Physics and tablets in Preschool

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Abstract. This paper reports on model-based teaching and collaborative inquiry learning of chemical processes and physical phenomena related to socio-scientific issues (SSI) in Swedish preschools (1-5 years). A special focus is children's learning related to intended and enacted teaching, and the research contrasts teaching and learning processes with and without scaffolding by tablets. A developed theoretical framework for analysis of different referential meanings experienced during work with chemistry and physics in preschool will be presented. Results describe in detail how reasoning and questioning during teaching engage children and preschool teachers. The role of tablets in collaborative physics learning will be discussed.

1 Introduction and Background

This project is about collaborative inquiry learning of chemistry and physics in Swedish preschool (1-5 years). One way to justify science in preschool is based on policy documents "children need to learn because society needs the knowledge" - 'children as human becomings'. Another is to see 'children as human beings', and consider children as actors in their own lives, letting them meet the content area for their own sake. The intention here is not to polarize between the two perspectives, but let them coexist.

The intention of science is to describe real phenomena by organizing explanations through theories and theoretical models. This project uses a semantic view of theoretical models, with focus on explanatory powers [1]. Observations and experiments are by necessity embedded in theory and "Theory laden" [2]. Hence, the two domains discussed for children's science learning; content and investigations are in this project synthesized in the science activities [3].

The Swedish preschool is a goal-directed institution, which implies the need to develop an 'early childhood education didactics' [4]. Teachers need to be carriers of both content knowledge and updated skills on how to provide supporting conditions for children's learning [5]. Fleer et al. [6] show that with a 'sciencing attitude', teachers have unique possibilities to teach science in preschool. Then mutual simultaneity can be established, i.e. the teacher can simultaneously take into account children's experiences and create links to the science content in focus, so the child can distinguish the new phenomenon as something special [7].

Specific justification of a specific content tends to affect the didactic approach selected by teachers. Therefore, we introduce chemistry and physics to the teachers in terms of Socio-Scientific Issues (SSI). SSI is used to give the teachers insights into how the science activity connects to everyday life of teachers and children.

2 Aim

The overarching aim is to, through a 3-year-longitudinal and design-based research approach together with personnel in preschools, develop and analyse collaborative inquiry teaching and learning activities in preschool. Specifically, the project aims to further develop a theoretical framework for analysis of different referential meanings experienced during chemistry and physics teaching in preschool with and without support by tablet computers.

3 Methodology

A pilot study in a school district in a medium sized Swedish town involved five preschools and one team of teachers in each preschool. The teams of teachers independently chose and jointly developed, with researchers, activities concerning water purification and management, and energy production by windmills. The groups met during planning, implementation, and evaluation. The chemistry and physics related phenomena was chosen in dialogues with teachers and children, and the activities was based on a consensus theoretical explanatory model of science phenomenon and SSI aspects. Teachers planning session, activities with the children and, follow-up interviews with teachers and children have been video recorded.

4 Results

A pre-pilot study [8] analysed children's talk and questions during work with evaporation scaffolded by tablets. A new work-model utilising timelapse and slowmation production was introduced. It was found that Timelapse photography helped intensify the children's focus and concentration during the activity and it introduced new ways for stimulated recall discussion of the experiment. The slowmation production helped elucidate the children's tentative explanatory models. Results showed that science was more clearly focused by the children during lab- and tablet-work [8]. We emphasize that the use of technology in preschool should not be disconnected from content, instead used to scaffold learning and development.

The analysis of the pilot study in the five preschools and one team of teachers in each preschool is ongoing. Results will be presented at the conference, and consequences for development and learning of dialogues with mutual intersubjectivity will be discussed.

5 Conclusion and Implications

We argue that in intertwining support of science content with implementation of teaching both knowledge of explanatory models in science and competencies in handling activities with children can be expected to improve. At the conference interesting discussions of presented results and the potential in the versatile timelapse-slowmation work-model as a teacher's tool for scientific explorations and discussions in preschool will be held. Further, it will contribute to important discussions about preschool teachers' role in science.

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References

[1] Adúriz-Bravo, A. (2012). A 'Semantic' View of Scientific Models for Science Education. *Science & Education,* 22(7), 1593-1611.
[2] Hanson N.R. (1958). *Patterns of Discovery*. Cambridge: Cambridge University Press.
[3] Eshach, H. (2006). *Science literacy in primary schools and pre-schools*. Dordrecht: Springer.
[4] Fleer, M. & Pramling, N. (2015). *A cultural-Historical Study of Children learning Science, Cultural Studies of Science Education.* Dordrecht: Springer.
[5] Thulin, S. & Redfors, A. (2017). Student Preschool Teachers' Experiences of Science and its Role in Preschool. *Early Childhood Education Journal* 45(4), 509–520.
[6] Fleer, M., Gomes, J., & March, S. (2014). Science learning affordances in preschool environments. *Australian Journal of Early Childhood,* 39(1), 38-48.
[7] Thulin, S. & Jonsson, A. (2014). Child perspectives and Children's perspectives – a Concern for Teachers in Preschool. *Childhood, Learning and Didactics, EDUCARE,* 2014:2 13-37.
[8] Fridberg, M, Redfors, A., & Thulin S. (2017). Preschool children's Communication during Collaborative Learning of Water Phases Scaffolded by Tablets. *Research in Science Education*, 1-20.