Case Studies

English version

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When two hands are not enough: spontaneous cooperation between children when constructing automata[1]

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[1] This case study is part of the article:

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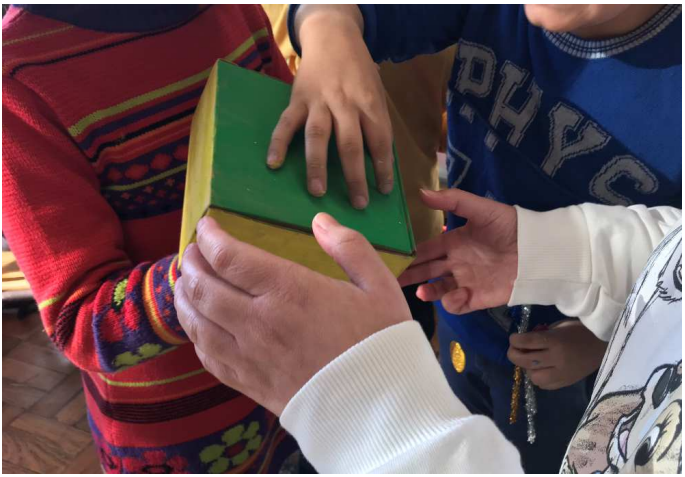


Introduction

The present case study focuses on the analysis of spontaneous co-operation between children who participate in four AutoSTEM project's workshops. Since one of the transversal competences that are intended to be developed with the activities of the project consists of cooperation, although cooperative learning strategies have not been introduced, we tried to observe how spontaneous cooperation forms emerge and how they can be suggested by the dynamics of the activity proposed, the habitus, culture and classroom arrangement, guidance of the educators, as well as the children's age.

Cooperation is a form of interaction between two or more individuals. What distinguishes cooperation from other forms of interaction is the fact that it takes place according to an objective common to these two or more individuals. In this way, cooperation emerges as a way to achieve a goal that individually could not be achieved (Warneken & Tomasello, 2007). Indeed, cooperative learning is now advocated as a form of high-impact instruction (Knight, 2013), which refers to various strategies used in the classroom, designed to create active learning and involvement among students. These strategies are based on principles and procedures, which are different from ordinary group work, constituting an alternative to competitive and individualistic structures, contributing to better cognitive learning and the development of social skills. Assuming different structures and syntaxes, which individualize them, they have different designations as: jigsaw, cooperative scripting, learning together, group investigation, among others.

Hargreaves (1994), a defender of these strategies, considers that these should be included in the repertoire of teachers, however they should be used with flexibility and discretion, recognizing that their introduction in schools and classrooms constitutes a safe simulation of the forms of collaboration more spontaneous that are possible among students, which have been somehow eradicated by the school and teachers, through discipline control and assessment practices. These forms of spontaneous cooperation are of great value and unpredictability since the locus of control of cooperation is in the student.

One of the components of cooperative learning consists of positive interdependence, which assumes several modalities, namely, the interdependence of purposes, when group members work towards a common purpose, of the task, when "two hands are not enough", of resources, (scissors, paper, glue, etc.), and the environment/space where the group works, which can become a unifying element (Johnson & Johnson,1999). So, the objective of this case study is to describe spontaneous forms of cooperation among children who participated in the automata construction workshops, without having been instructed for this type of learning.

Context, approach, and implementation

In this case study were considered four workshops. The general pedagogical method followed in all the workshops involved the presentation of automata and children being challenged to plan and construct their own automata. Workshop 1 and Workshop 2 had a very similar structure – in each one were present 22 students of the 2nd grade of a Basic School with ages between 7 and 8 years. The sessions lasted two hours. In these sessions was presented the friction drive mechanism with different narrative parts.

Workshop 3 took place in a classroom context and were present 24 children from the first grade with ages between 6 and 7 years. In this workshop were presented the linkages and the lever automata and each child built two automata. The session lasted three hours.

Workshop 4 had two sessions, making a total of three hours and were present 21 children, in the first session and 19 children in the second one. This children's ages were between 9 and 10 years. In this workshop were presented different automata like the one with the friction drive mechanism, with the lever and the linkages.

However, there were some differences between the workshops, in three of them, a poem about the earth was read; one of the workshops took place in the library, while the others occurred in class; the classroom arrangements changed according to the workshops between children seating in pairs, in round tables or in presentation format. Also, in the classroom workshops the teachers scaffolded the process by giving several instructions, while in the library workshop there was a minimum of instructions. The class teacher was not present in the library workshop. In all the workshops, from the instructions about how to construct the mechanism to the final product, several processes took place, namely spontaneous cooperation between children emerged.

