

Creating Stories and Learning Letters and Numbers with Cubetto

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Abstract

We conducted an educational robotics activity using a tangible programming tool at the Giner de los Ríos Centre in Fuenlabrada, working with children aged 4 and 5. The activity was carried out with half of the group, taking advantage of the split sessions implemented for the teaching of another language, allowing us to work with approximately 12 children at a time.

Over four weeks and across six sessions, we engaged the children in executing various activities with Cubetto (Primotoys, n.d.), exploring concepts of surplus and deficiency. These activities were introduced through storytelling and involved recognising the written form of certain letters. The activity was assessed using direct observation techniques, alongside a motivation test completed by the participants to evaluate their experience.

The children's feedback was highly positive, as was the evaluation provided by the school's management team.

Introduction

The primary motivation behind this activity was to introduce a tangible programming tool such as Cubetto into an early childhood classroom, ensuring its effectiveness in

fostering both verbal stimulation and executive functions (Verdejo-García & Bechara, 2010), including attention. Through the practice of executive functions, computational thinking—embedded in the pre-university curriculum (Wing, 2006)—is also developed.

The main objectives established were as follows:

- To familiarise students with a tangible programming tool, facilitating their understanding and use.
- To utilise a versatile tool that can be adapted to different themes according to students' interests.
- To integrate an educational robot into the early childhood classroom as a didactic resource to promote new learning experiences in an innovative and motivating way.

Activity design

The educational level targeted by this proposal is Early Childhood Education, specifically the second and third years of the second cycle of Early Childhood Education. To implement the activity, the use of an educational robot is required— in this case, Cubetto, which serves as the primary tool for learning.

The teaching methodology is based on an active and participatory approach, where children play a leading role in their own teaching-learning process.

Finally, the activity is organised into different sessions or steps, structured progressively to facilitate understanding and the acquisition of knowledge in a dynamic and effective manner.

Session 1

The session begins with the group seated on the carpet around the Cubetto map. First, an explanation is given about the elements involved in the activity: Cubetto, the control board, the programming blocks, and the map.

During this initial session, a story is narrated using the Cubetto map, and the group is encouraged to participate by deciding which programming block to place to make the robot perform the correct movement. Figure 1 illustrates an example of the teacher working with the children and the Cubetto robot in the classroom.



Figure 1. Image of the Assembly Where the Educational Robot Cubetto is Introduced

At the end of the session, the need to modify Cubetto is identified due to persistent difficulties in recognising its position in space. These modifications include attaching "hair" to help distinguish the robot's front-facing direction and sticking coloured cards corresponding to the programming blocks onto Cubetto so that the children do not need to memorise their meanings. The modifications made are illustrated in Figure 2.

Additionally, to further support the development of laterality, a red sticker is placed on each child's right hand and a yellow sticker on their left hand.



Figura 2. Modifications introduced in the robot to assist with spatial orientation

Session 2:

In this session, the students will be responsible for programming Cubetto. To enhance group attention, the activity's location is changed from the carpeted area to the tables and chairs section, as it was observed in the previous session that some children became distracted while waiting for their turn.

The activity, guided by the study facilitator, involves collaboratively constructing a story through Cubetto's programming. Each child, in turn, positions themselves in front of the control board and requests the necessary coding blocks to guide Cubetto to the designated square, thereby continuing the narrative.

To prevent frustration when the programming is incorrect, the story is occasionally adapted in real-time. During this session, two full rounds of the activity are conducted. Furthermore, in this particular group, students are given the option to seek assistance from their peers if they are unsure how to proceed. Several children hesitate at the control board, awaiting the opportunity to request help. This reluctance is largely due to the embarrassment they feel when having to ask for assistance in front of their classmates.

Session 3:

In the final session, a different activity is introduced. A customised map (see Figure 3), designed by the teacher, is used. Some squares contain the numerals from 1 to 5, while others display dots to reinforce the number-to-quantity association, allowing children to work on numerical concepts while programming Cubetto.

With the aim of assessing students' progress since the first session, each child is given the opportunity to programme Cubetto to move towards a specific square on the map.

