Designing Narrative Learning in the Digital Era

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ABSTRACT
This paper presents a first prototype of Mobeybou, a Digital Manipulative that uses physical blocks to interact with digital content. It intends to create an environment for promoting the development of language and narrative competences as well as digital literacy among pre and

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Digital Manipulatives; Tangible Interfaces; Storytelling; Oral expression; Multiculturalism; Collaboration.

Figure 1: The physical blocks (top); Children interacting with a paper prototype (bottom).

primary school children. Mobeybou offers a variety of characters, objects and landscapes from various cultures around the world and can be used for creating multicultural narratives. An interactive app developed for each country provides additional cultural and geographical information. A pilot study carried out with a group of 3rd graders showed that Mobeybou motivated and inspired them to actively and collaboratively create narratives integrating elements from the different cultures. This may indicate Mobeybou's potential to promote multiculturalism.

1 INTRODUCTION

Digital, discursive and multicultural competences are key dimensions in current international frameworks for early years' education [4], and an important part of educational curricula in various countries. As technology users, children have particular needs that have to be considered when developing technological products for them [7]. Digital Manipulatives (DMs), an interaction model that employs objects to manipulate digital content [8], are especially appropriate for young children. One of the major advantages of DMs is that they promote collaboration [5] and social interaction, which are driving forces for language development.

Storytelling has been one of the domains targeted in the development of such systems [3]. Besides playing a central role in children's lives, stories are a powerful way of transmitting cultural values, helping children to understand and to become part of the world [1, 2], and as such they provide the ideal territory to foster multiculturalism, contributing to build a more inclusive and tolerant world.

2 MOBEYBOU – MOVING BEYOND BOUNDARIES

Mobeybou builds and extends previous work [9], but while the former focused on traditional stories for children, Mobeybou provides elements for creating multicultural narratives, and at the same time, it empowers children with diverse cultural backgrounds to create and share their own stories. The manipulation of the digital content is done using physical blocks (see Figure 1 top), which supports and promotes collaboration and exchange of ideas [9]. Each physical block (4,5 x 4,5 x 1,5cm) has a visual representation on the top and a digital identification (ID) on its base. Placing a block on an electronic board triggers the corresponding virtual content on a device's screen. The visual narratives unfold according to the blocks that the children place on the board while they verbalize their stories.

An interactive app tailored for each culture presents a story and information about it, e.g. location, games involving local traditions, food or other elements that are representative for the culture (see Figure 10). We envision that Mobeybou can be used by young children in formal and informal educational contexts, individually, with peers or in group to promote the development of language and narrative competences as well as digital literacy and multiculturalism.

2.1 Design and Development

Mobeybou follows a user-centered design approach. Besides being shaped by research on the use of props to promote the creation of narratives [9, 10], studies on embodiment and tangible interaction [5, 10] its design is also informed by sessions carried out with the final users. In these sessions, we

Figure 2 – China's cultural set.

Figure 3 – India's cultural set.

Figure 4 – Brazil's cultural set.

use low-fidelity paper and functional prototypes (see Figure 1 bottom) to gather information on how the children use tangible elements to collaboratively create narratives. For the first design session we created different sets of paper cards representing elements from various cultures around the world. Each set of cards contained a protagonist, an animal, a mythical creature, a landscape, an object, and a musical instrument. There were also environment-cards, this is, cards representing rain, snow, wind and the night. The session took place at school in the classroom with a class of 3rd graders and their teacher. The children interacted with the prototype in groups of six. During the design session we talked with the children about the different elements represented on the paper cards and asked them if they would like to tell stories using the paper cards.

2.2 Observations

The children started using the paper cards like domino pieces, placing them together and creating rows. It was interesting to observe how the children used the paper cards and to talk with them about it. They identified the objects as magical, e.g., the Indian shoes could be used for floating; the Chinese fan could create a strong wind; the guitar would make the characters dance, and could be used to hit the antagonists on the head; the flute would enchant the characters, and the dragon would spit fire and burn the other characters.

2.3 Description of the System

The session at school informed the design of the interactions between the elements. There are various sets of blocks and each set represents a country. The design of each specific cultural set was based on a careful investigation in order to identify characteristic elements of the culture, which simultaneously have the potential to trigger the children's imagination and creativity. Presently we have completed sets for China, Brazil and India (see Figure 2, 3, 4). Each set comprises: one landscape, two protagonists (boy and girl), an animal, an antagonist, a musical instrument and a magical object (see Figure 5). The elements are divided into categories and behave according to a set of rules that define their actions in relation to the other active elements.

The relations between the elements were developed following the traditional narrative model from Western cultures [6]. This is, the antagonists attack the protagonists; the animals defend the latter (see Figure 6, 7). The protagonists and the animals can join forces to defend themselves from the antagonists, who can also join forces to attack the former. The musical instruments can be used by the protagonists to make all the other "living" elements dance and become happy (see Figure 8). The magical objects can be used to help the protagonists escape or to beat the antagonists (see Figure 9). The environment-blocks (rain, snow, wind, rainbow, night) allow to further customize the stories (see Figure 8). All the elements from the different cultures can be mixed and matched to create narratives, potentially promoting multiculturalism (Figure 8).

The physicality of the blocks supports and promotes agency, collaboration, and exchange of ideas [8, 9, 10]. Based on the feedback from the teacher, we have integrated an audio recording function, which allows the children to record their stories, and can be used, among other functions, to assess the children's learning curve along time.

Figure 5– India, China and Brazil's set.

Figure 6– Fight between *Hati*, the Indian animal and *Nagi* the Indian antagonist.

