating the factors that have influenced them and their possible consequences.

3.6. LANGUAGE OBJECTIVES.

As I mentioned before, the 4C's include Content, Communication, Cognition and Culture. In this section, I will show how the 4C's are related to the contents and skills that students acquire during the unit.

- **Content:** it includes key concepts.
  - Pure substances: elements and compounds.
  - Mixtures: heterogeneous and homogeneous.
  - Physical properties: magnetic substances, soluble, insoluble, boiling point, evaporation.
  - Separation of mixtures: magnetic separation, filtration, crystallisation and distillation.
- **Cognition:** it involves thinking skills.
  - Identification and classification of real substances.
  - Choosing a separation technique to each mixture.
  - Describing separation techniques.
  - Performing experiences of separation of mixtures.
  - Collecting data to write a lab report.
- **Culture:** also called citizenship and community.
  - Working in group, respecting others' ideas.
  - Working in the lab in a healthy and safety way.
  - Presenting their lab report in front of peers.
  - Peer-to-peer assessment.

- **Communication:** it includes the key language. According to Coyle, Hood and Marsh (2010:38), communication involves CLIL teachers and students in using and developing language of learning, language for learning and language through learning.



  - **Language of learning:** it is the language needed for students to access basic concepts and skills relating to the subject topic. That's the scientific vocabulary that students need to know and use during the unit. It includes nouns, adjectives and verbs.
    - **Types of matter:** pure substances, elements, components, homogeneous mixtures, heterogeneous mixtures, atoms, molecules, joined.
    - **Separation techniques:** magnetic separation, filtration, crystallisation, distillation, filtrate, residue, solution, saturated.
    - **Lab equipment:** beaker, flask, condenser, funnel, filter paper, thermometer, evaporating basin, magnet, Bunsen burner, bung.
    - **Lab processes:** to separate, to move through, to remove, to mix, to stir, to dissolve, to filter off, to wash, to allow, to attract, to add, to cover, to select, to pour, to fill.

- **Language for learning:** it is the language needed to operate in a foreign language environment. In CLIL settings this means that the student needs to be supported in developing skills such as those required for pair work, cooperative group work, asking questions, debating, chatting, enquiring, thinking, memorizing and so on. Unless students are able to understand and use language which enables them to learn, to support each other and to be supported, quality learning will not take place. In this unit, the language for learning includes the following types of expressions:
  - **How to compare different substances:** they are similar in that, they are different in that, their similarities are, their differences are.
  - **How to carry out an experiment to separate mixtures:** move a magnet through the mixture, the iron fillings stick to the magnet, the fillings can be removed from the magnet, mix the remaining components in water, stir the mixture, dissolve all of substance, filter off the sand from the solution, wash the sand with some fresh water, remove the last of the copper sulphate from the sand, put the copper sulphate in the evaporating basin and allow it to dry.
  - **How to process data to write a lab report:** this is an experiment to separate the components, iron fillings can be separated using a magnet, we can separate one substance from another using the method of, from my results I can conclude that, this is because.
- **Language through learning:** it is the language to support and advance the students thinking processes whilst acquiring new knowledge. It is based on the principle that effective learning cannot take place without active involvement of language and thinking. Language through learning means to capture language as it is needed by students during the learning process (any language that may arise during the unit).
  - **Expressing opinions:** I think that, in my opinion, from my point of view, I agree with you, I disagree with you, that's a good idea, you are right, you are wrong.
  - **Explaining processes:** first, second, then, next, after that, finally.

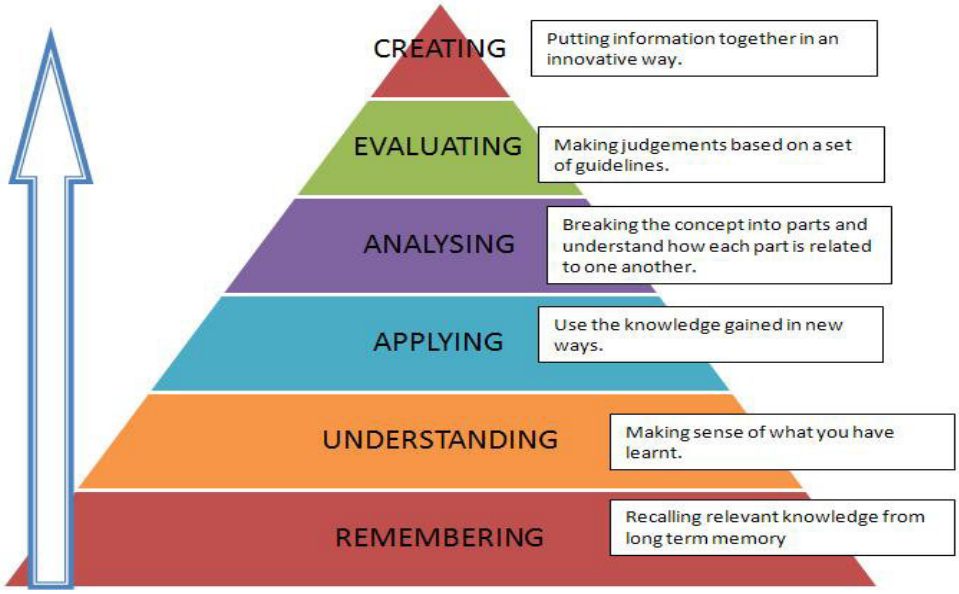
3.7. METHODOLOGY.

