



FACULTAD DE EDUCACIÓN DE PALENCIA  
UNIVERSIDAD DE VALLADOLID

# DEVELOPING THINKING SKILLS THROUGH DIGITAL LEARNING

---

DESARROLLO DE HABILIDADES DEL PENSAMIENTO A TRAVÉS DE  
LA ALFABETIZACIÓN DIGITAL

TRABAJO FIN DE GRADO  
GRADO EN EDUCACIÓN PRIMARIA  
(MENCIÓN LENGUA EXTRANJERA, INGLÉS)

**AUTHOR:** Germelina Jato Rey

**TUTOR:** Carmen Alario Trigueros

Palencia, junio 2015



“Education is not the learning of facts,  
But the training of the mind to think.”

Albert Einstein

## **ABSTRACT**

One of the main objectives of this paper is to show how tablets help to develop thinking skills and how students use them to carry out their tasks in the classroom. It is important to know to use them as educative tool, but it is also important to create independent thinkers able to take advantage of the resources they have for the aim the must reach.

In addition, this research includes a description of a Natural Sciences unit implementation in a group of 5th year of Primary Education. It was designed with very clear aims and including the different levels of thinking skills; as well as bearing in mind that we deal with a second language development, because we talk about a bilingual setting.

## **KEY WORDS**

Thinking skills, apps, tablet, multiple intelligences, mind map, cooperative learning, Bloom's taxonomy, digital learning, new methodologies

## **RESUMEN**

El principal objetivo de este trabajo es mostrar cómo el uso de tablets en las aulas, apoya el desarrollo de las destrezas del pensamiento, así como mostrar el uso que el alumnado hace de ellas cuando se les plantea una actividad. Tenemos que saber hacer un uso correcto de estos dispositivos como herramienta educativa, pero también debemos crear alumnos autónomos capaces de sacar partido a los recursos ofertados con el fin de alcanzar los objetivos que se deben alcanzar.

Además, se incluye la descripción del desarrollo de una unidad de Ciencias Naturales aplicada en quinto de primaria, la cual está diseñada incluyendo los diferentes niveles de las habilidades del pensamiento y unos claros objetivos; además de tener en cuenta que trabajamos en un entorno bilingüe y que por lo tanto se debe atender el desarrollo de la segunda lengua.

## **PALABRAS CLAVE**

Habilidades del pensamiento, aplicaciones, Tablet, inteligencias múltiples, aprendizaje cooperativo, taxonomía de Bloom, alfabetización digital, nuevas metodologías

# INDEX

INTRODUCTION.....	5
General objectives and competences .....	6
JUSTIFICATION .....	9
Piaget’s stages.....	11
Vygotsky’s theory .....	11
What are thinking skills .....	12
Bloom’s taxonomy .....	12
Using MI in a thinking classroom.....	16
METHODOLOGY AND DESIGN .....	19
Schools programs regarding to thinking skills development .....	19
Design .....	21
Main features of the group selected.....	21
Strategies applied to develop thinking skills.....	22
Data extracted.....	23
FINAL CONCLUSIONS .....	27
APPENDICES .....	32
Appendix 1: Science unit.....	33
Appendix 2: resources .....	38

## **INTRODUCTION**

This study is based on how tablets help in the classroom, especially centring our attention on Science as well as thinking skills development. The school where the present study was implemented is associated to UNESCO (United Nations Educational, Scientific and Cultural Organization) and promotes innovation in education, so as they follow these aims, this course they decided to start this programme, but first of all they had to agree both families and scholar council, once they got their agreement the plan started. The school came to an agreement grounded on the premises of using apps for tablets as essential device to be used in the bilingual subjects, as they offer students a great chance to use the resources they need as FL speakers at the same time they improve their communicative strategies. In this way Science and Technological resources are provided using English language and references as main vehicle to develop knowledge. Furthermore, these devices allow students to read, write and interact among them and people from other parts of the world, providing the opportunity will open classrooms borders, what will widen our minds. Bearing in minds this basis, we will understand that what we learn in a different language can be applied in a natural way.

This research was made along my internship in the school. In September, the School started to use these devices in year 5th, becoming the unique school in Palencia using them as the only tool in the classroom as a didactic resource. It is important to highlight the role that ICTs (Information and Communication Technologies) have in students' lives and the chances they offer when we look them as an educative tool, for this reason and the aim to change ICTs methodology they included it as mandatory in this level.

Moreover, we must bear in mind the requirements it has: good internet connection, cabinets, charger points, an e-learning support where you can organise and share the materials and resources, applications and plenty other factors that help students learn.

In addition, this school promotes thinking skills development, so I decided to join both programs in a research with the aim of finding out how tablets allow students to access information, learn and develop these thinking abilities to solve the situations proposed by the teacher as well as how they help in autonomous and group work. It also aims at/means realizing what I need to solve my task and find out the necessary resources, which sometimes are handy, but sometimes they are difficult to reach, becoming a challenge they have to solve. It is here where the main role of tablets appears; allowing students to manage themselves to accomplish their tasks.

Therefore, when talking about the aim of this study, I talk about the necessity to implement a unit according to the methodology they follow at this level right now. It means to design a planning which contains all the premises we must follow when teaching in such an innovative classroom. It also requires to investigate how students find and organise the information; even, how they manage to solve the situations with the only help of a tablet.

The school where the implementation was carried out, already works with plans to develop thinking skills, so students are used to use mind maps, cooperative learning and other features this aim requires.

It is also important to point that the analysis was done during Science lessons, so it is important to reflect about how these devices also help to develop language skills. The core of language skills development is based on a communicative approach; especially the written and oral skills. This premise will help students to use what they learn, this is to give learning a practical meaning, and learning to apply their knowledge in real situations. In addition, teachers promote a safe environment, where students can communicate leaving fears apart, and helping students to accept bilingualism as natural. As expected, mistakes are present when we deal with language skills development in a foreign language, so we must accept them as something positive which helps us, as teachers, to check what is harder for students and reinforce this possible weakness. In this sense, tablets will help students to check what the mistake is, learn why and find out a better solution. Reading and writing skills are enhanced because teachers offer students different resources to develop contents they are working; students must follow some instructions and sometimes they have to ask, so they are developing both thinking skills and language skills. It is because English helps Science development when using this language and Science helps English when dealing with linguistic competence.

In addition, as they do not have a textbook it is important to say that they follow the law, in this case LOMCE. This law changed the week hours for Natural Sciences and English:

Natural Sciences: two hours and a half per week.

English: three hours per week.

### **General objectives and competences**

The aim of this work is to show the link between our studies and the practice. To have a clear idea about the main objectives proposed for Primary Education Degree in order to create successful teachers, we must read the pedagogical headlines exposed in “Artículo 16 de la Ley Orgánica 2/2006 de 3 de mayo, de Educación para impartir la etapa de Educación Primaria”. This article proposes a methodology in which students receive a holistic formation

in all the fields they need both to start Secondary Education and participate actively in society. To accomplish the previous idea, at the end of our degree we also need to have reached some competences, and this work is the evidence. These competences are:

- To have and demonstrate knowledge about education in general, and demonstrate it through applying psychological, sociological and pedagogical supporting theories for this stage, as well as understand how education is organised and carried out.
- To be able to apply all the knowledge acquired during our time at university. This competence would include several sub-competences: analysing, planning, carry out as well as reflecting about our own praxis.
- To be able to transmit information to any person, it means to have linguistic and communicative competence. It also involves: being able to encourage students to work in group - linking competences and contents to real life knowledge, including multiple intelligences to make all students learn.
- To be able to use ICTs to communicate, interact or share information. This is intimately linked to this work, because ICTs usage includes for teachers the ability to find reliable resources for students to learn.
- To value diversity as a way to achieve enrichment in our society and our classrooms, respecting individual learning rates and encourage living together as natural in our lives.

