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CLIL in Science Classrooms: a Case Study in 1st and 2nd Course of Secondary Education in Asturias

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ABSTRACT

The implementation of bilingual programs following a CLIL approach is one of the educational trends nowadays. It implies the active participation of the school in the development of CLIL bilingual program, giving teachers the chance to meet the characteristics of this educational approach. In the case of Asturias, the introduction of bilingualism in schools is recent, as a consequence, there are few studies about it. Also, science education is immersed in a renewal of its pedagogy which seeks to enhance students' attitudes towards science in the context of STEM (Science, Technology, Engineering and Mathematics) education, among other objectives.

In this research we have examined a case study, the Auseva Marista School, in which a bilingual program is being developed in the first two years of Secondary education, in the areas of Science, Arts and Technology. Our objective was to analyze this bilingualism implementation, from a multiple perspective: to know the attitudes of students towards English learning and towards science in general, to find out if there was a gender gap in the students' beliefs towards scientific issues and to describe the perspective of the teachers involved in the bilingual program. To achieve our aims we have followed a quantitative approach and used questionnaires for both students and teachers.

We have found that students taking part in the bilingual program hold really positive attitudes towards English learning, which is valued as a powerful way of communication and expression. They are also more positive about science topics than the European average, and the sample of study has not shown any significant gender influence. It is worth mentioning that teachers participating in the bilingual program of this school invest great efforts on the development of the CLIL learning environment, from proper training activities to the implementation of methodological innovations that imply project group work and student-centered learning strategies. Our results have indicated that CLIL can enhance students' motivation towards learning, especially about English learning, and it also promotes positive beliefs and opinions about science. In that way, we can conclude that CLIL is a beneficial learning environment that boosts students' interest.

Keywords: Content and Language Integrated Learning (CLIL); Bilingualism; Science education; Science, Technology, Engineering and Technology (STEM); Language learning; Motivation; Attitudes; Interest

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Is life

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1. INTRODUCTION

Bilingualism and multilingualism have been present all throughout History, although at this point they are now cutting-edge practices in educational contexts (Baker, 2001). In this way, the adoption of Content and Language Integrated Learning pedagogies (*CLIL* henceforth) (Coyle, 2007) in the current teaching and learning practices needs to be analyzed and studied in order to stress good practices' guidelines and obtain an in-depth knowledge of what is being done at the moment.

An approximation to the context in which CLIL is now being developed is made in the first place, as although it is an emergent educational trend, it has no general guidelines. Consequently, CLIL implementation is very heterogeneous, as it is being adopted differently in each country, region, community or even school. That is the reason why it is absolutely important to describe its actual implementation in different cases of study, so that we can have an overview of the current teaching-learning practices which are being carried out. To that aim we will consider the research done in that field in different parts of the world, with emphasis on European authors and experiences, so as to understand in depth what is being done in that field. We have especially considered the paramount theoretical contributions made by two authors of reference: Coyle, who established "The Four C's of CLIL" (2007), Marsh (2000, 2002a, 2002b) and the work done by Coyle, Hood and Marsh (2010), who have been pioneer authors and researchers on CLIL implementation in Europe. Also, we have considered the work done by other renowned authors in CLIL, such as Dalton-Puffer (2007), Lasagabaster (2011), Lasagabaster and Sierra (2009, 2010), San Isidro and Calvo (2012) or Nikula, Dalton-Puffer and Llinares (2013). These authors have developed the CLIL approach in the latest years from a dynamic and critical perspective, being the essentials of any research done in European CLIL. Also, the indications made by the European authorities for languages education will be taken into account as well (European Commission, 2014a). The European Union considers languages knowledge as one key element for the future European citizenry and as a result, is undertaking great efforts on CLIL development across the European landscape. The national report "Bilingual education project Spain evaluation report: findings of the independent evaluation of the bilingual education project" (Dobson, Pérez-Murillo, & Johnstone, 2010) acts as a reference of CLIL practices assessment in our country.

Secondly, it is described how bilingualism and CLIL have been introduced in Asturias, considering the techniques and strategies, as well as the law specifications for bilingual programs in that region and the studies related. At the moment there are no official reports about Asturias' CLIL implementation, so the analysis of these

bilingual programs comes from research done by students in the context of different master's dissertations from the local university (Coalla, 2014; Medina, 2014; Menéndez, 2013; Montes, 2014; Roces, 2013; Sánchez, 2012; Tuya, 2014). That is a clear indicator of the recent implementation of CLIL in Asturias, as although bilingualism has been on the Asturian panorama for six years now and the number of educational centers taking part on bilingual programs is growing every year, there haven't been several studies on that topic yet.

An overview of the interrelation between learning and motivation is done afterwards, as this Master's Dissertation (MD) is set in the area of triangular confluence between CLIL, motivation and science education (**Figure 1**). It is necessary then to review the most important theories about learning motivation. Considering the practical reflections done by Sir Ken Robinson and Lou Aronica (2009) or Gardner (2001) among other important authors of reference, for this section we have taken Dörnyei as the key author. His studies with Ushioda (2009), with Ryan (2013) or by himself (2000, 2001, 2003, 2005, 2009) set the scene for the understanding of language learning motivation nowadays. In fact, he was the one to develop the now widely accepted theory of the "Second language (L2) motivational self system" (**Figure 2**), which describes the different dimensions and factors taking part in students' motivation for language learning in the L2 classroom.

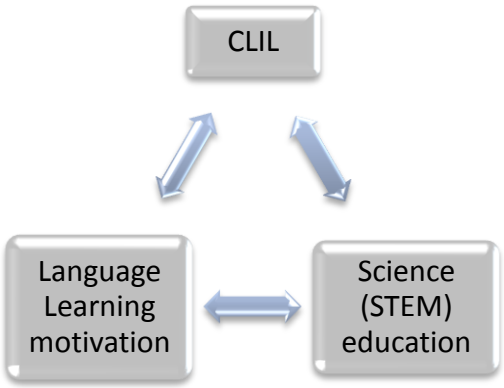

Figure 1. Mater's Dissertation triad of influence. This MD is developed in the area of confluence determined by the triad formed by CLIL, language learning motivation and science (STEM) education.

Research about CLIL and students' motivation in Spain is leaded by David Lasagabaster and Juan Manuel Sierra (2010), whose work on language learning and students' motivation is of paramount importance for studying the Spanish CLIL context.

The science education renewal has been a worldwide trend in the latest years, as the societal needs for people well-trained in the scientific and technological areas.

Also, the need for promoting scientific literacy in the school has set the scene for its pedagogical re-formulation. In that way, the "Science education in Europe: critical reflections" (Osborne & Dillon, 2008) is a report of reference, as well as the European Commission report from 2007, "Science education now: a renewed pedagogy for the future of Europe". We have considered authors such as Bybee (2010, 2013), Jarman & McClune (2007), Jorde & Dillon (2012), Osborne & Dillon (2008), Sjøberg & Schreiner (2007, 2008, 2010, 2012) and Zimmerman (2012), as the theoretical references for this MD. They are American and European authors which are leading the research done in that field, aiming to actively transform science education practices.

Also, an analysis of the implementation of CLIL and bilingualism in STEM areas will be done, with emphasis on the experiences and studies in Secondary Education. Although the analysis of motivation in CLIL STEM contexts is an almost unexplored research area in general terms, we have specifically taken Ardeo-Aresti (2015), Evnitskaya (2011, 2012), Grandinetti, Langellotti, & Ting (2013) and Marsh, Ting & Ying (2009) as authors of reference to this section, as they are pioneers to research the dynamics of science learning in CLIL environments.

1.1. Justification of the research questions and problem

The introduction of bilingualism in Asturias dates back to 1996, when this region took part in the agreement between the Ministry of Education and the British Council as well as Aragón, Baleares, Cantabria, Castilla-La Mancha, Castilla y León, Ceuta, Extremadura, Madrid, Murcia, Navarra y Melilla. At present times there are many schools taking part in that program, such as the CP San Mateo in Salamanca or two schools which are still participating in that program in Asturias: the Public School "La Atalaía" (Gijón), and the Public School of Ventanielles (Oviedo).

In parallel, Asturias started to implement bilingual sections in schools in 2004 in the "IES Sánchez Lastra" (Mieres). As the experience developed in that high school was a pilot, in 2009 the Asturian Department of Education published the call for taking part in bilingual programs in the academic year 2009/2010 (BOPA 121), following the European guidelines about language learning in a global context. Since then, many schools and high schools are taking part in the Asturiras' bilingual program, fostering language learning with great efforts done by teachers (Sánchez, 2012).

In that context, CLIL has been successfully adopted by many teachers in Asturias' schools as an autonomous decision. Research done in that field has been focused on primary education levels (Montes, 2014; Sánchez, 2012) or in the use or

design of curricular materials (Coalla, 2014; Medina, 2014; Menéndez, 2013; Roces, 2013; Tuya, 2014). As a consequence of that recent implementation, more research is needed in order to evaluate the current practices in CLIL contexts in Asturias.

1.2. Brief analysis of the state-of-the-art

It is absolutely necessary to reach a good level of communication in a second language. We live in a hyper-connected world, which is constantly changing and moving towards an uncertain future. But what is sure in that scenario is that education has changed towards new approaches and practices, looking for the development of people of the XXI century. The youth has to acquire abilities, skills and competences that will be necessary for their integral development and professional profile in their lives. In this kaleidoscopic context, bilingualism has emerged as a basic pilar in education nowadays (Marsh, 2002). The characteristics of CLIL lead to the promotion of active language communication in content classes, with different language competences favorably affected, such as receptive skills, morphology, vocabulary, creativity, risk-taking, fluency, quantity or affective and emotive outcomes, as shown by Dalton-Puffer (2007).

Motivation is one psychological construct which leads our lives and actions, our decisions and dreams. This is of special importance when talking about learning, education and young people. As stated by Sir Ken Robinson and Lou Aronica:

> I believe passionately that we are all born with tremendous natural capacities, and that we lose touch with many of them as we spend more time in the world. Ironically, one of the main reasons this happens is education. The result is that too many people never connect with their true talents and therefore don't know what they're really capable of achieving (2009, pp.11-12).

That call for focusing on what learners believe they can do and make them feel comfortable, secure and motivated is a key factor which should be always present for stakeholders and in particular, for teachers.

The study of the effects of CLIL on attitudes, motivation and beliefs seems to be a very interesting field of study (Papaja, 2012). Consequently, research should focus on it, so as to examine the factors CLIL is having an effect on, especially when referring to students' personal motivation towards learning. The study of Lasagaster and Sierra (2009) showed that students enrolled in CLIL classes held more positive attitudes towards English as a foreign language, whilst Van de Craen, Mondt, Allain and Gao (2007) put emphasis on noticing that CLIL contexts can impact students' attitudes in that students are highly motivated to learn languages and not just English language, as they express positive attitudes and do not loss their identity,

but they feel bilingualism is a core value for them and also a factor that enhances their self-esteem and their future intentions to learn languages.

However, as the implementation of CLIL hinges on different features, such as the characteristics and profile of the learner, the teacher's personality and teaching beliefs, the class-group, the support given from the administration, etc. (Lasagabaster, 2011), the studies on motivation in CLIL contexts have to be more comprehensive (Dörnyei, 2001; Dörnyei & Ushioda, 2009).

On the other hand, when it comes to particular content subjects, very little research has been done in relation to the implications of CLIL contexts on content-subjects. There are examples of research in the field of science education in CLIL contexts as the one examined by Jäppinen in Finland (2005), or the one done by Evnitskaya (2012) in the Spanish context, but they tend to be focused on cognition or language implications (Escobar & Sánchez, 2009; Fuentes, 2013; Santo-Tomás, 2011). However, there is an emerging trend towards the study of CLIL environments for science teaching and learning processes, focusing on different processes and dimensions of CLIL science learning environments (Aguilar & Muñoz, 2014; Bartika, Maertenb, Tudorc & Valcked, 2010; Gabillon & Ailincai, 2013; Grandinetti, Langellotti & Ting, 2013). Accordingly, the perceptions of pupils towards science have been studied by Yassin, Marsh, Tek and Ying in the Malaysian context (2009), with positive findings. Nevertheless, more research has to be done in that field in the European context in general and in the Spanish in particular.

These different parts settle the theoretical background of the study, which considers the different levels involved in a multifactorial context of a CLIL science learning environment in the European context, in the convergence of language learning motivation, science education and CLIL (**Figure 1**).

1.3. Aims

As the realization of a Master's Dissertation is a genuine work of research which has to be of use for the scientific community of interest and for the educational field related, we believe that more research has to be done about the teaching-learning strategies in the classrooms, especially in the area of STEM education (Fairweather, 2008; Jorde & Dillon, 2012; Osborne & Dillon, 2008).

The **primary objective** of this MD research is to:

- ***Analyze the implementation of CLIL in a particular case study in the context of science education, as an example of the current practices in secondary schools.***

Furthermore, in relation to this research, a series of particular objectives arise:

A. Know the attitudes, beliefs and motivations of the students taking part in the bilingual program.

B. Contrast the interest in science topics of the students taking part in a CLIL science education program with the European children.

C. Analyze the possible gender differences in motivation and attitudes for learning and science topics.

D. Describe the implementation of a bilingual program from the perspective of the teachers involved.

The educational stage selected is Compulsory Secondary Education (*CSE* henceforth), and the school that we have chosen for this case study is the "Auseva Marista School" (*Auseva* henceforth). We have valued this school as a particularly interesting one as it has bilingualism implemented in Science in 1st and 2nd course of CSE, and in Technology in 2nd of CSE. Consequently, bilingualism affects the initial scientific subjects of the science curriculum in this school, placed in an urban area in the centre of Asturias.

The **research questions** of this study are:

1. Does the implementation of CLIL foster students' interest for English learning?

2. Do students enrolled in the CLIL program hold positive attitudes towards science, in relation to the European context?

3. Does a remarkable gender difference exist on motivation and attitudes towards learning and science topics?

4. Are teachers involved in the bilingual program highly committed to the bilingual program in terms of effort, time spent and dedication?

1.4. Methodology

This MD is a research proposal which pursuits to describe the implementation of bilingualism and CLIL in a school of interest. To research this case study, and following the guidelines proposed by McMillan, Schumacher and Baides (2005), we have thought that a quantitative approach would give a better description of our topic of interest, as this study have strong theoretical and quantitative approaches.

Auseva is the school selected for this study. Its specific implementation of a successful bilingual program made it a suitable school for a research of the characteristics needed in the context of this MD. It is an urban school placed at the

heart of Oviedo, where children can study Early Childhood, Primary, Secondary and Baccalaureate Education. At the moment, the Bilingual program of the Auseva is implemented in Primary Education and on the two first courses of CSE. The academic year this research is conducted (2015-2016) it is the first time for the school that students of 1st CSE have taken part in the whole Primary bilingual program. As a consequence, these students have experienced CLIL since the previous educational stage, so that they feel comfortable using English as a second language in content subjects. At the moment, CLIL is established for 1st CSE Science and Arts, and 2nd CSE Science and Technology. Then, Science is the content subject which is developing CLIL in all stages of the bilingual program of the Auseva.

Also, Auseva has implemented what they called "the methodological change": the introduction of innovator pedagogies in all areas, in response to the educational demands of societies of the XXI century. It includes cooperative work and collaborative projects for both students and teachers, in each term of the academic year. This kind of educational approach suits CLIL specifications (Coyle, Hood & Marsh, 2010) and put students at the centre of the learning process. The fact that Auseva is carrying out this methodological innovation in CLIL areas adds a factor of interest to the study of pupils' beliefs, interest and motivation towards language learning and science education.

The information needed for this study have been gathered by means of questionnaires and by the revision of the school documents of interest for the aims of this research. The designed questionnaire for students (**Appendix 1**) has two well-differentiated parts: one related to the linguistic profile, attitudes and motivation towards languages learning, and another one focused on beliefs and attitudes towards science. Also, a questionnaire for gathering information about teachers taking part on the bilingual program has been used (**Appendix 2**).

The part related to language learning attitudes is adapted from the questionnaires which were validated and used in a previous research (Gené, 2010):

- Questionnaire for students taking part in the bilingual section: language profile, attitudes, beliefs and motivations.
- Questionnaire for content subject teachers, English as Second Language (ESL) teachers, and the European Section Program Coordinator at the school.

For estimating the interest in science topics of these students an adapted version of the questionnaire used in the ROSE project (Sjøberg, & Schreiner, 2010) have been used, incorporating items related to the Spanish curriculum (Linares, 2011).

This part of the questionnaire gives a general look into students' motivation towards STEM content in CLIL learning environments.

Also, given the aims and hypothesis of this study, informal interviews with the teachers involved in the bilingual section have been done, so that the information about students' attitudes and motivation have been complemented with data from the content and language teachers of the school. This qualitative approach complements the quantitative data and contributes to the depth of the analysis and the comprehension of the results.

This MD is structured in different sections: firstly the theoretical framework, or rationale, is set. It contains a review of the main aspects related to the triad in which this MD is developed –CLIL, students' learning and motivation, science education renewal-. Then, the methodology section describes the context of the school and the design of the questionnaires, as well as the statistical analysis that have been carried out. The results and analysis are placed in the next part, where the data obtain from the questionnaires and the informal interviews with the teachers taking part in the bilingual program of Auseva are examined. After presenting data, the next section is focused on the discussion of the results, after which the conclusions are drawn and future research lines and limitations are established. The references used alongside this MD are located at the end of this study, as well as the appendices developed in the research framework of this study.

2. LITERATURE REVIEW

"I believe that education is a process of living and not a preparation for future living."

John Dewey (1897, p.78)

2.1. CLIL educational context

Education is a key area for all societies. In fact, it has always been one of the most important aspects, as it provides citizens with the knowledge and specialization needed for their lives. When it comes to language learning, for the past thirty-forty years there have been a great number of changes and challenges. The introduction of content-based methods in language learning was due to the concept that language is acquired in a more natural way when it is attached to a particular subject, so that learning becomes meaningful. At this moment, the more common practice is the integration of content and language in learning, a multi-faceted educational approach which is encompassed under the umbrella of CLIL. This term was

incorporated in 1994 in the European context (Marsh, Maljers & Hartiala, 2001) and can be defined as: "an educational approach in which various language-supportive methodologies are used which lead to a dual-focused form of instruction where attention is given both to the language and the content" (Coyle, Hood & Marsh, 2010, p.3).

The adoption of CLIL within the European context was linked to another big change affecting all areas and levels, which was the introduction of key competences (Commission of the European Communities, 2005). The introduction of life skills and competences into the European *curricula* leads to the adoption of an international and global perspective of education: it was necessary to teach students how to learn now and in the future, as the world is now an interconnected environment under constant changes, emerging challenges and opportunities. It was then necessary to re-think education and to provide students with the background knowledge needed in the context of the XXI century. That situation coincided in time with the definitive adoption of information and communication technologies (ICTs), as well as with the change of paradigm from teacher-centered to student-centered education, with the emphasis put on learning rather than on the teaching process, and considering the importance of the social and cultural context in which education is taking place (Land, Hannafin & Oliver, 2012).

As language education was one of the main topics of interest in that context of competences, it was essential for European citizens to be able to communicate effectively in different languages, so that mobility, employment, culture and knowledge could be transferred and spread through the European Union and through the globe in general. In fact, CLIL was considered a suitable strategy for addressing the European challenge (Marsh, 2002a). In that context, languages are understood as a communication vehicle for action, which imbricates knowledge in all its dimensions and circumstances. The educational response to this educational rethinking was CLIL, which aims to develop bilingualism or multilingualism when learning about a particular subject. The change introduced by CLIL goes beyond the conception of the *just do it in English* (Lasagabaster & Sierra, 2010), as CLIL is a multi-dimensional approach which stimulates the integral development of students (Marsh, 2002b) and considers multi-ability groups of work, interculturality, integration of the ICTs' 2.0 and 3.0 tools, the diversity of students, teacher training specific needs, design and elaboration of materials, continuous, authentic and formative assessment, etc. (San Isidro & Calvo, 2012).

CLIL methodologies are based on four essential principles or the "4 C's" of CLIL (Coyle, Hood & Marsh, 2010):

- *Content*: the aspects of comprehension and understanding related to the specific content of the subject or area of knowledge.
- *Communication*: related to the use of the second language (L2) used in the CLIL environment while learning about the subject content. In Europe, it takes into consideration the Common European Framework of Reference for Languages and its four language skills (speaking, listening, reading and writing) (Verhelst, Van Avermaet, Takala, Figueras, & North, 2009).
- *Cognition*: refers to the development of the learning skills necessary in the learning process to construct the knowledge about content, language, thinking skills and competences, with great emphasis on the scaffolding needed in that processes.
- *Culture*: the interconnection with the socio-cultural factors surrounding the learning process in general, and the raising of the self and others' cultural dimension awareness, as well as the development of the sense of plurilingual community in an intercultural environment.