Data were gathered through participant observation, registering field notes, photos and videos. At the end of the workshop, children answered a short questionnaire about motivational issues and perception of learning. In the end, a report was elaborated for each of these sessions, which accounted for all the data collected and analysed.

Challenges

Being the cooperation one of the transversal skills that the implementation of this project intend to develop, the principal challenge was to recognize the forms of cooperation that emerged among children during the activity, although no instructions have been given in this regard. During the different workshops, spontaneously various forms of cooperation appeared among children, so it was a challenge to understand what could had led to this situation and which factors have enhanced and allowed this cooperation.

Results

Content analysis of different types of data identified four categories of spontaneous cooperation: Modality, Dimensions, Influencing factors and Outcomes,

Modality of spontaneous cooperation points to different ways of organizing this cooperation: one, where there is a **decision to construct a unique automaton for the whole group**; other, where **each child constructs its own automata but developed strategies of cooperation**.

In the first situation, where children spontaneously decided to cooperate and build a group automaton, there is a type of cooperation with a common goal and task, that could be considered a modality more similar to formal cooperative learning with convergent involvement between pairs (e.g. Figures 1, 2 & 3).



Figures 1, 2 & 3. Children cooperating to develop an automaton for the whole group.

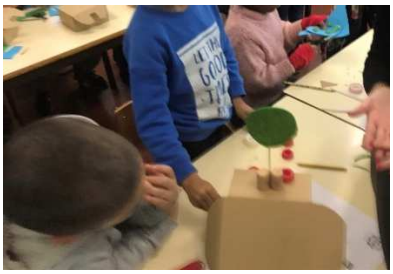
On the other hand, another type of cooperation was observed, when each children develop their own prototype while cooperating in an informal way with colleagues. In this case, there were no properly shared goals or tasks, so the cooperation that emerged can be considered as a divergent or not convergent cooperation (e.g. Figures 4, 5 & 6).



Figures 4, 5 & 6. Children cooperating while develop their own prototype.

Another category identified was **Dimensions of spontaneous cooperation**, that includes dimensions that appear in both the modalities identified or only in one of them

Some dimensions, **transversal to both working modalities,** can be: informal distribution of tasks, sharing materials, mutual observation of the work and the assistance in the construction. These can then be considered the **core dimensions** of spontaneous cooperation. There are then transversal indicators that appear in the workshops analysed that can be considered core dimensions of spontaneous cooperation (e.g. Figures 7, 8 & 9).


Figures 7, 8 & 9. Core dimensions of spontaneous cooperation: observing and learning from each other and sharing materials.

Working on the same project involves **interdependence of purposes**, **coordinating actions**, **shared tasks and all ideas of the participants** are **considered** and **included in the automaton**. Specially the interdependence of purposes and coordinated actions are characteristics of cooperative learning. This group of dimensions charactherize convergente spontaneuous cooperation.

Working on separate projects includes the indicators: **imitating and being inspired by the colleague's work**, and the **selfless willingness to help a colleague** (e.g. Figure 10). These indicators can be considered as dimensions of divergent spontaneous cooperation.

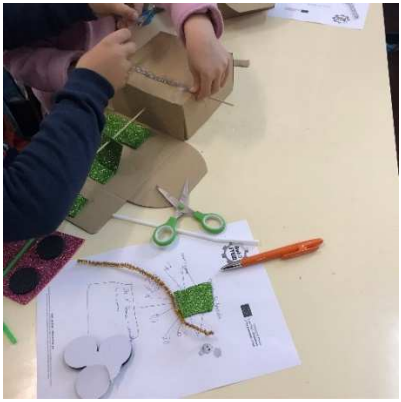
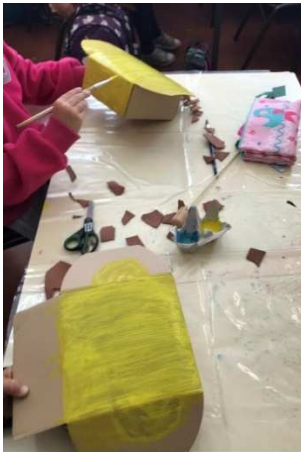
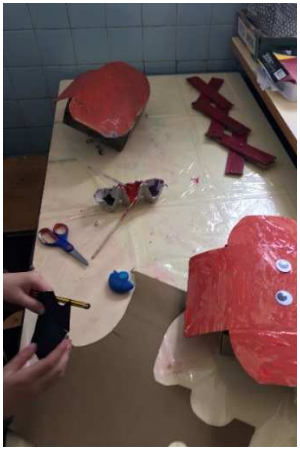
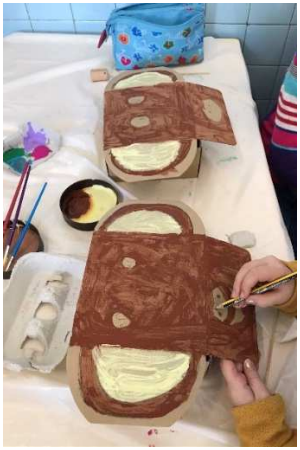


Figure 10. Selfless willingness to help a colleague.