Linked to these previous competences, as part of the specific context where I developed my work, it is essential to include in a bilingual section all the competences associated an EFLT (English Foreign Language Teacher), and more specifically the competences associated to the Teaching Profile the Council of Europe requires to follow a CLIL methodology when teaching other subjects such as Science, Arts and Crafts, or PE (Physical Education). We must develop and implement the following competences identified by Bertaux, Coonan, Frigols and Mehisto (2010).

Area of competence	Competences
Integration	Merging content, language and learning skills into an integrated approach.
Implementation	Lesson planning. Translating plans into action. Fostering outcome attainment.
Second Language Acquisition (SLA)	Knowing second language attainment levels. Applying SLA knowledge in lesson preparation. Applying SLA Knowledge in the classroom.
Interculturality	Promoting cultural awareness & interculturality.
Learning environment management	Taking into account the affective side of learning. Making the CLIL learning process efficient.
Learner focus in the CLIL environment	Applying interactive methodology.
Learning skills focus in CLIL	Having knowledge and awareness of cognition and metacognition in the CLIL environment.
Learning assessment and evaluation in CLIL	Knowing about and applying assessment and evaluation procedures and tools.
Lifelong learning & innovative teaching and learning approaches.	Keeping up with new developments. Using ICT as a teaching resource.



## JUSTIFICATION

The selection of the topic came as a result of a personal experience during internship period. When the training period started, I found out that in year 5th they only work with tablets. It was a great challenge for a trainee teacher, not only because it only existed a law to follow and little number of proposals, but also because following this methodology made the community eliminate textbooks, they were not necessary anymore. This great challenge and this chance to learn meant to start from zero, finding online resources or creating my own. The school team started to work this way at the beginning of this school year, so it is a pilot program they are working in. Indeed, teachers are testing and deciding how it will continue after Primary Education.

In addition, the interest on this topic comes because, as a XXI Century teacher, you should command online resources as well as new techniques to develop both scientific knowledge and ICT competence.

Besides the school where I developed my internship required the command of both knowledge. Hence, I had a great chance to learn and work with ICTs as the only tool in the classroom.

As LOMCE exposes, it is very important to include ICTs in a general way in the whole educative system. It is because technologies play a very important role in students' lives. In addition, as this school promotes, we learn by doing and this exactly what tablets allow students to reach and do every time they use them. ICTs allow students to work autonomously and in groups, but also help students to customize learning processes according to the different individual rates. It also helps students to motivate and reinforce learnings. According to LOMCE in its preface, "ICTs will be essential to produce the change that education needs, introducing a change in methodologies and offering students knowledge without limits" (LOMCE, 2013). Moreover, ICTs offer the opportunity to learn in such a way that they can change their way to communicate or develop a task; all of it will help our pupils to realise that we live in a global world. But only that, ICTs will also help them to develop tasks in a different way, it will produce better results.

Far away from being a Bilingual Section, which uses tablets as a basic tool and resources at this level, the school develops several important programmes, which added an extra challenge to a Trainee teacher: the IRATI programme, as well as a Cooperative work program and CREA.

Combining the methodologies and skills that provide the different programs, we can observe how all of them help students to reach objectives not individually, but in groups. Each group

has the same objective, but all of the members need to help in order to arrive to the end of the task. This kind of learning requires some specific techniques to develop some of the tasks.

Cooperative learning started in this school ten years ago, so it has become a natural learning method for most of the students. It is introduced step by step along Primary Education. At the beginning of the year and in different subjects, they start to introduce techniques, to do it in a successful way, they design a calendar. These techniques must be used every day and they have to try not to repeat the techniques.

It is also important to point that school assumes the role of providing the possibility for people to be able to think, criticise, improve society and so on; for that reason it is very important to develop these abilities in students. Moreover it is also considered in our educational law.

In addition, thinking skills development are a methodology in this school; apart from all the programs they have, their educational activity is based on the four pillars exposed by Jacques Delors (1992), these pillars are:

- Learning to know is based on contents itself
- Learning to do: apply the contents they learn in order to obtain significant learning.
- Learning to live together: understand others, respect pluralism
- Learning to be: it means to learn to live in a society in an active way.

All of these premises become extremely necessary when we talk about thinking skills development. Thinking skills techniques pursue to involve children, the goal is to immerse children in a student centred methodology; through it, children reach the objectives and become independent, sociable and good citizens.

In addition, in this school context they include key competences as a learning way, understood as the application of knowledge; it means to make thinking visible. To get this goal they propose IRATI program which promotes skills to help students develop their cognitive abilities when dealing with information organisation.

## **THEORETICAL FOUNDATION**

### **Piaget's stages**

It is difficult to analyse a context without the pedagogical references we use to implement any new technique as a teacher, we were working with Primary Education students, actually year 5 students. These students are around ten years old. Throughout this age their cognitive development, according to Piaget's theory, is in the concrete operational stage. They are in a middle childhood period, during it they focus on an empirical thought, in addition they can establish categories and hierarchies. They have "the ability to reason about two or more aspects of a problem simultaneously" (Case, 1984, in Feldman, 2004). Besides, "a quality of reversibility that allows the child to recapitulate a line of reasoning from beginning to end and from end to beginning" (Richardson, 1998, in Feldman, 2004). All of it means that pupils can use rational thought to consider many variables and decide the most suitable one.

When we apply this theory to education, we must bear in mind the teacher's role and learning ways. Piaget stands up for constructivism what promotes autonomous and social learning, it means to give students a guidance but not a direct tuition; because children need to discover their environment. It is also important to note that this theory and doing method requires an active learning, because according to Delval, 1996 (in Villar, 2003) and Piaget knowledge is linked to the transformations students make in their near environment. It is also important to know that "According to Piaget (1958), assimilation and accommodation require an active learner, not a passive one, because problem-solving skills cannot be taught, they must be discovered", (McLeod, 2015).

Therefore, we must create tasks that students can solve by themselves, being active when they are learning. The teacher must guide the process and interfere as less as possible. In this context, they use a tablet what helps students to develop all these abilities; because this tool helps them to be autonomous and lets the teacher propose some resources to help them transform their knowledge in an active way. It means to use scaffolding as teaching method.

### **Vygotsky's theory**

This theory provides us with an essential tool for cognitive teachers:

Scaffolding supports a method to guide students to build up their own knowledge through teacher's guidance and social learning environment; in the school this study was carried out, students use cooperative learning. Furthermore, his ZPD theory (Zone of Proximal Development) is linked to the previous ideas exposed. This ZPD is understood as the medium step. It is the place between the capacity of autonomous learning and assisted learning. It is on this place where teachers must focus the attention and work as a mediator

with students. As we see, the teacher's role is a mediator between what a child can do and what he will be able to do. On Vygotsky's words "the distance between the 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" (Vygotsky, 1978, p86).

