A digital manipulative for embodied "stage-narrative" creation ☆

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ABSTRACT

This paper presents a study of the use of a digital manipulative developed to promote creative narrative construction and storytelling. The study was carried with 27 groups of preschoolers, of five years of age, who interacted with the digital manipulative during free-play time, during a period of six months. The study sought to assess aspects of children's embodiment of the narratives, and how they shaped the creation of stories. We observed that by using the digital manipulative, children's narrative construction occurred in two levels, as children shared the stage, (controlling the characters, the location, the props, and the nature elements) and simultaneously performed on this stage. The sharing of the input devices (blocks) gave children equal control of the performance and orchestration of the story, while promoting and supporting peer collaboration. We conclude that the digital manipulative enables the performance of what we call embodied stage-narratives, promoting children's imagination and creative thinking, as well as fostering early literacy skills and metalinguistic awareness.

1. Introduction

The development of the language is among the major challenges that young children face during the preschool years. Language develops primarily to communicate with others, and through the interaction with others, in a process that is essentially social and interactive [73], while at the same time mediating learning, and being a tool to organize the world [18]. Language empowers children to express themselves, to communicate with others and to participate actively in educational activities [18,84,87].

Storytelling is an acknowledge dimension of linguistic development in childhood, and it is also considered a key dimension of cognitive and affective development [20,31]. Moreover, storytelling provides opportunities for social interaction [75] and innovative thinking, and offers children a "nourishing habitat for the growth of cognitive, narrative and social connectivity" [60]. In this study we sought to assess the kind of involvement that a digital manipulative, can offer for the construction of narratives, focusing on children's embodiment of their narratives, as we assumed that embodiment is directly related with children's involvement and immersion in the performed task.

2. Language development through narrative

Storytelling has the status of a privileged discourse format, however it is part of the "domain of language use, and narrative development is a subcomponent of language development" [9]. From a constructivist and constructionist point of view, language provides "the building blocks" and narrative is the domain in which these blocks are assembled together creating new experience and knowledge [9]. Certainly, due to their linguistic structure, and children's emotional bond with stories, stories are a privileged means for the development of language abilities.

Studies on children's early exposure to narratives have disclosed that hearing or telling stories has a major influence on the development of children's early literacy skills, being a creative and playful way of linguistic exploration [27,55,60,74,75]. At the same time stories offer a "memory framework", namely, the ability to remember and effortlessly analyse new stories, providing anticipation of information, which helps children to understand new stories and retell them [55], which in turn helps to construct meaning, and facilitates the creation of new stories [57].

In fact, retelling or creating stories implies a mental reconstruction of the story events, which fosters the development of metanarrative consciousness [17], and the emergence of more advanced language skills, enhancing grammar, vocabulary, and sentence formation [75]. Confirming that vocabulary and syntactic complexity

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in oral language are more advanced in children who are frequently exposed to a variety of stories [74].

Moreover, storytelling is a social activity [16,60], which helps children to develop their ability to imagine alternative possibilities and work out their implications, while learning to handle contributions made by their peers, and responding to them adequately [38]. Definitely, the importance of narratives goes beyond developing language abilities, encompassing other developmental dimensions. Unquestionably, stories help children to create their own identity, providing a gateway to the minds of others, their emotions and experiences, offering children a model and a mode to project, handle and ultimately helping them to solve own existing conflicts. As such, narratives help children to clarify their emotions, anxieties, fears and aspirations [28,32,33,60,89], offering a safe place to confront and explore their worries and insecurities.

2.1. Children's creation of narratives

At the level of the discourse, narratives are for children by far, more demanding than the discourse they use in daily life, presupposing the use of the past tense and a more elaborated and structured language, implying decontextualized use of the language, as the narrator always places himself at a distance from the related events [30]. As suggested by Van Scoter [84] a good way of helping children to construct their stories is through the use of props; while it is common to use verbal props to foster the structured flow of a narrative, objects can also act as elements that foster creativity and learning. Van Scoter [84] proposes using props for dramatic play, and Paley [59,60] approaches children's language and thought development through the dramatic play of children's narratives.