CLIL is both a holistic and a dual-focused approach, because students learn both content and language. Besides, it is student-centred, which means that the teacher is a guide in the process of learning, and students are the main part of the process. Moreover, this process is more important than the result, and this is something to take into account when assessing students.

CLIL is also a natural approach, because teachers use real materials and real situations to teach. Furthermore, CLIL involves changing methodology into cooperative learning and task-based learning. And this new methodology also includes using different areas and skills in a cross-curricular teaching.

CLIL teachers must plan the lessons taking into account the different characteristics of their students. This is related to the Multiple Intelligences Theory developed by Gardner (1983), which states that there are different types of intelligences. Gardner believes that intelligences are actually skills that can be trained, developed and improved. According to this, the methodology used in CLIL enables all the students to have the same opportunity to learn.

According to Coyle, Hood and Marsh (2010), it is necessary to integrate content and thinking skills. In 1956 Benjamin Bloom published his taxonomy outlining six different thinking skills. In this taxonomy, thinking skills are divided into lower-order thinking skills (remembering, understanding and applying), and higher-order thinking skills (analysing, evaluating and creating).



In this unit, the organisation of the teaching process is based on a number of methodological principles:

- **Activating prior knowledge**: the new knowledge will be built on students' previous ideas, using the connection to what they already know to restructure their thought patterns and facilitate the construction of new learning.
- **Continuity and progression of contents:** there will be a progress from general concepts to the details and particularities, beginning the processes of each new activity at the point where the previous one was left.
- **Interrelation of contents:** there will be an interrelation between contents from Physics and Chemistry and contents from other subjects, such as Biology or Technology. This is called interdisciplinarity.
- **Activity:** each student will be starring in the process of learning, applying knowledge to solve problems.
- **Personalized learning:** enhancing the individual responsibility to work through the assignment of tasks, functions and times, according to the characteristics of each student, covering all areas of the student's personality: different rhythms, abilities, interests, etc.
- **Socialization:** assessing the importance of teamwork through small group activities with distribution of roles and responsibilities, promoting the exchange of roles between students and enhancing participation in debates.
- **Functionality of learning:** relating the contents to the students' closest environment, working with real situations and real materials.
- **Sequencing of the activities and organisation of time:** activities will be undertaken from the simplest to the most complex, giving for each activity enough time to study all relevant aspects and ensuring that the activities will be successfully culminated. Students will do activities that involve lower-order thinking skills (remembering, understanding and applying) and activities that involve higher-order thinking skills (analysing, evaluating and creating), giving for each activity enough time to study all relevant aspects and ensuring that the activities will be successfully finished.

- **The role of the teacher:** guiding the learning process, raising questions and collaborating to strengthen the acquisition of work habits.

3.8. ASSESSMENT.

CLIL teachers can assess content, language, communication skills, cognitive skills (students think about what they have learnt and how and why they have learnt it), practical skills (carrying out investigations, doing experiments, measuring, drawing) and attitudes towards learning.

There are two main types of assessment in CLIL: summative and formative. (Coyle, Hood and Marsh (2010:114))

Summative assessment involves doing tests to find out what students have learnt about the content and the language.

Formative assessment consists of observing students during lessons and questioning what has already been learnt. Other forms of this kind of assessment are peer-to-peer assessment, when students assess each other and give feedback, and self-assessment, when learners assess their own progress. In addition, there is a new way to assess, called portfolio assessment, which is a collection of the work done over a year. It shows the students' knowledge, their skills and cognitive development, and it also provides feedback on learning.

The assessment of students' learning in Secondary Education is regulated by *Resolución de 27 de noviembre de 2007, de la Consejería de Educación y Ciencia* which states that assessment will be continuous and formative.

Due to its continuous nature, different techniques, procedures and instruments will be used to know the progress made by each student, taking into account the initial situation and considering the diversity of skills, attitudes, rhythms and learning styles.

For its formative nature, assessment will guide the teaching and learning that best promote the acquisition of basic competences and the achievement of teaching aims.

In this unit I will use the assessment criteria as the key to assess both the degree of acquisition of basic competences and the achievement of the objectives.