### **What are thinking skills**

According to Costa, 2001 thinking is a cognitive process which takes place in order to acquire a knowledge. Though currently the emphasis is on reasoning as the most important thinking technique. Consequently, we can say that thinking skills are those abilities involved in learning in an active way. Humans have different level of thinking (Costa, 2001, page 61) offering a catalogue thinking types:

- Cognitive: skills associated to essential and complex processes.
- Metacognition: skills associated with the learner's awareness of his or her own thinking.
- Epistemic cognition: skills associated to understanding the limits of knowing, as in particular subject matter and the nature of the problems that thinkers can address.
- Conation: the striving to think clearly, including personal disposition, which is the inclination to develop and use attitudes and practices over time.

So, after analysing how humans think, we, as teachers, must examine the materials we need and want to use in order to create a proper climate to develop students' thinking skills.

Thinking skills involve a wide range of capabilities which are necessary to accomplish objectives, but these skills will vary depending on our purpose as Cohen, in Costa 2001, page 58, exposes we find lower thinking skills and more complex thinking skills, which are derived from the first ones.

According to Cohen, the complex thinking skills are problem-solving, decision making, critical thinking and creative thinking. There isn't an only classification of thinking skills, but all of them agree on the necessity to move from the lower to the higher.

Nowadays, ICTs exist and help to develop these capabilities that people need to have for their lives.

### **Bloom's taxonomy**

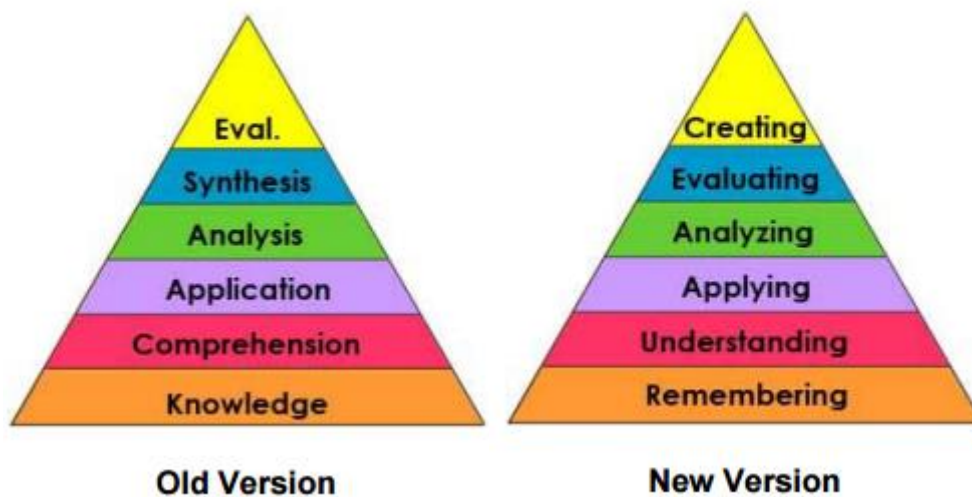
In order to develop thinking skills, we must design activities that help students to do so. It is important to take into account the levels of reasoning.

The steps were proposed by Benjamin Bloom. This taxonomy is divided into six levels of abstraction and according to Bloom (1956) "to create thinkers as opposed to students who

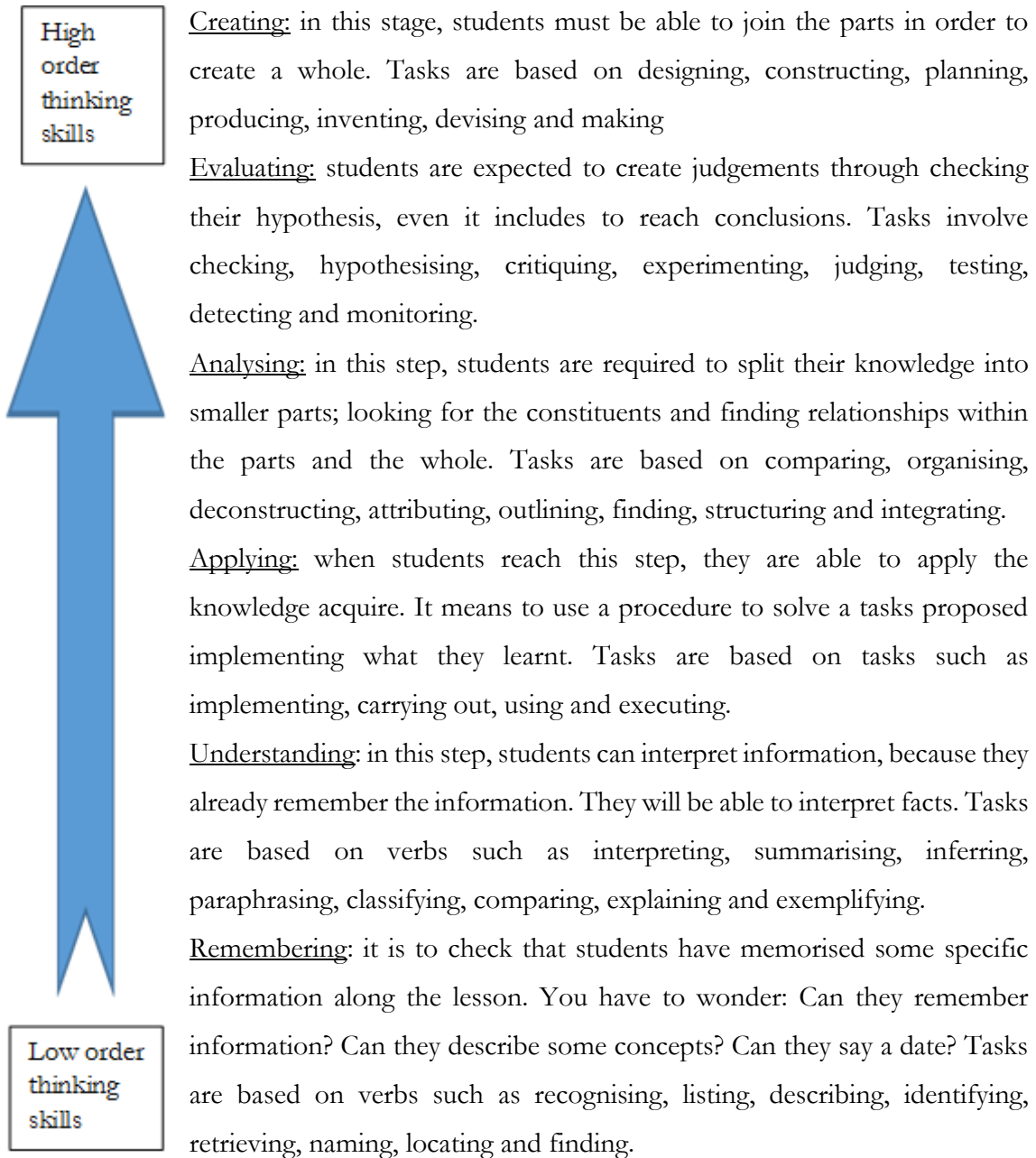
simply recall information, we must incorporate the higher levels into lesson plans and tests.” Therefore, as teachers, we must attempt students to progress along the steps proposed, what is linked to Vygotsky’s ZPD theory.

These previous theories connect their ideas because both of them promote moving students from their current abilities to achieve higher standards. This is the aim that thinking skills follow. This way, pupils will overtake the different steps the teacher proposes in order to adapt the methodology to get autonomous learners and thinkers. This is only possible if the teacher offer the guidance students need, applying constructivism, Vygotsky’s theories and thinking skills steps proposed by Bloom. When applying all together, we obtain a framework which allow teachers include the ideas from new methods and create the citizens that the current society demands. Because of the links they offer and the necessities students have we included these as basis for this work.

