CLIL in primary education: creativity, robots & STEM

LiceoLab

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1st Grade students preparing the activity

6th Grade students

6th Grade students

INTRODUCTION

Science, technology, engineering, and mathematics (STEM) education is a crucial issue in current educational trends. Research shows that integrative approaches improve students' interest and learning in STEM (Becker & Park, 2011). STEM methodology is based on the idea of educating students in these four specific disciplines in an interdisciplinary and applied approach. Rather than teach the four disciplines as separate and discrete subjects, STEM integrates them into a cohesive learning paradigm based on real-world applications (LiveScience). It is based on integrated and interdisciplinary science learning, mainly by means of solving open problems and situations rather than structured ones, using the content and procedure of these subjects as a whole. (Sanders, 2008, 2012).

On the other hand, in many parts of the world, bilingual education is currently an important issue, but there is little consensus on what it means in practical terms, or how different languages can best be incorporated into the education system (Breeze & Garcia, 2016). The need for multilingual citizens is becoming more and more evident in many different social spheres which encompass not only the job market, but also social integration (ever increasing migratory movements being a very good case in point), education, research and many others. As a result of this global trend, the learning of FLs (Foreign Languages) is playing a major role in many educational systems all over the world. This is the context in which **CLIL (Content and Language Integrated Learning)** programmes are becoming commonplace and leading many necessary avenues of research to suggest themselves (Lasagabaster & Sierra, 2009) This approach promotes the development of diverse learning strategies, the application of innovative teaching methods and techniques and the increase of learner motivation (Ioannou-Georgiou & Pavlou, 2011). Although not everyone is convinced of the benefits of multilingual education, many researchers have been able to show that the academic performance of students in bilingual/CLIL schools is comparable to that of students in monolingual centres, or that they even attain better results (Van the Craen et al. 2007).

As researchers have continuously urged foreign language educators to seek alternatives to traditional instruction, during the last decade the **GBL (Game Based Learning)** educational approach keeps increasing in the foreign language learning context, utilizing the ability of games to make language education entertaining and to provide learning environments that contextualize knowledge and immersive experiences for learners. In addition, GBL approach to foreign language learning provides more effective learning compared to traditional methods, develops positive attitudes in students and increases the retention process. GBL also provides the opportunity for Content-based Learning (CBL), as "games are not necessarily about memorizing or providing correct answers", but rather about the comprehension of the content provided in the game and the application of various learning strategies. (Dourda et al. 2014)

In the same way, **R-in-E (Robotics in Education)** tries to strengthen the learning skills of future engineers and scientists by means of robot-based projects. Both in school and in college, presenting robots in the classroom will give students a more interesting (and fun) vision of science and engineering, and they will be able to observe directly the practical application of theoretical concepts in the fields of mathematics and technology. One could also point out that R-in-E furthers and strengthens both in curricular and in extracurricular activities values such as creativity, innovation, support, cooperation and teamwork. Clearly, these values must be promoted in our society. (Curto & Moreno, 2016). Robotics is used to teach problem solving, programming, design, physics, math and even music and art to students at all levels of their education (Miller & Nourbakhsh, 2016).