3.8.1. ASSESSMENT CRITERIA.

The assessment criteria measure what students can do at the end of the unit:

1. Explain the differences between pure substances and mixtures.
2. Identify elements and compounds in real substances.
3. Name the differences between heterogeneous and homogeneous mixtures.
4. Identify homogeneous and heterogeneous mixtures in real substances.
5. Know which technique is used to separate each mixture.
6. Describe the separation of substances within a mixture.
7. Separate pure substances within a mixture by different physical processes.
8. Fill the lab report using scientific language.
9. Show their lab results in front of peers, using specific vocabulary.

3.8.2. STUDENTS' ASSESSMENT PROCEDURES AND CRITERIA RATING.

In order to check if students achieve the teaching aims, taking into account the assessment criteria, the following methods will be used. In parenthesis it is written the contribution of each item listed to the final grade.

1. **Observing the classroom work (10%):** the students are punctual, show interest and do the activities. In the laboratory the students follow the safety rules. In group work they collaborate, support and respect their peers.
2. **Workbook (10%):** the students lead daily tasks, complete activities at home; write summaries and outlines watching spelling, presentation and cleanliness.
3. **Lab (30%):** in this section two aspects are evaluated:
   - **a) Experiment (10%):** procedure, cleanliness, order and product obtained.
   - **b) Lab Report (10%):** students make a report after each lab experiment, which shall contain: objectives, equipment, procedure, results and observations, conclusions and diagrams.
   - **c) Oral presentation (10%):** organization of the information, the explanation is easy to understand, grammar, vocabulary and speaking.
4. **Written tests (50%):** the questions must be answered giving reasons and using appropriate scientific vocabulary. Drawings and/or graphics must be used where it needed careful watching the presentation.

3.9. GENERAL LESSON PLAN.

The general lesson plan explains how each session is going to be developed. It includes the contents that are explained during the session, how the teacher is going to guide the students' learning process, the activities students are going to do (**AC**), the necessary resources to carry out those activities, the grouping of students, in other words, if they are going to work individually, in pairs or in groups, and the time needed for each activity. It also includes the teaching aims (**TA**) and the basic competences (**BC**) that are worked in each activity. Below each table I have included the worksheets with the activities that are going to be worked on each session.

SESSION 1 – LESSON PLAN

SESSION 1	TEACHER	STUDENTS	AC	TA	BC
Matter. (5')	Asks questions to activate prior knowledge.	Answer questions in plenary.	A1	1	C1 C2 C5
Classification of matter. (15')	Classifies matter and gives examples.	Listen to the explanations. Do the activities individually. Check in pairs.	A2	1 2	C1 C2
Pure substances: elements and compounds. (15')	Defines pure substances and differences between elements and compounds. Gives examples. Checks students' answers.	Listen to the explanations. Do the activities in pairs.	A3	1 2	C1 C2 C4
Mixtures: heterogeneous and homogeneous. (15')	Defines mixtures and types of mixtures. Gives examples.	Listen to the explanations. Do the activities individually. Check in pairs.	A4	3 4	C1 C2
Mind map. (10')	Draws a mind map. Checks students' answers.	Complete the mind map. Check in plenary.	A5	1 2 3 4	C1 C2 C3 C4 C5 C6
RESOURCES					
Text book, worksheet 1.					

SESSION 1 – WORKSHEET 1

1. ***Warm-up activity (speaking-listening):*** *are these pure substances or mixtures? (modified from www.tes.co.uk)*

Water 	Iron 	Crude oil 
Wood 	Plastic 	Oxygen 
Brick 	Air 	Copper 
Gold 	Clay 	Aluminium 

This is the first activity of the first session, which means that I have to activate the students' prior knowledge. They have already studied the classification of matter as pure substances and mixtures in Natural Sciences during the first year of Secondary Education, so I need to know what they remember about that, in order to connect the new contents with the students' previous ideas.

This is a lower-order thinking activity, because students have to recall information, they have to remember what they already know.

This activity is going to be developed in plenary, showing the pictures and asking questions about them. So students develop their speaking and listening skills and at the same time they work on their social skills and citizenships.

2. ***(Reading activity)*** *Match the words to their meaning: (modified from www.tes.co.uk)*

Atom	Two or more different atoms that are chemically joined
Element	Two or more atoms chemically joined
Compound	The smallest particle
Mixture	Made of only one type of atom
Molecule	Two or more different atoms that are not chemically joined

This is a lower-order thinking activity, in which students must define each term. With this reading activity, students work on the content and the language, because they must understand both of them to do it.

