Nordic collaboration in mathematics education research – continued

In the previous issue of Nomad Barbro Grevholm (2009b) gives her last report as director of the Nordic Graduate School in Mathematics Education (NoGSME). In this report she hands over the responsibility to continue reporting from Nordic collaboration to NoRME, the Nordic Society for Research in Mathematics Education. The report in the present issue indeed marks the transition in the sense that it is written jointly by Barbro Grevholm and Frode Rønning, the chair of NoRME. NoRME was formally established during the Norma conference in Copenhagen in 2008 (Grevholm, 2009a), and it will be the responsibility of this organisation to administer the legacy that is handed down from NoGSME and to report from activities in the Nordic and Baltic region in Nomad in the future. The diverse activities that have been carried out during the NoGSME years have been greatly appreciated by students and supervisors alike and have led to a vast increase of contact and collaboration in the area of mathematics education in the Nordic and Baltic area. We have seen a large number of students graduating with a PhD degree in this period and as a result of this we have a much larger community of researchers in mathematics education today than in 2004.

In the constitution of NoRME it is said that "[t]he aim of the society is to support and raise the quality of Nordic and Baltic research in mathematics education, and especially through the collaboration among researchers in the Nordic and Baltic countries". Indeed NoRME will do its best to fulfil this aim but we must also issue a warning of not having too high expectations. NoRME is a completely voluntary organisation with no funding, hence most of the work will be done on the involved persons' own time, and funding will have to be sought for each individual activity. Contrary to this situation NoGSME was funded for five years and could therefore plan activities well ahead.

An important part of keeping contact within the Nordic and Baltic community has been played by the email lists for students and

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supervisors created by NoGSME. These email lists are still active and they will remain so also in the future. Madis Lepik has kindly agreed to take the responsibility for maintaining the lists on behalf of NoRME. Furthermore, a web page for NoRME has been established at www.norme.me. This is still somewhat rudimentary but it will be improved and it is the idea that this will take over as the main gateway to activities in mathematics education in the Nordic and Baltic area. It was always on the agenda for NoGSME to establish a database of people in mathematics education and their work. For various reasons this work has been delayed but it is now in progress and at some point the database will be handed over to NoRME. Then it will have to be discussed how it can be maintained.

We would like to draw attention to the Mathematics Education International Directory that has recently been revived. On www.directorymathsed.net you will find a matrix with 60 countries. Clicking on a country you will find a list of the individuals in that particular country that have signed up for the directory. This could be a valuable source of information provided that it is reasonably complete. Quickly browsing through the lists we can see that most countries in our area have great potential in making the list more complete. Some of our countries are not even represented. To be included in the list, this is what you should do: Go to the web page (www.directorymathsed.net) to see the format in which to compile your data and then send your data to the list manager, Alan Rogerson, alan@rogerson.pol.pl. We will encourage all of you to submit your data to the list and also encourage your colleagues to do the same.

Nordic summer course for doctoral students

An important part of the NoGSME activities has been the summer schools for doctoral students. The last NoGSME school was held in September 2009. NoRME has followed up this tradition in the way that we seek to find institutions and individuals that are willing to do the work required to raise funding and to proceed with the actual arrangement when the funding is secured. The University of Agder was asked to initiate a proposal to NordForsk in 2009. A partnership of five Nordic universities was formed and an application was sent in March 2009, which proved successful. Thus Barbro Grevholm at the University of Agder has announced a Nordic summer course for the period 25–30 May at Dømmesmoen in Grimstad in southern Norway. The interest is great and about 35 students have registered for the course, which will give 7.5 ECTS if fulfilled with examination in the form of an essay. Following the tradition there will be international experts leading the work in the groups during the course. These are Professors Willi Dörfler from