PURPOSE

The main purpose of this venture has been to introduce the aforementioned methodologies, namely, **CLIL, STEM** and **Robotics** into the students' learning process by appealing to the role of creativity in our day-to-day teaching as a means to foster students' interest in STEM, thus developing social skills and teamwork among motivated learners. As part of the process, literacy and communication have been some of the important skills in these activities. We have also taken into account the students' aptitudes for Art and Design as they play a key role in robot-based projects. Our hope is that the outcome of this venture will undoubtedly foster a learning environment in which motivation and creativity will help to stimulate the learning process of our students. Among the foreseeable we have set ourselves, we are glad to mention a few such as:
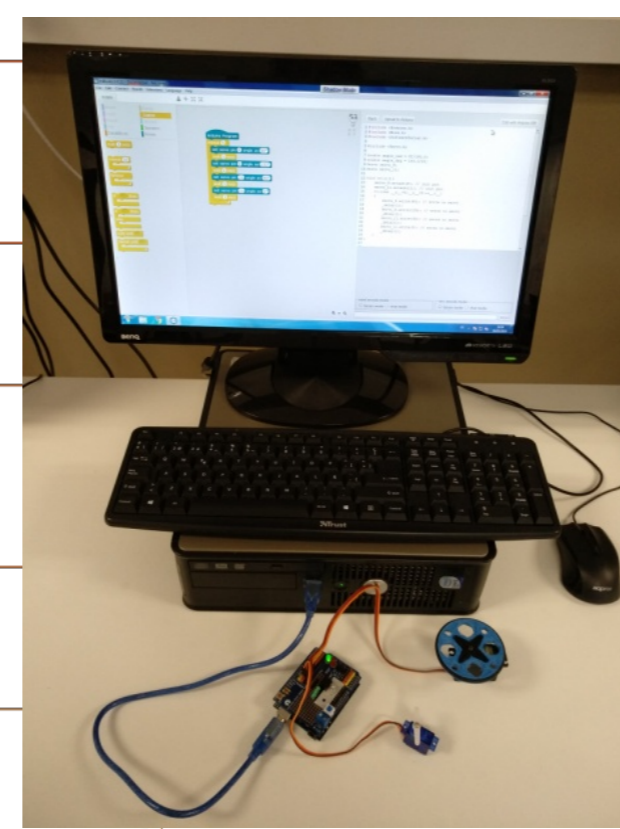
- To form a link between the primary and secondary school sections as regards their syllabus and contents
- To introduce the STEM methodology into primary education
- To boost the students' interest in Science, Technology, Engineering and Math (STEM) through robots and other projects right from the primary section
- To reinforce the English language through Game Based Learning
- To make students explore and create new learning environments