3. ***(Writing activity)*** *Indicate which material is a* ***mixture****, an* ***element*** *and a* ***compound****. Use the following sentences choosing the appropriate expressions to give reasons for your answers:*

The first	material is	a mixture	because it is formed by	one type of atom	chemically bonded
The second		an element		several types of atoms	not chemically bonded
The third		a compound			

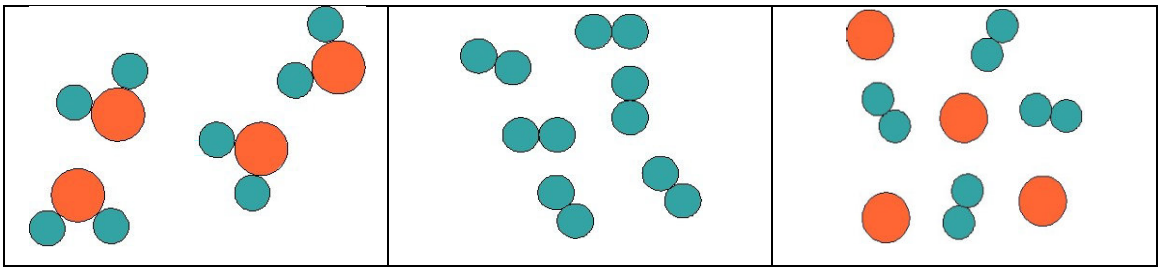


Image from www.bbc.co.uk

In this activity, students have to apply the concepts that we have been studying during the session to define each type of material. They also have to work on the language acquisition, that's why I give them some words to scaffold their language and to help them to write the definitions.

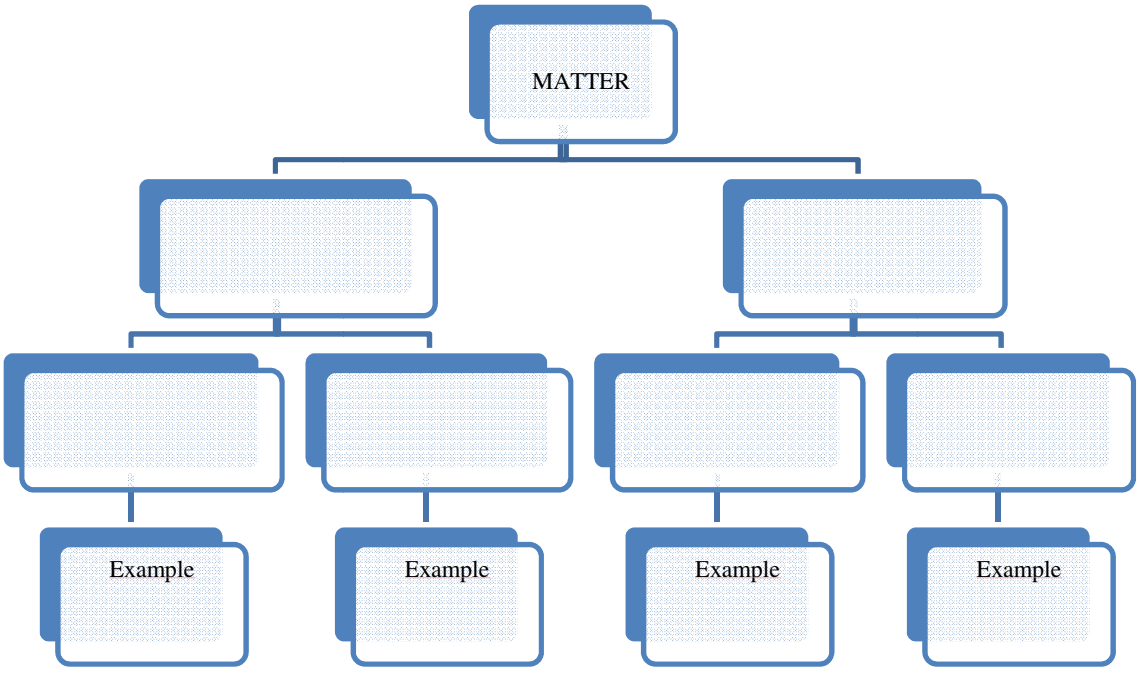
4. ***(Vocabulary activity)*** *Classify the following substances as homogeneous or heterogeneous mixtures.*

Air	*Sea water*	*Chocolate*	*Milk*	*Salad*	*Granite*	*Water with soil*

This is a lower-order thinking activity in which students have to classify different types or real substances. This activity shows the functionality of learning, because students work with real substances that they can find in their daily lives. Thus, we work on the knowledge and interaction with the physical world.

5. ***(Recap activity)*** *Complete the mind map with the words from the box:*

Pure substances, water, heterogeneous mixtures, air, compounds, mixtures, elements, gold, homogeneous mixtures, granite.



In this activity students have to demonstrate that they have understood the contents studied in this session, because they have to summarise them. This is another type of classifying activity which is very useful to acquire the concepts and vocabulary, because we are reviewing content and language in a different way.

