

# Digital tools and meaning making in mathematics

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This poster concerns using educational technology as tablet computers in order to improve children's mathematical achievements in grades 1-4 in a Norwegian primary school. In a modern and rapidly changing society, the use of Data technology is important and valuable tool in the learning of mathematics (Zhang, Trussell, Gallegos, & Asam, 2015). In addition to exercises and problems in textbooks, several Norwegian mathematics textbooks for elementary school have developed online tasks in which pupils can work with mathematical concepts. The development of PC-based software and use of tablet computers (iPad, iOS system and Android-based) and mobile phones with touchscreens has been enormous the recent years. Both Apple and Google Play (Android based) together have developed over one million Apps (Zhang et al., 2015) in different contexts within several subjects such as math, science, language etc. This development has led to a large availability of Apps, which teachers can apply a variety of learning purposes.

This presentation is based upon a school-initiated project: *with open doors to the world - A pilot on the use of technology in education at school*. The project is interdisciplinary and involves 1. – 4. grade at an elementary school in Northern Norway. Researchers from the Arctic University of Norway have collaborated closely with the participating teachers, in particular researchers from mathematics education, Norwegian language, and general education. The project aims to increase pupils' achievement in both Norwegian language and mathematics by applying educational technology extensively in teaching classroom at grade 1-4, four classes totally.

Mathematical concept is by its nature abstract. In order to achieve a richer understanding of mathematical and scientific terms, it is essential that children themselves attach meaning to these concepts (Steinbring, 2005). This process requires an active participation in a learning environment in which they make own meaning and dialogic interactions facilitates communicating different ideas and thoughts. Pupils are mostly familiar with using digital tools such as tablet computers in early age. It is interesting to investigate its potential for flexible forms of learning where they can actively participate and communicate their opinions with each other.

In this study, we focus on the interaction in classroom activities where they use tablet computers in learning mathematics. We chose pupils' verbal and written utterances as unit of analyses. This because meaning making in mathematics and science are based on sociocultural principles (Ernest, 1994; Mortimer & Scott, 2003). Steinbring (2005) asserts that abstract mathematical concepts are mediated through semiotic symbols and characters. The meanings pupils make of mathematical concepts (objects) takes place mostly in a social setting as classroom, home and other social areas. Thus, communication in and about mathematics necessarily bring about students' thoughts and beliefs of scientific concepts through conversation, text and images. Therefore, I focus on pupil's interaction in order to identifying indications of learning in mathematics.

The research question in this study is "To what extent will pupils' use of tablet computers in classroom activities influence their meaning making process of mathematical concepts?" Data gathered for our study consist of video recording of pupils' activity when using different educational apps and the pupils' written work from these episodes. Ongoing analyzes of the videos is based on work by Alrø & Skovsmose (2002) and Mortimer & Scott (2003).

## Relevance for teacher's practices and teacher education.

Preliminary analysis of the data indicates that teachers can get information on pupil's mathematic work in a way that was not possible in their practice before. Students can attach their arguments and explanations orally to written calculations in worksheet files on Ipad. Teachers have the opportunity to read the students texts, hear their oral explanation to their calculations and respond to utterances directly in a worksheet. We do not know to what extent teachers apply this technical function in the communication and feedback process and how they can benefit this usage in their practice. In further researches, it would be interesting to investigate whether or not using touchscreen devises in teaching have impact on teacher's approach to learning mathematics, which can be a traditional approach, or a more inquiry based approach.

This study intends to investigate possible benefits and disadvantages of applying touchscreen devices in learning mathematics. Therefore funding from this research can have important relevance to the development of teacher practice in school. This will in turn have implications for teacher-training education where learnings-perspectives and didactical views for teaching mathematics and science is a central theme.

## References

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