This educational approach has received great political support in the European Union (EU), so that the aim of the White Paper on Education and Training that all EU citizens should master two community languages in addition to their mother tongue would be achieved. CLIL adoption in Europe is uneven, as its implementation is not equal alongside the different countries: while in lower and upper Secondary Education the use of CLIL varies a lot, in Primary Education its use is widespread only in Spain (Extra & Yağmur, 2012).

However, CLIL has been put under question in many times because although it enhances individual and societal multilingualism, despite the variety of languages present in the European areas, in most cases the language of instruction in CLIL contexts is English (Nikula, Dalton-Puffer & Llinares, 2013). Also, as expressed by Ludbrook (2008), CLIL is on top of a series of debates and interesting research questions, because "although families generally express satisfaction at CLIL experiences, some reservations come from the parents of young learners who fear that too much exposure to a second language may lead to neglect of the child's first language".

However, research indicates that CLIL has a good impact on language skills, affecting positively the receptive skills, vocabulary, morphology, creativity, risk-taking, fluency and quantity of spoken language (Dalton-Puffer, 2007). There is no loss of content-learning caused by CLIL, as shown in the case of the Spanish Bilingual Education Program (Dobson, Pérez-Murillo & Johnstone, 2010). In fact,

CLIL can boost students' motivation towards languages learning and benefit cognitional development and skills (European Comission, 2014a).

2.2. CLIL in Spain: the Asturian case

The first bilingual initiatives in Spain took place in the form of individual actions in the decades of 50s-60s. There have been previous approaches to interesting language teaching methods, such as the one developed in the "Selgas schools" (Terrón & Mato, 1992). However, it was in the decade of the 80s-90s when bilingual education was officially introduced in Spain.

The first time bilingualism was set in Asturias was in 1996, when the Ministry of Education and Science of the Spanish Government (MEC) and the British Council signed an agreement towards an integrated curriculum. That instruction was developed in 43 state schools in Spain, two of which were in Asturias: the CP Ventanielles (Oviedo) and the CP Atalía (Gijón). The collaboration agreement between the MEC and the British Council was planned for students aged 3 to 16 years-old. As a result, it covered all the educational stages from Early Primary Education to the end of CSE.

After that first bilingual approach in the Asturian region, the Bilingual Education Programme (BEP) was created: in 2004 took place the first edition of the bilingual education experimental programme, which intended schedule was four academic courses. It was implemented in Secondary Education and then it expanded to Primary Education. The first year that the BEP was fully established in Asturias was in 2008/2009.

The Official Bulletin of the Principality of Asturias (BOPA) that regulated the development and structuring of bilingual programs in Asturias is the BOPA 121 of the 19th May 2009. That official regulation gave a legal framework to bilingualism in Asturias and contributed to its consolidation among the educational community. As a consequence, the number of centers and educational stages (from Early Primary-Primary (schools), Secondary Education (high schools), baccalaureate and Vocational Training taking part in the BEP is growing each year. The regulation for BEP in Asturias establishes that:

> Languages are essential knowledge in contemporary society, needed for the citizenry for their training, professional working opportunities, intercultural exchange and personal realization. The comprehension of other languages and the possibility of communicate through them give us the chance to fully participate in society and to enhance tolerant and respectful attitudes to other cultures (BOPA 121, p.1).

Also, teacher language requirements and the specific characteristics of the centers taking part in a bilingual program in Asturias are specified in that BOPA. It is to be mentioned that the two schools taking part in the MEC-British Council collaboration agreement are considered bilingual centers in terms of the BEP in Asturias.

In the situation of legislative instability in education, the adoption of the Organic Law for the Improvement of quality in education (LOMCE, 8/2013, of the 9th of November) is modifying several curricular aspects and dimensions, although language learning is established as a national priority for all students. That is very important to be considered, as the legislative framework governs the establishment and development of the BEP. In that context, the Asturian Government has regulated the transition of students taking part in the BEP from Primary Education to Secondary Education with the promulgation of the resolution that sets the legal framework for BEP in the first course of CSE (BOPA 138, 16-VI-2014).

At the moment, there are four Public Centers of Basic Education (CPEB), ten Gathered Rural Schools (CRA), 96 Public Schools (CP), 56 Secondary Education High Schools (IES) and 26 Chartered Schools taking part in the Bilingual Program in Asturias, which made bilingualism to be an emergent option for education in that region.

However, the research done about bilingualism in Asturias is predominantly done in the context of Master's dissertations from the local University of Oviedo, and that studies are focused on the Primary Education level on some cases (Montes, 2014; Sánchez, 2012) and explore the development or implementation of curricular materials in CLIL classes (Coalla, 2014; Medina, 2014; Menéndez, 2013; Roces, 2013 and Tuya, 2014). There has been detected a lack in proper Primary Education teacher training in CLIL methodological and pedagogical strategies, as described by Montes (2014), which can contribute to inherit the traditional teaching methods into the BEP of Asturias. As this is not the desirable situation for successful CLIL implementation (Di Martino & Di Sabato, 2012; Hussein, 2010) and probably that results are linked to the little research that has been conducted in the Asturian at the present time, there is a clear need to analyze and assess the current CLIL practices in the BEP.

2.3. Students' learning and motivation

The force that moves us to learn, to experience, and to have passion about different aspects in life is motivation. This is of more importance when talking about the youth, a stage at which the self is developing and in constant evolution. What is

appealing to students nowadays? What are they interested in? How can teachers motivate them to learn? Young people is living in one of the most stimulating period on History, as they are being besieged and coerced with constant and multimodal information at any moment (Robinson, 2010).

Education needs a great and deep change from traditional paradigms to new strategies and educational conceptions that consider students' motivations, aspirations and opinions (Bona, 2015), as research has found that motivational beliefs results from direct experiences of learning (Boekaerts, 2002). Not only learners' motivation is paramount, but students' subjective perception of teachers' commitment, motivation and implication (Matsumoto, 2009) is very important too.

Motivation has received great attention in research in the context of language learning. In fact, it is a direct determinant of L2 achievement (Lasagabaster, 2011). However, as learning a second language is a complex and generally extended process in time, the measurement of motivation in that context is a difficult issue (Ryan & Dörnyei, 2013) and in some CLIL contexts it has not received enough attention (Breidbach & Viebrock, 2012).

Dörnyei defines motivation as "the effort, desire and attitudes towards learning" (2005 p.68) and considers it as a constant evolving process "associated with a dynamically changing and evolving mental process, characterized by constant (re) appraisal and balancing of the various internal and external influences that the individual is exposed to'" (2000, p. 523). Different theories have been drawn in order to explain learning motivation, such as the Instinct, the Incentive, the Drive or the Arousal theory of motivation (Rehman & Haider, 2013, p.141), the Socio-Educational Model of Second Language Acquisition (Gardner, 2001) or the introduction of neurobiology implications for learning and motivation (Dörnyei, 2003).

As motivation is complex, research has been focused on the reasons behind it, more than about the effect of teaching approaches on attitudes (Lasagabaster, 2011), although not all students' are intrinsically motivated towards learning (Boekaerts, 2002) and different ideas can contribute to cater them (Rehman & Haider, 2013).

However, nowadays the integrative framework established by Dörnyei in 2009 with the L2 Motivational Self System is widely-accepted and his proposal for a motivational teaching practice is highly valued (**Figure 2**). The L2 Motivational Self System is made up of three dimensions (2003, p. 29):

- *Ideal L2 self*: the personal vision of the future self-competences and skills in L2. It determines the willingness to reach that ideal future point.

- *Ought-to L2 self*: refers to the perception of attributes that one person should have in L2, and is related to the extrinsic components of motivation.
- *L2 Learning experience*: bottom-up process concerning the immediate learning environment (classroom learning situation: teacher, curriculum, the learning group (Ushioda, 2003), the experience of success) and is developed in the current learning scenario.

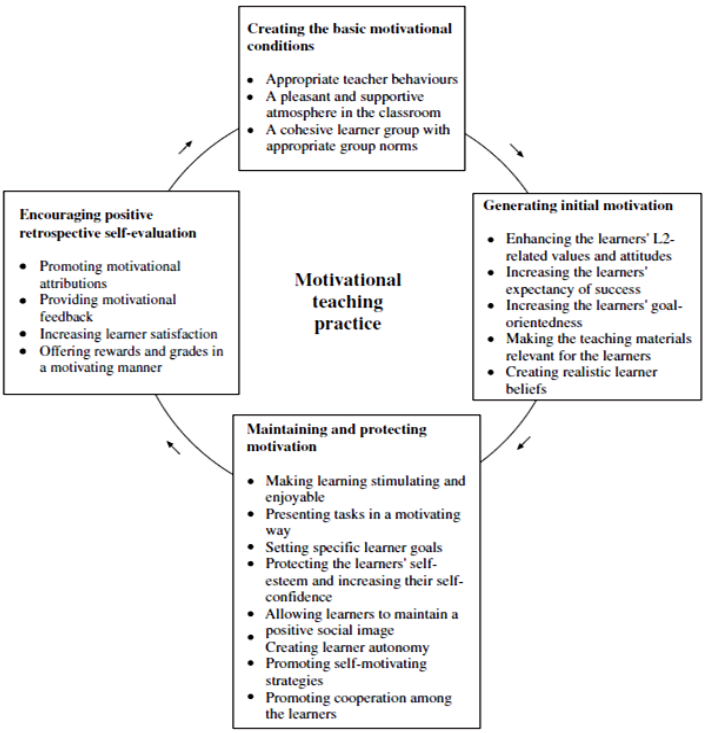

Figure 2. Components of motivational teaching practice in the L2 classroom. Source: *Motivational Strategies in the Language Classroom* (p.29) by Dörnyei, 2001, Cambridge, England: Cambridge University Press. Copyright by Cambridge University Press. In Dörnyei, Z. (2003).

The study of the impact of CLIL on students' motivation has yielded positive results (Merisuo-Storm, 2006; Papaja, 2012) and revealed that students taking part in CLIL learning environments held more positive attitudes towards English as a foreign language (Lasagabaster & Sierra, 2009) and towards languages learning in general (Van de Craen, Mondt, Allain & Gato, 2007). However, it is to be taken into account that motivation and CLIL should be studied from a multidimensional perspective and encompass intrinsic, extrinsic, integrative and instrumental motivation as well as students' interest in different cultures than own (Lasagabaster & López, 2015). Also, a gender tendency has been found, as girls appear to feel more attracted to CLIL (Sylvén & Thompson, 2015), which is a tendency that should be studied in depth. Students' taking part in CLIL express positive learning attitudes

(Van de Craen, Mondt, Allain & Gao, 2007) and are well-prepared for successful future studies (Merisuo-Storm, 2006).

CLIL appears to be an effective way to engage pupils in second language learning (Dörnyei, 2005), although as seen before motivation is a multimodal construct and consequently, the results cannot be generalized (Lasagabaster, 2011). However, as CLIL hinges on several factors such as the characteristics and profile of the learner, the teacher personality and teaching beliefs, the class-group, the support given from the administration, etc. (Lasagabaster, 2011), and its requirements include the subject content, language content, language skills, fluency and self-confidence and willingness to express themselves in the L2 and use that language outside school (Papaja, 2012), studies on motivation in CLIL contexts have to be more comprehensive (Dörnyei, 2001; Dörnyei &Ushioda, 2009) and consider the practical dimensions (Papaja, 2012; Sylvén & Thompson, 2015). In that way, the understanding of the practical implications of motivation development and enhancing in CLIL learning environments would become a powerful tool for drawing evidence of practical CLIL scenarios (Guilloteaux, 2007).

2.4. Science education renewal

In the latest years, a decrease in students' motivation and attitudes towards science has been detected (Jorde & Dillon, 2012; Osborne, Simon & Collins, 2003; Zimmerman, 2012). This tendency has come at the time of emergency of the new tendency in science education: the STEM literacy revolution. STEM is the acronym for Science, Technology, Engineering and Mathematics. This term rose in the North America context as a response to the need for strengthening education in these scientific areas. The importance that the professional activities related to STEM areas will have in the nearly future and the contemporary societies set the basis for raising concerns about STEM education (Bybee, 2010). The need for improve scientific education within the framework of a continuously changing science panorama in the XXI century was linked to the development of different changes in the national science curriculum in the United States of America, so that scientific literacy would become an explicit priority (Kuenzi, 2008; Stansfield, 2011), being motivation a key factor that can shape science literacy. UNESCO described scientific literacy as: "The capability to function with understanding and confidence, and at appropriate levels, in ways that bring about empowerment in the made world of scientific and technological ideas" (UNESCO, 1993, p. 3).

The environments in which science is being taught should look for scientific motivation and positive attitudes among students (Kennedy & Odell, 2014), so that

universities and scientific and technological enterprises would found it easy to fulfill their scientific recruitment needs and society in general would have a good scientific knowledge background, that is, a high level in scientific literacy (Jorde & Dillon, 2012). In the STEM context, as expressed by Bybee (2013), the concept of literacy includes:

- The knowledge, attitudes and skills to identify scientific questions and problems in everyday situations, as well as being able to explain the natural and technological world and to draw evidence-based conclusions about STEM topics.
- Understand the particularities and characteristics of STEM areas as different forms of knowledge, inquiry and design.
- Having the willingness to active participate in STEM related debates from a constructivist, concerned and reflective citizenry point of view.

At the time the STEM revolution was arising in the United States and in different parts of the world, in Europe the situation was similar, as science is seen as vital and essential for the European societies (European Commission, 2014b), and the majority of students in European countries do not aspire to become scientist or engineers in the near future (Sjøberg & Schreiner, 2012, 2008) and different curricular modifications and pedagogical transformations were needed in order to achieve the challenges of science education nowadays (Dewitt, Archer & Osborne, 2013; European Commission, 2011). After the calls for a science education renewal in the European context (European Commission, 2007; Osborne & Dillon, 2008) a new scenario was set in Europe. Also, the introduction of cross-national assessment for science in the Trends in International Mathematics and Science Study (TIMSS) since 1995, and the Programme for International Students Assessment (PISA), since year 2000, has raised concerns among European science education stakeholders in the different countries taking part in that international performance surveys.

Many initiatives emerged in that context, such as the one developed by the "ingenious" project, which is organized by the "European Coordination Body in STEM Education" and funded by the European Union. In this project, several resources and sub-projects are being carried out, as a way to research and put in practice different approaches about science education, and to reflect on what can be done to enhance the enrolment in STEM areas in Europe through a pedagogical change that implies a real connection with professional activities related to STEM knowledge (Joyce & Dzoga, 2011). In fact, in the USA and in Europe, motivation towards science is understood as a process driven by intrinsic factors (curiosity, self-

fulfillment, positive perception of the attractiveness of STEM subjects, etc.), while in most Asian countries it is seen as a process shaped by external factors such as the social prestige, the career opportunities, high incomes aspirations or family expectations (Taube, Renn & Hohlt, 2015, p. 200). That different conception of motivation towards science determines the actions developed in each context.

In Spain promoting science is a national priority, primarily conducted by the "Spanish Foundation for Science and Technology" (FECYT), which is a public foundation dependent on the Ministry of Economy and Competitiveness. It aims to promote the social integration of science and has developed a great number of scientific projects such as "Sounds in the night", "Barcelona Rocks", "Dinoscience 3D", "Life is science", "Tuberspot", "Famelab - Scientific monologues", "Photoscience" or Summer Scientific Camps for scholars (FECYT, 2014), as actions that contribute to stimulate scientific interest among scholars (Obra Social La Caixa & FECYT, 2015). Also, Spain has taken part in the European project "Scientix", founded by the European Commission and managed by the European Schoolnet (EUN). Scientix aims to facilitate the dissemination and knowledge-sharing of practical science education experiences across Europe (Grass-Velázquez, Schwarzenbacher, Tasiopoulou, Debry, Bargoin, Kudenko & Hernández, 2013).

Gender is an area which has received great interest in the framework of STEM, as the number of girls actively involved in science areas and careers is low and far from desirable percentages of girls/women taking part in science studies and professions (Sadler, Sonner, Hazari & Tai, 2012; Van Langen, Rekers-Mombarg, & Dekkers, 2006). Diverse pedagogical strategies have been identified as advantageous for making girls like science in secondary stages, such as considering the different learning styles, including more real-world activities and more collaborative work in science learning environments, or making students construct their own knowledge (Kulturel-Konak, D'Allegro & Dickinson, 2011). That is going from a traditional teacher-centered point of view about teaching to a student-centered dynamics, in which learning is the pivot of education. This educational approach is pedagogically inheritor from the theories of Dewey (1938), who actively advocated for introducing the possibility of giving students the chance to explore and check theories themselves, and Vygotsky (1978), who watched learning as a social process and also contemplated the discussing and negotiation of meaning between students as an essential part of learning.

In student-centered learning environments students are provided with opportunities to develop high-order thinking skills and critical knowledge, as well as to organize, analyze and synthesize the learning process themselves. Student-

centered learning is defined as a method in which "students learn to decide what they need to know to find success within the class and educational format" (Glasgow, 1997, p.34). In that way, the students are the main protagonists of the teaching-learning process, whilst teachers act as facilitators, making students take responsibility for their own learning.

Making students feel part of their own learning and allowing them to actively participate in the construction of their scientific knowledge is a key aspect that should be taken into account, as it enhances positive attitudes towards science (Armbruster, Patel, Johnson & Weiss, 2009; Hassan & Davies, 2014; Vedder-Weiss & Fortus, 2012). That active implication in their own learning is not only a benefit in terms of motivation, but also in terms of learning self-regulation and metacognition strategies (Freeman, Eddy, McDonough, Smith, Okoroafor, Jordt & Wenderoth, 2014; Schraw, Crippen & Hartley, 2006).

These are some considerations that should be taken into account when designing and developing science curriculum, so that science education would provide an appropriate response to the actual educational and social demands and to the specific needs related (Vassilou, 2012).

It has been shown that motivation plays an important role not only in education in general, but in science education in particular, as it fosters students' perception of achievement and the interest in science areas and careers (Bryan, Glynn & Kittleson, 2011).

Apart from the European International Surveys TIMSS and PISA, a big international survey on attitudes towards science was conducted in 2003-2005: the Relevance of Science Education (The ROSE project) (Sjøberg and Schreiner, 2008, 2010, 2012), which analyzed the attitudes of secondary students towards different scientific topics in different regions of Europe. Although students found science from a positive perspective, the traditional curricular topics (plants, chemicals, basic physic topics) were of their lowest interest in comparison with other topics such as the possibility of life outside the Earth. Also, marked differences were found about gender, as the kind of topics preferred for girls across Europe (e. g. "what to eat to keep healthy and fit") were really different from the ones preferred by boys (e. g. "how computers work"). Although this study has been put under question as the appropriate weighting techniques from national extrapolation were not applied (European Commission, 2011), it is a good descriptive study about the attitudes towards science in scholars, as it considers different dimensions of science and the results highlight the differences between curricular vs. real science (Jarman & McClune, 2007) and the gender gap on science attitudes.

The knowledge of the complex relationship between science and motivation has been debated and research for long time (Osborne, Simon & Collins, 2003), as it can brings light on different questions and facts, such as the implication with different scientific subjects and areas, the performance on science classes, the results in international surveys or the choice of careers and professional specialties.

As in the curriculum the diverse science sub-areas (biology, mathematics, Earth's science, physics, astronomy and chemistry) are separated into different subjects, with a quite rigid curricular structure, secondary students seems to like science topics independently of the traditional science domains and of different scientific clusters (Bathgate, Glynn & Kittleson, 2011). As a consequence, it has been recommended to linked different areas to enhance the learning of particular science sub-areas from a holistic point of view (Erduran & Dagher, 2014) and to make the real-life implications clear to students when the topic is not appealing at first for students, so that they can be aware of the applications for real-world that these areas have. It is necessary for teachers and stakeholders to be aware that the way to scientific literacy passes through motivation and not only by means of content, but also implies giving students the opportunities to develop their own and personal values and beliefs, so that they can build their own scientific multidimensional literacy, which would promote the use of science in their everyday lives (Fives, Huebner, Birnbaum & Nicolich, 2014) and can foster their academic performance (Caballo & Laubach, 2001; Hassan & Davies, 2014).

