

Moving between the boundaries of physical and digital contexts: a case study about a shared project by a group of children

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Abstract

Children are immersed in a world that is characterized by the continuous interplay of physical and digital dimensions, material objects and virtual realities. This article is centered on an experience with a group of 9-11 years old children where they worked on a shared project that they created together from the beginning, based on the constant flow of ideas and cooperation between individuals, small groups and the larger group, in dialogue with time, between real and virtual dimensions. The role of the adult as an attentive, participatory observer, resource and co-researcher with the children created an inclusive, child-centered atmosphere which kept the children's relationships and collaboration with each other at the heart of the experience. The digital realm was a resource and a material that enhanced the children's play, their ideas and allowed them to give shape to their project by broadening their range of action and the expressive possibilities. Using digital materials and tools and the effects they produced created a playful, immersive and narrative setting which inspired the children to interact with, play with, study, design and modify a hybrid reality which was both physical and digital at the same time.

KEYWORDS: Physical Materials, Digital Realm, Hybrid Context, Children's Play, Group Learning, Reggio Emilia Approach.

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1. Introduction

Children are immersed in a world that is characterized by the continuous interplay of physical and digital dimensions, between material objects and virtual realities. Research has shown that although children have greater access to digital tools and materials, which also greatly impact their play and consequently their learning processes, "it is not so much the *types* of play that have changed as a result of new digital contexts as the *nature* of play." (Marsh, 2016, p. 242-243). In reference to Vygotsky's (1978) theories that play is the main activity in cognitive and imaginative development, Edwards (2013) noted that it is important

to redefine the correlation between traditional play – i.e. construction, make believe, etc. – and 'converged play' – i.e. play with 'multi-modal', 'global-local' and 'traditional-digital' characteristics.

One way to approach this hybrid dimension is to consider the digital realm as a resource and a material that can enhance and broaden children's play, their ideas and allows them to give shape to their projects. In the Reggio Emilia Approach, children are offered opportunities and time to play, explore and reflect on these phenomena and discover the possibilities that each language can offer them (Rinaldi, 2021). In the same light, digital tools and the effects they produce can create playful, immersive and narrative settings which can inspire children to interact with, play with, study, design and modify a hybrid reality which is both physical and digital at the same time.

Very young children can manipulate playful physical-digital contexts while older children can create and modify them with greater intentionality [For example, see <https://scintillae.org/en/project/buttons-and-elephants/>]. This article is centered on an experience with a group of 9-11 years old children who created an original, playful context between physical and digital

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dimensions. Photographs, videos and pen-and-paper observations evidenced the fluidity with which they acted in small and big groups on a shared project that they created together from the beginning, based on intense exchange, listening, collaboration and compromise, in constant dialogue with each other and between real and virtual dimensions [This terminology is closely associated to the typical working methods of the Reggio Emilia approach to education]. In this contemporary physical-virtual setting, the experience discussed below “draws on both the digital and non-digital properties of things and in doing so moves fluidly across boundaries of space and time in ways that were not possible in the pre-digital era” (Marsh, 2016, p. 250).

2. Reference framework

Recent research has documented and studied different aspects of the development and impact of the digital realm on children’s play, learning and social, cognitive and emotional development (Vecchi et al., 2018; Marsh, 2016; Edwards, 2013, Flecha et al., 2020). “(Children) establish relationships with what is new, and invent new relationships with what they have already seen, using their capacity for opening up new scenarios in the world that surrounds them” (Cagliari et al., 2018). Digital contexts are no different. They are something new that children can interact with in a generative way, but they are also something known, which can be reinvented. In 2020 the European Commission conducted a study entitled “Effects of technology use on children’s empathy and attention capacity” in formal, non-formal and informal learning environments. It identified some guidelines regarding children’s empathy and attention capacity that mirror and confirm the underlying principles of the case study presented in this paper. “Digital technology has the effect of increasing children’s empathy when its content, use and interactions are prosocial (because) the inclusion of all voices (fosters) the creation of dialogic environments in which (all) participants organize themselves and make decisions on a consensual basis” (Flecha et al., 2020, p.6). In our research group, the creative and unconventional use of a range of digital tools and materials allowed the children to develop and enrich their shared project, both working on their own and in small and large groups, especially in conjunction with physical materials.