To ensure that our strategy works, we have broken down the contents into three grades depending on the different levels and learning capacities of the learners as follows:

| 1st Grade	2nd Grade	6th Grade
• Review the different techniques learnt in Arts and Crafts to decorate the mat: Open lines, closed lines, pointillism • Tell the difference between simple and complex machines	• Review the vocabulary of the unit: parts of the town • Be able to ask for and give directions using the vocabulary learnt in the unit • Review the mathematical concept of grid movement	• Learn to use a ruler to draw different geometric shapes • Draw the different polygons using specific measurements • Identify the different types of angles • Participate in teamwork activities, being responsible of their own tasks and learning from the others • Build a machine

MATERIAL & METHODS

The materials used in all the lesson plans have been based on robotic materials: **Arduino mother-boards, sensors and actuators** (continuous rotation servomotors, 0-180 degrees servos...) as well as the **"mouse-bots"** best suited for the younger learners. Regarding the Arts and Crafts, different materials have been used for the robotic-arm construction. The methodology which has been used is a mixture of STEM methodology and CLIL combined with our Learning-Service, as students from upper levels have taken charge of teaching the learners at the lower levels.
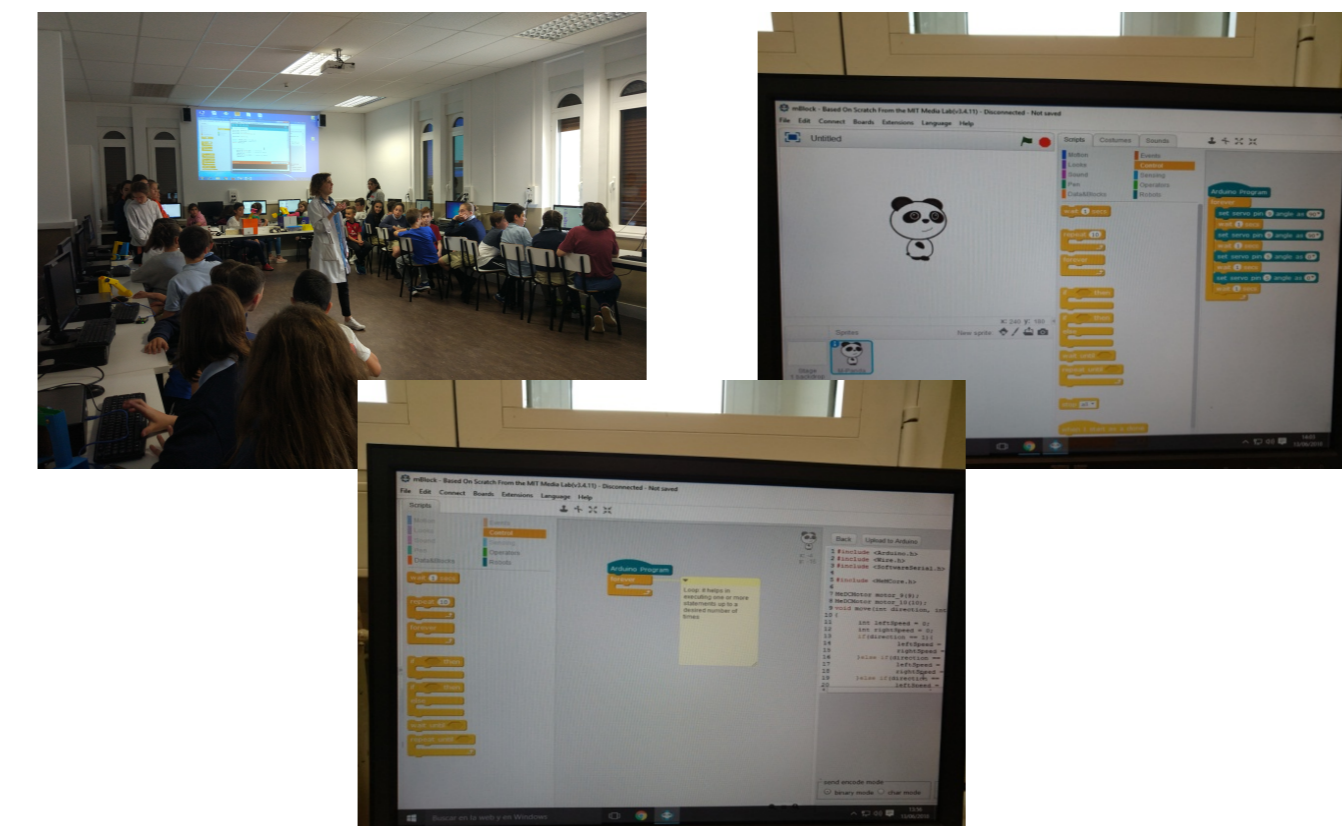
RESULTS