2.5. CLIL science education: towards new learning scenarios

Bilingual programs including science education are embedded in that framework of scientific renewed pedagogy. As CLIL learning environments take into consideration some of the strategies and recommendations given for improving scientific motivation and positive attitudes towards science, the question that arises is: how are CLIL-science learning scenarios?

CLIL and science have some pedagogical aspects in common, which inter-relate and generate an ideal learning matrix, such as the promotion of formative assessment in the learning process, the fostering of strategies for developing divergent, creative and critical thinking (Moore & Dooly, 2010), the great importance given to the communication process (science is built up from questions about the natural world, formulation of hypothesis, searching for evidences and drawing conclusions) and the use of continuous scaffolding techniques, collaborative work strategies (Chen, Wang & Lin, 2015) and self-conscious learning (Maldonado & Olivares, 2013).

However, the cross-field of CLIL and science education has been poorly researched. When researchers have focused on the characteristics of CLIL in science classrooms, they have put great emphasis on describing the cognitive or linguistic implications (Aguilar & Muñoz, 2014; Escobar & Evnitskaya, 2014; Escobar & Sánchez, 2009; Evnitskaya, 2012; Evnitskaya & Morton, 2011; Fuentes, 2013; Hansson, 2012; Jäppinen, 2005; Santo-Tomás, 2011; Vallbona, 2013). The characteristics of CLIL benefit the structuring of science lessons and also, CLIL have been found to act as a learning catalyst, improving students' L2 learning (Thompson, 2013) and general performance in science (Grandinetti, Langellotti & Ting, 2013). Motivation is a determining factor in the engagement in transformative science learning (Pugh, Linnenbrick-Garcia, Koskey, Stewart & Manzey, 2009) and enhances some processes of the scientific method of questioning, seek for alternatives and creative thinking strategies (Liu, Lin, Jian & Liou, 2012).

Preliminary practical studies have shown benefits both for science content and L2 learning (Gabillon & Ailincai, 2013; Suriel, 2011). As CLIL does not have clear guidelines in Europe, and is not strictly regulated by national laws in the countries across the European zone, teachers of scientific areas taking part in CLIL programs do not feel conformable and confident enough with the use of a second language – which in the majority of cases is English – for science lessons (Bartika, Maertenb, Tudorc & Valcked, 2010). However, the benefits of developing CLIL in science education outweigh the downsides. According to Ardeo-Aresti some of the positive effects are that CLIL improves the motivation of those who found it difficult with traditional methodologies, the activities proposed are perceived as more interesting, the L2 level improves, language is seen as a tool that will be useful in their future lives and that CLIL covers the whole competencies spectrum (2015).

CLIL science learning environments have positive effects on language dimensions, regardless of the L2 level of the students and on science attitudes (Yassin, Marsh, Tek & Ying, 2009). However, research on that field is at an early stage and some aspects remain unclear and have not been studied in depth.

3. METHODOLOGY

After setting the theoretical framework of this study, the description of the research instruments used for collecting data are done in the present section. Previously we have described and introduced the participants taking part in this case study: the Auseva Marista School and its bilingual program and context, the teachers

participating in the bilingual program, and the students that have the main research subjects of this study.

3.1. Context and participants of the research

The Auseva Marista School is one of the schools implementing the Asturias' bilingual program. It is placed in the centre of Oviedo, Asturias, and covers the whole compulsory and non-compulsory stages of pre-university education. In the latest years, it has been involved in a series of methodological innovations in coordination with the Compostela Province in which the Auseva School is included. The "methodological change" aims to introduce new pedagogies and learning approaches, according to the new educational challenges we face nowadays (Bona, 2015). It includes cooperative and collaborative learning strategies, group projects and ICTs as familiar tools, emotional learning strategies and a holistic and integral conception of learning. It requires great collaboration strategies and involvement for teachers, as they have to work coordinately, from different areas of knowledge, to develop this educational purpose efficiently and get students to be the centre of the learning process, active protagonists of their own learning.

These methodological challenges are combined with the implementation of the bilingual program. In the academic year 2015-2016 bilingualism is established in 1st and 2nd of CSE, as well as in Primary Education. In the case of the students which are now on 1st of CSE, they have been enrolled in the bilingual program since they were Primary Education students. That means they are familiar with CLIL and have good level of English, which is the L2 of this bilingual program. Also, considering that there have been no dropouts from Primary to CSE, it shows that their families value the bilingual program, as they want their children to continue taking part in bilingual education, which is a great success.

The content subjects in which CLIL is being developed in the Auseva are Science –in 1st and 2nd of CSE-, Arts –in 1st course- and Technology –in 2nd course-. Consequently, the teachers taking part in the program are three: the Science teacher, which is the coordinator of the bilingual program of the school, the Arts teacher, which is also the English teacher, and the Technology teacher. It is remarkable that Science is the subject of continuity in the bilingual program, as it is the only they are learning embedded in CLIL since the beginning of CSE. That characteristic makes Auseva a suitable school for examining the motivation towards science education in students taking part in CLIL learning environments.

The students participating in this MD are all the students of the two first courses of CSE, making a total of 103 students: 29 students of 1st CSE A, 25 students of 1st

CSE B, 29 students of 2nd CSE A and 20 students of 2nd CSE B. Although there are a few number of students in the classes of 1st and 2nd CSE (10 in sum), they have not taking part in this study, as the subjects of this research are just the students participating in the CLIL that is being developed in the Auseva School.

Also, it is to be highlighted that all school staff was interested in this research from the beginning, as the knowledge of their students' perceptions is paramount for them. The knowledge of their interests, beliefs and motivation for learning is a priority for the Auseva School, so the data obtained in this study is going to provide useful information for improving their bilingual program. The Auseva teaching staff and headmaster of the school have actively collaborated in this study and were delighted with the idea of being the case study of this research, so they were always kind and helpful in all situations.

3.2. Research instruments and data collection

For the aiming of this study, and considering that a quantitative approach is followed, the most suitable research instrument is the questionnaire (McMillan, Schumacher & Baides 2006). There have been designed two questionnaires, one for the students and another one for the teaching staff taking part in the bilingual program of the Auseva, which data has been complemented with the information obtained via informal observation of the bilingual learning classes and with the analysis of the documents related to the objectives of this study.

The students' questionnaire (**Appendix 1**) has two sections: the linguistic and the scientific one. The linguistic section has been designed from the questionnaire for researching students' attitudes and beliefs towards L2 learning that were used and validated by Gené (2010). The scientific section is adapted from the one used and validated by Linares (2011) to assess students' attitudes towards scientific topics of interest, present in the Spanish curriculum, general science topics, which are items taken from the European ROSE project designed by Sjøberg and Schreiner (2007, 2010). While Question 7 is similar to items of the ROSE questionnaire, Question 6 of the students' questionnaire is structured on items taken from the ROSE project (6.1-6.6), items of curricular science (6.7, 6.9, 6.12 and 6.13) and items related to present-day science (6.8, 6.10, 6.11, 6.14 and 6.15). In Question 7, Section (iii) – Attitudes towards science, part of the items shown (1, 2, 3, 7 and 10) are the ones which results were made public in the studies by Sjøberg and Schreiner (2007, 2010), while the other items of Question 7 were part of the general questions raised in this project (Sjøberg, 2005, Sjøberg & Schreiner, 2010).

In this case, items related to the content subjects present in the bilingual program has been included, considering that as mentioned in the Introduction, there no general guidelines for bilingualism, so its implementation is heterogeneous and diverse. It has two differentiated parts: the **Linguistic and academic profile** (9 informative items or of choosing response and 2 Likert-like scale items) and the Attitudes, beliefs and motivations, which is divided into three different sections: (i) **Motivation** (11 items: 6 of choosing response and 5 Likert-like scale items), (ii) **Beliefs and attitudes** (26 Likert-like scale questions) and (iii) **Attitudes towards science** (7 items: 4 informative items of choosing response and 3 questions with Likert-like scale items). As in the questionnaires this one is adapted from, the responses of the Likert-like scale in the Motivation section follow a psychometric scale of five levels of preference while for questions in the sections Beliefs and attitudes and Attitudes towards science, the psychometric scale has four levels of preference.

This questionnaire for students is related to the particular objective number 3 ("Motivation" and "Beliefs and attitudes sections") and to the particular objective number 4 ("Attitudes towards science" section). The whole students' questionnaire relates to the particular objective number 5 of this study. It is also related to the research questions 1, 2 and 3 of this MD (p.12).

On the other hand, **the questionnaire for teachers of the bilingual program** (**Appendix 2**) was adapted from the one designed by Gené (2010), with a special section consisting in 6 specific questions about coordination for the teacher with dual profile, as she is the Science teacher and also the Bilingualism Coordinator in the school. It consists in 16 questions, which seek to describe the implementation of this bilingual program from the perspective of the teachers involved (Particular objective 2). It is related to the research question number 4 of this study (p. 12).

The questionnaires were administrated in the third week of November, 2015-2016 (18th-19th November). The sample of this study consists in 107 students and 3 teachers (1-Science and coordinator, 2-Arts and English and 3-Technology). Respondents were always willing to participate in this research. As mentioned, this data was complemented with information obtain via informal observation and questioning.

3.3. Statistical analyses

This study has used two surveys to gather learners' perceptions. Data collected from the questionnaires were analyzed using the Statistical Package for Social Sciences (SPSS) Version 14.0 software. Different statistical analysis has been

employed to aid the interpretation of the data collected. Descriptive statistics using frequencies and percentages have been used to show the data distribution of the items and questions of the two questionnaires. In this case, as the sample is near one hundred, the data is expressed as frequencies or percentages, which in this case are pretty similar. Also, univariate analysis ANOVA was conducted to find out if there were significant gender differences for the scale items of the students' questionnaire.

4. RESULTS AND ANALYSIS

In response to the objectives and research questions of this study (**Section 1.3**) we have collected data from questionnaires administered to students and to the three teachers taking part in the bilingual program of the Auseva, as well as from direct observation in the classroom and informal questions to the teaching staff, which have provided a deep insight that help to analyze the results.

4.1. Students' attitudes, beliefs and motivations

The students' questionnaire was answered by all students taking part in the bilingual program, which as stated before, is established in the first and second year of CSE and make a total of 103 students. There is almost a fifty-fifty of students from the first and second year of CSE (52.4% of 1st CSE and 47.6% of 2nd CSE). The majority gender is male (56.3%), while there are few female students (43.7%). In the linguistic and academic profile we asked them their nationality and year of birth, which are just informative, as all the participants were born in Spain, and all students of 1st CSE in year 2003, whilst all students of 2nd CSE were born in 2002.

Research question 1: Does the implementation of CLIL foster students' interest for English learning?

The first question of the linguistic profile was about whether they are studying another language apart from English (**Figure 3**). It is worth mentioning that a significant 95.1% of students are studying a third language. The third language of preference, studied by the 97 of the 98 pupils that study a L3 is French. Also, the other languages mentioned are German (7 students), Chinese (n=3), and Italian, Catalan or Polish (1 student per language).

The second question enquired about whether they have been in an English-speaking country before, if yes, in which/-es, how long and the reasons why. The results show that more than half students have been in an English-speaking region before (56.3%) (**Figure 4**). The majority have been to the United Kingdom (49 out of 58 students, 84.5%), followed by the United States (n=13) and Ireland (n=2).

Other students have been in other countries which are not English-speaking ones but were considered like that maybe because students used English as the intercommunication language there (France, Czech Republic, Malta, and Tunisia).

The time spent abroad ranges from one to fourteen days in the 70.6% (n=41), followed by the 27.6% which have stayed from fifteen days to a month (n=16) and a student which spent from one to six months in an English speaking country (n=1, 1.8%). It is to be highlighted that none of the students spent more than 6 months abroad. These data indicate that the stays in English-speaking countries are short in the majority of cases. In the majority of cases the reason for that stays is holidays (n=52; 89.7%), followed by English learning (n=15; 25.9%), or both (n=9).

Question 3 enquired about whether students would like to participate in a school language exchange with youth from an English-speaking country. The majority of students are positive about that possibility (81.6%) (**Figure 5**). The main reason for that is the possibility to learn the English language (46%), followed by the value of the experience of being abroad or travelling (24%), for knowing other cultures and traditions (18%) and because of social reasons (12%) (**Figure 6**).

Different reasons were given to express their preference to participate in a language exchange, such as "I would like it because we would both learn from each other, different cultures and languages" (*Q1B15*), "I would like to have a C2 English level" (*Q1A27*), "Because I'd be glad to get to know more about other cultures, countries and traditions" (*Q2B7*) or "Because it is a unique experience and you learn a lot" (*Q2A22*). The 19 students (18.4%) that did not expressed a desired to travel abroad in a school language exchange argued social reasons in the majority of cases (13 out of 19), such as "Because I am not a highly social person" (*Q1A14*) and reasons related to not liking travelling abroad (6 out of 19 cases).

Question 4 enquired about when students started to learn English as a second language. Results indicate that almost all that students started at the first educational stage, in Early Childhood Education (94; 91.3%) (**Figure 7**). Consequently, the majority of them have a great English background, with more than six years studying English as a second language. Also, they have in the majority of cases previous CLIL experience (95.1%), as answered to Question 5 (**Figure 8**), in the content-subjects studied in the bilingual program of the Auseva (Science, Arts, Physical Education), from Primary Education in all cases (Question 5c). Their CLIL experience is long, as in the majority of cases (93.2%) they have been studying content subjects in English for four or more years (**Figure 9**).

In Question 7 students were asked to tell their marks in the content-subjects related to the bilingual program of the school in previous years, as well as in English and Spanish language (Technology was deleted, as they had not study it before). Results show their calcifications are high in the different areas, as in all of them the medium mark is higher than 8 points (Spanish language=8.1; Science=8; English language=8.5 and Arts=8.8) (**Figure 10**).

The next question enquired about the assistance to out-of-school English courses or activities (particular classes, official schools of languages, summer camps, etc.). Then, Question 8 is intended to find out whether these students have reinforced the English learning at school with other training in this field. The results show that the percentage of students attending out-of-school training activities is more than the half, a 62.1% of the sum of students (n=64) (**Figure 11**). The kind of English training activities they have attended vary from English academies (53.1%), particular classes (26.6%); summer camps (14%); official schools of languages (4.7%) and language exchanges (1.6%). There are 6 responses to the kind of training activities which has not been taken into account as they were not precise and referred to the subject they wanted to improve with English classes instead of the type of training activity. The results about since when have these students attended these training activities are heterogeneous and show that from 6 to 10 years old is the most common age to start attending this training (46%), although many children has participated in them since early stages (21% from 2 to 6 years old) or have recently join them (33%) (**Figure 12**). Two responses to this question were not taken into consideration, as they were incorrectly answered.

In Question 9 we enquired whether the out-of-school training continues in the present year, finding that half of students go to these activities, while the other half doesn't (**Figure 13**). This indicates that the assistance to these training activities has decreased with the educational stages, as this year the percentage of students not attending to them (49.5%) is higher than the percentage from the previous years (37.9%, Figure 11). The number of hours devoted to English training activities is in the majority of cases 2 per week (56%), as extracted from the second part of Question 9. Just a 15% of students assist to these activities one hour per week, a 13% three hours per week, a 10% five or more hours and a 6% four hours per week (**Figure 14**).

To established the language profile of these students, in Question 10 they were asked about the frequency with which they use to do different activities in English in their day-to-day life outside school (**Figure 15**). Results indicate that the more frequent activity is to listen to music or the radio in English (59.2% do it "Very

often"). Other activity they use to do with a high frequency is to speak to somebody in English: almost half of students do it often and very often (47%), which is an indicator of their oral skills. The less frequent activity is to read books or magazines in English, with a 66% doing it "Hardly ever" or "Never", or to watch movies or videos in English, with almost half of them(49%) not doing it usually.

Question 11 enquired about the language used to answer depending on the language they are spoken to. As shown in **Figure 16**, when students are spoken in English they respond in English in the majority of cases ('Always'=53; 'Often'=27). However, when the language they are spoken to is Spanish, they tend to communicate not using the English language, even though they are in the bilingual classes ('Never'=14 and 'Hardly ever'=36). This data indicates that the language used for communication between peers is very important, as it establishes the language for communicating the majority of times.

The second part of the students' questionnaire is devoted to studying their "Attitudes, beliefs and motivations" towards learning in the bilingual program context. To that aim, the first questions are related to English classes (Qi1-Qi6), while there are other questions that explore students' attitudes towards the content-subjects of the bilingual program (Qi7-Qi11) and the attitudes towards science in the final section (iii: Q1-Q7).

Question 1 of Section (i) enquired about what aspect was the most liked about English classes: speak, listen, write, read or practice grammar and vocabulary activities. Results indicate that their preferred aspect is speaking (70%), followed by listening (18%) and reading (8%) (**Figure 17**). It is to be highlight that the majority of students like expressing themselves and communicating with others.

There are two questions which have had unanimity in their responses, with total affirmative responses from all the students. These questions are Question 2 and Question 6 from Section (i). In both cases the 103 students agreed in their responses: in Question 2i they were asked about their studying for English classes, whilst in Question 6i they were asked about their motivation in English classes. In both cases they chose the highest positive degree of response: all students study English very much and are highly motivated towards English classes. That is remarkable, as they are absolutely positive about learning English and make great efforts on studying it. According to that response we can say that students love English classes in all cases.

Question 3i enquired about the most important reason for them to study English. Responses show they really like English language, as learning the English

language itself is the most chosen option (50%). Finding a good job is a remarkable option for many of them too (35%), followed by knowing other culture (11%) or passing the English course (4%) (**Figure 18**).

In Question 5i they were asked about their most appealing aspect of English as a language. They reveal a practical point of view, as the possibilities of communication in English with other people (40%) and the things they can do in English (22%) are the most valued options, although other important factor is how it sounds (21%) (**Figure 19**). These results indicate their practical approximation to English language, as a vehicle to communicate and exchange knowledge and opinions.

The second part of this section is devoted to their opinions, beliefs and motivation in the content-subjects included in the CLIL bilingual program of the Auseva. In Question 7i we enquired them about their reasons to do it well on the CLIL subjects. Results show they want to be proud of their performance in bilingual classes, as a 38% want to do a good job. Liking these subjects (23%), valuating the possibility of communication with other people in English (21%) or passing these subjects (18%) are also valued by students (**Figure 20**).

Although all students agreed about their high effort on English classes, when referring to the CLIL content subjects (Question 7i), they are not homogenous: a 50% study them much, a 32% very much and just a 18% invest in them medium (14%) or little (4%) efforts.

We wanted to know what the most appealing aspects of English and content-subject classes are, so to find out in Question 4i and in Question 9i we asked students about it. We have found that when referring to English classes results are heterogeneous: group projects are the most appealing aspect (36%), followed by how English is taught (24%), the activities they do in English classes (22%) and the mark (18%) (**Figure 21**). As a consequence, although they all agree about their absolute preference for English classes, they have different aspects of it as their most appealing factor. As all students taking part in the study are taking part in the Methodological innovation of Auseva, it is to be highlighted that the group projects, which are usually interdisciplinary one, is the most liked aspect. However, when it comes to the CLIL content-subjects results differ: although group projects are the predominant option for the majority of students (36%), the activities they do are the next appealing option (33%), followed by how they are taught (17%) and the mark (14%) (**Figure 21**).

Question 10i enquired about their motivation in Science, Arts and Technology, the content subjects included in the bilingual program of the school. Results take

into account that in 1st CSE students do not study Technology, and in 2nd CSE they do not study Arts, so as a result, the sum for Science is 103 but for Arts is 54 and for Technology, 49. Results show they are greatly motivated towards the three subjects, as the sum of 'high' and 'very high' for the three of them is always more than half of students (**Figure 22**).

When comparing English and CLIL content-subjects their motivation differs (Question 11i). As a general aspect, using English in content subjects (Science, Arts and Technology) is appealing to the majority: a 61% (15 'very much' and 46 'much' appealing) founds it highly appealing, whilst a 32% value it as medium degree of appealing (8% 'A little' and a 2% 'Almost nothing' appealing). That indicates that using English acts as a motivator factor for studying content subjects for the majority of students.

