8. From guided play to creativity: metamorphoses and stories of a bird[1]

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Introduction

This Case Study describes a workshop developed for the **AutoSTEM** project that was designed to investigate how automata can enrich young children's play to promote a better understanding of Science, Technology, Engineering, and Mathematics subjects (STEM) and to promote the development of motivation for STEM and creative thinking.

Today the benefits of play in learning are already known, although these two principles are often presented dichotomously. To respond to this opposition, the guided-play concept emerges as a middle term between both principles. Guided-play concerns "learning experiences that combine the child-directed nature of free play with a focus on learning outcomes and adult mentorship" (Weisberg, Hirsh-Pasek, Golinkoff, Kittredge & Klahr, 2016, p.177). Guided play is only established in the presence of two key elements, the child's autonomy and the guidance of an adult.

The balance between adult guidance and the child's self-discovery is often difficult to achieve, as the concepts to be learned become more complex, there is an increased need for scaffolding by the adult.

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Therefore, the implementation of this strategy in the **AutoSTEM** project is extremely pertinent, as the concepts of STEM subjects, in addition to being important, can be extremely complex, requiring as an essential the mentoring of an adult to achieve full learning.

Figure 1. Overview of children working on the JellyBird.

Given the characteristics of automata, especially that they include a narrative part and a mechanical part, they can be used within a play-based pedagogy, to implement activities related to the planning and construction of toys, and to promote competences including observation, problem solving, and creativity in STEM subjects.

This case study is based on a workshop that was developed using the construction of automata with a sliding mechanism, called the JellyBird. The JellyBird is a moving toy made from paper and cardboard that flaps it's wings like a bird when constructed. STEM subjects can be introduced when constructing the JellyBird:

- To learn about physics and mechanisms,
- To develop engineering competences of analysis and construction
- Other soft-learning goals including problem solving and creativity.

Taking in to account the Guided play concept, the workshop also aimed to analyse the relationship between the teacher's guidance during the activity, and the children's creativity.

Context, approach, and implementation

21 children aged 7 to 8 years attended this session. During the session, university students from the Science Education Bachelor and Master courses were also present, as participant observers.

The workshop started with the presentation of the automata and the construction of JellyBird automata. Firstly, the teacher showed a model of the JellyBird. Children observed the JellyBird and made comments and asked questions about how it functions. Teachers talked about the movement in a very simple way, calling attention for the sliding motion.

Following the presentation and observation part, the children were given some instructions about how to construct the JellyBird, and then a time to decorate it, and develop a narrative about it.

As the children were building, the teacher explained the next steps. Firstly, the students cut out the geometric shapes from the supplied template that had been pre-printed, that would shape the automata (Figure 1). This initial stage was guided by the teacher, afterwards the children continued the activity, finishing the construction and painting the prototype. There was some variability in the steps described above, as some children started decorating the prototype before finishing gluing and construction it (Figure 2), while others completed the construction and only after started painting (Figure 3).

After this step was completed, the teacher asked the children to compose a story, about the toy they had made.

Figure 2. Child working on the decoration.

Figure 3. Child working on the construction.

An evaluation of the workshop was completed through:

- Participant observation,
- An evaluation questionnaire
- Analysis of products developed (the automata and the narratives).

The observation guide included indicators on interest and motivational learning, experienced difficulties and creativity.

The questionnaire included statements and open questions about motivation and perception of learning. The automata produced as well as the narratives were also considered for analysis of the learning outcomes and creativity.

For analysis of the learning processes (Figure 4), perception of learning was considered but also analysis of the mechanism and its functioning of the automata.

Figure 4. Child counting the parts of the automata.

For creativity analysis, indicators considered were:

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- Is the automata mechanism a copy of the one shown /does the automata have new mechanisms;
- Is the automata narrative part a copy of the one shown/ has the automata new elements;
- Characteristics of the narrative and similarity between them

During the workshop, the trainers talked with the children, about their ideas, took some notes and made photos and videos of the constructions (Figure 5). After the workshop, children answered a questionnaire

Figure 5.Trainer talking and helping a child.

Challenges

How to reconcile the need for instructions to carry out the task without inhibiting creativity? Both aspects are necessary, the instructions are important to a feeling of accomplishing the task, but they must not be so excessive that they hinder creative expression.

Results

An analysis of:

- The observation records

- And answers to the questionnaire

show that during the construction of JellyBird, the children were enthusiastic and curious about the activity, showed interest and cooperated with everyone. During the activity there was no child who showed any resistance to participation, in general, they all showed great enthusiasm.

