EMBODIED REASONING WITH DIGITAL TOOLS IN THE PRESCHOOL ECOLOGY: SCIENCE LEARNING BEYOND DIGITAL/ANALOGUE DICHOTOMIES

R. Samuelsson
Sodertorn University (SWEDEN)

Abstract

The role for digital technology in educational settings is a widely debated topic. This paper takes a different way of approaching digital/analogue activities in early childhood, through the embodied and interactional view of children’s reasoning. The data builds on a visual and sensory ethnography [1], of a science project about spinning at a preschool. During the science project, the children encounter a range of educational activities, consisting of both digital technology and more traditional activities promoting bodily movement and outdoor play. The data analyzed for this paper concerns how children reason with and without the use of digital tools across the science project.

The children use movements and gestures from their bodily play activities and integrate these when they are reasoning in front of the digital screen. This suggest a view of digital technology as integrated in the educational encounter. It suggests a perspective, following Edwards et al. [2] that encourages researchers to overview the ecology of educational activities and tools that children actually encounter during their days, to understand how digital technologies interplay with range of other educational environments, tools and activities.

The results suggest how reasoning with digital interfaces is an embodied endeavor, that might be influenced by previous non-virtual activities with similar aims. This suggests a view of young children's thinking in educational environments, that cut across concepts such as a digital-analogue divide and instead directs the foci to the experiencing child and its development in relation to an array of educational activities.

Keywords: early childhood education, digital tools, embodied, ecology, science learning.

1 INTRODUCTION

The use of digital technology continue to be a widely debated topic. While, for instance the American Pediatric Association advise against any use of screen-based media for children under the age of 24 months [6], such recommendations rely mostly on studies of children and the use of passive video-watching. Simultaneously, there is a growing research literature of reports on that children learn from interactive mobile devices from an early age [7]. Some findings also suggest that, contrary to findings of children using passive media, there might be opportunities for children’s learning and development with interactive media, especially when those technologies are used as part of established social interactions [6]. Notions such as that of children being “digital natives”, have caught attention from both practitioners in early childhood education and from researchers [7]. Edwards et al. [2] instead propose that researchers should adopt an ecological approach to study of digital technologies in early childhood. They advise researchers to adopt an ecological approach to overview the totalities of children’s experiences, as these must be impacted by both digital and non-digital types of influences [2]. This paper takes on this challenge, and recruits an ecological view of children’s learning and development to the study of a group of preschool children during a project about spinning. This study aims to understand the ecology of the preschool during the project about spinning and how it can influence children’s reasoning about concepts.

Science learning is notoriously difficult for children, as children often must revise their experiential understanding of phenomena into more abstract models [8]. This pose a unique problem for science learning at the preschool age, since learning at this age happens at the deictic level, in thehere-and-
now interaction around observable phenomena. However, there might be pedagogical opportunities here for the use of digital tools, as they might be used to model scientific concepts for children [9].

This study recruits a theoretical framework from ecological psychology. Gibson [3] proposed that it is the visual and perceived affordances of the environment, that provides opportunities to understand and act in the world. Thus, it is key, what type of tools the environment offer, and today these might indeed consists also of digital tools and artifacts presented through them [10]. Along this line of reasoning, it is then employable to look at the different type of means for understanding the concept of spinning the children encounter at the preschool during the project.

In more recent literature, human cognition has been viewed as an embodied phenomena [4], [11]. From an embodied cognition perspective, thinking is not only present in one’s brain, but moreover extendedly use the affordances of the tools we use as part of being situated in an environment [4], [12]. This perspective is not least relevant to learning in early childhood, were a main task is to convert tacit embodied experiences of children into common understanding as words, concepts etc.

The paper proposes a concept of embodied reasoning, as reasoning that is meaningfully making use of the affordances of the environment. This concept thus aims to capture both the interactional and material possibilities of reasoning about concepts that is ecologically valid to the early childhood educational setting. The research questions used to understand this are:

1. What affordances of the preschool ecology do the children encounter during the science project?
2. How are the affordances of this environment used in children’s actual reasoning during the project?

2 METHODOLOGY

The Swedish preschool system is founded on a child-centered pedagogy, where most preschools use an approach where children’s interests are a fundamental driver in learning activities conducted at preschools [13]. In the case of the science project about spinning studied, the project had grown out of the children’s interest in a Japanese animated serial called Beyblade, in which the characters compete using spinning tops. This has spawned an interest in spinning and associated phenomena, and the preschool department saw this as an opportunity for the children to learn about the underlying concepts.

A ethnographical method has been used to study the learning activities at the preschool as they occur. Moreover, the work has been inspired by the sensory ethnographical approach [1], to capture children’s behavior as being embodied and situated within the environment studied.

Data collection was conducted on mostly weekly visits during an eight week period. Data primarily consist of video recordings and field notes of the children’s activities, and secondarily of photos and teacher documentation of the projects.