Levels in Bloom’s taxonomy are as follow (from lower to higher). Note that I am explaining the revised Bloom’s taxonomy (Forehead, 2011; Churches, 2009). This revision was done by Anderson & Krathwohl, as the image shows, it was done to adapt the taxonomy to the XXI century (Forehead, 2011; page 3).



*Figure 1. changes in Bloom's taxonomy. From Overbaugh*



But the aim of this study is to show how tablets and ICTs let children to become thinkers through using this device. Bloom's taxonomy is also useful when we want to include ICTs as learning way in the classroom. Nowadays, these kind of methodologies are quite extended, so when we use it in digital worlds, some of the tasks basis change:

# Bloom's Digital Taxonomy

Bloom's taxonomy	Bloom's modified taxonomy	Bloom's extended digital taxonomy	Functional Levels	Activities with digital tools	
		Sharing	Publicly sharing, publishing, broadcasting	Contributing to open social networks, publishing, broadcasting, networking	Higher Order Thinking Skills ↑
Evaluation	Creating	Creating	Designing, constructing, planning, producing, inventing, devising, making	Programming, filming, animating, blogging, video blogging, mixing, re-mixing, wiki-ing, videocasting, podcasting, directing	
Synthesis	Evaluating	Evaluating	Checking, hypothesising, critiquing, experimenting, judging, testing, detecting, monitoring	Blog commenting, reviewing, posting, moderating, collaborating, refactoring, testing	
Analysis	Analyzing	Conceptualizing	Comparing, organising, deconstructing, attributing, outlining, finding, structuring, integrating	Hacking, mashing, linking, validating, reverse engineering, cracking	
Application	Applying	Applying	Implementing, carrying out, using, executing	Running, loading, playing, operating, uploading, sharing with group, editing	
Comprehension	Understanding	Connecting	Interpreting, summarizing, inferring, paraphrasing, classifying, comparing, explaining, exemplifying	Boolean searches, advanced searches, blog journaling, tweeting, categorizing, tagging, commenting, annotating, subscribing	
Knowledge	Remembering	Doing	Recognizing, listing, describing, identifying, retrieving, naming, locating, finding	Bullet pointing, highlighting, bookmarking, group networking, shared bookmarking, searching	Lower Order Thinking Skills ↓

Figure 2: Bloom's digital taxonomy

However, we must bear in mind that following the premises exposed by Bloom in his taxonomy and using tablets in the classroom requires some apps (applications) pupils have to use in order to accomplish their activities.

One example we can use to decide which one is more suitable is the one that follows; though we have to think about our objectives and how the application can help. Applications are divided according to Bloom's taxonomy.



Figure 3. Apps we can use with tablets following the taxonomy

### Using MI in a thinking classroom

Multiple Intelligences theory was proposed by Gardner in 1983. He set eight different intelligences and learning styles we can find in our classrooms. It means to offer children more than learning method, because not all of us are good at the same thing. It means that all of us have a bit of each, but we have a prominent one.



Collins and Cook (2001) define intelligences as:

**Linguistic intelligence** allows individuals to communicate and make sense of the world through language. Typical professions include journalists, novelists and lawyers.

**Logical-mathematical intelligence** enables individuals to use and appreciate abstract relations. Typical professions include scientists, accountants and philosophers.

**Musical intelligence** allows people to create, communicate, and understand meanings made out of sound. Typical professions include composers, conductors and singers.

**Spatial intelligence** makes it possible for people to perceive visual or spatial information, to transform this information, and to recreate visual images from memory. Typical professions include architects, sculptors and mechanics.

**Bodily-kinesthetic intelligence** allows individuals to use all or part of the body to create products or solve problems. Typical professions include athletes, dancers and actors.

**Intrapersonal intelligence** helps individuals to distinguish among their own feelings, to build accurate mental models of themselves, and to draw on these models to make decisions about their lives. Typical professions include therapists and certain kinds of artists and religious leaders.

**Interpersonal intelligence** enables individuals to recognize and make distinctions about others' feelings and intentions. Typical professions include teachers, politicians and salespeople.

**Naturalist intelligence** allows people to distinguish among, classify, and use features of the environment. Typical professions include farmers, gardeners and geologists.

Figure 4: MI definition

These intelligences have a profile and some kinds of activities linked to each. According to M Loon, in Budden, 2005, the following chart shows the types of intelligences and suggested kinds of activities.

Learner type	Is good at	Learns best by	Activities
<b>Linguistic</b>	Reading, writing and stories	Saying, hearing and seeing words	Memory games Trivia quizzes Stories.
<b>Logical / mathematical</b>	Solving puzzles, exploring patterns, reasoning and logic	Asking questions, categorising and working with patterns	Puzzles Problem solving.
<b>Visual / Spatial</b>	Drawing, building, arts and crafts	Visualising, using the mind's eye	Flashcards Colours Pictures Drawing Project work.
<b>Musical</b>	Singing, listening to music and playing instruments	Using rhythm, with music on	Using songs Chants Drilling.

<b>Bodily Kinaesthetic</b>	/ Moving around, touching things and body language	Moving, touching and doing	TPR activities Action songs Running dictations Miming Realia.
<b>Interpersonal</b>	Mixing with others, leading groups, understanding others and mediating	Co-operating, working in groups and sharing	Mingle activities Group work Debates Discussions.
<b>Intrapersonal</b>	Working alone and pursuing own interests	Working alone	Working individually on personalised projects
<b>Naturalistic</b>	Nature	Working outside and observing nature	Environmental projects.

## **METHODOLOGY AND DESIGN**

To choose a proper methodology to reach my objectives, first of all I had to know the features that build up the school I am in, and that has been the first task I tackled. I was in a school which is joined to UNESCO because it promotes innovative programmes in order to educate students in a really successful way including all the fields from real life.

Students are also used to work in groups, because they develop cooperative learning as methodology day to day. So I will be able to see how they organise their ideas when they are working in groups and how they manage their interpersonal intelligence (M.I.).

In order to get some results I designed a Science unit. As I said, I had to start from zero, finding resources and thinking compatible activities both for tablets, the aims of this work and thinking skills development.

With all the ideas developed above, we built up reasons to figure out aims to improve society with well-educated citizens, this school promotes this kind of theories, applying them in their lessons, to reach the objective of innovation in education.

### **Schools programs regarding to thinking skills development**

IRATI: This is to develop thinking skills in students, especially those related to information management and organisation. The main objective of this program is to make thinking visible; for this aim they use Mind Maps, and according to Tony Buzan, its creator, “the Mind Map is a dynamic and exciting tool to help all thinking and planning become a smarter and faster activity. The creation of a Mind Map is a revolutionary way to tap into the infinite resources in your brain, to make appropriate decisions and to understand your feelings.” (Buzan, 2006).

In addition, they also develop a cooperative learning programs for social thinking and the different kinds of personal intelligences.

Cooperative learning is a teaching-learning strategy which allow to mix students with different learning rates; this allows students to be responsible of their own learning, being aware of their improvements. Also makes students responsible of other partners in order to be successful as a group. It is a learner centred methodology. It can be applied in all levels if you use the proper techniques or giving the proper time. Of course, it provides communication situations, though teachers have to pay attention, because sometimes students do not use the second language. This strategy provides social situations, in which pupils learn how to behave; it improves thinking skills development, enhances self-esteem and a big set of more advantages. All this is possible thanks to different techniques you can apply in most of the subjects.

