

# News from Nordic mathematics education

In the previous issue of NOMAD the pages with *Nordic news* were missing but now it is time to present some of what has happened in our part of the world recently. As will be seen later the number of new doctoral candidates is substantial and more is to come. As before I will encourage all of you having information that might be relevant for this column, and/or also relevant for the NORME web page ([www.norme.me](http://www.norme.me)), to send me a mail ([frode.ronning@hist.no](mailto:frode.ronning@hist.no)). I will take this opportunity to thank everybody that has contributed with information leading to what is presented below.

## Norma 11 in Iceland

In the editorial of NOMAD No 4 2010 some data concerning Nordic representation at CERME 7 were given. Since the CERME conference NORMA 11 has also been completed. This was the sixth Nordic Conference on Mathematics Education since the start in 1994, and the largest ever with close to 150 participants from 12 countries. All five Nordic countries were represented and also Estonia and Latvia from the Baltic region. It is good to see that the conference attracts participants also from countries outside of the Nordic and Baltic region. Plenary lectures were given by Roger Säljö, Núria Planas, Bharath Sriraman, and Marit Johnsen-Høines. There were in total 59 regular paper presentations (according to the programme), three working groups and a number of short communications. The conference ended with a panel discussion by young researchers under the heading *Future challenges of mathematics education research in the Nordic region*. Proceedings from the conference will be published at Háskólaútgáfan (Iceland University Press) and according to the time schedule the proceedings should be out by the end of this year.

The Icelandic mathematics education community had done a great job arranging everything in connection with the conference and in addition

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to many interesting scientific sessions the conference participants also got the opportunity to see some of the beautiful and fascinating Icelandic nature in the most splendid weather. On behalf of all who had the pleasure of being in Reykjavik for the conference I would like to express sincere thanks to Guðn? and her group for the tremendous work in connection with the conference.

### Seminar on mathematical knowledge for teaching (MKT)

Researchers in mathematics education at the University of Stavanger (Raymond Bjuland, Janne Fauskanger, Arne Jakobsen and Reidar Mosvold) have been working with a focus on MKT for some years now, initially inspired by researchers from the University of Michigan.

In June 2011 sixteen researchers from Ireland, Norway, Portugal, Sweden, and the US participated in a two-day seminar at Sola Strand Hotel, Stavanger. The intention with this seminar was to share and learn from each other's experiences with research related to MKT in order to facilitate future research collaborations. Although not a particularly Nordic event, I think this is worth mentioning among the activities in our community.

### News from NoRME

During the NORMA conference the first regular General Assembly of NoRME (Nordic Society for Research in Mathematics Education) was held. As is probably well known NoRME was established during the previous NORMA conference in Copenhagen and according to the constitution a General Assembly is to be held at each NORMA conference. The chair went through the activity report for the preceding period and this can be found in full version at the web pages [www.norme.me](http://www.norme.me). An important event of the General Assembly was to welcome *The Icelandic Association for Research on Mathematics Education* as a member of NoRME. This association was established with 20 founding members in Reykjavik on 2 March 2011. With this addition all the Nordic countries and Estonia are members of NoRME. The British Society for Research into Learning Mathematics (BSRLM) has approached NoRME and suggested to organise a joint meeting. BSRLM organises meetings on a regular basis and the plan is to have one of the meetings scheduled for 2012 as a joint meeting between BSRLM and NoRME. Plans for the next NORMA conference were briefly discussed, and the idea is that it will be held in Finland in 2014, most likely organised by the University of Tampere.

The University of Agder has sent a proposal to Nordforsk to host a summer school for doctoral students in 2012. It was hoped that the outcome of this proposal would be known before this issue of *NOMAD* went into print but unfortunately this did not happen.

The board of NoRME for the next period is as follows: Christer Bergsten (S) is the new chair. The other board members are Mette Andresen (DK), Markku Hannula (FIN), Frode Rønning (N), Gu?n? Helga Gunnarsdóttir (IS), and Madis Lepik (ES). Morten Blomhøj will represent *NOMAD* in the board until the end of 2011 when a new Editor in Chief of *NOMAD* is supposed to be in place. The NoRME board is working together with NCM to resolve the issue of finding a new Editor in Chief.