Their level of engagement was very high throughout the experience, not because they had access to different devices per se, but because of the open-ended, inclusive atmosphere and the time they had to explore and experiment with the range of physical and digital materials available to them. Using physical and digital materials in this way led to possibilities for creative expression, while also fostering soft skill development like teamwork, collaboration, dialogue, negotiation,

flexibility and adaptability, respect, mutual listening, creativity, communication skills and problem solving, which are among the fundamental, transversal skills. “Technology, which can be digital but not only, is a natural connector, an alphabet, an expressive material which can be manipulated, bent, reinvented. Through an unconventional approach, trial and error and exchange, we can foster a natural relationship with technology that promotes a complex, systemic vision of the world. A new empathy, with and thanks to the digital dimension, maps out the future of relationships between children and between children and technology” (Manera et al., 2021).

3. Methods

3.1 Research question

The research question that guided us during this experience was: *How is it possible to facilitate the use of digital and non-digital tools and materials as expressive means in children’s play?*

To answer this question, the atelieristas chose to work with a small group of 6 children aged 9-11, where in-depth case study methodology was implemented. According to Peter Gray (2012), an American professor and researcher, “children are designed, by nature, to play and explore on their own, independently of adults. ... (If children are) free to pursue their own interests through play, (they) will not only learn all they need to know, but will do so with energy and passion. Children come into this world burning to learn, equipped with the curiosity, playfulness, and sociability to direct their own education.” (Gray, 2012, p.6).

From the authors’ experience and observations, play includes sharing and agreeing on ideas, projects, rules, roles, materials, times, words, looks, emotions; making discoveries, testing hypotheses, dialoguing with others, maintaining an open mind, listening to others and to each other, following wherever the experience takes us: to a new, unknown world.

When observing the intermingling of play between physical and digital dimensions, one of the keys to answering our research question had to do with the dimension of time. Extended time allowed for a spontaneous approach to the digital dimension, which at first was exploratory and then became intentional, where adults, through observation and questions, supported the process. Another important key was the constant flow of ideas and cooperation between individuals, small groups and the larger group in sharing information, negotiating, making decisions to create a project that truly included contributions from each person, becoming a unique expression of that particular group.

The role of the adult, as an attentive and participatory observer, resource and co-researcher with the children,

added to creating an inclusive and child-centered atmosphere which kept the children's ideas and autonomy at the center of the experience. Of course, the selection of digital tools and materials available to the children - and their prior knowledge or experience with them, or their real-time exploration and discovery of the ways to broaden of their range of action and the expressive possibilities thanks to them – also played a key role in the development of their group project, as will be discussed in more detail below.

3.2. Research context

A group of 6 children (5 Italian and 1 Japanese) between the ages of 9-11 attended a week-long Summer Camp (from 8-12 July 2019) at *scintillae*, a research project and space jointly promoted by Fondazione Reggio Children and the Lego Foundation, physically located at the Loris Malaguzzi International Centre in Reggio Emilia (Italy).

The *scintillae* project aims to create and offer contexts where the expressive potential of play and digital tools generate ideas, connections and new knowledge, and is based on the assumption that the playful dimension is part of everyday learning and that children actively build, through reciprocity and sharing, a model of the world through play (Figure 1). In our digital age, *scintillae* represents a learning context characterized by a natural and playful approach to digital technology, where the physical and digital worlds interact, creating unexpected and unusual encounters for learning, designing and constructing knowledge together.

In this experience, the children conceived of and developed the idea and the specific project they wanted to work on, based on the request of the *atelieristas* that they create a new playful context for children and adults who would visit *scintillae* in the future. The group was invited to use whatever physical and digital tools and materials available in the space to realize their shared project, as discussed below. The space was set up with both physical and technological/digital tools and materials. Physical materials included pieces of rubber, fabric, Lego elements, plastic and other deconstructed materials, as well as natural materials like leaves, seeds, sticks and plants. The digital devices available in the space were tablets, laptops, projectors and Light Play, a series of 3 portable, flexible lights which are coded using Scratch-like drag and drop blocks to create different sequences to personalize colors and timing [Several iPads were used for taking photos, and also to isolate details and compose images using the app Photoshop mix. Light Play is a prototype that is not commercially available, but there is an instructable available for those who want to try to make one: <https://www.instructables.com/Light-Play-Set/>].