CREA: it is a specific program to develop the ability to use lateral thought. It is developed from foundation stages to 6th former. This program is very useful to develop thinkers in such a way they become creative for problem solution, other strategies are based on leadership or strategies to be cooperative. So it is intimately linked to thinking skills, M.I. and key competences students must develop.

Bilingual section: this section promotes thinking skills because students are always asked to get in touch with the world that surrounds them. In addition, it is important to point that they normally use KWL chart (what I Know, what I Want to know, what I Learnt). This strategy helps students to manage their own learning and realise about their processes and rates.

In addition, this program helps students not only to communicate in a foreign language but also to develop cooperative learning. Teachers from this section use a lot this technique. Also, using mistakes as an opportunity to introduce a correction; this helps students to see their strengths and weakness, forcing them to reinforcement and thinking next time. Even, this communicative situations help students to use their competences and their MI, because they are immerse in natural situation in which they must use a second language.

With all those premises in mind I designed a Science Unit to be implemented in English language, as part of the bilingual program, at the same time, following the British planning pattern we set these **objectives** to find out the features that compose a thinking and digital learning environment:

- To find out how children are able to work in an autonomous way using a tablet.
- To find out how children solve their doubts using a tablet as their only learning resource.
- To analyse how children cover their learning necessities using different applications according to the task they must accomplish.
- To analyse how schools programs, regarding to thinking skills, are included using technologies.
- To analyse how children behave and motivate when they learn with tablets.
- To use applications which allow to develop thinking skills and how children discover how to use them.
- To check how tablets allow teachers to introduce new methodologies.

- To expose the requirements, physical and virtual, when using tablets (Wi-Fi, cabinets, an e-learning support ...)
- To use different resources and take advantage of possibilities they offer when learning.
- To check how children solve the problems proposed by teachers with the resources give.
- To analyse how teachers develop a suitable syllabus for the requirements of the program.
- To analyse how a Tablet as only tool and rules usage, avoids distractions and promotes greater participation and thinking skills usage.

### **Design**

In order to extract relevant conclusions on how tablets help students reach objectives and develop thinking skills, I designed a Science unit. According to the year plan and the law, the content I had to work had to do with energy. (See the lesson plan in annex 1)

To design a proper unit to reach my goals I had to take into account the theories proposed in this work. The most important one was Bloom's taxonomy; these categories helped me when I had to decide what kind of task I should develop.

Besides, it was really important because it showed me the step I was working and the requirements of the tasks. As well, it helped me to decide which tablet application fitted better for my objective; even it helped me to decide if it was better to use paper rather than tablets. To find the resources or design the materials I also had to look to the previous theories. If I did not have them in mind, I would fail, because cognitive development is very important when we talk about learning; skipping steps can drive to failure for both teacher and students.

### **Main features of the group selected**

The groups I selected to carry out this study were two classrooms of 5<sup>th</sup> year of Primary Education. They have similar learning rates and cognitive development. Both of the classrooms are used to work in the same way.

One of the group is noisier than the other one, it provokes a small delay when they stop in the classroom.

Both groups are used to work in groups, though sometimes this methodology seems to be new for them and do not behave as the teacher expects. Because of this, sometimes you must use some strategies to avoid wasting time.

In both classrooms and most of the students show interest for the topic. It is something near them and they are also worry about these problems.

Their curiosity leads them to investigate and expose their personal experiences. It encourages them to participate actively both in big group and small groups. Not all of them desire to participate. Shyness, sometimes, makes them feel insecure and they do not feel confident to participate. But, we as teachers have to encourage them and help them. For this reason, the thinking time is very important.

Their English level is very good. They have been in contact with English since they started school, so they are used to interact and use English in a natural way. They have some structures interiorised, so they use them. In addition, they know structures to ask for the information they need. Before asking for an explanation in Spanish or permission to express themselves in this language, they do their best to express in English; however, if they need to express in Spanish they always ask for permission.

It is easy to find evidences to identify who has help outside the school and who cannot afford it. The first ones are more confident and have more fluency, the second ones participate less. Moreover, some students are new. Some of them came from another bilingual school but others do not. The second ones understand but do not participate a lot. The first ones have small problems with methodology and adapting to cooperative learning. Most of them sometimes are lost when using tablets, if it is a new application or an old one when you introduce more of the functions they have. Normally, their partner, they are sitting in twos and join in fours when using cooperative, can help to solve their problems; sometimes, the teacher asks for help to those ones who have more advantage and have finished their task. In general, both groups have similar characteristics. Between the two classrooms there are eleven working groups.

#### **Strategies applied to develop thinking skills**

- Provide time: it is very important to allow a time to let student think. This way they will order their ideas and their discourse.
- Follow Bloom's taxonomy: having a clear verb for task's instructions helped me when I had to plan the aim of each activity.
- Control classroom rules, especially those ones related to tablets usage: it was very important when students had to go around the classroom or use them for a task.
- Cooperative learning: to help students use intra and interpersonal intelligence and be aware of the necessity to be immersed in society, some activities needed this methodology.

- Use applications which allow students to reach the end of the task according to Bloom's digital taxonomy, but also decide when it is the time to use their notebooks.
- Mix groups for different activities in order to develop personal intelligences, it helped them to work with different partners from habitual ones.
- Answer students' questions with another one, to make them reflect about their questions and find an answer.

### **Data extracted**

As I said, in each lesson there were different activities based on different thinking methods; for this reason I am going to divide the results per lessons:

- **First lesson:** they had to recall the knowledge they already had. As the topic had to do with energy, we started by a brainstorming about the sources of energy and the advantages and disadvantages. We use the energy resources game which offers information relating to renewable and non-renewable sources; also examples, advantages and disadvantages and effects they cause. While they were reading, they had to take notes to share them in their groups later. Before sharing in groups we reflected about what kind of information we found; it will help them to order their ideas in the following task. To organise all the information they knew and the new pieces they obtained, students could choose among doing a mind map, a double entrance chart and question-answer. They worked with Comprehension and Analysis level in Bloom's taxonomy.
  - **Results after first lesson:** Before they received instructions, they wanted to make a mind map; it is because they have a lot of information and they do not know what to do with it. Only two groups decided to make a chart, for the only reason to change the technique and include more information. These groups realised that their work will be more complete joining all the information from all the members in the group, so in turns they exposed their information, but it is done only by one group. The groups that choose to do a mind map say that it is easier to do. Even they explained me that when you study it is easier to find the information, it is more organised and you find the information in a quick look. I did not want them to use the tablet to make it because they are slower when they use Mindomo application, therefore they used their notebooks to make the mind map.

- **Second lesson:** throughout this lesson they have to reflect about fossil fuel depletion. I introduced the term and I asked students about what the fossil fuels are. They gave some ideas about this and after that they took their tablets. They had a text (see annex 2, resource 2) to open in Pics Art. Their instructions were to underline in green positive aspects and in red the negative ones. After that, children had to centre their attention in evaluating and making hypothesis. Later, we saw an image where they could see the years left for each fossil fuel (see annex 2, resource 3). They were given them time to think and reflect on the consequences, which we would share later.
  - **Results after second lesson:** deducing information is quite difficult for them yet, especially when they do not have a big source of information. However, they are concerned about environmental problems and apply their knowledge, experiences and practises to find the problem and the solution. Even, they are up to date with the newest inventions and apply them as solutions.
- **Third lesson:** they were working with acid rain. They had to read The Tale of Lucy Lake (see annex 2, resource 4); it offers information about the topic but as tale. This format is close to children's' interests. In addition, it has pictures what helps them to understand better what they read. They are working with inferring from Bloom's taxonomy. After that, they had to read scientific information about acid rain (see annex 2, resource 4.2) where they could enquire into this phenomena deeper.
  - **Results after third lesson:** once again they knew some about the topic. Even, in one of the classrooms they created a debate about some of the solutions they offer (applying level). Some questions acted as guide to find out the relevant information they had to extract. I asked them to create a document in Drive, but as we wanted to include photos, pupils suggested to use WPS, because it allows them to do so and to answer the questions, because it is not the only resource they are using. I observed how some of them do not understand the task but others are quick and effective. They are using their mind before asking the teacher. When time is over, they open a document where they find scientific information about acid rain; but I realised that some of them are not able to join both sources of information, because the second one works with scientific information; though it is adapted for children. Anyway the found a way to solve: separating the



information and answering the same questions separately. It shows how children are concerned about their learning processes and how they manage to accomplish the tasks given.