In Section (ii) they were asked to value different options related to their attitudes towards English learning and the bilingual program (**Figure 23**). Learning English (Question 8) is perceived as an essential learning for them, with an 82% totally agreeing with the fact that learning English is important. It is to be highlighted that they do not value understanding (Question 10) or speaking in English (Question 1) in the CLIL sessions as difficult issues. On the contrary, they believe their English level is improving because of participating in the bilingual program (Question 11). All indicators about English learning and English as a language are positive in more than half of the sample, so we can conclude they value English learning and the language itself for their lives. They love listening to music in English (Question 16) and want to know that L2 as a way to communicate with other people (Question 19). They are happy about the methodology of the bilingual program (Question 25) and about taking part in the bilingual program itself (Question 26).

Research question 2: Do students enrolled in the CLIL program hold positive attitudes towards science, in relation to the European context?

The Section (iii) is referred to the attitudes towards science. In Question 1 they were asked about their learning preferred styles, which are predominantly active: the majority of students like a combination of styles (46), followed by those who prefer learning something by practicing it (38), listening (16) or reading (3). That indicates they are active learners when it comes to science.

Question 2iii enquired about how much they like science. While a 74% of students like science "Very much" or "Much", just a 27% chose it as "Very much". Also, a 23% like science a little and a 6% almost nothing. This question about science

in general is related to the next one, Question 3iii, in which they were asked about whether they like science more than other subjects: a 44% like it more than others, though a 55% do not. That indicates that although students like science in general, it is not general their preference when it turns into a curricular content.

Question 4iii wanted to know their view of science, whether explained with words, schemas or drawings. In 36 cases they gave an explanation about what is science, while 41 students made a drawing or schema and 14 students did both (explanation and drawing). There were twelve incorrect responses (empty or not correctly answered). The drawings (**Appendix 3**) show that many students relate science with the laboratory work (29 drawings, 59%), or with scientist (5 drawings, 10%). Other drawings are in relation to the whole planet, astronomic activity, the future, curing diseases or cells. Explanations show different aspects of science, such as: "Science is learning the secrets of the Universe, the mysteries of human life. It is also learning the hidden mysteries of Earth. Science is about understanding and discovering" (*Q1A10*), "For me science is life, without it many diseases would be mortal" (*Q1B23*), "Science is a way of understanding natural knowledge, living things, the places of the world and the human body, as well as other knowledge, and I think it is important to understand science because it can help us in our life" (*Q1B2*), "Science is everything, without science there would not be anything!" (*Q1A19*), "For me science is learning and discovering new things, knowing how things work and the chemistry, the reason of many things, how they happen and why" (*Q2B9*), "Science is a way of finding the answers to life and Universe's questions" (*Q1A15*) or "It is the art of understanding what the world is" (*Q1A27*).

Students consider science as not only general knowledge, but an important aspect for their future: "For me science is much more than studying and I love it so I would like to study telecommunication engineering. For me, technology is the development of life" (*Q2B18*), "For me science is about searching the explanation to what doesn't have one. I want to study Physics and be a sanitary or experimental radio-physicist. I like all science very much, though some aspects more than others" (*Q2A19*), "It is my favorite subject; I love it and is very interesting. I want to study it (science or biology) and be a teacher" (*Q2A2*) or "Science is important for me because I want to be a vet and I like it" (*Q1B10*).

Question 5iii enquired about the source of scientific information that students use in their lives. Although responses are heterogeneous (**Figure 24**), the majority of students are informed about science via their teacher (n=42). Other important sources of scientific information are Internet (n=35) and television (n=35). Parents act as scientific agents (n=11), while just a few are informed about science using

magazines (n=7) and newspapers (n=3). There are also a small group of students that use several sources of scientific information (n=6), though it is not common in the sample of study.

The next question was in reference to the attitudes towards specific areas of science. In that way, in Question 6iii students had to mark their degree of preference in relation to different scientific topics. Considering the two first options of choice as positive attitudes, there are five topics which are specially liked by students (**Figure 25**). These topics are: "10.How to cure cancer and other diseases" (96 positive choices), "6.The possibility of life outside Earth" (89 positive choices), "4.How computers work" (85 positive choices), "13.How life began on Earth" (81 positive choices) and "5.What to eat to keep healthy and fit" (80 positive choices). The most liked of them is "How to cure cancer and other diseases" (68 "Much" likes). On the contrary, the less preferred topics are "1.How plants grow and reproduce" (63 not positive choices), "3.Lives of famous science men and women" (58 not positive choices) and "8.How a nuclear central works" (53 not positive choices). Apart from that three, all topics got more than half of positive choices, which mean that the majority of them like scientific topics in general.

Question 7iii enquired about their agreement with different statements related to science importance for day-to-day life and society (**Figure 26**). All options are valued with a good level of agreement –more than half of students-, unless options "9.School science has helped me with health issues" (38 positive choices / 65 not positive choices) and "7.School science has made me more critical and skeptical" (40 positive choices / 63 negative choices). The item that reached greater agreement is the first "1.Scientific and technological progress helps curing diseases such as AIDS, cancer, etc." (96 positive choices /7 not positive choices). Also items 2, 3 and 10 were really well-valued (91, 90 and 88 positive choices, respectively).

4.2. CLIL teachers' point of view

Research question 4: Are teachers involved in the bilingual program highly committed to the bilingual program in terms of effort, time spent and dedication?

The Questionnaire for teachers of the bilingual program (**Appendix 2**) was answered by the three CLIL teachers: the Science teacher and Coordinator of the program, the Arts and English teacher and the Technology teacher. They are young teachers, with no more than between five to ten years of experience. Their profiles are diverse, with different years of experience in bilingual programs, ranging from three to one, and different training background on CLIL: post-graduate training,

training courses by the official educational authorities and other school training activities. The amount of hours is also diverse: from less than 25, to 26-50 or more than 200 hours.

The use of English in CLIL classes is high: more than 50% in all cases, and between 70-90% in the majority. The reasons argued for not reaching a 100% of English-speaking in CLIL classes are related to the characteristics of some class-groups, in which bilingual and no-bilingual students are mixed and to the English competence of students: "Sometimes I need to reinforce certain explanations of some concepts in Spanish. There are pupils with difficulties and they need it" (*QT1*). Also, the percentage perceived by teachers of students speaking in English in CLIL sessions is high: more than 50% in all cases, and between 70-90% in the majority. This happens because do not always speak in English between them, or because of their linguistic competence. Language objectives are not assessed in the content subjects of the bilingual program, because "The use of language is a medium for working subject-contents, not an objective to be assessed" (*QT2*) and "It is valued but not assessed with a particular weight in the mark. We try to get them to use English for communication" (*QT1*). All teachers agree about the need for using students' mother tongue, Spanish, sometimes, for making complex concepts clear, for acquiring contents properly or for giving important advice, such as exams data. That is, for information considered essential in the context of the classes.

All teachers agree on that make an extra effort preparing and developing the classes of the bilingual program, because "According to the CLIL methodology we are developing, classes have to be very well structured and require great variety of resources. Search and organize in a foreign language is an additional aspect" (*QT1*).

About the bilingual program itself, they all feel satisfied with it, at different levels, or about different aspects: "satisfied about content learning and highly satisfied about the use of English" (*QT3*). The advantages of the bilingual program they mentioned are: the possibility of learning a second language in a practical way, social skills, language competence, language fluidity, work group and the loss of fear about public speaking. It is explained as "Pupils have a lot of fluidity with the use of language. Although they have grammatical mistakes they understand and express themselves with a very high level to their age. The fear of public speaking doesn't exist anymore" (*QT1*). On the other hand, the main disadvantages and challenges of the bilingual program are: more training is needed; the attention to diversity requires more efforts and the need for students to become more autonomous when it comes to learning in that kind of learning environments.

Teachers perceived students as highly motivated about the bilingual program, as they want more content-subjects to participate on it, enjoy interacting in English, they do participate a lot and value the opportunity to learn a second language. About learning in general, teachers believe students' motivation is high, developing critic thinking and interest for research different areas of knowledge.

The teacher who is coordinator of the bilingual program develops horizontal and vertical coordination of linguistic and no-linguistic subjects. She also carries out the integration of the bilingual program with the interdisciplinary projects and the implementation of European linguistic programs and certifications. This is done by weekly meetings and the use of technologies.

She believes the implication of the teachers with the bilingual program is very good, as they very good disposition and make extra-efforts. Also, families have adopted the bilingual program in a natural way. This bilingual program, in terms of a SWOT analysis, have the weaknesses related to the pupils with specific needs and the balance between bilingual and no-bilingual students, strengths related to the updated training of teachers, threats related to the offer of extra-school activities in Spanish and opportunities related to the interdisciplinary projects and the international exchanges. In the future, other content-subjects will be added to the bilingual program in the second cycle of CSE (social sciences, arts, physical education or informatics) and they will take part on eTwinning on 1st CSE and on an international exchange with the United Kingdom for 2nd and 3rd CSE.

4.3. Gender analysis of students' questionnaire

Research question 3: Does a remarkable gender difference exist on motivation and attitudes towards learning and science topics?

In order to find out if there were significant gender differences in the items related to the interest for specific scientific items, an ANOVA test was conducted. First, the homogeneity of variances was measured, finding that only the item 15 ("Why did dinosaurs extinct") presented that premise for conducting an ANOVA test, with a significant level of .007 (**Figure 27**). However, the ANOVA test for that factor lead to the acceptance of the null hypothesis of equality of the variance, as the significant level was .165 (**Figure 28**). As a conclusion, no differences have been found between the attitudes towards science.

5. DISCUSSION

In this study we wanted to analyze the implementation of CLIL in a particular case study, in the context of science education, as an example of the current practices in secondary schools. This primary objective of the research was sub-divided into particular objectives, in relation to the motivation and beliefs of students taking part in this CLIL learning environment towards English learning, their attitudes towards science and the emergence of gender gaps in that area, or the view of the teachers taking part in that learning scenario. These objectives (listed with letters) were put in relation to the research questions of this study (listed with numbers): A-1, B-2, C-3 and D-4. The school we used as a case study for this research is the Auseva Marista School.

In relation to Objective A of this study: "Know the attitudes, beliefs and motivations of the students taking part in the bilingual program", results obtain in this research show that the attitudes of students towards English learning are very positive. As all students have a great L2 learning background, it is not surprising that when asked about the difficulty of understand English or CLIL classes they find them easy. It is also significant that almost the totality of the students taking part in this research is studying a third language apart from English, which is their L2. That implies they, their families or both have a very positive attitude towards languages learning. This means these pupils are fulfilling the European guidelines about learning two languages apart from the *lingua franca*.

They perceive English learning as a very important aspect in their lives, as many of them go to other language learning activities outside school, and have attended them since they were young. Also, they value English language itself, as the majority of them study English because they want to know more than they know, that is because of the language as a significant learning.

The sample of this study perceives the L2 as a communication vehicle, which is an important aspect in CLIL, where language has a very important communication dimension. These students use English language for communication and want to learn more of it so that they can be able to communicate with people from other parts of the world. It is to be highlighted that the majority of them want to make an exchange with other students from the United Kingdom. Also, the most valued aspect of their English classes is the speaking activities, which is an indicator of their preference to practice interpersonal language skills. This is something teachers should take into account, so they should foster the development of oral and conversational skills at the classroom, as indicated by the study of Llinares and Whittaker (2010) too. However, the greater use of English they make in their every-

day lives is to listen to music in English, which is not an active communication activity, as they do not interact directly with other people.

One of the most important aspects found in this study is the one related to the importance of the language spoken in CLIL learning environments, as it conditions the language of the conversation. They recognize that if they are spoken to in English, they continue to use English as the language of communication. However, if they are spoken in Spanish, it has a very low possibility that the language of this communication would turn into English, as expected in a CLIL learning environment. This is of paramount importance in the kind of school we use as case study, where methodological innovations are being introduced, implying project group work and other techniques in which controlling the language spoken in the groups can be difficult. It is an aspect that should be tracked by teachers and professionals of the schools in which bilingual programs are being implemented, as the language of communication can be controlled by giving them for example a battery of questions in English, so that they can work in groups using them, as a way to promote the use English in CLIL environments.

Another important finding of this study is the agreement between all students taking part in the bilingual program about their involvement and motivation in English classes: they all study English very much and have a very high motivation towards its study. It is surprising to find that the 103 students of the sample have the same belief and motivation about these aspects, because it is not easy to find unanimity in this kind of studies. However, considering the context we are examining in this research, that results are in the same direction of the other findings, indicating that English is viewed as a key aspect of their education.

Learning is a highly valued aspect by these students, as an 81.6% stated they like to learn new things. This item is interesting, as it refers to learning in general, not fixed to a particular context (school, bilingual program, a specific subject), but is about learning as a natural aspect.

However, when it comes to the content-subjects taking part in the bilingual program of the school, results differ from the language classes: they do not share opinions. Although their efforts in content-subjects are large (the 82% study them very much and much), their motivation rates are heterogeneous. However, they have good levels of motivation towards Science, Arts and Technology. This kind of diverse result is the expected when we enquire students on motivation aspects. It is remarkable that they have positive attitudes not only for subjects in which they have had good marks previously (Science, Arts) but for a subject they are experiencing for the first time (Technology). We can conclude they like these content-subjects and

invest great efforts on their learning, having good attitudes towards new content-subjects introduced in CLIL learning scenarios. This could be related to the content itself, to the fact that the content-subject is embedded in a CLIL context or to a combination of both.

These results show students have very positive attitudes towards learning, and especially towards English learning, as Dörnyei indicated about CLIL influence on fostering language learning motivation (2005). It is remarkable that this research shows this evidence for the first time on its context, reaffirming a general motivational implication.

The bilingual program of study is successful and makes students feel happy to be part of it. This aspect, in the context of the responses obtained in this research, completes the positive attitudes students taking part in the bilingual program of the Auseva have. They hold positive attitudes towards English language, towards the content-subjects of the program, towards learning in general and towards the bilingual program in particular. One of the elements to succeed when learning is motivation (Robinson, 2009), so that findings indicate students are on the way to improve their performance on learning in different areas of life and in the academic context.

In relation to objective B of this study: "B. Contrast the interest in science topics of the students taking part in a CLIL science education program with the European children", which is related to the research question 2: "B. Contrast the interest in science topics of the students taking part in a CLIL science education program with the European children", it is important to highlight that the attitudes towards science of our case study are very positive. If we compare them with the attitudes measured in the ROSE project study (Sjøberg 2005; Sjøberg & Schreiner, 2007, 2010), we found that they are relatively positive too. We cannot compare our data with a Spanish reference, because although Spain is present in this cross-cultural comparative project, the data shown in that study were only obtained in the Balearic Islands context and that is why they are not representative of the Spanish territory. Because of that, our data will be compared with the average European attitudes towards different scientific topics.

As done in the ROSE project data (Sjøberg, 2005, Sjøberg & Schreiner, 2007, 2010), we compare the positive responses of this study, which are the sum of frequencies in "Very much" and "Much" (the first positive options) on the Likert agree-scale used in the students' questionnaire. The items compared are those similar to the ones used in this international study, which are 6.1, 6.2, 6.3, 6.4, 6.5 and 6.6.

	Auseva School average (this study)	European average (the ROSE project)
1. How plants grow and reproduce	38.8%	22%
2.How different chemical substances react	66%	35%
3.Lives of famous science men and women	43.7%	20%
4. How computers work	82.6%	60%
5.What to eat to keep healthy and fit	77.7%	65%
6. The possibility of life outside Earth	86.4%	72%

Figure 29. Comparison of data about attitudes towards science topics. Part of the figure is adapted from the ROSE project.

As shown in **Figure 29**, the percentage of students that have positive attitudes towards these scientific items is much more positive between the students of our research. The European average indicated in the data from The ROSE project (Sjøberg & Schreiner, 2010) is in all cases less positive that the results we have obtained in this study. This indicates that students taking part in this kind of learning environment do have more positive attitudes towards science topics than the European average.

	Auseva School average (this study)	European average (the ROSE project)
1. Scientific and technological progress helps curing diseases such as AIDS, cancer, etc.	93.2%	85%
2. Science and technology make our lives healthier, easier and more comfortable	88.3%	70%
3. A country needs science and technology for its development	87.4%	79%
7. School science has made me more critical and skeptical	38.9%	30%
10. Science and technology are important for society	85.4%	80%

Figure 30. Comparison of data about beliefs on the importance of science for society. Part of the figure is adapted from the ROSE project.

But, what happens about the importance of science for life? As shown in **Figure 30**, we can see that students' beliefs on the importance of science for societies are greater in this case study than the European average shown in the ROSE project (Sjøberg , 2005; Sjøberg & Schreiner, 2007, 2010).

These findings are significant as they show students taking part in this CLIL learning environment hold more positive attitudes towards science (specific topics or general views of science importance for society) than the European average. These students belief science plays a key role for societies, although they do not value school science in that positive way, as they do not find it more appealing than other subjects. They do not think it has made them more critical and skeptical and do not believe it has helped them with health issues. This might be due to the fact that curricular science is not focused on contemporary science topics (Jarman & McClune, 2007) and for example, the contents related to health are only addressed in depth in the third level of CSE. That curricular development leaves students with the feeling that the science they are studying is not strongly linked to their lives or the actual science.

In this study we also wanted to know if there was a gender gap on science attitudes, as expressed in the third particular objective: "C. Analyze the possible gender differences in motivation and attitudes for learning and science topics" and research question 3: "Does a remarkable gender difference exist on motivation and attitudes towards learning and science topics?". We didn't find any significant gender difference between the opinions and beliefs of students towards science, so in this case study, the opinion of boys and girls does not differ significantly. This may be linked to the CLIL learning environment which encourages students towards science in a general way that is not influenced by gender aspects. This result should be contrasted with other results from similar context, so that it can be examined in detailed, because in the ROSE project the gender differences were clearly marked, although in our case they do not play a crucial role.

To complete the view of the principal characters taking part in this CLIL context, we also took into account the beliefs of teachers who participate in the bilingual program of the Auseva. The fourth particular objective of this research is "D. Describe the implementation of a bilingual program from the perspective of the teachers involved", which is related to the research question 4: "Are teachers involved in the bilingual program highly committed to the bilingual program in terms of effort, time spent and dedication?" we found that teachers' implication with the implementation of the bilingual program was total, with high interest on their part about proper training on CLIL and methodological aspects, as well as on the

efforts devoted to the preparation and development of CLIL classes. This may be due to the fact that they are young teachers, with great interest for being good CLIL teachers that develop good CLIL classes.

6. CONCLUSIONS

In the light of the evidence presented in this research we can conclude that the implementation of this bilingual program is a successful one. Then, it acts as an example of good practice about the current bilingualism practices developed in secondary education. In this case, both teachers and students show positive attitudes towards the development of the bilingual program, which contributes to its success in terms of implication and personal efforts.

All items used in the questionnaire to elaborate the linguistic profile of students show that this sample is made up of pupils which are highly committed to the learning of a second language, which in this case is English. Accordingly to that situation, their motivation towards English language learning is absolutely positive. Although it is difficult to find unanimity in research samples like that, we found that when it comes to the efforts they do about English studying or about their motivation towards English language, all students agree at the maximum level of liking. Then, we can conclude that students of this case study do love English language and enjoy very much its learning. They value English not only as a school subject, but as a useful tool for their future and what is more, in the majority of cases, as a tool for communicating with other people. This goes along with their high valuation of speaking as the most interesting aspect of English classes and their preference to participate in social activities such as international students' language exchanges. They also hold positive opinions about the development of the three content-subjects taking part in the bilingual program of Auseva, though results are more heterogeneous.

As well as in the case of English learning, students' attitudes and beliefs towards science are really positive. They view science as an area of knowledge related to laboratory activity in many cases, and although school science is viewed with different degree of enjoyment, their beliefs and opinions about scientific issues are above the European average for the same issues. That implies that these students taking part in a CLIL science context hold more positive attitudes and opinions about science than the European average, which is an indicator of their really positive motivation and attitudes.

In this study we did not find a significant gender difference in the attitudes towards science, which lead us to the conclusion that these students like or dislike different STEM topics regardless of gender.

Also, the perspective of the teachers involved in the bilingual program gave us record of their strong commitment and compromise to the development of bilingualism in the school. All teachers taking part in the Auseva CLIL environment share positive views of the program and although in classes English is not used all the time, due to assure important facts or to help understand complex concepts, they are satisfied with the development of the program. This positive vision about the program is shared by the responsible of its implementation in the school, as it is planned to include new content-subjects and to expand it to more courses of CSE.