4. Results and discussion

4.1 Multi-material and multi-modal collages: 4 approaches

In the experience our article is based on, the children activated individual design processes, each developing a methodology that included both physical and digital materials in the realization of the project that evolved over the time spent working together. The phases were: the design and creation of a hand puppet, the invention of group story and its settings and the recording of a short video trailer. The underlying idea was to facilitate children and adults who would use these puppets in the future, since they remained at *scintillae*. Thus, each child applied their own creative processes, both during individual work and also when working as a group to brainstorm the shared story, identify and agree on the actions necessary to carry out what they had decided and divide the tasks among themselves. Each child kept the others informed about their progress; this promoted the creation of a shared group project. The way the children worked (individually or as a group) was freely decided each morning together with the *atelieristas*, recalling what had been done the day before and planning the day's activities, creating the agenda in real time. The children organized themselves autonomously to work individually, in pairs or in small groups. The *atelieristas* made sure to verbally mirror these choices explicitly, to valorize the children's self-organization. It was important to create and support a context where the children had the freedom and autonomy to observe and choose any material or tool available for their projects. This laid the foundation for exploration, improvisation and consequently opened up new opportunities for discovery and research. The materials themselves were developed and transformed according to the children's needs and ideas. Their inventions and ideas gave rise to new creations and their ideas materialized. In this process, the partnership between physical and digital materials was particularly significant.

At our first session, the group was given time to observe, touch and imagine what the objects and materials were all around them in the space. Some materials, such as yarn, mosaic tiles and corks, were recognizable and easily linked to known uses. Others, which were unrecognizable to the children, were observed, named and utilized based on their characteristics and qualities (Figures 2, 3).

This moment for becoming familiar with the space, materials and tools available was essential in promoting the children's confidence and autonomy. They subsequently designed and produced their hand puppets, and each had a unique story and lived in a unique world which reflected the characteristics and history of each character. Each child created their puppet's world, part of the story created together, using a mixture of physical and digital materials. Their

freedom and autonomy in selecting different materials, testing them, editing and hybridizing them using different languages (analog and digital) led to the creation of multi-material and multi-modal collages (Figures 4, 5).

Anna

Anna chose an iPad as her main tool and proceeded to design the world of her unicorn *Scintillae* using graphic language. Given the complexity and variety of subjects in her project, the *atelierista* suggested the possibility of using the Photoshop Mix app: this allowed her to photograph, adapt and assemble different elements - “A chocolate waterfall, gummy candies, cake-houses and castles” (Anna, 9) - into a single image.

The combined, digitized materials took on new characteristics and meanings: beads became candies, a piece of light brown fabric created a chocolate waterfall, the cake-house was made of Lego bricks, with fabric as icing and a bead as a cherry. The castle was a drawing. A natural and fluid transition between analog and digital elements created the world of *Scintillae* the unicorn (Figures 6, 7).

Marlene

Marlene also chose an iPad as a tool to represent the green world of her snake *Veleno*, but unlike Anna, she decided to describe the characteristics of this world in writing:

“Oak trees are populated by poisonous snakes” (Marlene, 9)

Her search for materials to create her world began: pieces of green plastic became the foliage of oak trees, wood chips were tree trunks and the snakes were drawn, colored, photographed, isolated and added to the image. The green background is a close-up photo of the fabric of one of the hand puppets already at *scintillae*: Marlene deconstructed the puppet-object to isolate its characteristic quality in order to use it in creating her character’s world.

Like Anna, Marlene’s process combined digital and analog instruments and the materials present in space. The continuous exchange of ideas, techniques and languages with Anna, seated at the same table, contributed not only to their creativity, but also to their autonomy; the adult became less and less necessary until she became an observer and documenter of the processes that were taking place (Figures 8, 9).

Ludovico

Mattia and Ludovico were working at another table: they chose a computer with Scratch. Both used the same tool but with different ideas and processes.

Ludovico, for the world of his dragon *Graffio*, was inspired by a piece of red plastic that reminded him of “Firey rocks and spaghetti” (Ludovico, 11)

The *atelierista* suggested using the app that Anna and Marlene were using to photograph the material and import it into Scratch. Having already had programming experience with Scratch, Ludovico used the image of a piece of red plastic he had photographed as if it were a stamp. By multiplying it, he created a world of “spaghetti rocks”: the food of the dragons who inhabited his world. To add more details, characters and other elements, he also decided to draw a red sun which, thanks to the app, he imported and placed on the spaghetti rocks. To portray the dragons that inhabited his world, Ludovico created a sort of bestiary of dragons made with different languages: isolated photographs of his puppet *Graffio* (lower right corner), a toy dragon and a sprite imported from the Scratch library (Figures 10, 11).

Mattia

Mattia’s process was similar to, yet different from Ludovico’s. He also chose a computer with Scratch as his main tool, given his previous knowledge of this language. Instead of starting from an existing material or object, he decided to digitally draw the basic element that characterized the world of *Ermano* the werewolf chicken: a chicken biscuit.