- **Fourth lesson:** they are going to learn about radioactivity. In order to learn the consequences, I worked with real news adapted to their language level. These news dealt with health problems (see annex 2, resource 6.1), food problems (see annex 2, resource 6.2) and people and homes problems (see annex 2, resource 6.3). I chose Fukushima as example of



*Figure 5. students working in groups after extracting information*

consequences caused by radioactivity. To have an idea of what radioactivity is, they read a comic where Tiki the penguin (see annex 2, resource 5) gave information about this topic. It helped them to understand how radioactivity is produced and understand problems and consequences for subsequent activity. First of all, I assigned an area to each group; they read the piece of news individually (see annex 2, resource 6); after that, they joined in groups and they wrote in their post-it papers reasons or consequences, depending on the assignment. Later, original groups were split and joined in groups according to the category (food, health or people) and decided which were problems or consequences; once they had the decision and I had checked they were correct, they could write on their notebooks their chart. After that, the groups were mixed with one person from each category; they exposed their results and completed the whole chart.

- **Results after fourth lesson:** they are now used to work with more than one source of information, what helped them to understand radioactivity. I also noticed that they could work more autonomously and ask their partners before the teacher. Sometimes, they tried to ask before think, but I reminded them to think previously, sometime later I used to go back and ask for an answer. This answer was normally showed in a correct result for the task.

- **Fifth lesson:** this lesson focus on the greenhouse effect. They watched a video (see annex 2, resource 7) individually in their tablets and had to find some information about the points proposed: what it is, what the effects are and what they can do.
  - **Results after fifth lesson:** I could see how they realise that they must go back and forward when they are watching a video; even, how they first try to solve their problem before asking, mainly I received questions about scientific terms they did not know. In some cases, I could see how images and animations help them to understand and give a more powerful description about the topic they work with.

- **Sixth lesson:** it is the moment to create a poster to protest about the environmental problems we are creating. They are in creating, the highest order thinking skill from Bloom's taxonomy. I wanted to use Glogster, but it required a purchase, so we used Pics Art. To discover and recall the knowledge they had



*Figure 6. students working on their posters*

- to apply, we watched a sustainability video (see annex 2, resource 8).
  - **Results after sixth lesson:** some students were centred in the artistic and creative part of the task, others were centred on the content and not in the format. They chose photos they could understand and reflect the problem they were exposing. It means that they understood the problem, but according to MI theory, we see that they use different intelligences when dealing with a task. Doing this task means to use all thinking skills, because first of all they needed to recall their knowledge, understand the information they have, apply what they learnt, analyse the resources, spaces and app in use, evaluate what resources they use and fit best for their task and last, they must create a poster where they show their new knowledge.

## FINAL CONCLUSIONS

After applying the unit I designed I could extract the following points as the most important when we deal with thinking skills and tablets usage as only tool in the classroom.

✚ For students I found the following conclusions:

- ✓ As they do not have where to look or read when their tablet is closed, they try to think more and recall the information they already know.
- ✓ It is very important to provide time to think, otherwise students say whatever it comes to their mind. In addition, they do not have an organised discourse.
- ✓ Some students, whose this is their first year in this school, showed a lower performance when they had to answer or extract information. It shows how thinking skills are a long process to develop.
- ✓ They prefer to use mind maps as the way to organise information because they always do them, in addition, they consider them as a very good tool to organise their thoughts. If you want to use the tablets and Mindomo to make Mind Maps, you must know that it takes longer time, but they can add images and more accurate information, with the risk to copy directly from information source.
- ✓ Tablets allow students to go back if they make a mistake; recover the previous solutions they were offering. It means they are conscious about their learning process.
- ✓ Students have the information handy and up to date, it helps them to learn the newest; even they can go back and forward. It changes students' learning disposition, because this methodology helps to respect individual rates.
- ✓ When a task is proposed and they need to use an application, they suggest the one that fits the best; they give tips and explain why they chose. Again, it shows they analyse their possibilities and are able to reason.
- ✓ Children analyse their resources and decide the one that fits the best; even when they need to find a meaning or other aspects surged from the learning process.
- ✓ Students' motivation is higher when they work with a tablet. Sometimes, we give resources which seem to be game, but nevertheless they are working with the contents proposed.
- ✓ Tablets allow to connect real world with contents, producing interest and significance to learning.

- ✓ Tablets appreciate the diversity of students; because they provide flexibility for learning rates; it allow slower students to develop their thinking skills according to their abilities.
  - ✓ Using tablets in a classroom requires to organise the classroom and acquire a huge amount of physical and virtual requirements. It is not easy to develop a program like this. Hence, we can say that tablets promote autonomous learning processes.
  - ✓ Tablets rules usage must be rehearsed and learnt at the beginning of the year. They must be clear and teachers must control them perfectly and should not change in every lesson; otherwise students seem to be lost and discipline is lost.
  - ✓ Though they try to develop cooperative learning, when we use a tablet as only tool, I could discover that many times they have to work individually; group work would be higher developed if they worked shared documents or similar. School programs are included using applications or just managing without this device.
- ✚ For teachers
- ✓ Tablets help them to have a good record of students' achievements and progress, because you can see the thinking processes they are working with.
  - ✓ Designing a syllabus for digital environments, requires to command ICT's and having a resource bank; as well as an e-learning support where they can post the resources needed for lessons development.
  - ✓ Depending on the law and not on a textbook allow teachers to develop the capabilities exposed by the law. As well as providing some freedom to organise the teaching process.
  - ✓ Allow teachers to implement new pedagogical tendencies so as to immerse students in our current living way.
  - ✓ Answer students' questions with another question helps them to remind the thinking process before asking and do not take the easy way.
- ✚ Regarding to linguistic development:
- ✓ Pupils learn to listen, read and write; what improves and enriches their subsequent oral expression.
  - ✓ As students use a second language, they develop their communicative competence in a natural way when expressing hypothesis, results or problems.
  - ✓ Children can manage more and newer information sources, because they are able to use English, which is considered Science Language.

- ✓ Sometimes, we need to use really difficult terms and children with lower language level are left behind.

So, we can conclude that developing thinking skills and multiple intelligences is not an easy task either for student or for teachers. As teachers, it is extremely important to include ICTs and new methodologies in order to help students develop thinking, this way we will students to grow in all fields life demands. Paraphrasing Carol McGuinness (1999), ICTs enhance children's understanding and power up their reasoning, in the sense, children can explore the world and their near environment; what empowers their abilities to establish associations, deducing abilities and plenty others which will helps the both developing their thinking skills to solve any task they come across in real life; deep inside it also means to acquire learning to learn competence. Besides, ICTs provide some situations for cooperative learning. All together builds up some part of new methodologies to create the citizens which current society demands.