The data gathered in this research indicates that CLIL learning environments can boost students' motivation towards different areas of knowledge, such as English language or science. Although it implies very hard work for both students and teachers, they are very satisfied with the bilingual program and its implementation. As a consequence, this study emerges as an example of a good practice about CLIL learning scenarios, amplifying the type of analyzed contexts and providing evidence on the motivation towards language learning and science in a CLIL context.

7. FUTURE RESEARCH LINES AND LIMITATIONS

As this research is a case study, it has deepened into one context, studying its different dimensions and circumstances. In this case, we have studied the implementation of a bilingual program in the Auseva Marista School, finding that both students and teachers taking part in the program are satisfied. However, although a case study offers diverse strengths, as it analyzes and describes a contextualized learning environment, it also implies a series of limitations due to its characteristics (McMillan, Schumacher & Baides, 2005). The case study research does not search for universal principles, generalized truths or cause-effect relationships. On the contrary, the emphasis is put on descriptions and explorations of a particular situation. Also, this type of research is not suitable for large-scale projects, and its results cannot be transferable to other situations or contexts.

However, this study is focused on an educational context, with the aim of researching what are the views and perceptions of the participants on the bilingual program of study. In this way, a case study was the better option to that aim, although the results have to be taken with careful, as they are the descriptors of this context, and thus, cannot be extrapolated to other situations.

Future research lines emerge as a consequence of the limitations of this study, offering a new research panorama for further studies. There are different approaches which can be followed in the context of educational research in CLIL learning environments that will enrich the studies done at the moment and will add more dimensions to this very interesting and complex kaleidoscopic reality that CLIL is.

7.1. In first place, **the implementation of bilingual programs can be studied in different contexts**: educational stage, school, region or country. The more data we get from case studies about the implementation of bilingualism in schools and high schools, these explorations will be closer to the truth. In education it is important to study particular cases in detail, especially when the implementation of bilingual programs is not a national shared aspect; it is desirable to have a lot of studies about that topic. That way, we could have a more realistic idea about what is happening with attitudes towards learning in the bilingual programs nowadays. It is recommended to expand the realization of similar studies in the regional and national context. Also, focus groups (discussion groups) can be added as research instrument, for obtaining information from groups of students, teachers or bilingual program coordinators.

7.2. Also, in further studies **families could be included as research actors too**. As parents are a very important factor about students' learning (Redding, 1998), it is important to take into account their opinions and beliefs too. It would be interesting to know the reasons why families decided to include their children in the bilingual programs, as well as to explore what their views about the development of the bilingual programs are. In that way, we could know how bilingual programs are perceived by families, maybe using a SWOT analysis, interviews or even focus groups, to find out what do they find more and less interesting about them.

7.3. A longitudinal study could be done: the bilingual program of the Auseva School could be studied again after for example 3 or 5 years, to find out if the opinions, motivations and beliefs of students and teachers have changed throughout time. That kind of study will give us an overview of the evolution of students' attitudes towards English and science learning and their involvement in the bilingual program. This kind of study will act as learning and cultural study, as it brings light into the opinion of a same kind of subject, "students", which change over time and can develop different opinions about similar concepts or in this case, in relation to the bilingual program. Also, as the Auseva bilingual program will change in time, it can be expected that changes will happen to it: involving more content-subjects and teachers, including other types of English learning activities, etc. These

adjustments will influence the bilingual program itself, so that it would be worthy to study it in depth.

7.4. Intervention proposals in the context of experimental research: different types of interventions could be done in the context of this school and bilingual program, or in other of similar characteristics, so that an experimental research could be conducted. It would imply having experimental and control groups, so that the intervention could be measured properly. For example, future research could focus on the development of scientific argumentation in CLIL environments, the introduction of multiple intelligences in the CLIL classrooms, about emotional education in CLIL, etc. It would add dimensions to the study of CLIL contexts and would spread the areas of study as well, which would be very interesting.

7.5. Measurement of similar aims with different instruments: to examine and measure the interest and attitudes of students towards English learning, different questionnaires could be used. For example, the Motivational Factors Questionnaire (MFQ) developed by Ryan (2009) or others, with similar aims and objectives. Also, for measure science motivation other types of questionnaires could be used. That could add new perspectives to similar studies, which will enrich the field of study.

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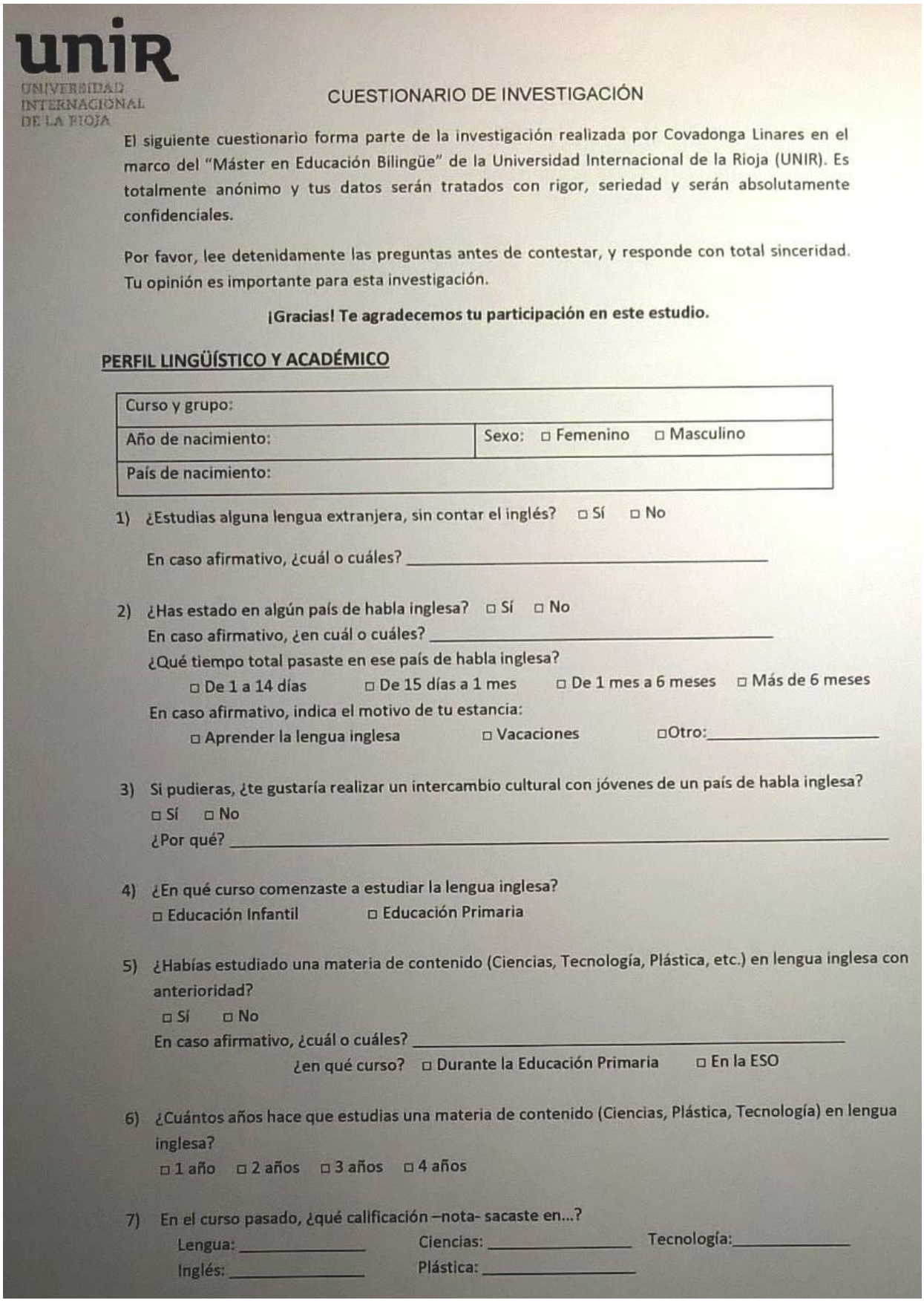
9. APPENDICES

APPENDIX 1. QUESTIONNAIRE FOR STUDENTS



UNIVERSIDAD INTERNACIONAL DE LA RIOJA

CUESTIONARIO DE INVESTIGACIÓN

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Por favor, lee detenidamente las preguntas antes de contestar, y responde con total sinceridad. Tu opinión es importante para esta investigación.

¡Gracias! Te agradecemos tu participación en este estudio.

PERFIL LINGÜÍSTICO Y ACADÉMICO

Curso y grupo:	
Año de nacimiento:	Sexo: □ Femenino □ Masculino
País de nacimiento:	

1) ¿Estudias alguna lengua extranjera, sin contar el inglés? □ Sí □ No

   En caso afirmativo, ¿cuál o cuáles? _____

2) ¿Has estado en algún país de habla inglesa? □ Sí □ No
   En caso afirmativo, ¿en cuál o cuáles? _____
   ¿Qué tiempo total pasaste en ese país de habla inglesa?
   □ De 1 a 14 días □ De 15 días a 1 mes □ De 1 mes a 6 meses □ Más de 6 meses
   En caso afirmativo, indica el motivo de tu estancia:
   □ Aprender la lengua inglesa □ Vacaciones □Otro:_____

3) Si pudieras, ¿te gustaría realizar un intercambio cultural con jóvenes de un país de habla inglesa?
   □ Sí □ No
   ¿Por qué? _____

4) ¿En qué curso comenzaste a estudiar la lengua inglesa?
   □ Educación Infantil □ Educación Primaria

5) ¿Habías estudiado una materia de contenido (Ciencias, Tecnología, Plástica, etc.) en lengua inglesa con anterioridad?
   □ Sí □ No
   En caso afirmativo, ¿cuál o cuáles? _____
   ¿en qué curso? □ Durante la Educación Primaria □ En la ESO

6) ¿Cuántos años hace que estudias una materia de contenido (Ciencias, Plástica, Tecnología) en lengua inglesa?
   □ 1 año □ 2 años □ 3 años □ 4 años

7) En el curso pasado, ¿qué calificación –nota- sacaste en...?
   Lengua: _____ Ciencias: _____ Tecnología:_____
   Inglés: _____ Plástica: _____

8) Desde tu infancia, ¿acudes a cursos de lengua inglesa fuera del colegio (escuelas de idiomas, clases particulares, cursos de verano, etc.)?

□ Sí □ No

En caso afirmativo, ¿a cuál o cuáles? _____

¿desde hace cuántos años? _____

9) ¿Realizas este año algún curso de lengua inglesa fuera del colegio?

□ Sí □ No

En caso afirmativo, ¿cuántas horas a la semana dedicas a aprender inglés?

□ 1 hora □2 horas □3 horas □4 horas □ 5 o más horas

10) Indica con cuánta frecuencia realizas las siguientes actividades fuera del colegio:

	Muy a menudo	A menudo	A veces	Casi nunca	Nunca
Ver películas o vídeos en inglés					
Escuchar música o la radio en inglés					
Leer libros, revistas, etc. en inglés					
Consultar páginas web en inglés					
Escribir en las redes sociales o textos en inglés					
Hablar con alguien en inglés					

11) Indica qué haces en las siguientes situaciones:

Si otro estudiante te habla en castellano en clase de bilingüe, ¿contestas en inglés?

□ Siempre □ A menudo □ A veces □Casi nunca □ Nunca

Si otro estudiante te habla en inglés en clase de bilingüe, ¿contestas en inglés?

□ Siempre □ A menudo □ A veces □Casi nunca □ Nunca

ACTITUDES, CREENCIAS Y MOTIVACIONES

(i) Motivación

1) ¿Qué es lo que más te gusta de la clase de inglés?

□ Hablar □ Escuchar □ Escribir □Leer □ Hacer actividades de gramática y vocabulario

2) Estudio inglés.... □ Mucho □ Bastante □ Regular □Poco □ Casi nada

3) La razón más importante para aprender inglés es...

□ Encontrar un buen trabajo □ Aprender el idioma □ Conocer otra cultura

□ Aprobar la asignatura □ Otra: _____

4) Lo que más me motiva de las clases de inglés es....

□ Cómo se enseña □ Las actividades que hacemos □ Los proyectos en grupo

□ La nota □ Otra: _____

5) Lo que más me motiva del inglés como idioma es...

□ Cómo suena □ Cómo se escribe □ La cultura de los países de habla inglesa

□ La gente con la que me puedo comunicar en inglés □ Las cosas que puedo hacer en inglés

6) ¿Cómo es tu motivación en las clases de inglés?

□ Muy alta □ Alta □ Regular □ Baja □ Muy baja

7) Quiero hacerlo bien en las clases de bilingüe (ciencias, plástica, tecnología) porque...
□ Me gusta □ Quiero hacer un buen trabajo □ Hay que aprobar
□ Podré comunicarme con otras personas en inglés □ Otro:_____

8) En las clases de bilingüe estoy estudiando...
□ Mucho □ Bastante □ Regular □Poco □ Casi nada

9) Lo que más me motiva de las clases del programa bilingüe (ciencias/plástica/tecnología) es....
□ Cómo se enseña □ Las actividades que hacemos □ Los proyectos en grupo
□ La nota □ Otra : _____

10) ¿Cómo es tu motivación en las clases de...? (contesta según corresponda)
Science: □ Muy alta □ Alta □ Regular □ Baja □ Muy baja
Arts: □ Muy alta □ Alta □ Regular □ Baja □ Muy baja
Technology: □ Muy alta □ Alta □ Regular □ Baja □ Muy baja

11) El utilizar el inglés en las clases de otras materias (ciencias, plástica, tecnología), me motiva...
□ Mucho □ Bastante □ Regular □Poco □ Casi nada

(ii) Creencias y actitudes

Selecciona la opción correcta en cada caso (sólo una):

1=Totalmente de acuerdo 2= De acuerdo 3=En desacuerdo 4=totalmente en desacuerdo

	1	2	3	4
1.Hablar en inglés es difícil				
2.Leer en inglés es fácil				
3.Escribir textos en inglés es difícil				
4.Entender el inglés hablado es fácil				
5.Me pongo nervioso cuando tengo que hablar en inglés				
6.Me gustaría conocer más gente con la que comunicarme en inglés				
7.Me esfuerzo mucho en la clase de inglés				
8.En general, creo que aprender inglés es importante				
9.Me esfuerzo mucho en las clases de bilingüe				
10.Me resulta difícil entender los contenidos de las clases de bilingüe				
11.Mi nivel de inglés está mejorando gracias a las clases de bilingüe				
12.Estudiar una materia en inglés es más fácil de lo que pensaba				
13.Tener buen nivel de inglés es necesario para las clases de bilingüe				
14.Es importante tener buenos conocimientos de inglés				
15.Aunque es obligatorio, me gusta aprender inglés				
16. En general, me gusta la música en inglés y quiero entenderla				
17. Me gusta mirar películas en inglés y entender lo que dicen				
18. Quiero poder viajar al extranjero y saber inglés me ayudará				
19.Quiero saber inglés para poder comunicarse con gente de otros países				
20. En general, me interesa aprender otras lenguas				
21. Si pudiera, estudiaría otra lengua extranjera además del inglés				
22. Me gusta aprender cosas nuevas				
23. Saco buena nota en la clase de lengua inglesa				
24. Saco buena nota en las clases de bilingüe				
25. Me gustan las clases de bilingüe y cómo nos las enseñan				
26. Me siento feliz por participar en el programa bilingüe del colegio				

(iii) Actitudes hacia la ciencia

1) ¿Cuál es para ti la forma más sencilla de aprender algo nuevo?
□ Escuchando □ Haciéndolo / practicando □ Mirando
□ Leyendo □ Todas las anteriores

2) ¿Cuánto te gustan las ciencias? □ Mucho □ Bastante □Poco □Casi nada

3) ¿Te gusta Ciencias más que otras asignaturas? □ Sí □ No

4) ¿Qué es para ti la ciencia? (explícalo o haz un dibujo esquemático en la hoja adjunta)

5) ¿Cómo te informas de temas científicos?
□ En los periódicos □ En revistas □ En Internet □ En la tele
□ Lo que me dice el profesor en clase □ Lo que me dicen mis padres □ Otro:_____

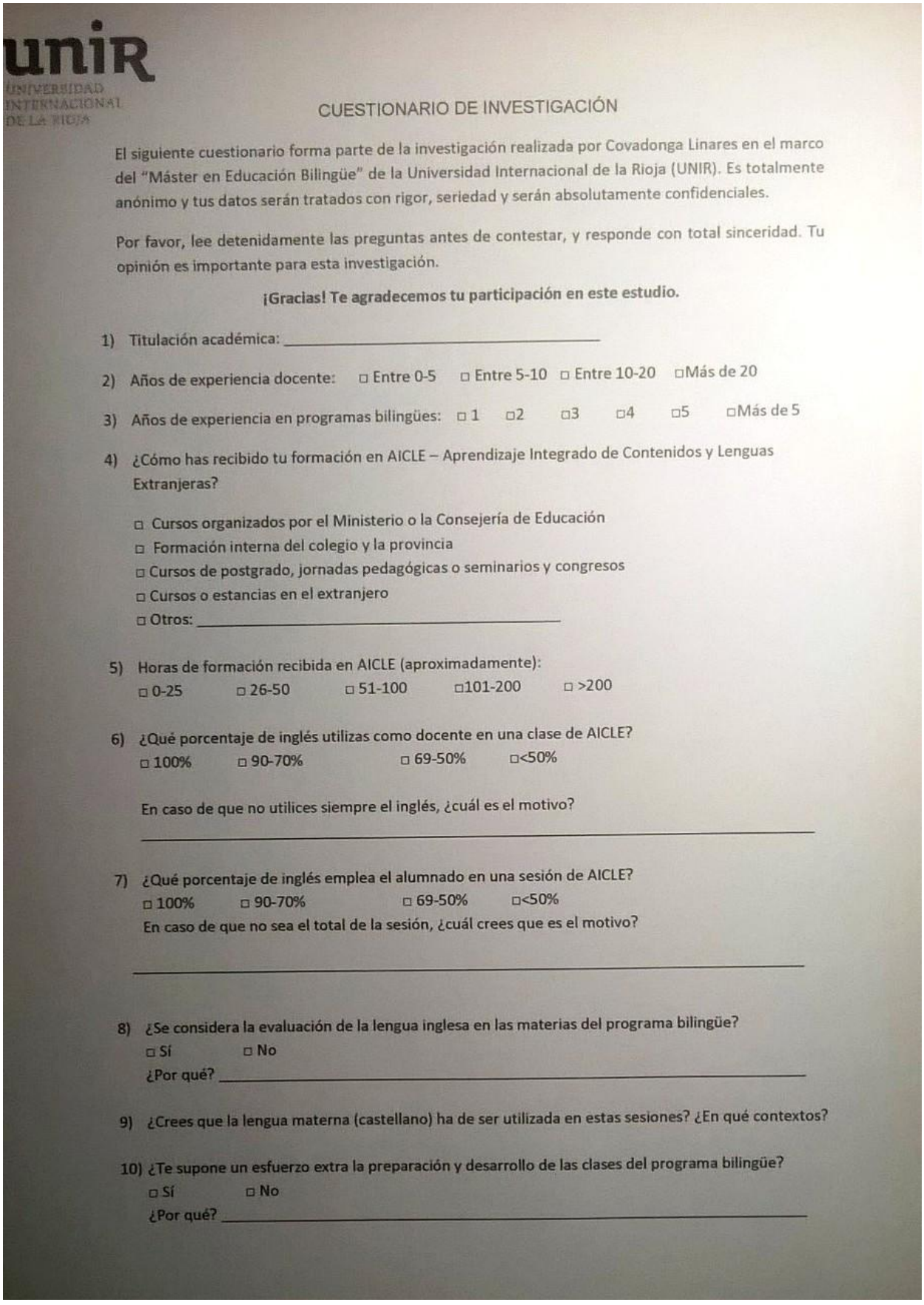
6) Señala cuánto te interesan estos temas:

	Mucho	Bastante	Poco	Nada
1. Cómo crecen y se reproducen las plantas	1	2	3	4
2. Cómo reaccionan las sustancias químicas	1	2	3	4
3. Vidas de científicos/as famosos	1	2	3	4
4. Cómo funcionan los ordenadores	1	2	3	4
5. Qué dieta es mejor para la salud	1	2	3	4
6. La posibilidad de vida fuera de la Tierra	1	2	3	4
7. Cómo se evapora el agua	1	2	3	4
8. Cómo funciona una central nuclear	1	2	3	4
9. De qué materia están hechos los animales	1	2	3	4
10. Cómo curar el cáncer y otras enfermedades	1	2	3	4
11. Por qué se producen terremotos y tsunamis	1	2	3	4
12. Cómo se clasifican los animales y plantas	1	2	3	4
13. Cómo se originó la vida en la Tierra	1	2	3	4
14. El diseño de coches más potentes	1	2	3	4
15. Por qué se extinguieron los dinosaurios	1	2	3	4

7) ¿En qué grado estás de acuerdo con las siguientes frases referidas a la ciencia o tecnología?