SESSION 2 – LESSON PLAN

SESSION 2	TEACHER	STUDENTS	AC	TA	BC
Physical properties of heterogeneous mixtures. (10‘)	Asks questions and checks answers.	Answer questions in plenary.	A1	3 4	C1 C2 C5
Separation techniques of heterogeneous mixtures: magnetic separation. (15‘)	Explains separation techniques playing the videos. Checks answers.	Watch videos, listen to the explanations and do the activity individually.	A2	5 6	C1 C2
Separation techniques of heterogeneous mixtures: filtration. (15‘)	Explains separation techniques playing the videos. Checks answers.	Watch videos, listen to the explanations and do the activity individually.	A3	5 6	C1 C2
Activities. (15‘)	Solves problems and questions students might have. Checks answers.	Do activities and check them.	A4 A5	3 4 5 6	C1 C2 C3 C5
RESOURCES					
Text book, worksheet 2, computer, projector, speakers, videos: https://www.youtube.com/watch?v=7Wa443fZKHI https://www.youtube.com/watch?v=Q0s71cjCNWs					

SESSION 2 – WORKSHEET 2

1. ***Warm-up activity (speaking-listening):*** *how can you separate these heterogeneous mixtures?*

Water and sand

Image from fphoto.photoshelter.com

Salt and iron fillings

image from www.sciencebuddies.org

This is the first activity of the second session, so I have to be sure that they remember what we studied during the last session, recalling information. Besides, the activity is going to be done in plenary, and students must give their opinions and agree or disagree with others’ opinions. So we are working on social skills and citizenships at the same time that students develop their listening and speaking skills.

2. ***(Listening-reading-writing activity)*** *Watch the video and say if these sentences are true or false. Correct the false sentences.*
    a. *When two or more elements mix together they lose their individual properties.*
    b. *The magnet attracts iron fillings.*
    c. *The magnet attracts sulphur.*
    d. *A compound does not retain the properties of its constituent elements.*

This is a lower-order thinking activity in which students must understand the information (content and language) given in the video and answer some questions. They are fostering their language acquisition, because they have to listen, read and write.

3. ***(Listening-reading activity)*** *Watch the video and fill in the gaps with the words from the box:*

funnel	*water*	*filter paper*	*filtration*	*stand*	*filtrate*	*beaker*

Take a round _____ and fold it into halves to make a cone, as shown here. Fix the funnel on a _____. Put the filter paper in the _____. Pour the muddy _____ through the filter paper. Clear water will be collected in the _____ below the funnel. The clear water obtained is called the _____. This method of purifying water is called _____.

In this activity the students deal with the acquisition of specific vocabulary, and also the kind of expressions used to describe an experiment. So we are actively working on language whilst learning a separation technique.

4. ***(Vocabulary activity)*** *Label the following diagrams and write the name of each separation technique:*

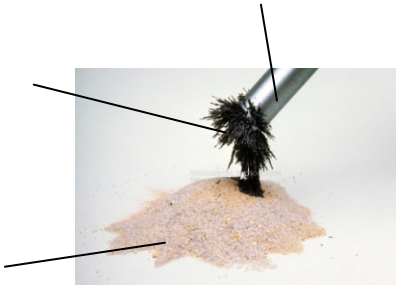


Image from fphoto.photoshelter.com

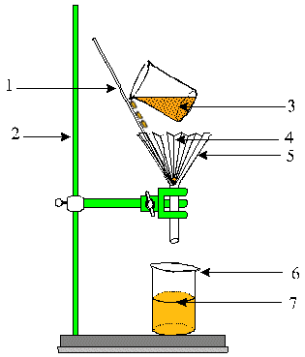


Image from phys.free.fr

With this activity the students develop the basic competence of data processing, because they have to work with diagrams, they have to recognise the separation techniques and the lab equipment used in each of them. They also reinforce their language acquisition, due to the specific vocabulary used in this activity.

5. ***(Recap activity)*** *Sort the cards into two piles, one that can be separated by filtration and one that cannot. (modified from www.tes.co.uk)*

 *Copper sulphate solution*	 *Muddy water*	 *Sand and iron filings*	 *Blue ink*
 *Sandy sea water*	 *Coca cola*	 *Chalky water*	 *Tea leaves and boiled water in a teapot*

This is a lower-order thinking activity, because students have to apply the information collected during the session to a similar situation. In this activity the students work in pairs, so they have to talk to each other respecting others ideas and reaching an agreement. Thus, they strengthen their listening, speaking and social skills.

