

Exploring new territories: A mathematics teacher's practice regarding programming with young learners

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In this presentation we report parts of ongoing research, where a mathematics teacher enters a new arena of teaching programming and computational thinking skills to young learners. In this project, the programming environment of Emil the robot is utilized for achieving the competency goals of the new Norwegian curriculum. Emil allows pupils to learn the fundamentals of programming and computing through plugged and unplugged activities. Emil does not give feedback or tell the pupils whether their solutions are right or wrong. It is intended that pupils should give feedback to each other while working in pairs. Our ongoing classroom observation replicates that the teacher's role is of crucial importance in setting classroom activities and orchestrating the pupils' learning and thinking.

Introduction

In August 2020, a new curriculum (LK20) was launched in Norway. Programming became an integral part of mathematics from the 3rd grade. Computational Thinking (CT) is in LK20 presented as a problem-solving method. Its main ingredient is to develop strategies and procedures to solve problems, especially by breaking down a problem into subproblems that can be solved systematically, with or without digital tools (Utdanningsdirektoratet, 2020). Further, CT has additional components like automatization, generalization, abstraction, and algorithmic thinking, which are, according to the Delphi study conducted by Kallia et al. (2021), certainly aspects of CT that can be addressed in mathematics education. Therefore, exploring students' and teachers' CT and programming practices is of particular interest to researchers in mathematics education.

From the didactical point of view, teachers need more experiences regarding CT and programming activities, and professional development programs. In our project, which is conducted by the research group 'Learning and teaching mathematics with digital tools' at Department of Teacher Education (NTNU, Norway), we focus on one particular initiative, Emil the robot [1], that integrates a digital and an analogue resource attempting to train young learners in the fundamentals of programming and computing (Kalaš, 2018).

The context and the research plan

In our study, 20 fourth graders and their mathematics teacher work with Emil. Pupils are about to gradually learn how to command Emil by creating step-by-step instructions and how to create simple algorithms that use loops. The method of programming with Emil includes tasks where the pupils (always working in pairs) solve tasks on a computer and in the workbook in combination, or, in other words, do plugged or unplugged activities. Only after completing some or all the tasks in one unit, a whole class discussion, facilitated by the teacher, should follow, focusing on comparing and analysing solutions, argumentation, and explanations.

We are in the early stage of the study and our data will consist of field notes, recordings of classroom situations and individual pupils' work on screen and paper, as well as teacher interviews. This way we aim to shed light on

- teacher's orchestration of classroom situations regarding unplugged/plugged programming
- teacher's practices and the whole class argumentation regarding programming and computational thinking
- pupils' interaction, reasoning and argumentation related to programming tasks
- mathematical knowledge emerging from pupils' work on programming tasks.

In this communication, we plan to focus on the teacher's pre-interview within the lens of Pedagogical Technology Knowledge (Thomas & Palmer, 2014), related to CT and programming. We also consider using Toulmin's (2003) functional model of argumentation for analysing pupils' work.

Notes

1. <https://www.robotemil.com>

References

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