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Children's explorations of the concept of spinning in preschool: Science learning in mediated activity[☆]

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ABSTRACT

This paper examines how children explore the concept of spinning during a preschool project. It takes a cultural-historical approach, and analyzes how artifacts can be used in development of abstract concepts. In line with the pedagogical goals teachers employ these in learning activities during the project in line with their pedagogical goals. Children encounter the activities with different linguistic and perceptual means; there is, however, across the project a shift towards learning activities that promote verbal explanations. The interrelation of verbal and perceptual means, suggest ways in how children dynamically develop abstract concepts out of perceptual knowledge in activities with appropriate artifacts and teacher scaffolding.

1. Introduction

The aim of this paper is to examine how children explore abstract concepts in a preschool context during a project about the spinning motion. The paper analyzes different learning activities during the project, and how teachers employ artifacts to enable ways for children to explore the concept of spinning across the science project.

The pedagogical aim of the preschools' project was for the children to learn, which specifically includes verbal reasoning about spinning, all in accordance with the Swedish preschool curricula. The project emerged from the children's interest in the spinning tops used by the characters of an animated TV-series. These spinning tops, called Beyblades, were sold as toys for children to play, or "duel" with. Noticing the children's engagement and play activities, the teachers used spinning tops to initiate a project on "centrifugal force". Here, the teachers adapted the environment and staged both formal and informal activities in order to achieve science learning.

Vygotsky famously made the distinction between "spontaneous" or everyday and "scientific" or abstract concepts in the developing child, and the fundamental importance of cultural mediators. When elaborating upon this divide, [Vygotsky \(1986, p. 162\)](#) dynamically concluded that "we submit that the two concepts must differ in their development as well as in their functioning and that these two variants of the process of concept formation must influence each other's evolution." This paper delves into this dynamic relation as preschool children (age 4–5) approach the spinning motion in the preschool setting, and more importantly, with a starting point in that children explore the concept mediated by linguistic as well as physical tools and artifacts.

In the cultural-historical psychological tradition, artifacts are seen as mediating between the individual and the environment and artifacts become "fundamental constituents of culture" ([Cole, 1996, p. 144](#)). In this tradition, material and intellectual tools, such as artifacts and concepts, are defining features of an institution, for example the preschool ([Hedegaard, 2007](#)). In the spinning project

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studied specific artifacts and concepts are employed in accordance with the institutional settings and curricular goals. This is in line with developments in the cultural-historical tradition, also known as Cultural-historical activity theory (CHAT), that has added insights on how development occurs through collective activities, where knowledge is distributed among social actors and artifacts of the environment (Cole & Engeström, 1993).

In this paper this is pinpointed in how children explore tools and artifacts that spins, such as spinning tops, during the preschool project. It specifically addresses how a sample of learning activities where mediating spinning artifacts are employed to promote ways for children to explore the concepts, and how the activities progress along the project. It is important to note that the preschool children explore their world and communicate their perceptions and understanding about it with different means – or as Finnegan (2014, p. 8) states, that humans “draw on a multitude of resources to interconnect with each other and in so doing interactively create their human world.” In so, it also maps the relation between spontaneous and scientific concepts, in situ of the project activities, when children develop conceptual understanding with others around the artifacts of the preschool (cf. Vygotsky, 1986).

2. Young children's science learning

Preschool science in Sweden can be described as commonly functioning within the *emergent science* paradigm (Siraj-Blatchford, 2001), where children are actively encouraged to engage in exploration of natural phenomena for sustained periods of time together with peers and teachers. As such, play environments are key, as in these children can play with water, be outdoors in nature, and try out the properties of different artifacts with the guiding interactions of teachers and peers. Conezio and French (2002) consider preschool science activities to be heavily contextualized by the environment and artifacts as children experiment with them. The authors propose a connection between preschool science activities and language learning. Schoultz, Säljö and Wyndhamn (2001) point to artifacts as being central to children's reasoning about scientific concepts functioning as an auxiliary mean in children's reasoning about “scientific” concepts (cf. Vygotsky, 1986).

Sundberg et al. (2016) observe a large diversity among the science projects in three preschools. The different approaches to science in preschool can be traced back to the Swedish preschool model of *educare*, blending education and care. This possibly creates ambiguity in regards to science being a teacher-guided activity or based on children's own discovery learning. The authors find six categories of science activities, supported by the curricula: physical, sensory, creative/aesthetic, imaginative, play and storytelling. This study adds to this list how different types of activity might be used for science learning in preschool, and how different activities might be appropriated at different times during the project.

Important for this paper is how different means, including human perception, are used together with artifacts in science learning, something Goodwin (1995) pointed to as being central even for practicing scientists who use language, bodily means, the environment and artifacts to mediate their practices. Roth & Lawless (2002, p. 380) draw parallels to scientists learning through deictic and iconic gesturing to science students during a science project in school. The students followed a pattern of going from manipulation and feeling of objects, to symbolic gesturing, and later emerging into descriptive and theoretical language. The authors go on to conclude that “hands-on learning affords new forms of observational and theoretical talk.” For this paper, this sequence of learning is to be noted, and the learning activities studied will show how language and gestures, along with other means progresses over time during the observed project.

Such other means of explorative activities have been studied by Klaar & Öhman (2014) who point to the centrality of actions and bodily movement when children engage in nature, and how teacher actions may promote children's possibilities to further engagement in nature-oriented preschool activities. They highlight the interactions between individual and environment, in both teacher-planned and spontaneous activities, and how teacher instruction and confirmation of children's movement can guide learning in outdoor activities, sometimes blurring the distinction between education and care. This emphasizes how science learning in Swedish preschools is not content-based, but rather multifaceted and relies heavily on the child's experiences of everyday phenomena. Larsson (2013) studied four children's exploration of friction during their days at a preschool. The children explored friction in everyday activities, sometimes in disjunction with the institutional agenda. Larsson (2013) observed critical moments when children played in the preschool environment and used its artifacts, such as when friction increases when a sledge gets stuck, creating an opportunity for reflection about the phenomena. However, she observed that such opportunities often fail to be observed by teachers.

The dual nature of the preschool as both supplying care and explorative activities where children can learn, is manifested in different ways, as mentioned. Sundberg et al. (2016) studied a preschool conducting a rolling and spinning project. The children were supplied with artifacts such as beads, balls and cylinders that they used to explore rolling and spinning. Besides this, they did exploration during physical activities such as rolling down a slope. However, the children only explored these motions themselves without any guidance of teachers, as their pedagogical goal was to merely provide the children with the opportunity to discover the phenomena for themselves. This study will add to how such tensions, emanating from the different goals, or objects of children and teachers, might be productive during one and the same science project.

For this study, ways in which children explore concepts through mediating tools and artifacts are of fundamental concern. Pramling & Pramling Samuelsson (2001) takes their starting point in that scientific thinking of preschool children must be based on the fundamental understanding that phenomena can be explained. They follow a young child (3.3 years) who experiences and tries to understand the concepts of floating and sinking, and actively explores these concepts with teachers and in play. The play with different artifacts in water is seen as a sort of hypothesis testing. The teacher makes the child come up with predictions that are tested in play. The authors conclude that children develop their spontaneous concepts in experiencing, thinking and talking about them with others, long before the concepts are fully grasped by the child.

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