Figure 7– Outcome of a fight between *Gugu*, the Chinese animal and *Nian* the Chinese antagonist.

Inspired by the design session with the children, where they used the paper cards like domino pieces, we are developing a new hardware where the blocks connect to each other through magnets and communicate via I2C protocol. A master block receives the IDs of the connected blocks (clients), and sends them to the computer /tablet via Bluetooth, triggering the corresponding digital content on a device's screen, always updating the elements present in the game. The master block has a battery to power all the blocks and a Bluetooth module to communicate with the device. The electronic circuit uses a peripheral interface controller (PIC) and magnets, which makes it possible to use small physical blocks.

2.4 The Story App

Ongoing and future work includes the development of a story app for each culture, which informs about the culture in a playful way, while simultaneously nourishing children's creativity. The app presents a story and information about the culture, e.g. countries mostly associated with each culture and their location, games involving local traditions, food or other elements that belong and inform about each specific culture (see Figure 10).

3 PILOT STUDY

Following the first development of the software we carried out a pilot study at school with 12 children from the same class of 3rd graders, the intervention took place in a separate room (the gymnasium). The teacher divided the children in pairs, and one pair at a time came to the room to play with Mobeybou (for around 20 minutes). The group was gender balanced with the following composition: G 1 (boy/girl), G 2 (girl/girl), G 3 (boy/girl), G 4 (girl/girl), G 5 (boy/boy), G 6 (boy/boy). The researchers stood in the background, observing and taking notes, a video camera set up behind the children recorded the interactions. After each interaction, the researchers talked with each pair about their experience.

3.1 Observations

The children started by exploring the different blocks and the interactions among them, placing and removing the blocks from the board, experimenting different combinations. They often commented on what they were doing, talked about the blocks and the visualizations shown on the screen. The activity was collaborative, this seems to be also promoted by the blocks, which provided the children equal access to the input devices (blocks). The children easily identified the protagonists, the opponents and found out that the animals were the protagonists' friends.

One boy told us how he came to this conclusion: "I experimented the snake with the panda and the result was bad, the panda with the lion also resulted badly. From there*, there was only a possible conclusion*: these two were friends [elephant & panda] and these two were also friends [lion & snake]. By looking at what they are doing *I concluded* that the panda and the elephant are friends because they help each other, and with music they calm down."

Several children spontaneously identified the characters as being Chinese and Indian and explicitly included China and India in their narratives. Some groups used the musical instruments to calm down the antagonists and stop the fights. The following narrative quotations exemplify this:

Figure 8 – *Meera* (Indian protagonist) and *Gugu*, the Chinese animal, listen to *Xiao Li* (Chinese protagonist) playing the pipa, while snow is falling.

Figure 9 – Ju Long, a Chinese protagonist, uses the fan (magical object) to create a tornado that knocks-out Nian, the Chinese antagonist.

Figure 10 – Screen shot of the India App.

Pair N. 2 - "[...] The girl was asleep and all the animals appeared and they started to fight, but then the girl played the pipa (Indian flute) to stop the animals from attacking each other, and then the Chinese siblings appeared" [...].
Pair N. 5 - "Tiago went to China and Nuno also went, there they saw a snake and the panda and they got very scared and started fighting [the animals]"; "and then Tiago played the guitar and the panda and the lion calmed down [...]". Interestingly, Pair 5 gave their own names to the protagonists, and each one embodied the character of the other, using direct and indirect speech as well as dialogues in their stories.

3.2 Informal Interviews with the Children

Following each group's interaction, the researchers talked with the children about their experience. All the children identified Mobeybou as a tool for creating stories, some interesting descriptions were: [it is a] "Doll Projector"; "It is for making theatre with the pieces [...] we invent sceneries, stories, and happenings. It is also a game, we have these pieces and when we place scenarios it helps us in the stories... and we have more ideas with these blocks". Another pair had the following conversation with the researchers. Pair: "We did stories with pieces that give us a lot of ideas". Researcher: "Is it a game?" Pair: "it's more than that, it helps us create a story, when we want to create a story... when the teacher tells us to create a story, we have more things in our head". Another pair said that the board was a game to tell stories, saying that it was to: "make more creative stories". We also asked each pair about their favorite blocks, surprisingly, a great number of the children expressed preference for the landscapes and the environment-blocks. The children also told us that they particularly liked to place the blocks on the platform and see the interaction on the screen.

3.3 Informal Interview with the Teacher

At the end of the intervention, we talked with the teacher, who was very positive about the potential of Mobeybou for promoting narrative competences, and knowledge of the world, by working across the different cultures. We talked also about the children participants and were surprised to hear that one of the children, who had enthusiastically created narratives with Mobeybou, was one of the less accomplished students in her class. However, during this activity, she used a rich vocabulary in her storytelling, used adjectives and linked the sentences with connectors e.g., "on a full moon night it was snowing heavily, suddenly a strong wind started to blew". The child was curious and engaged, she asked questions about unknown vocabulary and quickly applied what she had learned, e.g., she asked the name of the instruments and only called them by their name afterwards.

4 CONCLUSION AND FUTURE WORK

The session with Mobeybou showed that it was easy to understand and use. The elements inspired the children to create narratives, and they showed interest for the represented cultures. The children mixed the different elements in their stories, inventing family relations between the protagonists. The use of the physical blocks and the corresponding visualizations on the screen promoted verbalizations, exchange of ideas and collaboration, which are driving forces for the development of

oral and narrative competencies. Future work includes the optimization of the new hardware, and the development of more sets for different countries. Following this, Mobeybo will be used in pre and primary school to investigate its potential for promoting language and narrative competences, as well as multiculturalism.

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