Austria, Fulvia Furinghetti from Italy, Birgit Pepin from Norway, and Jeppe Skott from Sweden/Denmark. A visit from Professor Jo Boaler from Sussex University will also take place and she will give a lecture and a workshop. The programme consists of lectures, working groups, workshops, individual supervision and informal discussions. Students prepare their participation by writing a paper based on their doctoral studies, presenting the research questions, methods and methodology, theoretical framework, data collection and analysis and results and discussion. Many participants have been part of Nordic summer schools before but there is also a large number of newcomers in the group this year. Dømmesmoen, which used to be a school educating gardeners, is part of the University of Agder campus, beautifully situated just outside the small coastal city Grimstad. The social programme will include meetings with historical literary giants such as Knut Hamsun and Henrik Ibsen, as they both have connections to the place. A visit to a nearby upper secondary school is also scheduled to give foreign visitors a view of the quality of the Norwegian school system. The participants come from all five Nordic countries, from Estonia, and also one visiting student from Spain.

NoRME has a clear intention to try to keep the summer schools alive, and as this is being written a new proposal to NordForsk for a summer school in 2011, with the University of Helsinki as the leading institution, has just been submitted.

New doctoral theses in the Nordic countries

On 3 February at the University of Agder Mary Billington defended her thesis entitled *Processes of instrumental genesis for teachers of mathematics. A case study of teacher practice with digital tools in an upper secondary school in Norway*. Her work is a case study of the practice of two teachers from one school in the project *Teaching better mathematics* (TBM). The study tries to identify and characterise changes in teacher practice as a consequence of the integration of digital tools and the aim is to achieve extended understanding of the teacher's role and activity. The theoretical framework used is instrumental approach in didactics using notions from the anthropological theory of didactics.

Data consists of interviews and classroom observations and is analysed in three parts. The first part presents the teachers' perspectives on the process of integration of digital tools in their practice. The second part interprets established didactical practices in the classroom. How and for which purpose teachers used different tools, was observed. The results reveal moments where digital tools were formed to existing practices and moments where practice was formed by the digital tools. The third part of the analysis deals with the introduction of new software,

investigative tasks, and new configuration modes in the classroom. The innovative changes led to changed patterns of interaction. Unexpected techniques to solve tasks demanded from teachers more reflected justification of the activity in mathematics. These changes of didactical practices are interpreted as indications of processes of instrumental genesis.

Per Sigurd Hundeland at the University of Agder defended his work on 5 March with the title *Matematikklærerens kompetanse. En studie om hva lærerne på videregående trinn vektlegger i sin matematikkundervisning* (The competence of the mathematics teacher. A study of what teachers in upper secondary school emphasise in their teaching). He asked what teachers value when they prepare and carry out their mathematics teaching. Hundeland worked closely together with three teachers and studied their teaching by doing observations in the classroom and he also made a number of interviews over time with them.

He used a Danish competence model as a tool for analysing what teachers were able to do in their work in the classroom. The thesis documents how the teachers are reasoning about pupils' learning of mathematics, what teaching methods they prioritised and what factors influenced their choice of methods. Several interesting phenomena were uncovered in the study. The teachers' beliefs about how pupils learn mathematics are based on how the teachers themselves learnt mathematics as pupils and students. Their own experiences of mathematics as a subject demanding much work influence their own teaching. The teachers emphasise how useful it is for pupils to work with tasks. The teachers are positive towards inquiry, meaning problem-based and explorative methods in teaching, but they realise that the use of such methods in teaching can create conflicts with their, strongly felt, duty to cover the curriculum. Teaching by lecturing and making the pupils work with tasks/problems are therefore prioritised. The study documents that teachers encounter many difficult dilemmas in their work. When pupils do not understand the mathematics that is being taught, teachers often have to choose between assisting the pupils or cover the syllabus for the examination. In such situations teachers choose to be loyal to the system and cover the material they are expected to cover, often at the expense of the pupils' understanding, even if they do not wish to act like that. The examination regulations are to a high degree determining the conditions for teaching.