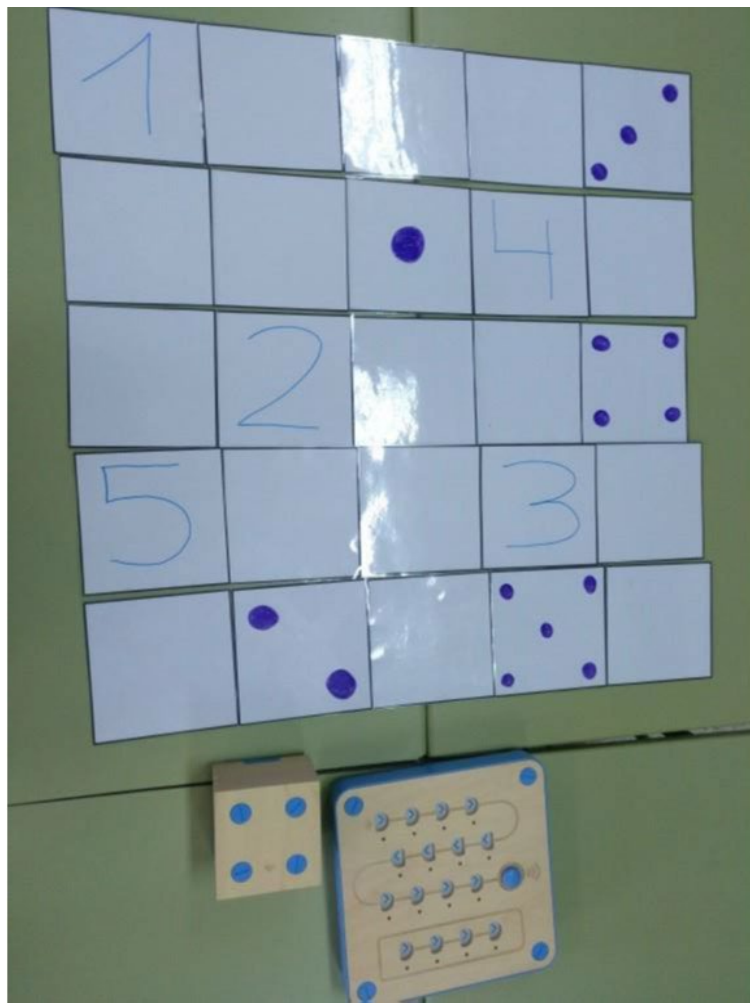


Figure 3. Customised Number Board in the Implemented Experience

Implementation of the Activity

The educational centre where this activity takes place is CEIP Giner de los Ríos, located in Fuenlabrada. The educational stage it belongs to is Early Years, specifically the second and third years of the second cycle of Early Childhood Education.

In this teaching proposal, 20 four-year-old pupils participated, including one child with a provisional medical diagnosis of Autism Spectrum Disorder, as well as 24 five-year-old pupils.

The methodology used is active and participatory, where children are the main protagonists of their learning. The aim is to foster their autonomy and motivation through dynamic and interactive activities.

From a pedagogical and didactic approach, it is essential to organise groups heterogeneously, allowing the group to benefit from a diversity of skills and knowledge. Moreover, this methodology supports the development of children's laterality while increasing their motivation using a robot as an educational resource. Additionally, the SEN pupil receives constant support from the tutor during activities and expresses satisfaction with a smile when completing the process correctly.

To evaluate the experience and considering the age of the participants, assessment is carried out through direct observation, recording the most relevant classroom events in a diary. A motivation test with five questions is also administered to some of the participants in this experience. Since the pupils have not yet fully developed literacy skills, the teacher reads the questions aloud, provides explanations on how to respond, and clarifies any doubts—though in this case, none arose. The responses were represented by three pictograms reflecting emotions: happy, neutral, or sad. Pupils had to circle their chosen response. The test questions were as follows:

- Q1: When we use Cubetto in class, I feel...
- Q2: I like that Cubetto has pieces to set the movements.
- Q3: Doing activities with my classmates makes me feel...
- Q4: Waiting for my turn to play makes me feel...
- Q5: Asking my classmates for help seems...

Results

The overall results were very positive:

- The pupils remained active and engaged throughout all sessions.
- The teacher identified many potential benefits of using this robot in the classroom.
- The children were excited when it was time for the robotics session and quickly took their places on the mat to begin.
- Over the course of the sessions, it became evident that the children were creating more coherent and longer stories.

After completing the three sessions, it has been observed that six pupils in the four-year-old class are able to programme Cubetto correctly, although one of them is still in the process of acquiring laterality. The rest of the group requires considerable assistance in determining the direction in which Cubetto should move, but they have all fully understood how it works. However, they experience difficulties with fitting the pieces, as they have non-circular shapes and are motorically challenging to insert into the board. Despite these challenges, a significant improvement has been evident in all four-year-old pupils since the first session.