	De Acuerdo	Bastante de acuerdo	Regular	Muy en desacuerdo
1. El progreso científico y tecnológico ayuda a curar enfermedades como SIDA, cáncer, etc.	1	2	3	4
2. La ciencia y la tecnología hacen nuestra vida más saludable, más fácil y más cómoda	1	2	3	4
3. Un país necesita ciencia y tecnología para desarrollarse	1	2	3	4
4. La ciencia que he aprendido en la escuela es interesante	1	2	3	4
5. La ciencia escolar es fácil de aprender	1	2	3	4
6. Yo creo que todos deberían aprender ciencia en la escuela.	1	2	3	4
7. La ciencia escolar me ha hecho más crítico y escéptico	1	2	3	4
8. Las cosas que aprendo en la ciencia escolar son útiles en mi vida cotidiana	1	2	3	4
9. La ciencia escolar me ha ayudado a curar mi salud	1	2	3	4
10. La ciencia y la tecnología son importantes para la sociedad	1	2	3	4

APPENDIX 2. QUESTIONNAIRE FOR TEACHERS OF THE BILINGUAL PROGRAM



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¡Gracias! Te agradecemos tu participación en este estudio.

1) Titulación académica: _____

2) Años de experiencia docente: □ Entre 0-5 □ Entre 5-10 □ Entre 10-20 □Más de 20

3) Años de experiencia en programas bilingües: □ 1 □2 □3 □4 □5 □Más de 5

4) ¿Cómo has recibido tu formación en AICLE – Aprendizaje Integrado de Contenidos y Lenguas Extranjeras?

□ Cursos organizados por el Ministerio o la Consejería de Educación
□ Formación interna del colegio y la provincia
□ Cursos de postgrado, jornadas pedagógicas o seminarios y congresos
□ Cursos o estancias en el extranjero
□ Otros: _____

5) Horas de formación recibida en AICLE (aproximadamente):
□ 0-25 □ 26-50 □ 51-100 □101-200 □ >200

6) ¿Qué porcentaje de inglés utilizas como docente en una clase de AICLE?
□ 100% □ 90-70% □ 69-50% □<50%

En caso de que no utilices siempre el inglés, ¿cuál es el motivo?

_____

7) ¿Qué porcentaje de inglés emplea el alumnado en una sesión de AICLE?
□ 100% □ 90-70% □ 69-50% □<50%
En caso de que no sea el total de la sesión, ¿cuál crees que es el motivo?

_____

8) ¿Se considera la evaluación de la lengua inglesa en las materias del programa bilingüe?
□ Sí □ No
¿Por qué? _____

9) ¿Crees que la lengua materna (castellano) ha de ser utilizada en estas sesiones? ¿En qué contextos?

10) ¿Te supone un esfuerzo extra la preparación y desarrollo de las clases del programa bilingüe?
□ Sí □ No
¿Por qué? _____

11) ¿Cuál es su grado de satisfacción con respecto al desarrollo del programa bilingüe?
□ Altamente satisfactorio □ Satisfactorio □Poco satisfactorio □Nada satisfactorio

12) ¿Cuáles son las principales ventajas que presenta el desarrollo del programa bilingüe en el centro?

13) ¿Cuáles son las mayores dificultades, obstáculos o desafíos del mismo?

14) ¿Cómo crees que es la motivación del alumnado hacia el programa bilingüe?

15) ¿Y hacia el aprendizaje en general?

16) Otras apreciaciones que consideres oportunas:

***CUESTIONES ESPECÍFICAS PARA LA COORDINADORA DEL PROGRAMA BILINGÜE DEL COLEGIO AUSEVA:**

-¿En qué consisten tus tareas como coordinadora?

-¿Qué mecanismos de coordinación existen?

-¿Cómo es la implicación del profesorado con el programa?

-¿Y la del alumnado? ¿Y sus familias?

-¿Cómo valoras el programa bilingüe en términos de análisis DAFO?

Debilidades	Amenazas
Fortalezas	Oportunidades

-¿Qué cambios se prevé realizar en el programa (ampliación a otros cursos y materias, adición de otro idioma al programa, participación en programas europeos, etc.)?