## REFERENCES

- Armstrong, T. (2009). *Multiple Intelligences in the Classroom, 3rd Edition*. ASCD.
- Bertaux , P., Coonan, C. M., Frigols-Martín, M., & Mehisto, P. (2010). *Underpinning CLIL*. Retrieved June 18th, 2015, from ccn-clil: <http://www.ccn-clil.eu/index.php?name=Content&nodeIDX=3857>
- Bloom, B. (1956). *Taxonomy of Educational Objectives. Vol. 1: Cognitive Domain*. New York: McKay.
- Budden, J. (2005). *Multiple intelligences*. Retrieved June 18th, 2015, from TeachingEnglish | British Council | BBC: <http://www.teachingenglish.org.uk/article/multiple-intelligences>
- Buzan, T. (2006). *Mind Mapping*. Pearson Education.
- Churches, A. (2009). *Bloom's digital taxonomy*. Retrieved June 18th, 2015, from <http://edorigami.wikispaces.com/file/view/bloom%27s%20Digital%20taxonomy%20v3.01.pdf/65720266/bloom%27s%20Digital%20taxonomy%20v3.01.pdf>
- Collins, J. C. (2001). *Understanding Learning: Influences and Outcomes*. London: SAGE.
- Costa, A. L. (2001). *Developing Minds: A resource book for teaching thinking* (Third Edition ed.). Alexandria: Association for Supervision and Curriculum Development.
- Delors, J. (1992). *Learning: the treasure within. Report to UNESCO of the international comission on Education for the XXI Century*. UNESCO Publishing.
- Feldman, D. H. (2004, Decemeber). Piaget's stages: the unfinished symphony of cognitive development. *New Ideas in Psychology*, 22(3), 175-231. Retrieved June 18th, 2015, from <http://www.sciencedirect.com/science/article/pii/S0732118X04000327>
- Forehand, M. (2010). Bloom's taxonomy. *Emerging perspectives on learning, teaching, and technology*, 41-47. Retrieved June 18th, 2015, from [http://www.kjakalski.d41teachers.org/enews/think\\_tank\\_articles/articles/Blooms\\_Taxonomy.pdf](http://www.kjakalski.d41teachers.org/enews/think_tank_articles/articles/Blooms_Taxonomy.pdf)

- Fuller, U. J.-L. (2007). Developing a computer science-specific learning taxonomy. *ACM SIGCSE Bulletin. ITiCSE 2007 Student Bursary of the British Computer Society and the grant of FGU No 21/2007 (Faculty of Management Science and Informatics, University of Zilina)*, 39(4), 152-170. Retrieved June 18th, 2015, from <http://core.ac.uk/download/pdf/13677.pdf>
- LOMCE. Ley Orgánica 8/2013, de 9 de diciembre, para la mejora de la calidad educativa. (2013, December 10). *BOE*(295), 97858-97921.
- McGuinness, C. (1999). From thinking skills to thinking classrooms. *Research brief*(115).
- McLeod, S. (2009). *Jean Piaget*. Retrieved June 18th, 2015, from Simply Psychology: <http://www.simplypsychology.org/piaget.html>
- Overbaugh, R. C. (n.d.). Bloom's taxonomy. *Old Dominion University*. Retrieved June 18th, 2015, from
- PMB Publications, (. (2007). *Thinking skills and personal capabilities for key stages 1 & 2*. Retrieved June 18th, 2015, from Norther Ireland Curriculum: [http://www.nicurriculum.org.uk/docs/skills\\_and\\_capabilities/training/TSPC-Guidance-KS12.pdf](http://www.nicurriculum.org.uk/docs/skills_and_capabilities/training/TSPC-Guidance-KS12.pdf)
- Salle, L. (2014/2015). *Plan General Anual (PGA)*. Palencia.
- Villar, F. (2003). Capítulo 5: El enfoque constructivista de Piaget. *Proyecto docente Psicología Evolutiva y Psicología de la Educación*. Barcelona. Retrieved June 18th, 2015, from [http://www.ub.edu/dppsed/fvillar/principal/pdf/proyecto/cap\\_05\\_piaget.pdf](http://www.ub.edu/dppsed/fvillar/principal/pdf/proyecto/cap_05_piaget.pdf)
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. USA: Harvard University Press.
- What Is Cooperative Learning, and What Does It Do?: Groupwork Advice for Teachers*. (n.d.). Retrieved June 18th, 2015, from <https://www.teachervision.com/cooperative-learning/teaching-methods/48448.html>

## **APPENDICES**

Appendix 1. Science unit

Appendix 2: resources



## Appendix 1: Science unit

About the unit		
<p>This unit fits in the year plan for 5<sup>th</sup> grade of Primary Education. It has to do with sustainable development and to expose opinions for it. We must develop these kind of attitudes on children, because some resources contaminate and other will finish in short time.</p> <p>LOMCE exposes the following:</p> <p>Contents: “el desarrollo energético, sostenible y equitativo. Uso responsable de la de energía.”</p> <p>Assessment criteria: “valorar la importancia de hacer un uso responsable de las de energía en el planeta.”</p> <p>Estándares de aprendizaje evaluables: 6.1 Identifica y explica los beneficios y riesgos relacionados con la utilización de la energía: agotamiento, lluvia ácida, radiactividad, efecto invernadero, exponiendo posibles actuaciones para un desarrollo sostenible.</p> <p>6.2 Argumenta sobre las acciones necesarias para el desarrollo energético sostenible y equitativo.</p> <p>This unit will help student to think about the future we can have. This way, they will think about possible actuaciones they can do today in order to preserve our planet.</p>		
Prior learning	Language used in the unit	Important resources
Students need to know the different sources of energy that exist and we use in our lives.	<p>I consider...</p> <p>I think...</p> <p>It is important...</p>	<p>Online resources</p> <p>Tablets</p> <p>Digital resources</p>

<b>Expectations</b>	
At the end of the unit all the children must	<p>Realise about the effects energy consumption has for Earth.</p> <p>Expose basic actuations we can carry out to conserve energy.</p> <p>Be able to work in groups.</p>
At the end of the unit most of the children should	<p>Identify the problem exposed around them.</p> <p>Describe the problems, giving proper information.</p> <p>Participate in groups actively.</p>
At the end of the unit some of the children could	<p>Establish relationships between energy sources advantages or disadvantages and effects.</p> <p>Explain the effects or energy consumption using Scientific words.</p> <p>Lead the group.</p>

Lesson overview				
Lesson	Learning goals	Learning outcomes	Main activity	Assessment criteria
1	<ul style="list-style-type: none"> <li>-To distinguish between advantages and disadvantages.</li> <li>-To recall the information they already know.</li> <li>-To extract information from a game.</li> </ul>	<ul style="list-style-type: none"> <li>-To organise the information according to the criteria.</li> <li>-To follow tablets usage rules.</li> <li>-To build up a mind map with the required information.</li> </ul>	<p>Create a mind map, chart or essay about energy sources.</p> <p>They have to include the advantages and disadvantages.</p>	<ul style="list-style-type: none"> <li>-To be able to include the information extracted in the proper way.</li> <li>-To work in groups avoiding arguments.</li> <li>-To follow a method when working.</li> <li>-To use rules as an organisation way to avoid misbehaviour.</li> </ul>
2	<ul style="list-style-type: none"> <li>-To reflect about life problems if fuels run out.</li> <li>-To realise about the problems we, as humans, are creating.</li> <li>-To collect information about fossil fuels.</li> </ul>	<ul style="list-style-type: none"> <li>-To expose tips we can develop to avoid using fossil fuels.</li> <li>-To identify which fossil fuels contaminates the less.</li> <li>-To expose what fossil fuels are.</li> </ul>	<p>Fossil fuel depletion: showing them the years left, we reflect and think on the problems depletion can create.</p>	<ul style="list-style-type: none"> <li>-To define fossil fuels importance in our lives.</li> <li>-To propose solutions to this problems.</li> <li>-To apply knowledge.</li> <li>-To follow a method when working.</li> <li>-To use rules as an organisation way to avoid misbehaviour.</li> </ul>