With the group of 5-year-olds, and after carrying out the three sessions, it has been observed that, despite a higher number of children having a defined laterality, the group has not achieved as remarkable an improvement as the 4-year-old class in terms of Cubetto programming. This is largely because the group has very little ability to concentrate on the task, and this aptitude hinders learning. Some pupils have improved compared to the first session, but there is still a high number of pupils who have not managed to correctly programme Cubetto.

Regarding the motivation test, the results obtained reflect a positive experience with the use of Cubetto in the classroom. In the case of the 4-year-olds, it was observed that two children do not enjoy using the Cubetto tiles to express movements, while another two show indifference towards it. This may be related to the difficulty of fitting the tiles, combined with fine motor skills still in development. On the other hand, only one child expresses a negative opinion about group activities, and another expresses their dislike of having to wait for their turn. However, a noteworthy aspect is that all the pupils agree that being able to ask their classmates for help is a gratifying experience.

In the case of the 5-year-old classroom, and similarly to the 4-year-old classroom, most students respond positively to the questions posed. However, a significant percentage of children— in some cases reaching 25 % of the group— show indifference towards the use of the tiles, group activities, waiting for their turn, and the possibility of asking for help. This behaviour aligns with what was observed during the sessions, as these pupils displayed a limited ability to concentrate for their age. Figure 4 shows the results

obtained for each of the questions with the 5-year-old participants. The meaning of “Pregunta 1” is “Question 1” (Q1: When we use Cubetto in class, I feel...).

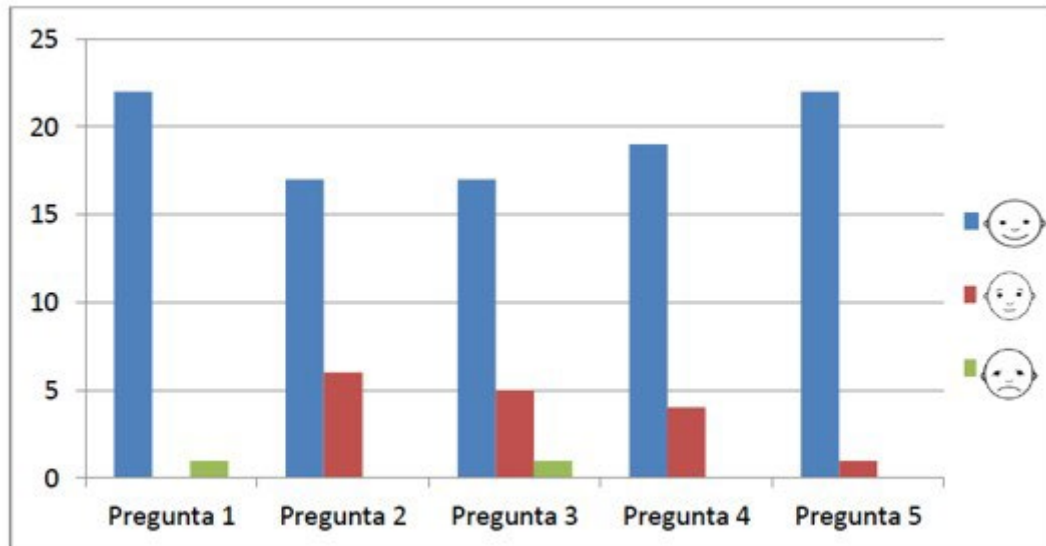


Figura 4. Responses to the motivation test in the 5-year-old classroom

Conclusions

The conducted experience has proven to be highly motivating for the participants, as reflected in the results obtained. However, for Cubetto to be effectively utilised in the classroom, it is essential for teachers to implement certain adaptations:

- **Modification of the robot:** Incorporating visual elements such as “hair” and a replica of the tiles on the top to facilitate the identification of position and directionality.
- **Practice with tile placement:** Allowing pupils to practise placing the tiles on the control board beforehand, as this can be challenging for early years students.
- **Customisation of maps:** Creating blank boards with 15x15 cm squares, incorporating images, numbers, or other elements according to the group's interests and needs. These maps can be used for storytelling or to develop activities tailored to the pupils.

These adaptations make Cubetto easier to integrate into the classroom, supporting personalized learning and collaborative activities in subjects like math, reading, and programming.