From this, all data where the children engage with spinning, either in bodily ways, such as during play, or in instruction activities, were coded and extracted from the data set for further analysis. From these analyses it can be drawn both what affordances depicting spinning the children use during the science project, and situated interactional analyses of children reasoning can be carried out.

3 RESULTS

The results have been divided into two subsections responding to the first and second research question. First the general ecology of the science project is explored and how it affords experiences of spinning for the children. The second subsection explores the notion of embodied reasoning from examples and an excerpt of how children reason during the science project.

3.1 Affordances of Spinning during the Science Project

During the science project the children were observed in a range of different activities related to the concept of spinning. Thus, there were a vast array of encounters where children could relate to the concept. Recruiting the ecological approach from Edwards et al. [2], we look at the whole of influences to the child experiential encounter with spinning. The most commonly occurring of these during the science project are listed and illustrated in Fig. 1.
In Fig. 1, the different activities including spinning in one form or another are listed and illustrated with associated observations of the practice. In this illustration the child is at the center and we can see how there are a vast of different type of activities that the children can experience, talk about, and eventually conceptually reason about spinning and related phenomena.

These activities come with different affordances for the child to encounter spinning. For example, in the spontaneous play, there are indeed instances for children to first-hand experience what spinning feels like. However, these activities themselves are not observed to spur dialogue about conceptual matters among the children.

The construction of spinning tops is a popular activity among the children, who use their constructions as a form of dueling seen in a popular series. The building material affords the children to construct different shapes and sizes of spinning tops and these activities result in a range of trial-and-error type of construction activities where children try-out the different properties of these constructions.

There is however a third set of activities, where teachers document children, either in children’s spontaneous play, or in activities teachers themselves have arranged. This provides an important pedagogical tool, as teachers can capture, and later use images or video from activity where children experience spinning, and spur dialogues about the conceptual foundations of their experiences. This leads to the next question of how children actually reason within this project.

### 3.2 Children’s Embodied Reasoning

A set of important activities during the science project is when children reason about spinning in relatively more conceptual ways. These activities do sometimes emerge spontaneously when a teacher might ask children something during play, but reasoning activities are observed in a more systematic way during planned sessions such as circle time devoted to the spinning project. Interestingly, for our purposes here, is that the computer and projector are used in several of these sessions that aim for conceptual reasoning with the children.
These sessions typically take place when the teachers want to sum up an activity, for example a visit to the woods, where children tried to spin different materials on the natural surfaces of the woods. The teachers take photos of these during the children’s activity, and can ask children about their experiences when back at the preschool.

When children do reason about spinning, they are throughout the project observed to do this with various means of communication. The children seemingly gain vocabulary for explanation of conceptual phenomena, but are also seen to use their bodies, in explanations throughout the project. This can be seen in Fig. 2, where children are looking at documented pictures from a former activity where the children spun objects in the woods.

In Fig. 2 the teacher asks what the child will do with a spinning top, about to be spun in the woods, and a child Lucas shows how this object would be “thrown”. Then, on line 9, a child is asked to explain this and another child, Elias, uses his whole arm to depict this notion in front of the screen. Lucas then, fills in to Elias’ explanation, with a depiction of how the object would fall. On Line 11, Lucas depicts this drop, first on the screen, as the object would expectedly drop to the ground in the woods – however Lucas continues this gravitational drop to extend beyond the projector surface, off the screen, and onto the radiator below and further onto the floor of the room.

This type of reasoning happens throughout the project, and the children use their bodies in meaningful ways when they try to explain conceptual matters. When digital tools are present, the children can make use of these, but they are notably blended with children other bodily resources when reasoning about spinning, and thus it can be argued as these are instances of embodied reasoning. In these type of reasoning activities, children’s embodied means of expression are meshed with the environmental affordances in ways that defy a strict dichotomization between the digital and analogue.

4 CONCLUSIONS

The paper takes the approach to view at the whole ecology of a preschool during a science project. This overview of influences to children’s experiences show how there are a range of activities that may
influence how children encounter a concept, that are both the traditional or “analogue” and includes digital tools as well.

Moreover, when we in more detail analyze how the actual reasoning of children look, we encounter a more nuanced picture. Children’s reasoning can in these instances be seen as embodied reasoning, as children use their bodies along with language in their explanations. Here children can employ affordances of bodily, physical and the digital environment when they enact their conceptual thought. These results thus align with the notions of cognition as being situated and embodied [3], [4], as children employ both embodied means as well as digital and physical affordances of their environment when they talk about conceptual matters.

The conclusions point to a view that underscores the importance of what the affordances of the tools actually bring to the developing child in the educational setting. Interestingly, the children are observed to simultaneously make use of both digital and analogue means of approaching the concept of spinning during the project weeks. Furthermore, to understand children’s reasoning as an embodied phenomenon may intersect the sometimes arbitrary barrier between digital and analogue educational tools, as they are jointly used when children try to make sense of their worlds and form their conceptual thought.

REFERENCES