APPENDIX 3. FIGURES AND GRAPHICS

Figure 3. Question 1. Linguistic and academic profile

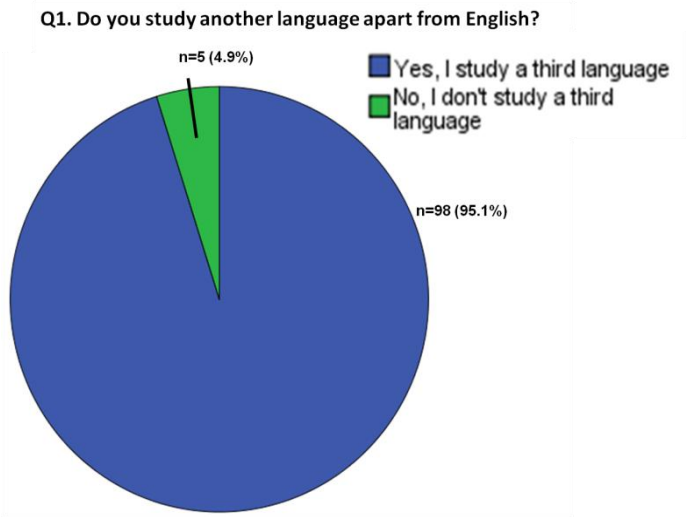


Figure 4. Question 2. Linguistic and academic profile

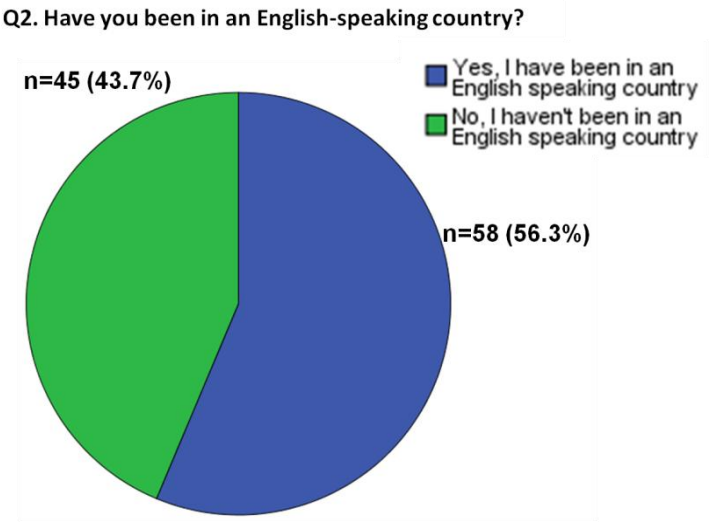


Figure 5. Question 3. Linguistic and academic profile

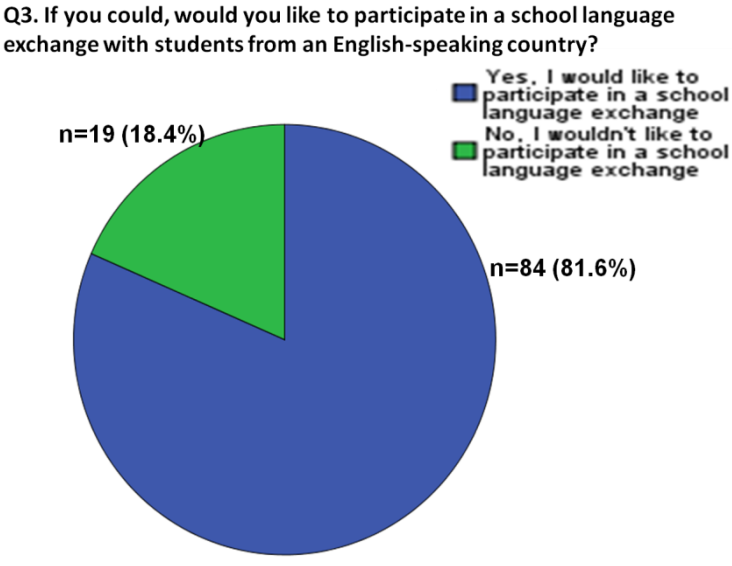


Figure 6. Question 3b. Linguistic and academic profile

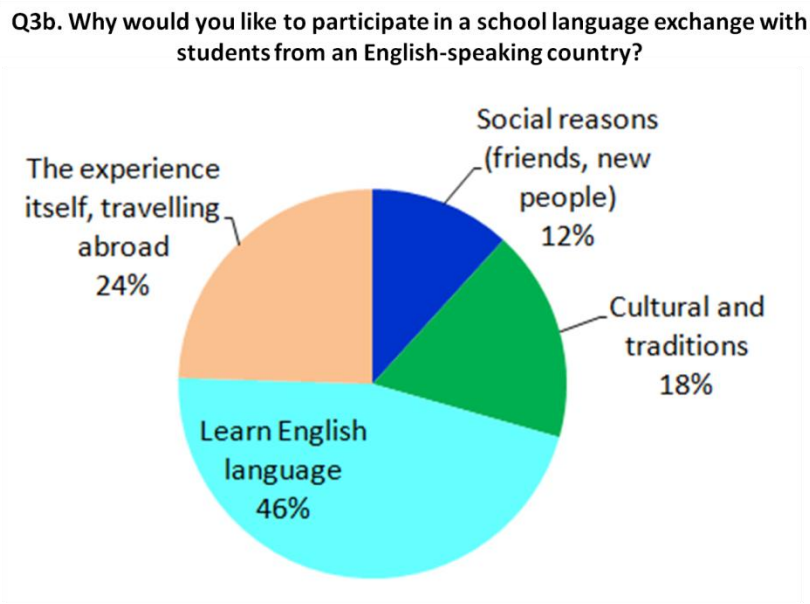


Figure 7. Question 4. Linguistic and academic profile

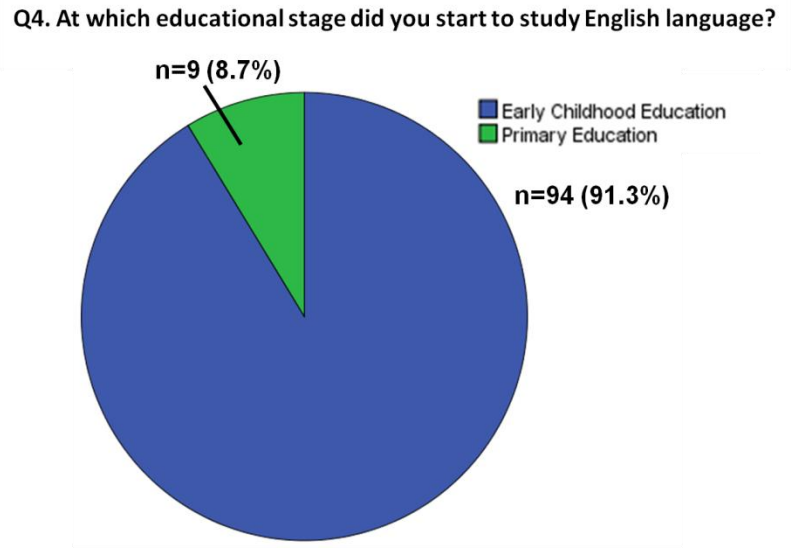


Figure 8. Question 5. Linguistic and academic profile

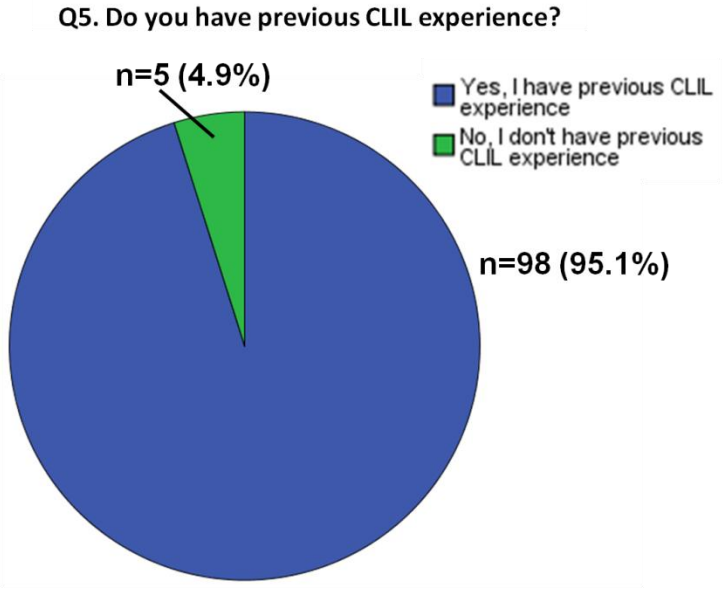


Figure 9. Question 6. Linguistic and academic profile

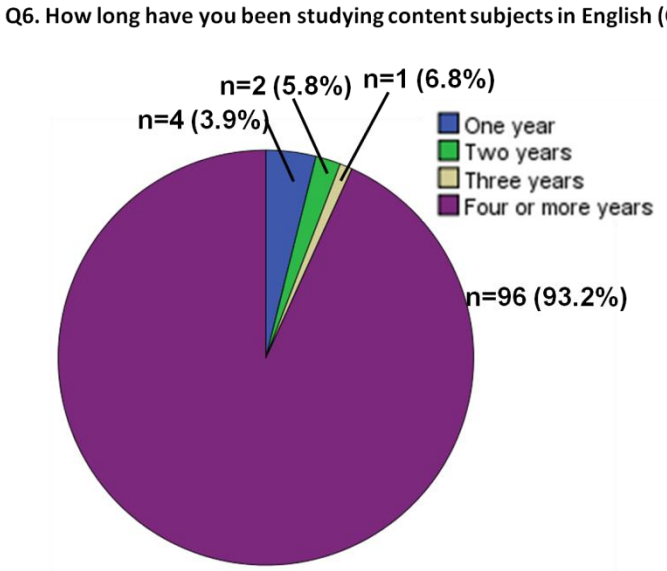


Figure 10. Question 7. Linguistic and academic profile

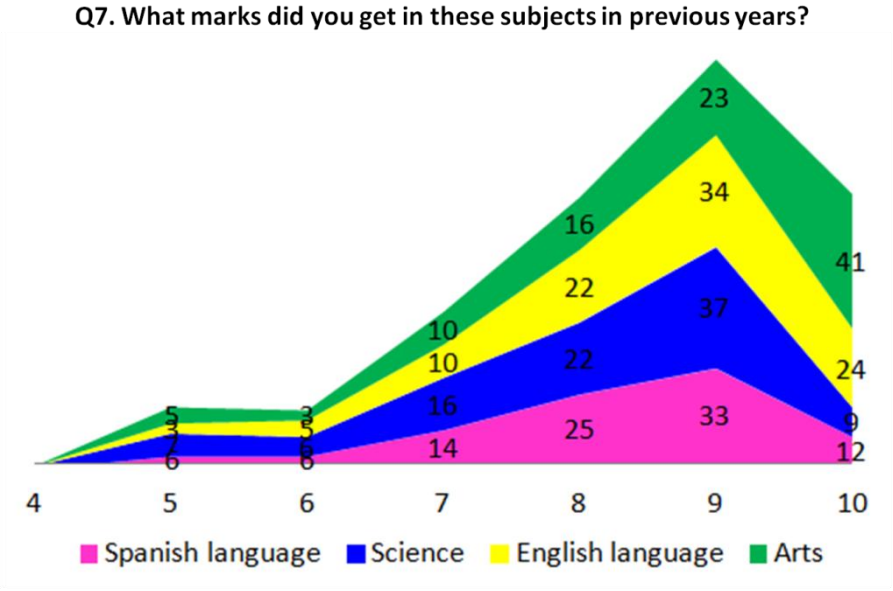


Figure 11. Question 8. Linguistic and academic profile

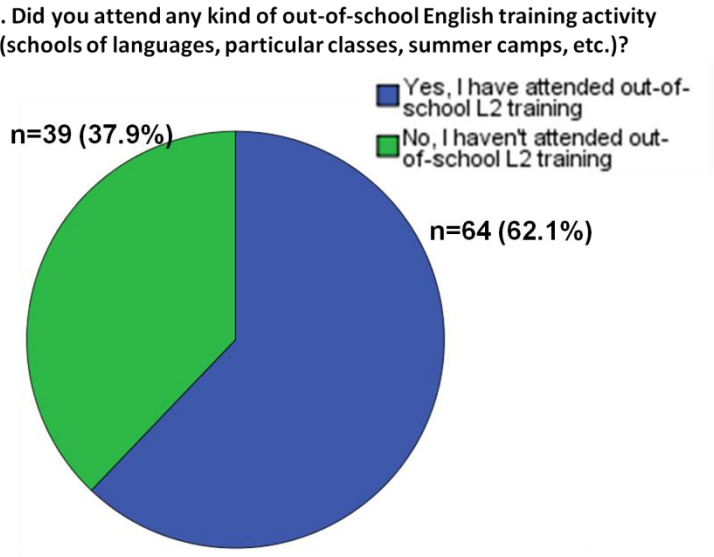


Figure 12. Question 8c. Linguistic and academic profile

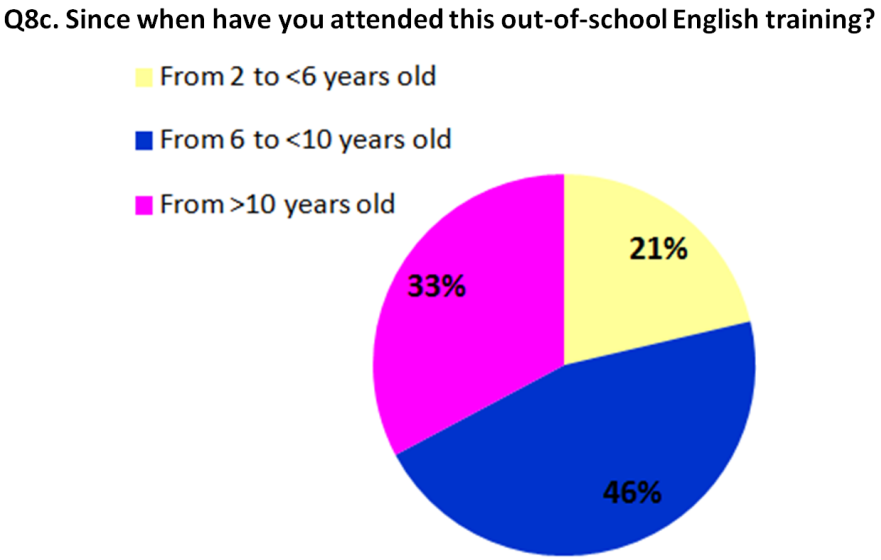


Figure 13. Question 9. Linguistic and academic profile

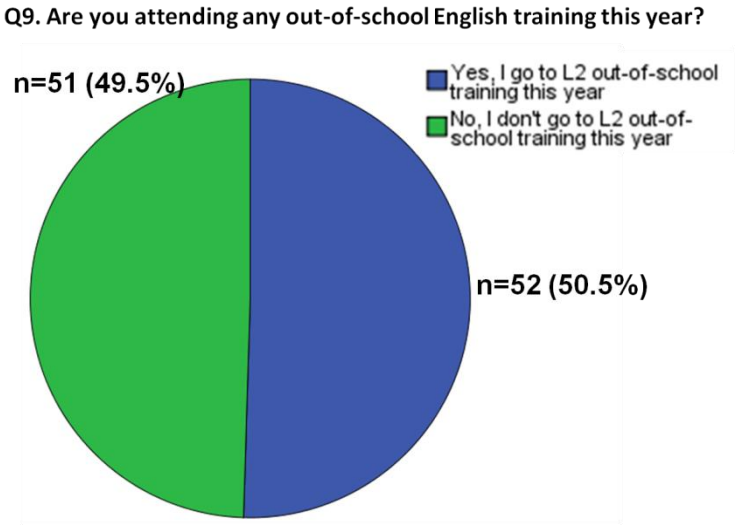


Figure 14. Question 9b. Linguistic and academic profile

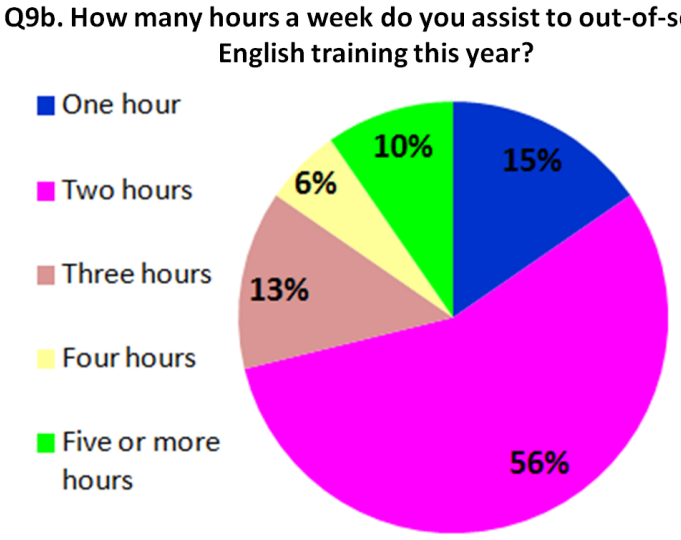


Figure 15. Question 10. Linguistic and academic profile

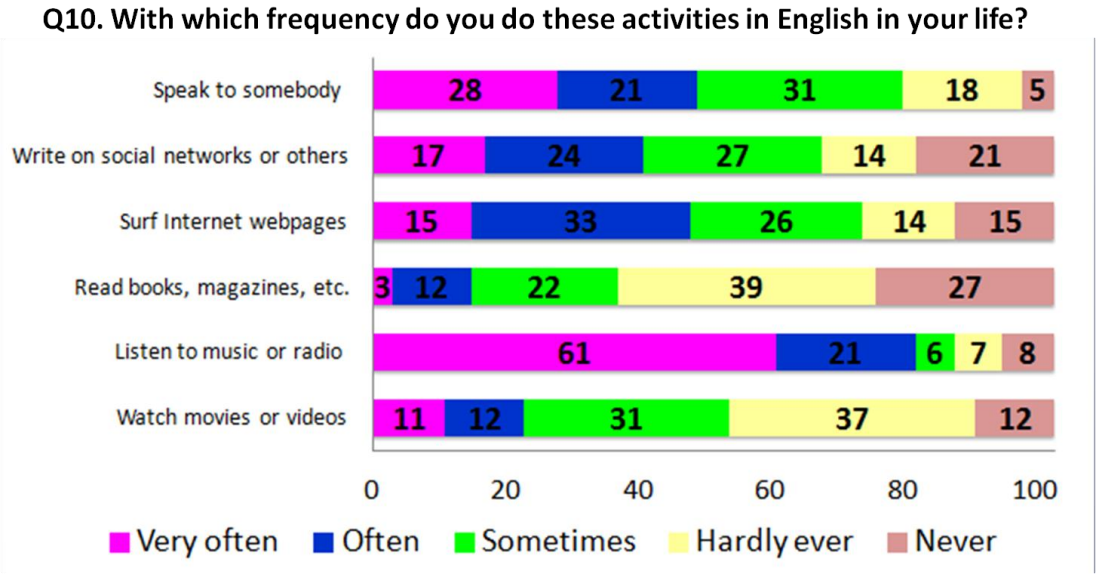


Figure 16. Question 11. Linguistic and academic profile

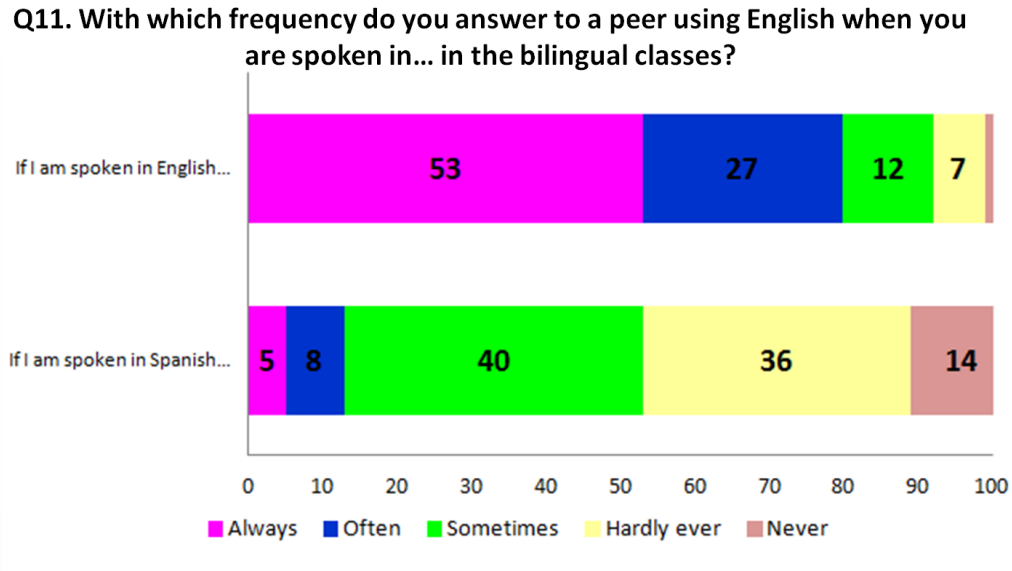


Figure 17. Question 1i. Attitudes, beliefs and motivations

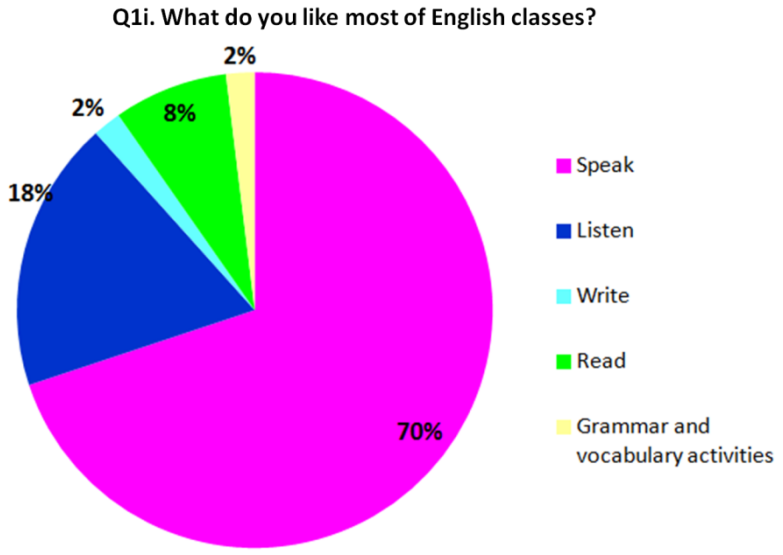


Figure 18. Question 3i. Attitudes, beliefs and motivations

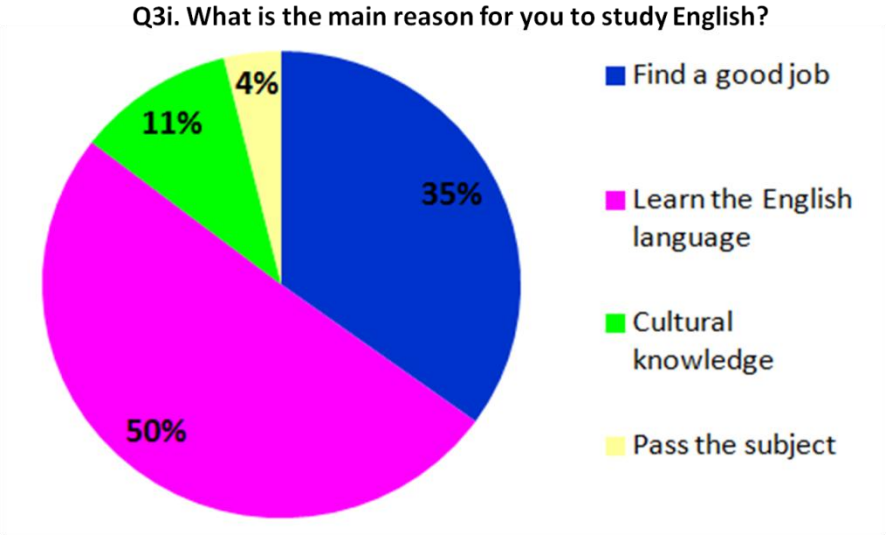


Figure 19. Question 5i. Attitudes, beliefs and motivations

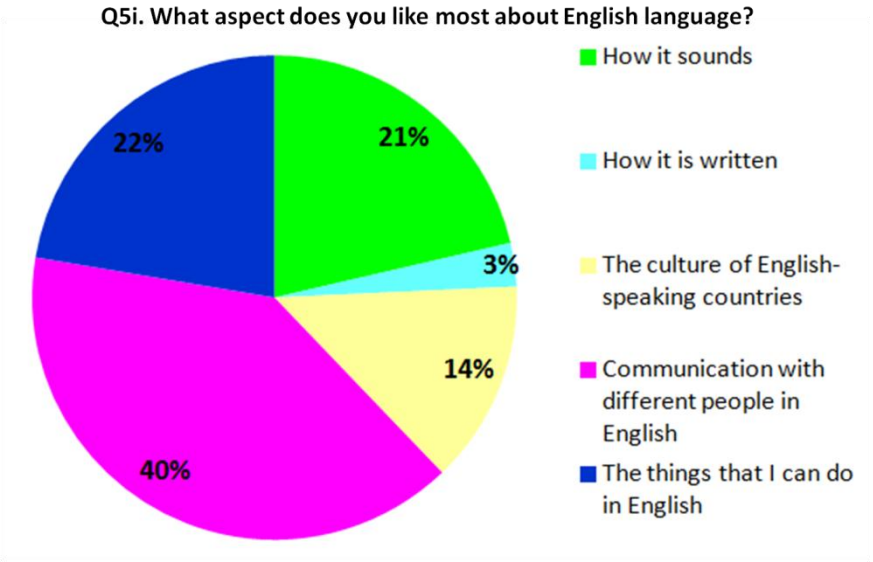


Figure 20. Question 7i. Attitudes, beliefs and motivations

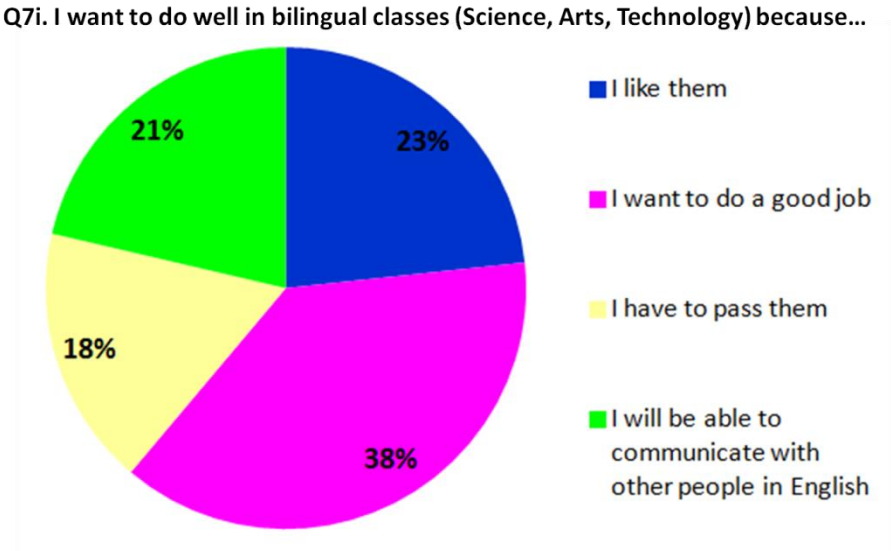


Figure 21. Questions 4i and 9i. Attitudes, beliefs and motivations

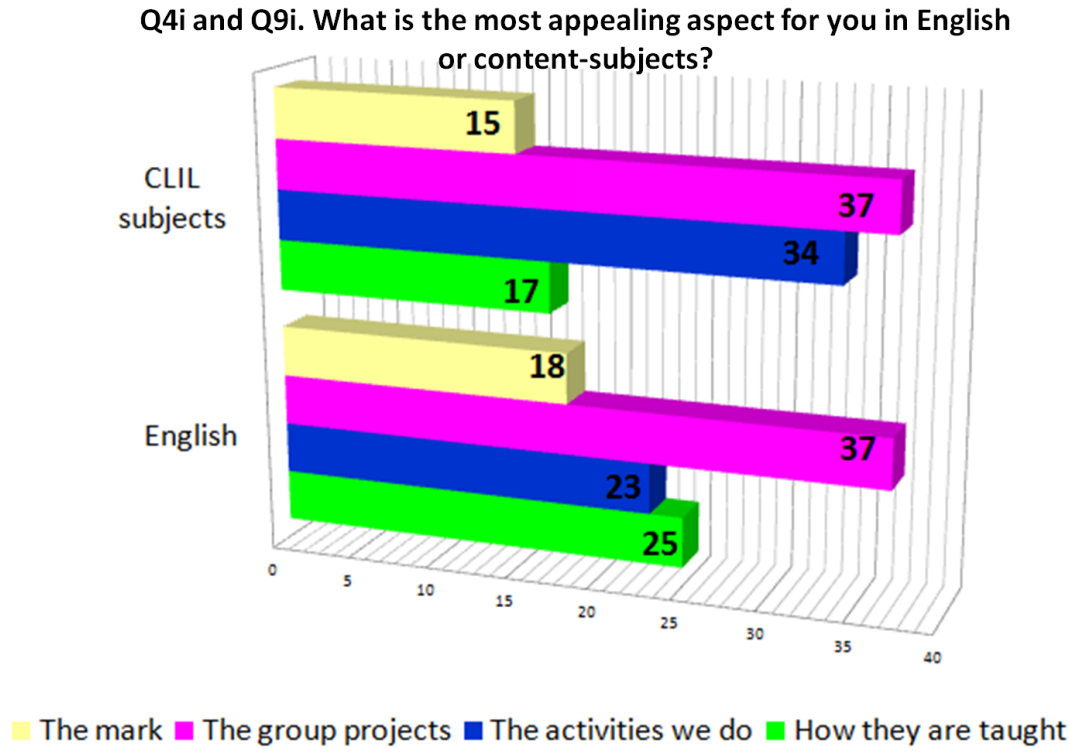


Figure 22. Question 10i. Attitudes, beliefs and motivations

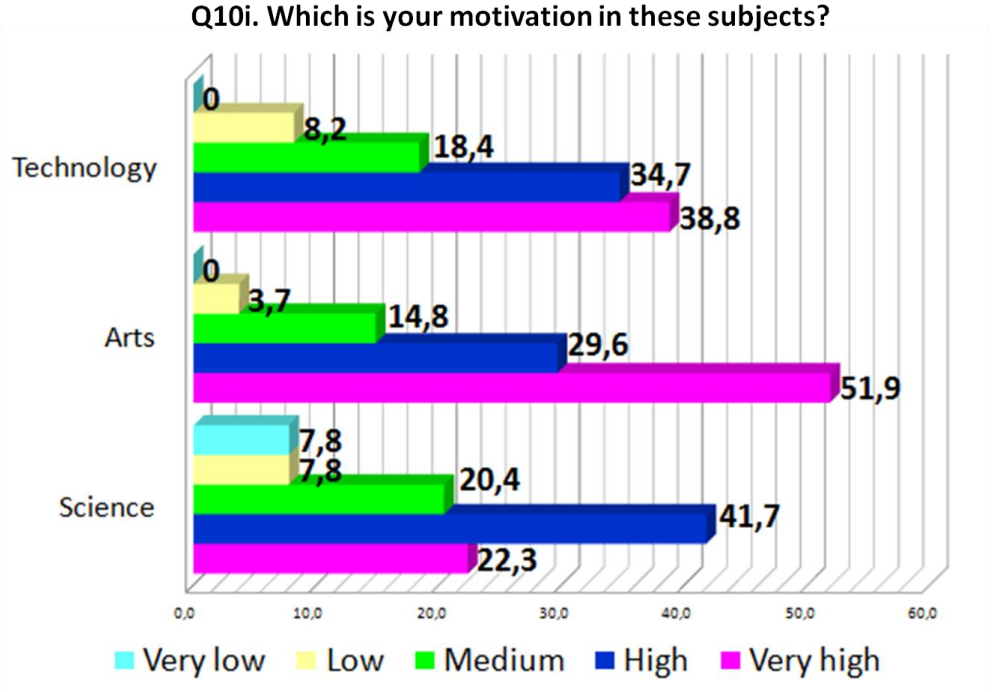
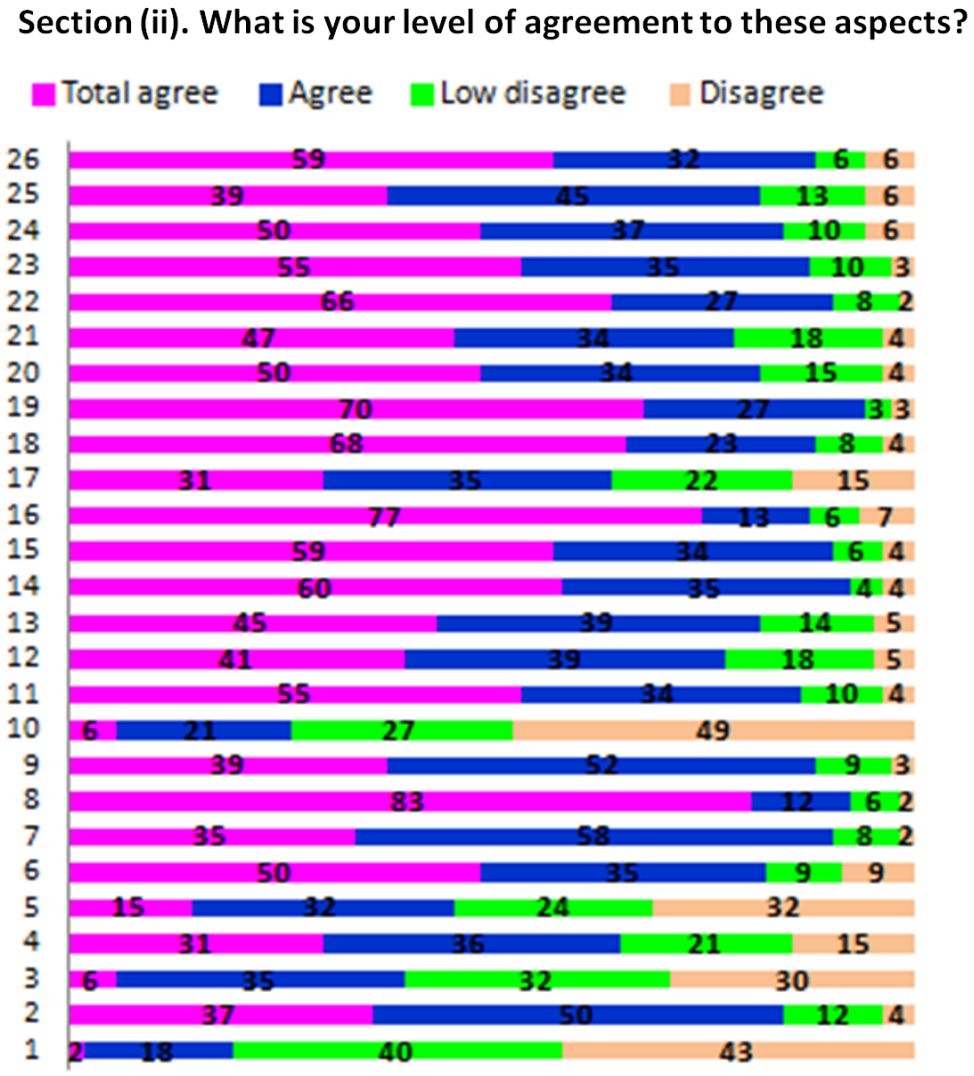