SESSION 3 – LESSON PLAN

SESSION 3	TEACHER	STUDENTS	AC	TA	BC
Physical properties of homogeneous mixtures.(10‘)	Asks questions and checks answers.	Answer questions in plenary.	A1	3 4	C1 C2 C5
Separation techniques of homogeneous mixtures: crystallisation. (15‘)	Explains separation techniques playing the videos. Checks answers.	Watch videos, listen to the explanations and do the activity individually.	A2	5 6	C1 C2
Separation techniques of homogeneous mixtures: distillation. (15‘)	Explains separation techniques playing the videos. Checks answers.	Watch videos, listen to the explanations and do the activity individually.	A3	5 6	C1 C2
Activities. (15‘)	Solves problems and questions students might have.	Do activities and check them.	A4 A5	3 4 5 6	C1 C2 C5 C6
RESOURCES					
Text book, worksheet 3, computer, projector, speakers, videos: https://www.youtube.com/watch?v=WYcHkd0d7RQ https://www.youtube.com/watch?v=xxNfJLMNS4E					

SESSION 3 – WORKSHEET 3

1. ***Warm-up activity (speaking-listening):*** *how can you separate these homogeneous mixtures?*

Salt and water

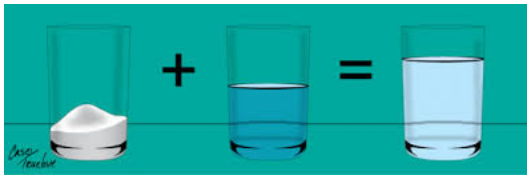


Image from plus.google.com

Wine

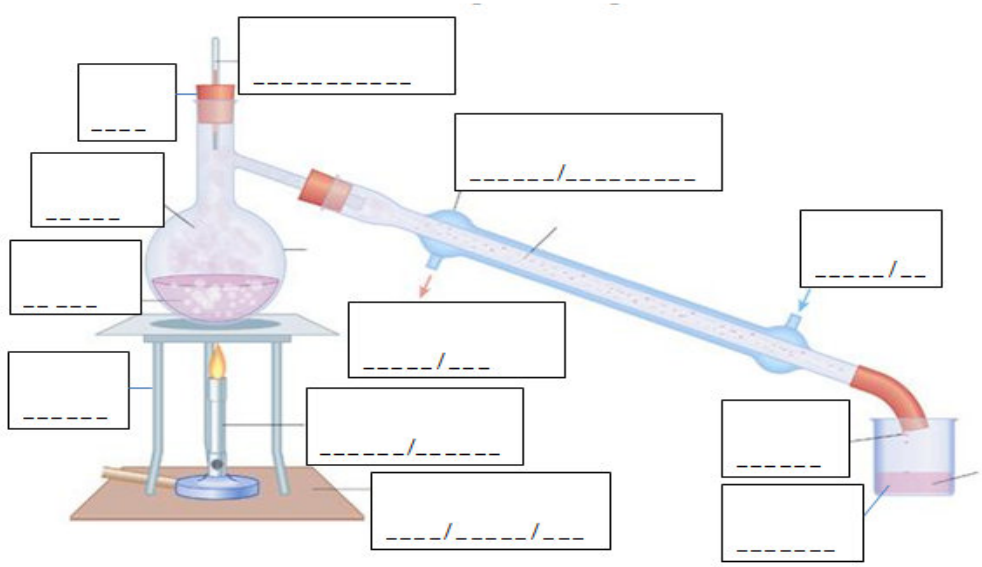
image from www.fitsugar.com

This activity is designed to recall information from previous sessions. It’s a plenary activity, which means that students must debate about the separation technique used so they have to speak and listen, respecting others’ ideas. Because of this, their social skills and citizenships are reinforced, as well as their oral skills.

2. ***(Listening-reading activity)*** *Watch the video and put these processes in the correct order.*
   a. *Keep adding copper sulphate until no more copper can be dissolved in the water.*
   b. *Fill a small container with boiling water.*
   c. *Now you have a saturated solution.*
   d. *Cover the container with a paper towel.*
   e. *Add copper sulphate to the water and stir until it dissolves.*
   f. *Select one of the crystals and tie the string around it.*
   g. *Pour the solution into a container.*

This activity is very useful to reinforce students' content and language acquisition, because they learn how to describe a process using a different type of activity.

3. ***(Listening activity)*** *Watch the video and label the diagram (modified from www.tes.co.uk)*



Water out	Liebig condenser	Tripod	Bunsen burner	Heat proof mat	Water
Bung	Flask	Water in	Ethanol	Thermometer	Beaker

With this type of activity students improve their listening skills. At the same time they strengthen specific vocabulary and contents.

4. ***(Recap activity)*** *Read the questions about crystallisation and choose the right answer.*

   a. *Do you need to wear gloves in this experiment? Yes/No*
   b. *Can you dissolve more copper sulphate in a saturated solution? Yes/No*
   c. *Do you need to pour all the solution in the container? Yes/No*
   d. *Are there any crystals in the container over a night? Yes/No*

5. ***(Reading-vocabulary activity)*** *Read the text and fill in the gaps with words from the box. (modified from www.tes.co.uk)*

Water	*Gas*	*Heated*	*Boiling Point*	*Beaker*
Distillation	*Ethanol*	*Liquid*	*Gas*	*Water*

Today we are separating a mixture of _____ and _____ in a process called _____.