The main reasons for it having been an enjoyable activity have been categorized into three categories:

- The activity was interesting and fun
- That they were able to learn something new/ how to do make toy/ a bird
- Independence and autonomy" I could follow my ideas" and " my work is original"

The category with the highest number of responses was "I' learned something new/how to make a toy / a bird".

From the analysis of the responses to the question about the main areas the children had learnt, three categories were identified:

- To construct a toy / bird,
- To construct a mechanism,
- To do new things / to invent / to be creative - To cut, being the most mentioned

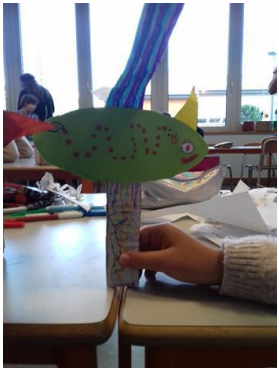
However, difficulties experienced during the workshop also centered around the mechanism construction and bringing the different parts together and sticking them.

An analysis of the automata built by the children makes it possible to note that all the participants successfully carried out the activity (Figures 6, 7, 8 & 9). At the end of the session, each child had an automaton that worked as intended. This data is in agreement with the data obtained from the questionnaire; in particular, the statement "This activity is useful to learn about mechanisms and moving toys".

An analysis of the automata produced shows that in all cases, the automata mechanism is a copy of the one the children were shown. However, some differences emerged, both in terms of the procedures followed by each child during construction, when it was painted or the toy created.

As the instructions progressed and the different parts of the automata were identified, some children chose to paint it first, while others finished the construction first.

In addition, although the instructions were given in a similar way to the class, the automata produced were all different from each other, especially in the painting and decoration. The work produced was diverse: most of the children made birds following on from the initial presentation, but there were also whales, rockets, and unicorns, and others.

Figures 6, 7, 8 & 9. Examples of some JellyBirds created in the workshop.

The stories produced by each child about their automata also show a high degree of creativity. All the stories were different, having different characters, plot, problems and the duration of the story.

Examples, can be seen just from the titles of the children's stories that included 'The spaceship and the bird' 'The sparkling bird', 'The seagull and the fish', 'The footballer bird', 'The Tonico Whale', 'The green bird', 'The paper bird', 'The bird Herb extinguishes the fire', 'The Luluu bird'. The children were very creative in their stories, and these were just some of the titles. One child, although using the same template as everyone else, chose to change his into a whale.

As an example, here is one of the children's stories, 'The spaceship and the bird', that has been chosen for its originality and creativity (Figure 10).

Figure 10. Illustration of one of the narratives made by the children.

In this story, the child tells us that there was a spaceship that did not know how to fly and therefore it felt sad to be in the middle of the other spaceships that could fly. Then, on a stormy day, a bird appeared next to the spaceship, The bird had lost his nest

because it had flown away and asked the spaceship if it could take shelter inside it. The bird asks the spaceship why it is sad and as soon as the spaceship says, 'Because I don't know how to fly', the bird agrees to teach it. After much training, the ship learns to fly and becomes friends with the bird and whenever they flew in the sky, they did it together.

The booklet with all the narratives in Portuguese can be found here (Figure 11). You will need an account on Issuu to access the book. It is also available on Google at: https://docs.google.com/document/d/1J4NCo3gQCIEelHY2i1HbjYQbiQSp5WrT4eW5IGrksTk/edit?usp=sharing

https://issuu.com/home/published/cesolum_sul_-3_sesso_es._v8

Figure 11. Cover of the booklet.

From the analysis above, it can be seen that a high level of creativity and initiative emerged from the activity

Evaluation

The activity generated a high degree of interest, with all the children actively participating and building their own toy. In general, the children followed the instructions given for the construction of the automata.

However, it was also found that after an initial construction phase, some of the children preferred to decorate it, only finishing its construction after, while others followed the opposite procedure. In addition to this difference, it was also found that, despite the instructions, the built automata differed in decoration, color, accessories, etc. even with figures other than the suggested bird. However, it was in the narratives around the automata that the unique creativity of each child emerged, with diversity of characters, plots or type of text constructed.

Considering the high degree of satisfaction and the lessons learned, it seems possible to state that the instructions given were important for the successful completion of the mechanism, but in no way limited or inhibited creative thinking.

We can see that the middle ground between the child's autonomy and the adult's instructions, in this group of children had no impact on the child's creativity. In this case, the teacher's guidelines were essential, otherwise, children would not be able to assemble the toy, however, the children had complete freedom to decorate their toy and the narrative associated with it, making that part completely autonomous and for this reason, creative and diverse results emerged.

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