Figure 23. Section (ii). Attitudes, beliefs and motivations



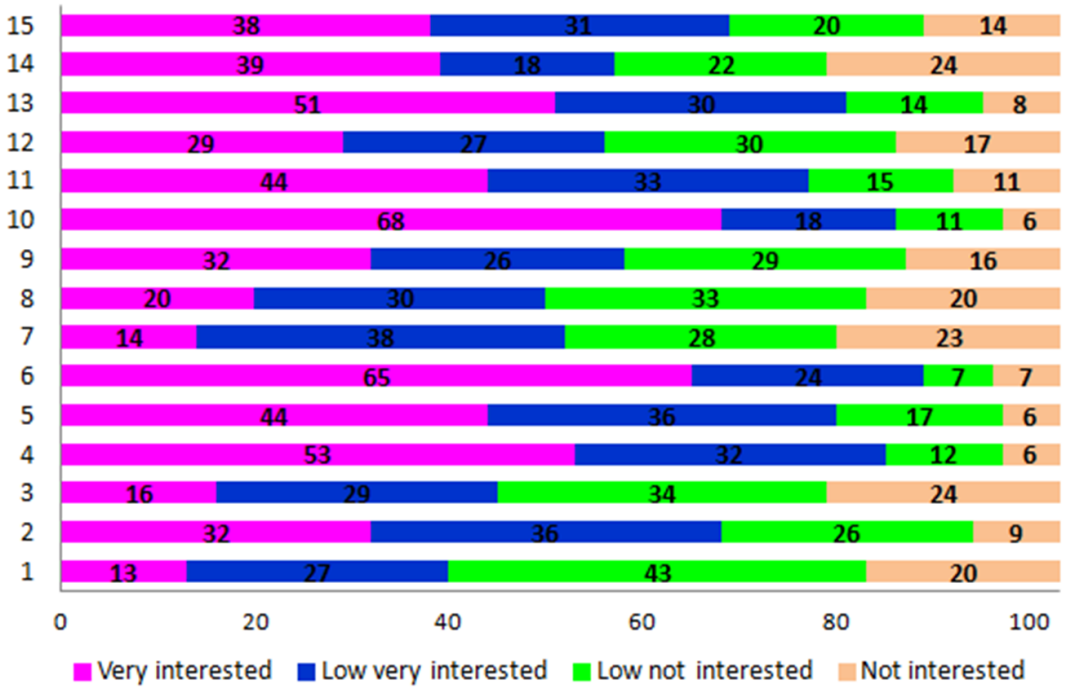
1. Speak in English is difficult
2. Read in English is difficult
3. Write texts in English is difficult
4. Understand oral English is easy
5. I feel nervous when I have to speak in English
6. I'd like to know more people to communicate in English to
7. I make great efforts at English classes
8. In general, I believe learning English is important
9. I make great efforts at the bilingual classes
10. It is difficult for me to understand the contents in bilingual classes
11. My English level is improving because of the bilingual program
12. Study a subject in English is easier than I thought
13. It is a need to have good English level for bilingual classes
14. It is important to have good English command
15. Thought it is compulsory, I like learning English
16. In general, I like music in English and I want to understand it
17. I like watching movies in English and understand what they are saying
18. I want to travel abroad, and learning English will help me

19. I want to learn more English to communicate with people from other countries
20. In general, I am interested in learning other languages
21. If I could, I'd learn other language apart from English
22. I like learning new things
23. I get good marks on English
24. I get good marks on the bilingual subjects
25. I like bilingual classes and how they are taught
26. I am happy for being in the bilingual program of the school

Figure 24. Question 1iii. Attitudes towards science

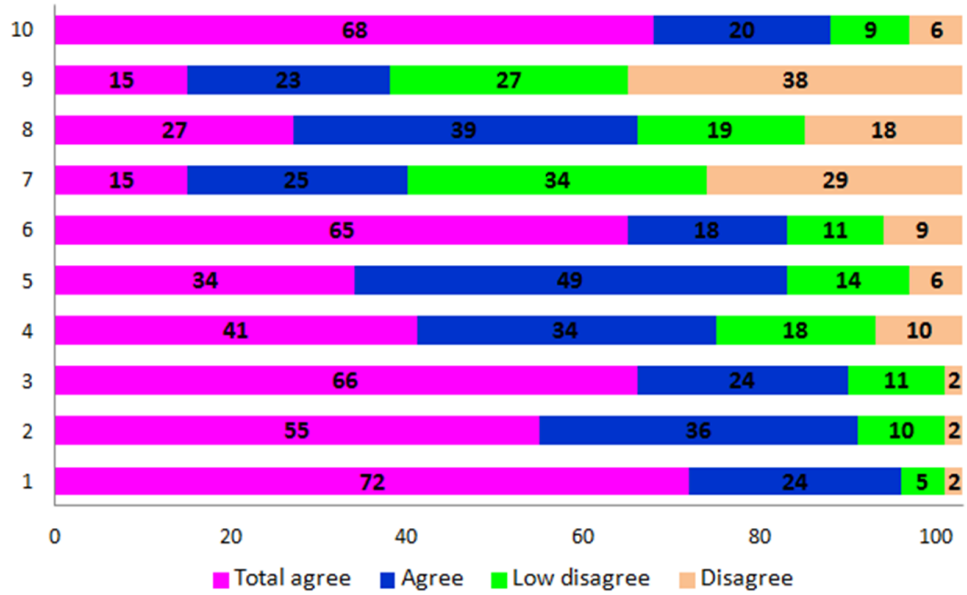
Q3iii. What is your prefered way to learn something new?	
Newspapers	3
Magazines	7
Internet	35
TV	35
Teacher	42
Parents	11
All options	6

Figure 25. Question 6iii. Attitudes towards science



1. How plants grow and reproduce
2. How different chemical substances react
3. Lives of famous science men and women
4. How computers work
5. What to eat to keep healthy and fit
6. The possibility of life outside Earth
7. How water evaporates
8. How a nuclear central works
9. What matter are animals made of
10. How to cure cancer and other diseases
11. Why do earthquakes and tsunamis take place
12. How to classify plants and animals
13. How life began on Earth
14. The design of more powerful cars
15. Why did dinosaurs extinct

Figure 26. Question 7iii. Attitudes towards science



1. Scientific and technological progress helps curing diseases such as AIDS, cancer, etc.
2. Science and technology make our lives healthier, easier and more comfortable
3. A country needs science and technology for its development
4. School science I have learnt is interesting
5. School science is easy
6. I believe all people should learn science at school
7. School science has made me more critical and skeptical
8. What I have learnt in school science is useful for my day-to-day life
9. School science has helped me with health issues
10. Science and technology are important for society

Figure 27. Test of homogeneity of variances for science attitudes items

Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
Q_iii6.1	,164	1	101	,686
Q_iii6.2	,512	1	101	,476
Q_iii6.3	2,344	1	101	,129
Q_iii6.4	,000	1	101	,987
Q_iii6.5	,001	1	101	,976
Q_iii6.6	1,942	1	101	,167
Q_iii6.7	2,109	1	101	,150
Q_iii6.8	,071	1	101	,790
Q_iii6.9	1,126	1	101	,291
Q_iii6.10	1,594	1	101	,210
Q_iii6.11	,006	1	101	,941
Q_iii6.12	,195	1	101	,660
Q_iii6.13	,010	1	101	,922
Q_iii6.14	2,213	1	101	,140
Q_iii6.15	7,477	1	101	,007

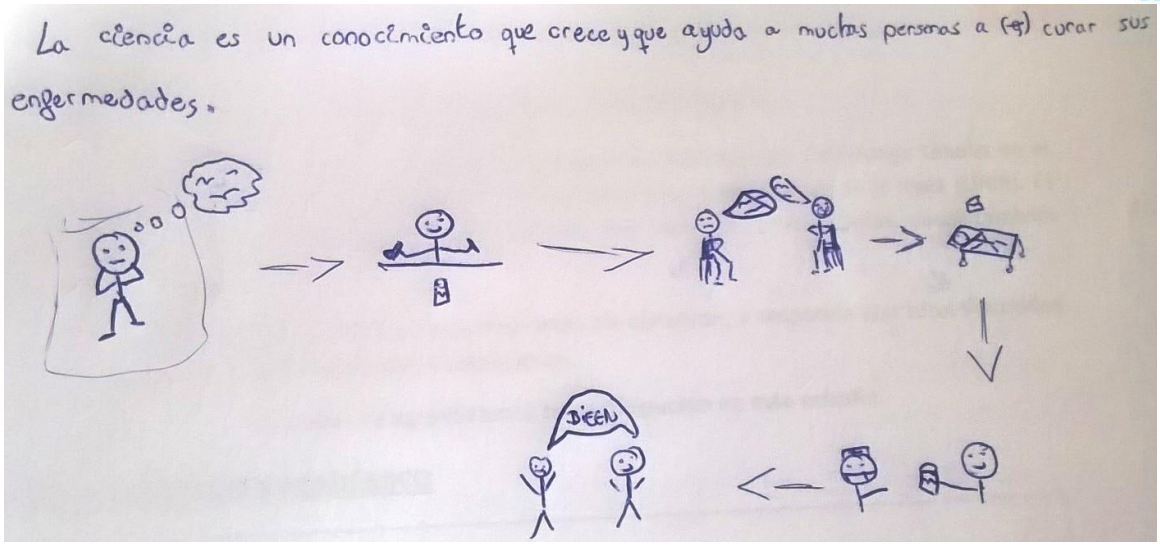
Figure 28. ANOVA test for item 15, question 6. Section (iii)

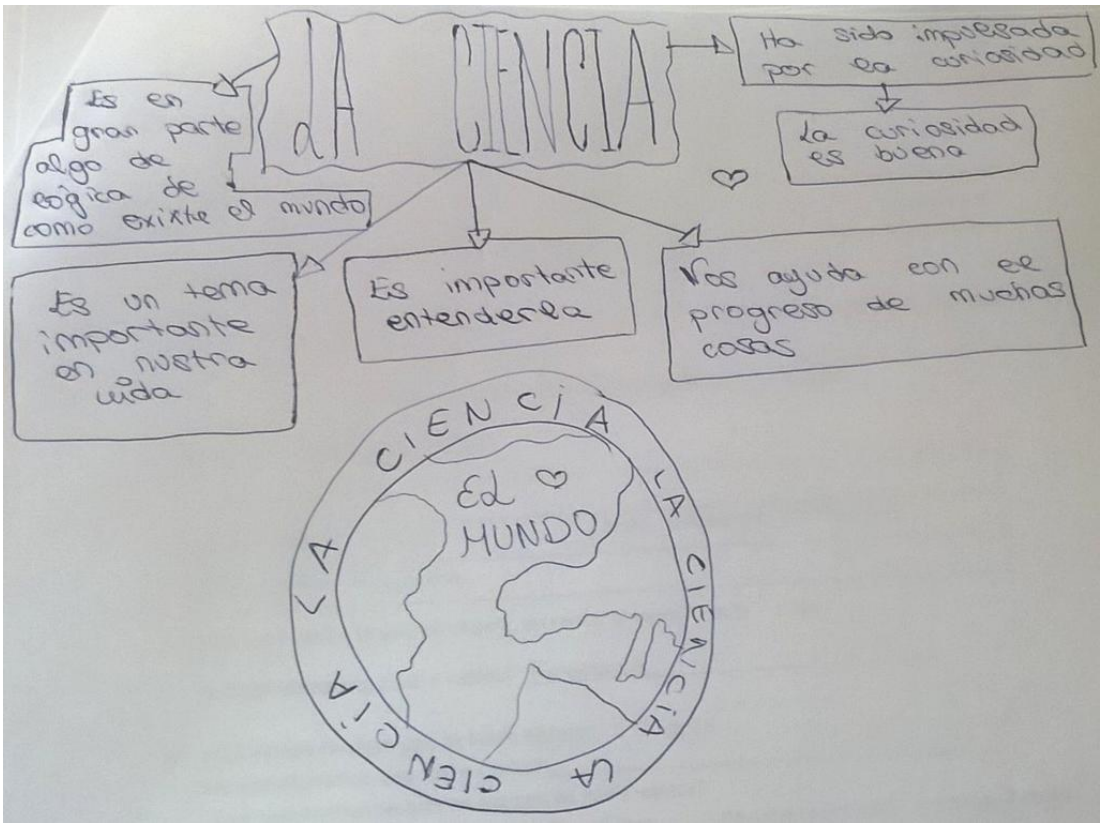
ANOVA

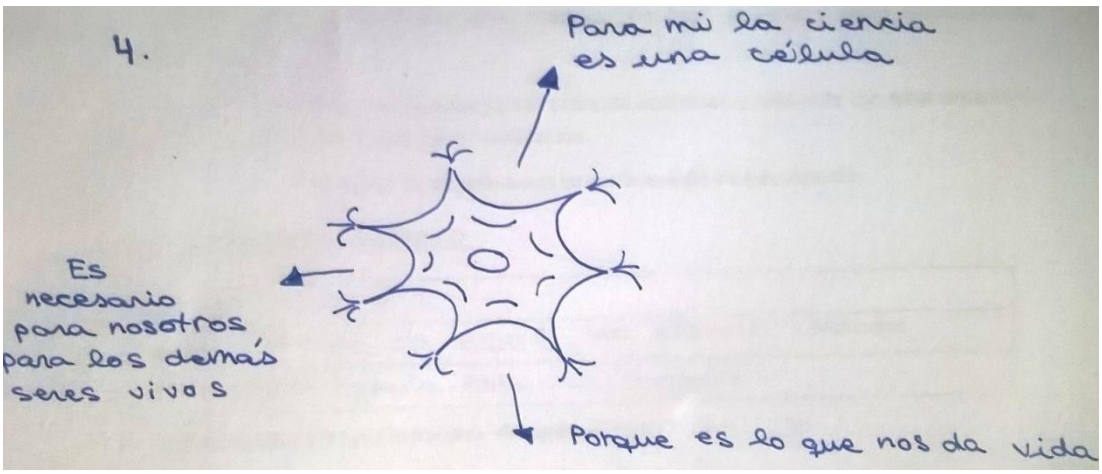
Q_iii6.15

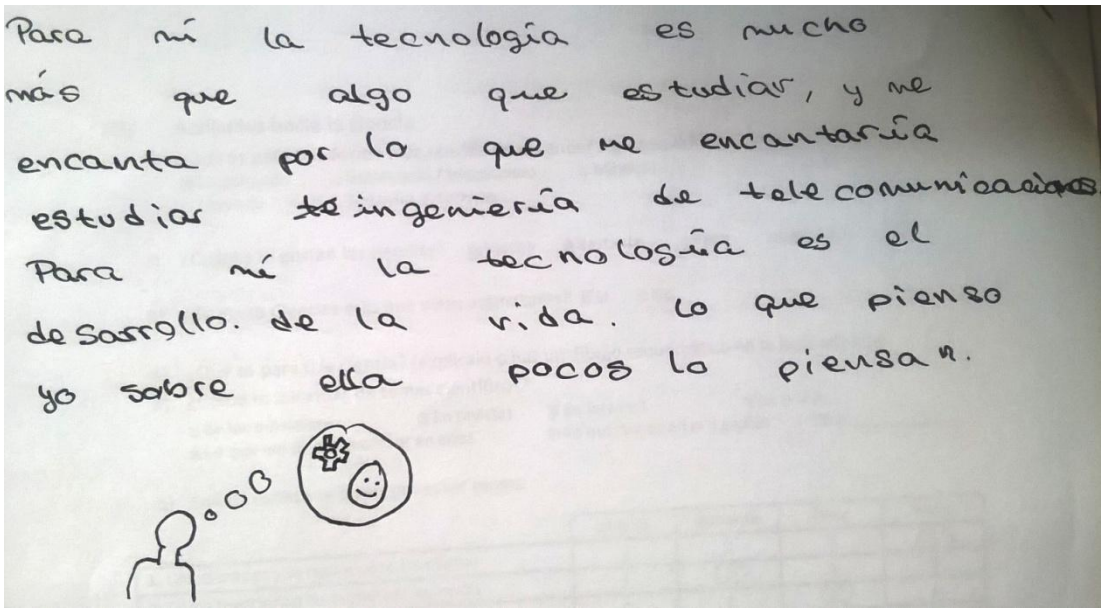
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2,143	1	2,143	1,952	,165
Within Groups	110,886	101	1,098		
Total	113,029	102			

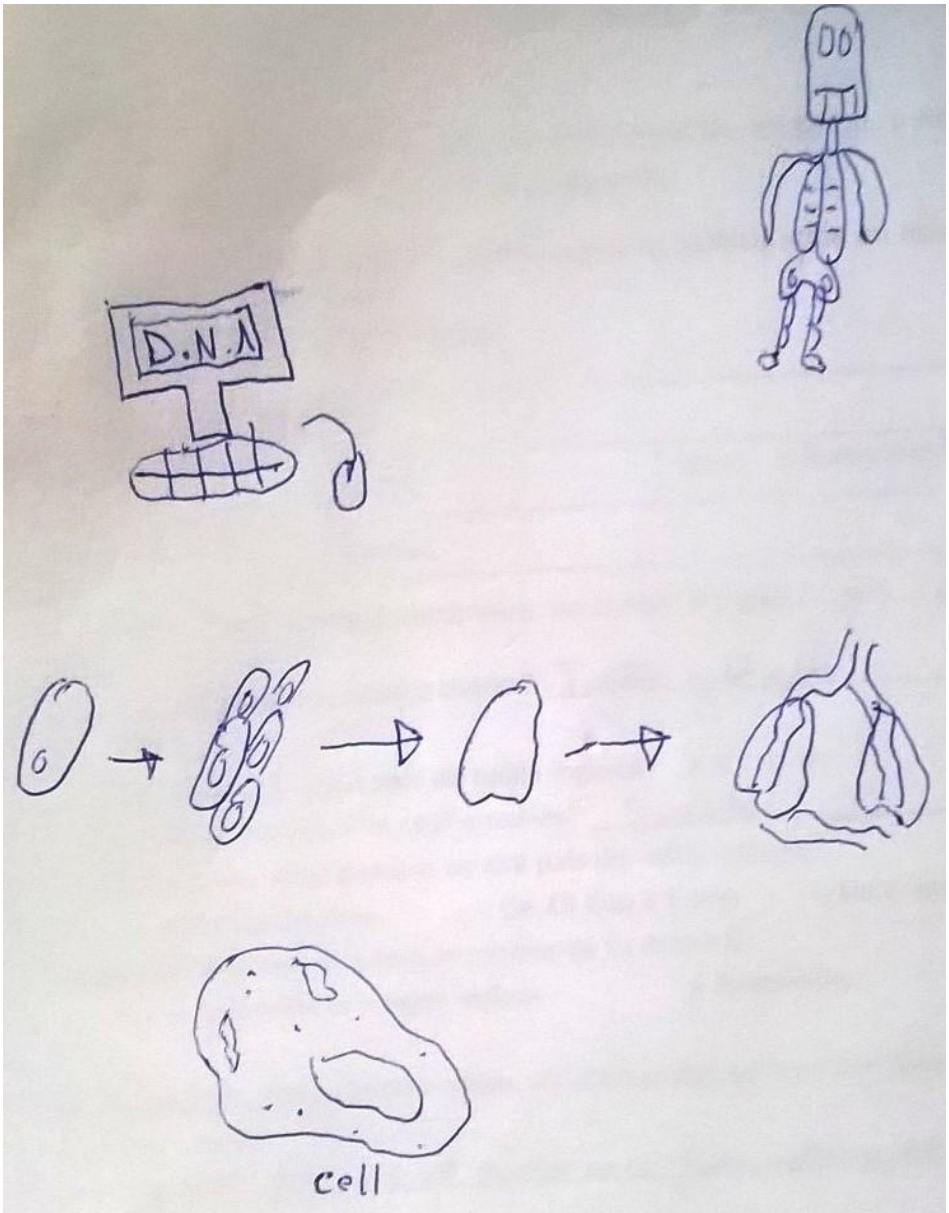
APPENDIX 4. STUDENTS' VIEW OF SCIENCE


La ciencia es un conocimiento que crece y que ayuda a muchas personas a (q) curar sus enfermedades.
CIENCIA


LA CIENCIA
Es en gran parte algo de lógica de como existe el mundo
Ha sido impulsada por la curiosidad
La curiosidad es buena
Es un tema importante en nuestra vida
Es importante entenderla
Nos ayuda con el progreso de muchas cosas
CIENCIA
EL MUNDO
LA CIENCIA
LA CIENCIA


4.
Para mi la ciencia es una célula
Es necesario para nosotros para los demás seres vivos
Porque es lo que nos da vida


Para mí la tecnología es mucho
más que algo que estudiar, y me
encanta por lo que me encantaría
estudiar de ingeniería de telecomunicaciones
Para mí la tecnología es el
desarrollo de la vida. Lo que pienso
yo sobre ella pocos lo piensan.


D.N.A
cell