The mixture is _____ up, and ethanol will boil first because it has a lower _____of 78°C.

The ethanol will turn into a _____ and evaporate.

As it evaporates, it leaves the flask through the side arm.

Cold ____ is passed through the Liebig condenser and condenses the ethanol from a _____ back into a _____.

The liquid ethanol drips down into the collection _____.

The heat energy is transferred from the ethanol gas to the water which is being pumped through the condenser.

Activities 4 and 5 are thought to reinforce specific vocabulary and concepts doing different types of tasks. Students strengthen the acquisition of language and content by repeating concepts and vocabulary.

SESSION 4 – LESSON PLAN

SESSION 4	TEACHER	STUDENTS	AC	TA	BC
Revise concepts. (5')	Explains procedure.	Read the instructions and listen to the explanations.	A1	5	C1 C2
Separating a mixture of iron filings, sand and salt. (35')	Solves problems and questions students might have.	Read the procedure and carry on the experiments in pairs.	A2	7	C1 C2 C3 C4 C5 C6
Lab report.(15')	Solves problems and questions students might have.	Write the lab report in pairs, answering the questions.	A3	6 8	C1 C2 C3 C4 C5 C6
RESOURCES					
Lab equipment, worksheet 4.					

SESSION 4 – WORKSHEET 4

LAB EXPERIMENT: SEPARATION OF IRON FILLINGS, SAND AND COPPER SULPHATE.

1. ***Warm-up activity (reading-listening).*** *Read the separation techniques theory.*

When you have to separate a mixture, the first thing you have to do is to look for differences in the physical properties of the substances.

- *Iron is magnetic and the other two aren't which means a magnet can be used to attract the iron fillings out of the mixture, leaving the copper sulphate and sand.*
- *Copper sulphate is water soluble, while sand is not. This means you can add water and stir. The copper sulphate will dissolve and the sand will not.*
- *These differences are used to separate the three materials.*

This is a higher-order thinking activity, because students have to analyse the problem and think about how to solve it. They are going to work in pairs, so with the given data they have to agree on the separation technique they are going to use. Again, social skills and citizenships are developed at the same time that oral skills also are.

2. (Speaking-listening activity). *Carry out the experiment.*

This is a practical activity in which students perform the separation of mixtures in the lab. Speaking and listening skills are involved in this higher-order thinking activity, in which they have to carry out the experiment and rethink if something goes wrong.

3. (Writing activity) *Report sheet. (modified from Science Matters 2012:89)*

TITLE OF EXPERIMENT: *write what you are doing.*
An experiment to separate...
EQUIPMENT AND CHEMICALS USED: *list all the equipment you use. Check spelling and use correct laboratory terms.*
PROCEDURE: *write step-by-step what you did. Be careful with the past tenses of the verbs!*
First *Second* *Next* *Finally*
RESULTS AND OBSERVATIONS: *explain what you have observed.*
Irons fillings can be separated using... *Using the method of ..... we can separate ..... from.....*
CONCLUSION: *what can you conclude from your experiments and results?*
From my results I can conclude that.... *This is because....*
LABELLED DIAGRAM OF APPARATUS:

Writing and speaking skills are developed in this activity. Students also work on social skills and citizenships.

SESSION 5 – LESSON PLAN

SESSION 5	TEACHER	STUDENTS	AC	TA	BC
Oral presentations. (40 min: 5 min each group)	Listens to the oral presentations and marks the assessment template.	Present their report/Listen to their peers' presentations.	A1	9	C1 C2 C3 C4
Feed-back. (10min)	Gives feed-back to each group.	Give/receive feed-back to/from their peers.	AE	9	C1 C2 C3 C4 C5
RESOURCES					
Teacher's assessment rubric, peer assessment rubric, computer, projector.					

SESSION 5 – ORAL PRESENTATIONS

In this session students must present in front of their peers their experimental results. With this type of activity students reinforce their oral skills. As they have to assess each other they can realise their own mistakes in their classmates' mistakes.

TEACHER'S ASSESSMENT RUBRIC

***Name of student being assessed**:*

CRITERIA	☹	😐	☺
Organisation	*Information is disorganised*	*Information is partially organised*	*Information is presented in an organised way*
Understandability	*Topic not explained or difficult to understand*	*Topic explained*	*Topic well explained and easy to understand*
Gammar	*Multiple grammar mistakes*	*Some grammar mistakes*	*No grammar mistakes*
Vocabulary	*Wrong vocabulary and multiple spelling mistakes*	*Apropriate terms and some spelling mistakes*	*Accurate terms and no spelling mistakes*
Speaking	*Any group member speak clearly*	*Some group members speak clearly*	*All group members speak clearly*

Comments:

PEER ASSESSMENT RUBRIC

***Name of students being assessed**:*

***Name of student completing the assessment**:*

CRITERIA	☹	😐	☺
Organisation: is the information well organised?			
Understandability: is the information easy to understand?			
Participation: do all group members participate equally?			
Speaking: do they speak clearly?			
Voice: is it easy to hear?			