With the support of Ludovico who was working alongside him, Mattia experimented with the same code that allowed him to multiply the image: one chicken biscuit became a group of chicken biscuits. Subsequently, Mattia decided his world was not only made up of digital materials, but also of concrete ones. He identified some elements in the space - a plant and a stool - that were transformed respectively into the woods and a throne for *Ermano* the werewolf chicken (Figures 12, 13).

4.2 Using physical and digital materials as a group

The children’s shared and original idea- to record their puppets and the story they invented together in a video-trailer “so that others could finish the story” (Ludovico, 11) in the future- meant that digital materials and tools continued to expand the creative process and allowed the children to realize their ideas.

For example, the scenes in the story needed to be lit. While programming the Light Play lights, Anna was in dialogue with the other children, sharing her ideas about the color sequences: these quick and frequent comparisons made the individual moments into group experiences, creating a virtuous cycle of mutual exchange and enrichment (Figures 14, 15).



Figure 2 - The children freely observed and explored the materials available at *scintillae*.



Figure 3 - The materials themselves were developed and transformed according to the children's imaginations.



Figure 4 - Physical objects were an important part of the children's digital compositions.



Figure 5 - Giulia and Seryka worked next to each other, individually and also exchanging information and ideas.



Figure 6 - Anna used a mixture of physical and digital materials.



Figure 7 - Anna's finished composition on the iPad.



Figure 8 - Marlene and Anna worked together at the same table, exchanging ideas.



Figure 9 - Marlene's completed composition.



Figure 10 - Ludovico drawing the red sun visible in the final composition.



Figure 11 - Ludovico's dragon world.



Figure 12 - Mattia used Scratch to multiply his chicken biscuit.

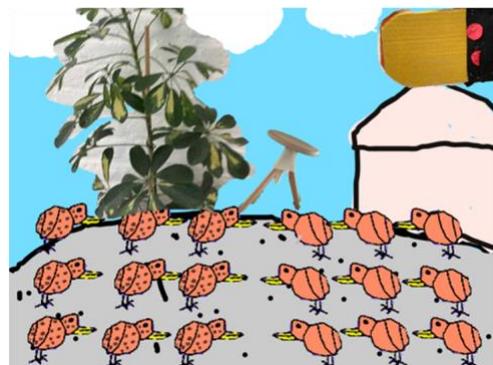


Figure 13 - Mattia's finished composition.

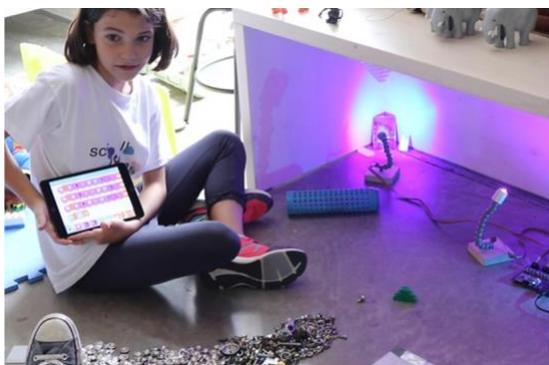


Figure 14 - Anna programming lights to set a scene in the children's story.



Figure 15 - The group tries out the light sequences.



Figure 16 - Ludovico and Mattia recording a scene of the story.

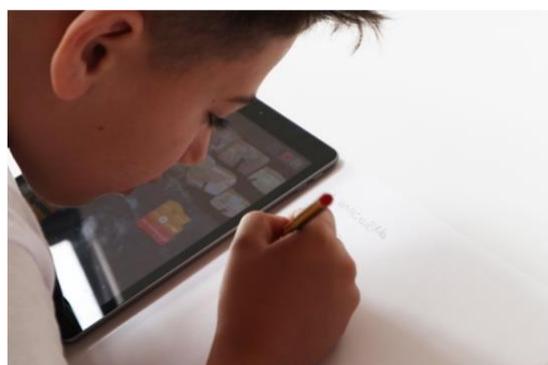


Figure 17 - Ludovico calculating the timing between one sequence and another.

Ludovico was the “director” of the trailer: he recorded each puppet in their world separately, but with group support. After each recording, together with Mattia and the creator of the character, they watched the video and if there were details to change, they recorded it again. The group thus became a place for exchange, where the actions of each individual became material to be created and de-constructed, adding details and new ideas to improve and enrich it (Figures 16, 17).

After recording the videos, Ludovico spent some time working individually on editing the trailer. He created the sequence with the worlds of the various characters and calculated the time that elapsed between one world and another, so that each video started in an orderly and logical way.