3	<ul style="list-style-type: none"> <li>-To reflect about the damage it causes.</li> <li>-To realise about the problems it causes in our environment.</li> <li>-To learn how we can avoid acid rain.</li> <li>-To identify the main sources of this kind of rain.</li> </ul>	<ul style="list-style-type: none"> <li>-To expose some tips we can do in our daily life.</li> <li>-To describe the problems acid rain causes.</li> <li>-To realise about the importance of using renewable energy.</li> </ul>	<p>Acid rain: after reading a tale, they answer some questions. After that, they can read scientific information in order to include to the previous data.</p>	<ul style="list-style-type: none"> <li>-To join information from different sources.</li> <li>-To extract information from a tale.</li> <li>-To reflect about the problems it causes.</li> <li>-To follow a method when working.</li> <li>-To use rules as an organisation way to avoid misbehaviour.</li> </ul>
4	<ul style="list-style-type: none"> <li>-To extract information from real materials.</li> <li>-To read scientific information and join to real stories.</li> <li>-To distinguish and decide where the information fits according to the premises.</li> </ul>	<ul style="list-style-type: none"> <li>-To join information from all categories.</li> <li>-To distinguish whether reason or consequence and place them correctly in the chart.</li> <li>-To work in groups in an organised way to fulfil the task.</li> <li>-To consider more than one reason for the same field.</li> </ul>	<p>Radioactivity: working with adapted news about the Fukushima accident, extract information about people &amp; homes, food and health consequences and reasons.</p> <p>Previously, they read about radioactivity in Tiki the Penguin.</p>	<ul style="list-style-type: none"> <li>-To show they understand the most relevant information.</li> <li>-To deduce general information from specific one.</li> <li>-To follow a method when working.</li> <li>-To use rules as an organisation way to avoid misbehaviour.</li> </ul>

5	<ul style="list-style-type: none"> <li>-To extract information from a video.</li> <li>-To reflect on our actuations and give tips to change.</li> <li>-To extract reasons and consequences.</li> </ul>	<ul style="list-style-type: none"> <li>-To be able to answer the questions with accurate information.</li> <li>-To realise about the problems we create.</li> <li>-To expose the reasons and consequences for us and Earth.</li> </ul>	<p>Greenhouse effect: watch a video and extract the information teacher requires. The guidance is proposed with some questions they must answer.</p>	<ul style="list-style-type: none"> <li>-To expose what the effect is.</li> <li>-To attribute some reasons and consequences.</li> <li>-To give tips to avoid this effect.</li> <li>To realise this is effect is necessary, but in high levels.</li> <li>-To follow a method when working.</li> <li>-To use rules as an organisation way to avoid misbehaviour.</li> </ul>
6	<ul style="list-style-type: none"> <li>-To include in a poster the knowledge acquired.</li> <li>-To use Internet as a resource bank, but deciding what information is reliable or not.</li> </ul>	<ul style="list-style-type: none"> <li>-To value responsible use of energy.</li> <li>-To show that they understood the effects.</li> <li>-To use ICTs as a tool to communicate and create.</li> <li>-To apply knowledge.</li> <li>-To collect trustful information and/or images.</li> </ul>	<p>Poster: apply all the knowledge acquired. They will use Pics Art application to create a poster as if they could protest.</p>	<ul style="list-style-type: none"> <li>-To create a poster including all the effects they learnt.</li> <li>-To include general tips for sustainability.</li> <li>-To realise about the importance of our actuations.</li> <li>-To create green awareness.</li> <li>-To realise about the actuations we can develop.</li> </ul>

## Appendix 2: resources

Resource 1									
<a href="#">Energy game</a>	<p>They read about the energy sources and solved the short quiz. While reading they took some notes about the kinds of energy they were reading about.</p> <p>Once they had their notes, they shared their ideas in their groups.</p> <p>After that, they did a mind map in groups.</p>								
Resource 2									
<p style="text-align: center;"><b>Fossil fuel resources depletion</b></p> <p>Some of these fuels produce greenhouse gases. Oil is important for all our industries and lives. Coal, oil and natural gas will finish in some years. We use all of these fuels in our houses, cars or industries. They help a lot in our lives. We must think before we use them. All of them produce pollutant substances, it damages Earth. They are very easy to extract. They are cheap, so sometimes, we abuse from them. All of them are limited, so we must make a rationale use. We cannot produce coal, oil or natural gas in a factory. We are damaging the Earth seriously. Fossil fuels (coal, oil and natural gas) take very long time to produce, because they are the remains of living things from millions of years ago. The use of fossil fuels is unsustainable. The Earth cannot produce so much fossil fuels as we need.</p>	<p>This text was used to learn about the problem of depletion in lesson 2. They opened in Pics Art and underlined in red the problems and in green the advantages fossil fuels have.</p> <p>After that, we thought and reflected about depletion and the problems.</p> <p>For homework they wrote about how life would be without fossil fuels. Even, they proposed solutions.</p>								
Resource 3									
<p><b>Estimated length of time left for fossil fuels</b></p> <table border="1"> <thead> <tr> <th>Fossil fuel</th> <th>Time left</th> </tr> </thead> <tbody> <tr> <td>Oil</td> <td>50 years</td> </tr> <tr> <td>Natural gas</td> <td>70 years</td> </tr> <tr> <td>Coal</td> <td>250 years</td> </tr> </tbody> </table>	Fossil fuel	Time left	Oil	50 years	Natural gas	70 years	Coal	250 years	<p>I used this picture to reflect about the problems we could have in some years and make them realise that they will be affected if they do not act now.</p>
Fossil fuel	Time left								
Oil	50 years								
Natural gas	70 years								
Coal	250 years								
Resource 4									
<p>4.1 <a href="#">The tale of Lucy Lake</a></p> <p>4.2 <a href="#">Acid rain scientific information</a></p>	<p>With this tale about acid rain, they answered some general questions with information they could extract from both text and images.</p>								

	After that, they read scientific information which they had to join in the same document.
Resource 5	
<a href="#">Tiki the penguin. Information about radioactivity</a>	To have scientific information about radioactivity they read this comic. They read and all together discuss about it.
Resource 6	
6.1 <a href="#">Fukushima health effects</a> (original text) 6.2 <a href="#">Fukushima food effects</a> (original text) 6.3 <a href="#">Fukushima people and homes</a> (original text)	These resources were adapted to students' level. In groups, they had to extract whether reasons or consequences. Later, as experts groups I mixed all categories to complete a chart about radioactivity problems.
Resource 7	
<a href="#">Greenhouse effect video</a>	With this information in a different format, they had to answer some questions centred in the most useful and important information concerning to this effect.
Resource 8	
<a href="#">Sustainability video</a>	All together in the class will watch the video in order to learn what sustainability is, this way they will have information to create their posters.