On 12 March Per-Eskil Persson defended his dissertation at Luleå university of technology with the title *Räkna med bokstäver! En longitudinell studie av vägar till en förbättrad algebraundervisning på gymnasienivå* (Reckon with letters! A longitudinal study of ways to improve algebra teaching and learning at upper secondary level). The main aim of the study is to create deeper insight into students' algebraic knowledge and the conditions for algebra learning at upper secondary level, in

particular within the Natural science programme. A broad approach is taken, in which both cognitive and affective aspects are considered, and in which all parts of the didactical triangle are represented. Additionally, a goal is to suggest ways to improve algebra teaching and learning within the Swedish educational system. The study builds on an extended research and development project, which is presented in four phases. In the longitudinal empirical study two cohorts of students were followed during their studies within the Natural science programme (partly reported already in his licentiate thesis). The following three phases are described in the three articles, on which this thesis rests. The second part holds reflections upon the author's development from being a teacher into being a teacher-researcher and what this has meant for his understanding of what happens in the classroom, and in what ways this has changed, especially enhanced, his way of teaching. In particular the double role of teacher and researcher is discussed, and what advantages and risks it entailed. In the third part, a deepened analysis is made of students' answers to how a functional relation can be explained, which was one of the algebraic objects investigated in the empirical study. Here comparisons are made with two other studies of the same object, at lower secondary and university levels, respectively. The fourth part is a literature review of recent research about the use of calculators in mathematics education. Special attention is given to research studies that aim at investigating the influence of technological tools on algebraic knowledge and skills. A range of findings from the different parts of the study are presented and compiled, both on the basis of the theoretical framework and the didactical triangle. These results then form the starting point for consideration of significant implications for educational practice in mathematics within the areas knowledge and development, symbols and representational forms, algebra as a strand in mathematics education, technology in mathematics education, the importance of affective factors, and development projects.

Jonas Bergman Ärlebäck at the University of Linköping on 12 March defended his thesis with the title *Mathematical modelling in upper secondary mathematical education in Sweden. A curricula and design study.* In his thesis, which is based on five papers and reports, Ärlebäck aims to enhance the understanding of the notions of mathematical models and modelling at the Swedish upper secondary school level. Focus is on how mathematical models and modelling are viewed by the different actors in the school system, and what characterises the collaborative process of a didactician and a group of teachers engaged in designing, developing, implementing and evaluating teaching modules exposing students to mathematical modelling.

The thesis uses both qualitative and quantitative methods and draws partly on design-based research methodology and cultural-historical activity theory (CHAT). The results show that since 1965 and to the present gradually more and more explicit emphasis has been put on mathematical models and modelling in the syllabi at the upper secondary school level. However, no explicit definitions of these notions are provided. They are described only implicitly and thus opening up for a diversity of interpretations.

From the collaborative work case study it is concluded that the participating teachers could not express a clear conception of the notions mathematical models or modelling, that the designing process often was restrained by constraints originating from the local school context, and that working with modelling highlights many systemic tensions in the established school practice. In addition, meta-results such as suggestions of how to resolve different kinds of tensions in order to improve the study design are reported. From a survey with 381 participating students it is concluded that only one out of four students stated that they had heard about or used mathematical models or modelling in their education before, and the expressed overall attitudes towards working with mathematical modelling as represented in the test items were negative. Students' modelling proficiency was positively affected by the students' grades, last taken mathematics course, and if they thought the problems in the test were easy or interesting.

A common feature of these four theses is that they deal with mathematics teaching and learning in upper secondary school. In addition, a common theme for three of them can be said to be algebra, mathematical modelling, and use of tools, with slightly varying emphasis. Two of the theses have a main focus on the teachers whereas two of them deal more with the pupils. All four theses are mainly using qualitative data even if there is a slight tendency towards mixing of methods. The short accounts we have given here do not do justice to the studies and we recommend interested readers to carry out a deeper study of the dissertations.

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