Inlfuencing factors were related to workshops characteristics as: **children's age, guidance, teacher's class presence, seating arrangement**. In fact, 6-7 years old cooperated while developing their own project and 9 years old decided to work on the same project. When a teahcer or educator guided the workshop, children cooperated while developing their own project, but when was given more autonomy to the children, the class teacher was not present and the children were seated in round tables, children decided to work on the same project. This way, seating

arrangement in pairs or presentation was associated to children cooperation while developed their own project.

The Automata produced were analysed as **outcomes** and had the following types: **similar to the one presented, automata 'in pairs', predominance of an idea.**
These types of automata could be associated to the workshops previously referred. In fact, in all the workshops analysed some of the automata were very similar to the ones presented. However, children also produced automata similar to the ones produced by the colleague seated by their side. This was interpreted as a class working routine, a way of working that already happened and children usually developed (e.g. Figures 11, 12 & 13).

Figures 11, 12. & 13. Examples of automata built a similar to the ones produced by the colleague seated on the same table.

In one of the workshops, the children produced automata very similar to each other, althoug each children worked on their own construction (e.g. Figure 14).

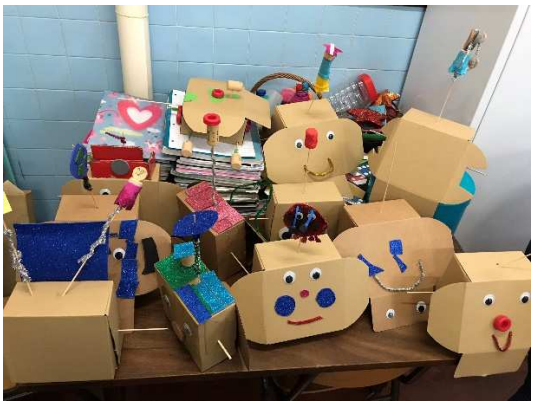


Figure 14. Similar automatas built in one session.

When children decided to work on the same project, the automata produced included differences from the automata initially presented. This was interpreted as na evidence of creativity.

Based on the answers to the question What did you learn in this workshop?, there are evidences that most of the children learn how to construct a simple mechanism, how to do a moving toy and also albotu the topic of the narrative initially presented. Children also reffered other competendes as to cooperate or to solve problems.

Several emotions were also registered. In general, children expressed joy and satisfaction for the works deveped, some expressed being proud for their work. This could be observed when each children devepoed their own automata (e.g. Figure 15) and when developed a 'shared automata' (e.g. Figures 16 & 17).

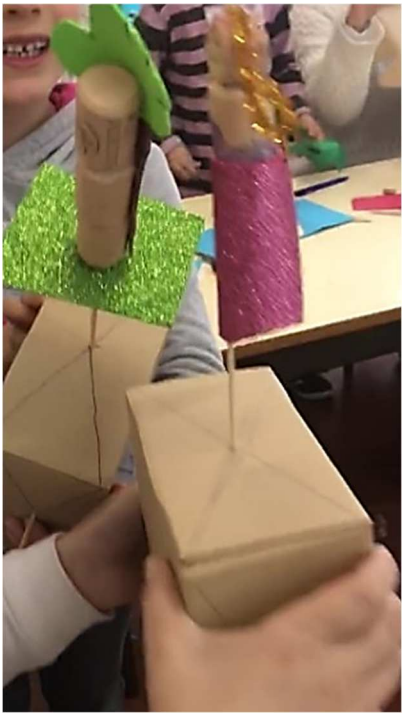


Figure 15. Children were influenced by each other while developing their own automata

Figures 16 & 17 Happiness and pride when developing unique automata.

Evaluation

In summary, data analysis pointed out that despite the characteristics of cooperative work were not formally established, spontaneous cooperation between children emerged. This spontaneous cooperation can take different features, namely, to decide to work on the same automata or to develop their own automata while cooperating in an informal way with colleagues. In this case, cooperation can be seen in dimensions as observing each other work, sharing materials, helping with the construction, to imitate and being inspired by the colleague's work. Spontaneous cooperation also varied according to the children's age, and the dynamics of the workshop, e.g. the seating arrangement, context where it took place, the presence of class teacher, the guidance of the educators. The mechanism used did not seem associated with the characteristics of the cooperation.

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