Mattia and Marlene worked together to create some scenery for a part of the story, thanks to their common interest in using the computer as a design tool and their desire to create other characters using graphic languages. They began with Ludovico’s drawing of his dragon. Both of them digitally reworked the drawing using different colors, using both a computer and a tablet. The support of digital technology allowed them

to amplify their collaboration, increasing the possibilities and results (Figures 18, 19).

The final trailer of the story featured each character in their respective world, which then merged into a single, shared unicum: each part of the project worked on individually fit together perfectly in the realization of the shared project. The individual dimension was therefore necessary, both to deepen personal research on form and materials and to contribute to the functioning of the group project, making use of previously acquired knowledge and combining it with that of others (Figures 20, 21).

The continuous, fluid passage between physical and digital materials and between individual and group design processes led to the creation of a complete, rich, complex project: a story told with videos, puppets, unstructured materials, Lego, light, shadow... A story given to *scintillae* by these children, for other children who, in the future, will be able to watch and enrich it with other ideas and suggestions.



Figure 18 - Mattia and Marlene digitally reworking Ludovico’s drawing of a dragon.



Figure 19 - Creating the scenery for the battle scene.



Figure 20 - Anna recording a scene of the story.



Figure 21 - Ludovico recording a scene of the story.

4.3 Adults able to listen

This in-depth case study is an example of how a group of children used physical and digital materials individually and as a group to create a shared project. The intertwining on different levels between people, languages, ideas and strategies was made possible also thanks to the attentive and intentional role of the adults who were able to listen, working alongside the children. "Listening means being open to differences, recognizing the value of another's point of view and interpretation. Thus, listening becomes not only a pedagogical strategy but also a way of thinking and looking at the others. Listening is an active verb that involves giving meaning and value to the perspective of others... This kind of listening is a way of welcoming the others and their differences, and a way of welcoming different theories and perspectives." (Rinaldi, 2004, p.3).

This listening approach on the part of the adults manifested in several ways: one aspect was in the alternation between individual and group work, always keeping the children connected and interconnected, as mentioned and discussed above. The adult played an important role in helping to orchestrate this rhythm. Another aspect is the expertise and know-how in choosing certain materials rather than others and hypothesizing possible scenarios and interactions which formed the basis for setting up a context for the children. At the same time, it was essential to keep an open mind and welcome the children's intuitions, interests and ideas for enriching or modifying what we as adults might have prefigured in our minds. In addition to physical and digital materials, offering time both to children and adults was fundamental. "The most important gift that we can give to the children... is time... to offer our time to the children, because time is the only possibility for listening and being listened to by others." (Rinaldi, 2004, p.3). A time to observe, to explore, but above all a time to listen to what is happening and let go of one's initial hypotheses and deconstruct them, turn them around and recreate them continuously, together with the children and their processes.

5. Conclusions and suggestions

This case study brought to light and confirms elements underlined by Marsh (2016) and Edwards (2013) about the impact of digital contexts on children's play, suggesting possible directions for future research. In our experience, the children used the digital realm as a material itself, not only as a tool, not only as a medium, to create something else. Their initially exploratory approach became more intentional over time. The children, for example, not only invented names for the different light effects they created, but

they also learned the rules to program them. Light Play became an important material and tool for the realization of their project, since light added a communicative and expressive value to the individual characters and the scenes of the story. In any case, there was little need for us adults to support their exploration processes, and we were able to observe the children in action. The *atelieristas* supported the children and made sure that they were aware of the potential of the digital tools and materials in relation to the projects they were working on. After acquiring the basic ideas, the children shared their knowledge with each other and even explored other possibilities that had not been explained. Due to their varying degrees of prior experience, it was always interesting to observe the mutual support and exchange among the children regarding information and strategies for using digital materials and tools. What emerged from this experience was how an invitation and the time dedicated to observing, exploring and relating to the materials were essential for building new and unexpected meanings. Playing with physical and digital materials, improvising (i.e., creating and doing something with what was available at a given moment) opened the door to immense creative and inventive complexity for both children and adults. If the digital dimension is not only a tool, but also seen as a material that can be produced, transformed, manipulated and adapted, the possibilities multiply. Subjects, materials and languages in dialogue and in play, where thoughts and intentions are mixed with invention and improvisation; research becomes play and play becomes research.

"To invent, then, is to find, to discover. But to find one must act, hands and mind in action, rummaging, fumbling, rooting around, in both physical and intellectual reality. (Zingale, 2016, p. 31)" (Translation by authors).

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