Acknowledgements

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Additionally, I must acknowledge the support of my family, as without their help, I would not have been able to carry out this work

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CoTEDI – Activity Sheet

Activity title	Creating Stories and Learning Letters and Numbers with Cubetto
Author	Hermelinda Quintanar Ferreira
Name of Educational Center	CEIP Giner de los Ríos
Status	Done
Start Date	February 2018
End Date	March 2018
Target groups	
Age range of students	4-5 years
Grade level	Early education
Number of students involved	44 children
Educational context	The activity takes place in a classroom at the school, making use of the split sessions with other subjects to work with half of the group.
Diversity	In this case, we are dealing with a very homogeneous classroom in terms of abilities and skills, so the robot activities can be adapted based on the results.
Required resources	
WiFi connection is required	No
Devices	Robot Cubetto and its control tablet.
Tangible materials	Robot Cubetto and its components (tablet and tokens). Additionally, a map is required, which the robot will navigate, and it can be customised with the theme to be worked on
Activity description	

Activity Description	It is a collaborative activity aimed at introducing students to a tangible programming tool while simultaneously working on curriculum content. During the activity, we will programme Cubetto, and based on its movements, we will narrate a story or come up with a word that starts with the letter it lands on. All of this can be adapted to the theme currently being worked on in the classroom.
Total time needed	45 minutes per session (with three sessions in total). Two sessions are required to work with the entire class group.
Subject(s)	With this activity, we work on the three areas: 1. Growth in harmony. 2. Discovery and exploration of the environment. 3. Communication and representation of reality.
Specific topic addressed	▪ Letter formation. ▪ Phonological awareness. ▪ Lateralisation. ▪ Development of creativity. ▪ Stimulation of oral language.
Plugged / Unplugged	Plugged (robots)
Type of Activity	Educational robotics
Individual / Collaborative.	It is a collaborative activity that, taking place in a 4 and 5-year-old Early Childhood Education classroom, is carried out with half of the group (12 children) by making use of a split session with the English subject.
Level of creativity	High
Level of technology	Medium
Computational skills worked and how they are developed	▪ Abstraction ▪ Pattern recognition ▪ Generalisation ▪ Evaluation ▪ Error detection

Activity protocol and guidelines		
Activity	Protocol	and Guidelines
		The session begins with the group sitting on the carpet around the Cubetto map. First, an explanation is given about the elements that make up the activity: Cubetto, the control board, the programming tiles, and the map. It is important to emphasise the need to pay attention to the direction in which the "robot is looking" to programme it, as these students have not yet developed lateralisation. From there, in turns, we indicate to the students the tile where the robot needs to go, and initially, we help by breaking down the path into individual movements. The activity should always end with a group discussion about what we liked most, what we liked least, and what was the most difficult, to make the necessary adaptations. In this experience, the activities were structured in three progressive sessions to facilitate understanding and the acquisition of knowledge: ▪ Session 1: Introduction and exploration. The children sit on the carpet around the Cubetto map, and the use of the robot, control board, and programming tiles is explained. Through a narrated story, the group collaborates to choose the correct tiles and move Cubetto properly. ▪ Session 2: Guided programming. In this session, the children program Cubetto in turns, now in the area with tables and chairs to improve concentration. They build a collaborative story, and when programming errors occur, the narrative is adapted to avoid frustration. Teamwork is encouraged by allowing the children to ask for help. ▪ Session 3: Number-quantity association. A customised map with numbers and dots is introduced to work on the number-quantity association while the children programme Cubetto. To evaluate their progress, each child must guide the robot to a specific tile.

	The specific details of the activity can be found in the section on the design and implementation of the activity.
Inclusion	
Adaptation for Special Needs	In the 4-year-old group, there was a student with a possible ASD (Autism Spectrum Disorder) who required continuous assistance from the teacher. In the 5-year-old group, there were no students with special educational needs. However, this robot, being tangible, would allow for better adaptation for all students, as the pieces (despite having to fit in only one way) are large, brightly coloured, and easy to handle. Additionally, the activity can always be adapted based on the motivation and performance of the group.
Inclusive Adaptation	At times, it will be necessary to place an image of each of the pieces on the top part of the robot to help with its positioning on the map and the direction to follow. It is also important to add some "hairs" so that the children can clearly distinguish where the robot's face is at all times. Stickers of the same colours as the tiles can be used and placed on the children's hands to help them clearly identify the direction the robot will move in. As for the language used during the activity, since it is a collaborative one, it develops based on the different contributions, with each child participating within their capabilities.
Additional details	
Additional Details	Cubetto is a very versatile tangible programming tool, as we can customise the maps it moves on with the theme being worked on at that moment, making the possibilities for adaptation endless. It is important to keep in mind that, since it is not plugged into an electrical socket, the robot and the tablet use 6 batteries. Therefore, if the activity is not prepared in advance, it may run out of power. Additionally, it is recommended to use rechargeable batteries.