2.2. Narrative performance

The fictional nature of stories provides the ideal territory for exploration and experimentation, the use of the *magic words*, "Once upon a time…" or "A long time ago…" place stories in an imagined time and space. Similarly to a theatre performance [21], where agents act upon a stage, encompassing particular social interactions [36], narrative performance [52,53,82], is essentially an act of embodied communication [54,62], constructed and negotiated with others [10], acting as social mediator, while helping to structure the self and understand the world [9,18,19,27].

2.3. Meaning making through embodiment

The extent to which embodiment shapes our understanding of the world has been extensively investigated by Embodied Cognition, which has highlighted that our bodily experiences are the basis of all cognition, and that even higher cognitive processes ground on embodiment [45,50]. As [13,14] explain, the body is deeply involved and plays a central role in human cognition, and "all psychological processes are influenced by body morphology, sensory systems, motor systems, and emotions" [35]. In the field of tangible computing, embodiment refers to the kind of interaction used to manipulate digital content by using physical objects [3]. Indeed, instead of placing the emphasis on the tool itself, the interaction provided by tangible interfaces focus primarily on the manipulation of the objects [44,58,83], facilitating understanding and meaning making.

Research in the field of child computer interaction has investigated the connection between body and mind, how the bodily experience is involved in meaning making [5,6,40,41], and how body position, gaze and access to interaction shapes multimodal action flow [66]. According to Ackermann "Tools, media, and cultural artifacts are the tangible forms, or meditational means, through which we make sense of our world and negotiate meaning with others" [2].

3. A digital manipulative for creative stage-narrative construction

3.1. Motivation

Discussions about the use of technology in the classroom have disclosed how technology often fails to exploit the affordances of the medium, by merely transposing traditional learning materials to the corresponding electronic format [65]. In fact, while it is widely recognized that technology can have significant impacts on learning in early education [84,86], there seems to be a lack of well-designed materials, as well of studies that investigate the role of digital media in early education [65]. Moreover, studies involving children less than eight years of age are even more rare [46,47,51,90].

Exposing children to rich contexts and situations stimulates their natural need for exploration and discovery [85], offering an enormous opportunity for the development of pedagogical materials that target learning in the early years. Well-designed technology has the potential to create rich environments, providing challenge and adventure, while encouraging exploration and imagination [65,69,85]. Indeed, technology has the potential to provide new experiences and interactions that go beyond what is possible in the real world [85].

Aiming at contributing to a deeper understanding of the educational value provided by the use of digital manipulatives in preschool, we developed a digital manipulative for tangible narrative creation. The choice of narratives was motivated by the fact that narratives are privileged means for targeting personal and social development as well as the development of language and communication dimensions, which we together addressed in our study.

3.2. Design and development

The design and development process of the interface extended for a period of three years, involving various classes of five years old pre-schoolers and their teachers [76–78]. Although the teachers were always the same, the researchers worked every year with the children from the class attending the last preschool year, just before entering primary school the year after. From the conception to the development of the final product, several design iterations were carried with the children, in which the research team tried to understand how to design an engaging and compelling tool, where children could play and experiment with story elements, creating their own narratives as "players rather than spectators" [18].

During this period the design underwent multiple iterations, and the feedback provided by the children and the teachers was incorporated in the development of several prototypes, always following a cyclical process of developing, testing and redesigning [11,25]. The final interface elaborates on the feedback received during the various iterations. While it is beyond the scope of this article to give a detailed description of the development process, we will shortly present some relevant insights that informed the design of the final system. One of the prototypes used to access how children create narratives was an A4 paper cardboard and a set of cards with drawings representing characters, places and actions (Fig. 1). As we observed the children placing the cards in rows on the paper platform it was visible that they were concerned with the cards' alignment, which suggested that a functional platform needed slots to place the cards, thus facilitating children's task, while offloading extra cognitive processes, as children would not have to worry about alignment issues.