The best part of this presentation was:

Things they can improve are:

SESSION 6 – LESSON PLAN

SESSION 6	TEACHER	STUDENTS	AC	TA	BC
Assessment test (55')	Monitors students	Do the test	Test	All of them	All of them
RESOURCES					
Assessment test					

SESSION 6 – ASSESSMENT TEST

The assessment test is a compilation of the different activities carried out during the last sessions. It includes lower-order thinking skills such as classify or identify and higher-order thinking skills such as evaluate or analyse.

1. *Are these sentences true or false? Correct the false ones:*
   a. *An element is made of only one type of atom.*
   b. *A mixture is made of different atoms that are chemically joined.*
   c. *A compound is made of different atoms that are not chemically joined.*
   d. *An atom is the smallest particle.*

2. *Write below each picture: "element, compound, homogeneous mixture or heterogeneous mixture":*

(Images from en.wikipedia.org)

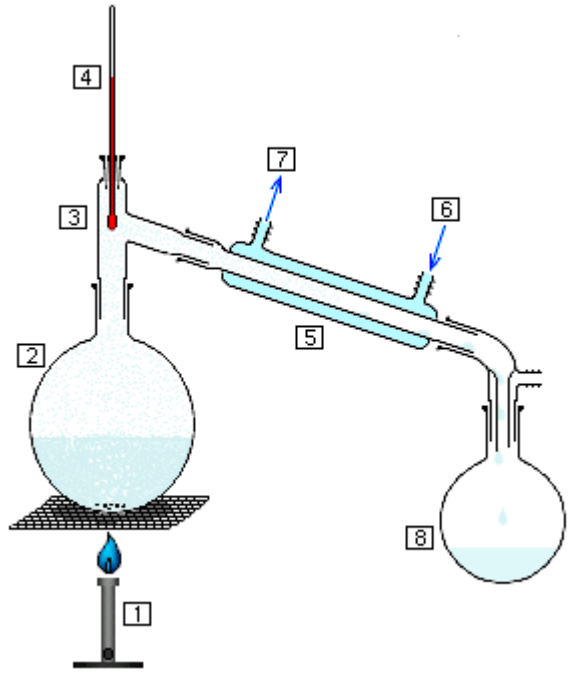
3. *Explain the differences between homogeneous and heterogeneous mixtures. Use the following words to help you: components, identify, distinguish, phases.*

4. *Complete these sentences with the words from the box: (Modified from http://www.softschools.com/quizzes/chemistry/mixtures_separation/quiz804.html)*

crystallisation	*filtration*	*magnet*	*distillation*

a. *If you want to separate iron fillings from sand you use a _____.*
b. *The process used to separate heterogeneous mixtures of solids and liquids is called _____.*
c. *_____ is a separation technique that uses the boiling points of various substances to separate mixtures.*
d. *The formation of pure solid particles of a substance from a solution is called _____.*

5. *Label the diagram with the words from the box:*



Thermometer
Steam
Bunsen burner
Condenser
Water out
Pure water
Water in
Ink

Image from simple.wikipedia.org

6. *Put these processes in the correct order:*
   a. *The steam cools and condenses to liquid water.*
   b. *The water begins to evaporate into steam.*
   c. *Water in the mixture reaches its boiling point.*
   d. *This process is called distillation, and is used to separate the different substances in a liquid.*
   e. *Clean water collects at the bottom of the condenser.*
   f. *The Bunsen burner is turned on and begins to heat the mixture of ink and water.*
   g. *Ink in the mixture does not boil, and remains in the flask.*

4. CONCLUSIONS.

There are many benefits to integrating content and learning.

To start with, students are motivated, because they feel they are developing their language skills through content, they are learning both a subject and a language.

They also improve their ability to communicate. Through CLIL, students develop an ability to understand and use spoken and written language in specific subjects. In fact, students become fluent and accurate, because they receive a lot of input and work effectively with it. They have to hear, read and understand the language, and use it to speak and write. This ability to communicate effectively prepares students for studying and working in countries where the language is used.

Another benefit of CLIL is that students develop cognitively because their brains have to work harder when they learn the content through a foreign language. They need to concentrate more to understand the subject concepts and they develop their thinking skills and their creativity. Besides, they link new content in the second language to previous content in their first language and they transfer the meaning they have from one language to another, especially when they relate the classroom activities to real life.

The different learning ways used in CLIL, adapted to the different learning styles of the students, reinforce the learning of both content and language because students can review content and language several times and in different ways.

Students also develop cultural awareness, as they have the opportunity to communicate with people from other cultures.

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