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A narrative account of collaboration between teachers and researchers in LaUDiM
(Language Use and Development in the Mathematics Classroom)

—for ICME-13 Survey on *Mathematics teachers working and learning through collaboration*

Project participants

LaUDiM is a four year intervention project (2014-2018) at Norwegian University of Science and Technology, in Trondheim. It is a developmental project that involves close collaboration between two teachers (Grade 3, this academic year) and seven researchers from the university (two pedagogues, four mathematics didacticians, and a PhD student of mathematics education). The group of teachers and researchers is referred to as the ‘project team’, whereas the group of researchers is referred to as the ‘researcher team’. One of the pedagogues is the project manager.

Goals and (one) theoretical underpinning

There are three main goals of the project: The first is to develop interventions in collaboration with the teachers that aim at pupils’ meaningful appropriation of particular pieces of mathematical knowledge. The second is to understand teaching and learning processes in the classroom (based on the interventions), where a central element is pupils’ development of language to express mathematical ideas (conceptual understanding, mathematical reasoning and explanation). The third goal is to study second-year student teachers’ mathematics field practice, during placement in one of the involved teacher’s (referred to as a mentor) classroom, where video analysis is used as an instrument in their learning.

Brousseau’s (1997) theory of didactical situations in mathematics (TDS) informs the project. The notions of *adidactical situation* and *milieu* are central in the development of interventions for the classroom, together with a model of *phases* of a mathematics teaching situation: devolution, action, formulation, validation, and institutionalisation. This model is used as a conceptual framework both in the project team and in the researcher team (together with other theories).

Data sources

Data sources are: preliminary analysis sessions aiming at epistemological analysis of the target knowledge (video recorded); planning sessions with the teachers aiming at development of interventions and design of adidactical milieus (video recorded); classroom sessions (video recorded); results of pupils’ engagement with the interventions (documents collected); post classroom reflections (audio recorded); discussions of classroom sessions based on video recordings (video recorded); interviews with the two teachers (audio recorded); student

teachers' field practice (video recorded); mentoring conversations (student teachers and their mentor; video recorded).

Collaboration with the two schools

The project has close contact with the management of the two schools; the principals are members of a steering committee for LaUDiM. The principals proposed the two teachers to take part in the project (which the teachers agreed to do); one of them has a master's degree in mathematics education, and the other in science education. The two teachers have some reduction in the joint meeting time (for planning and overarching themes) at their schools, which afford them more time on the project. In addition, the teachers have some minor economic resources from LaUDiM that enable them to teach less in periods (paying substitute teachers). One of the teachers is in charge of the development of mathematics teaching at her school (this is not managed by LaUDiM).

Researchers from LaUDiM will be leading course/seminar days with the staff at the two schools. The focus of these courses or seminar days will be on mathematics teaching development, and presentation and explanation of results from the project.

Collaboration between the two teachers

The two teachers take part in planning each other's sessions together with the research team. Whenever possible, they take part in the other teacher's implementation in the classroom (as an observer). Further, they take part in discussion of the observation of the other teacher's implementation in the classroom.

This is what one of the teachers (Jane) said in an interview:

I'm very pleased that we are TWO teachers. Because... well, I actually don't know what we learn from each other. But listening to what experiences the other one has got... yes, someone who is... in the classroom every day, who experiences things and has viewpoints, that is very... useful, I think, and feels very good, in a way.

[Interview by one of the pedagogues, 17 Sept. 2015, transl. into English by H. S.]

Collaboration between teachers and researchers

TDS has been introduced (by one of the researchers) to the project group as a framework for designing interventions (milieus for pupils to engage in). Further, it incorporates models that enable the teams to communicate about the structure of teaching sessions, both on a descriptive and an analytic level. The relevance of the theory is expressed by Jane when she reflects upon the expectations she had for the project (same interview):

THAT is perhaps what I have learnt most from, I think, getting input from a somewhat different theory, a kind of model for teaching on the basis of which you can plan, which I had never heard of before.

Other things mentioned by the teachers in the (individual) interviews, about what they have learned from the project are: the importance of pupils' learning to express their own thinking in mathematics (reasoning and arguing); that collaboration and communication in groups need to be taught and (e.g., what it means to agree in mathematics); the importance and complexity of creating an adidactic potential of the milieus (expressed as necessary "resistance" in a task that can keep the activity going without the teacher's involvement); rather than just conveying mathematical ideas and definitions to the pupils, one of them (Jane) has made her pupils act on empirical milieus (made by her) as a basis for communicating with them about the mathematics at stake; planning and implementation of teaching has (for Jane) been informed by TDS, beyond the sessions that are being researched as part of LaUDiM.

What the researchers have learnt is: pupils of age 7-8 are capable of concentrating for shorter intervals of time than imagined at the outset (by the didacticians); the complexity of designing appropriate milieus, even identifying what the target knowledge is or should be; insights from the teachers when it comes to pupils' (assumed and actual) capabilities.

Collaboration between researchers

Pedagogues and didacticians are taking part in a joint enterprise, that of preservice and in-service education of teachers for primary and lower secondary education. Through the research project, we are coming to know more about each other's discipline (pedagogy and mathematics education): There is scholarly knowledge in mathematics that needs to be transformed into the classroom context – pedagogues gain insight into what that takes. There are elements of professional knowledge for teachers (e.g. knowledge of learners and their characteristics) that need to be enacted in the classroom – didacticians gain insight into what that takes.