As we can see in the pictures, the six-grade pupils built a robotic arm. It was able to move up and down, right and left due to the 0° - 180° mini servos. On their part, the first and second grade pupils programmed the "MouseBot" in order to complete organised sequences or events in which various math concepts were applied. In both cases, the English was the language used for communication, thus giving our students more opportunities to practice and use the already learnt vocabulary and grammar contents.
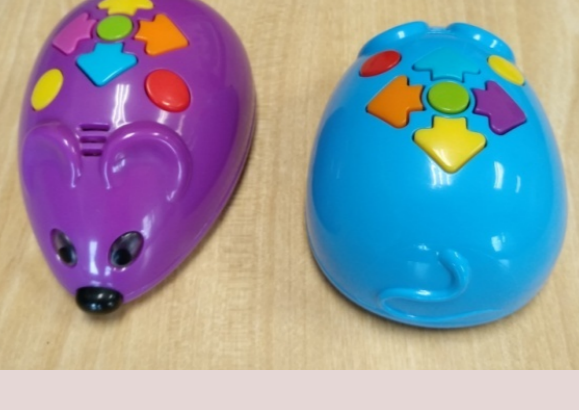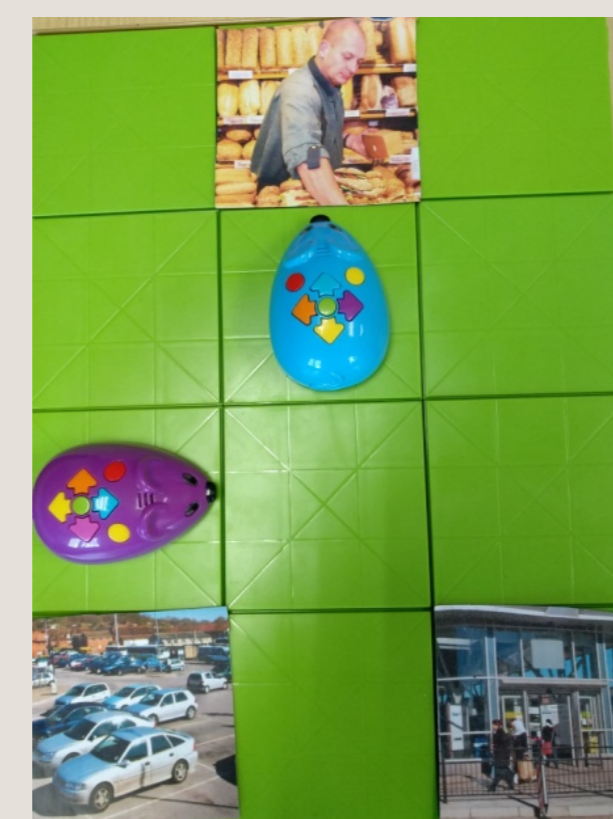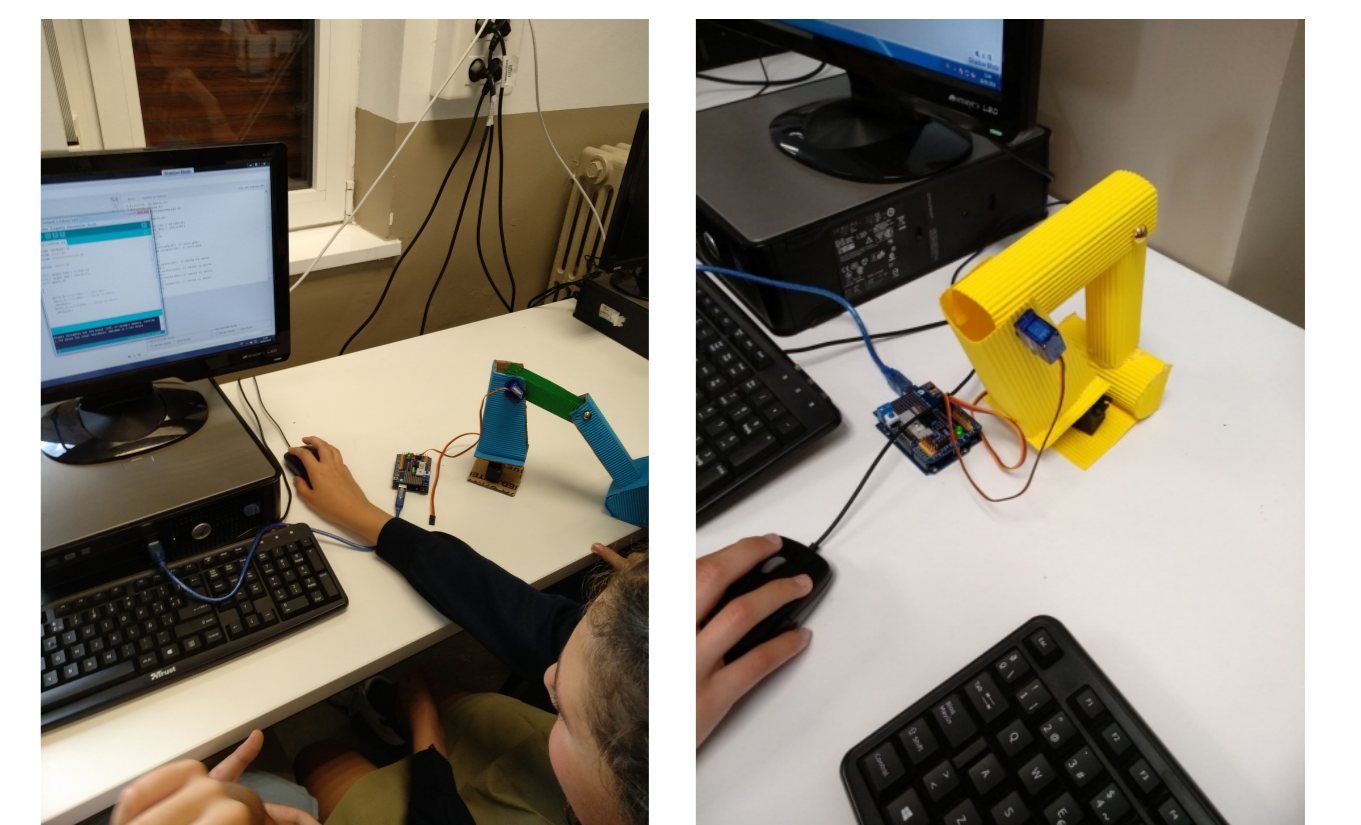
CONCLUSION

In the light of the results, we can conclude that robotics activities not only avail new learning opportunities to our students but also an entertaining and creative environment in which problem solving and pair learning play a key role in the development of such activities. Critical thinking, collaboration across networks and leading by influence could as well be mentioned as some of the other important conclusions that we have observed from in the above process.

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