### New doctoral dissertations

In the previous report with *Nordic News* I gave a brief summary of eight new PhD thesis and this time I can report on six. I think this is a considerable number and shows the development of mathematics education as a scientific field in our region. Out of the six new theses, three are from Sweden and three are from Norway. Adding up the numbers from the previous report we get a total of six from Sweden, four from Norway, two from Finland and one from each of Denmark and Estonia. I will not draw any conclusions based on these numbers but I think they are of some interest. They might be even more interesting if they are seen together with the list of participants at NORMA 11. As I said above there were approximately 150 participants and according to the list 54 came from Sweden and 36 from Norway. Iceland had 23 participants.

I will now give a brief presentation of the six PhD dissertations in chronological order according to the date of the defence.

Lisa Björklund Boistrup defended her thesis entitled *Assessment discourses in mathematics classrooms: a multimodal social semiotic study* on 12 November 2010 at the University of Stockholm. Björklund Boistrup is interested in classroom assessment and her study is based on empirical data (video recordings and written classroom material) from five classrooms in grade 4. She has previously worked in the PRIM group which is responsible for developing national assessment material and diagnostic material in mathematics in Sweden. It is natural that this work, in combination also with her work as a mathematics teacher, has developed in her a strong interest for assessment. She is in particular interested in assessment acts in the classroom and she has analysed communication between teacher and student from three perspectives; the assessment acts themselves, the focuses of the assessment acts in the mathematics

classroom, and the roles of semiotic resources (symbols, gestures, speech) in the assessment acts. She takes as a starting point that assessment is one of several features that influence students' active agency and learning. The word *agency* is used to denote a capacity for people to make choices and to impose those choices on the world. The notion agency is inspired by Foucault, and Björklund Boistrup also uses the notion *power*, drawing on Foucault and also on Valero. Here power is seen as a relational capacity that social actors position themselves in. Power is a way to shed light on affordances for students to take active agency in the assessment discourses in the mathematics classroom. Björklund Boistrup distinguishes between *implicit* and *explicit* assessment acts, and on page 5 in her thesis she describes the purpose of her study "to analyse and understand explicit and implicit assessment acts in discursive practices in mathematics classroom communication in terms of affordances for students' active agency and learning." A main outcome of the thesis is the identification of four discourses with different affordances for the students' active agency and learning. In two of the identified discourses, "Do it quick and do it right" and "Anything goes", students' affordances are considered low. On the other hand, in the discourses "Anything can be up for a discussion" and "Reasoning takes time", the affordances for students' active agency and learning of mathematics are high.

Eva Norén defended her thesis entitled *Flerspråkiga matematikklassrum: om diskurser i grundskolans matematikundervisning* (Multilingual mathematics classrooms: discourses in compulsory school in Sweden) on 3 December 2010 at the University of Stockholm. Norén's thesis is built up of five papers and an overview (Swedish: kapp). The aim of Norén's research is to investigate and analyse practices in multilingual mathematics classrooms in compulsory school in Sweden. Using ethnographic methods she has collected data in a number of multilingual mathematics classrooms in suburban areas of a major city. The data include field notes, interviews and informal conversations with students, teachers and school administrators. In terms of theoretical basis Norén's work has similarities with that of Björklund Boistrup in that also Norén builds on Foucault's discourse theory but she also builds on Skovsmose's notion of critical mathematics education. The concept of discourse is used to analyse individuals' communicative actions and language use in discursive practices in multilingual mathematics classrooms in relation to a wider context in society. The concept of power is also important as it is assumed that power relations influence pupils' possibilities to agency and learning. Discourses create frames that make possible and limit certain forms of practice and learning. The first paper, *Bilingual students' mother tongue: a resource for teaching and learning mathematics* (published in NOMAD, no 4, 2008)

presents results from a bilingual mathematics teaching project that was conducted in five multicultural schools. The idea of the project was that the pupils should be given the opportunity to learn mathematics both supported by their mother tongue and by Swedish. The paper presents the effect the bilingual teaching had on the participating schools' mathematics teaching practice. An important finding is that in the bilingual teaching practice the teaching became more transparent and explicit. The communication in the classroom increased and more conceptual discourses of instruction became apparent. Individual work in work books became less frequent. The second paper, *An immigrant student's identity formation in a Swedish bilingual mathematics classroom* (published in Proceedings from MADIF 7) is a study of one pupil's possibilities of identity formation in the mathematics classroom. Norén has followed this pupil in grades 8 and 9 in compulsory school. In the paper this pupil is described as a person undergoing a change from being a "noisy multicultural student" to an "engaged mathematics learner". Norén relates the change in this pupil's attitude to the fact that the teaching changed from being monolingual to being bilingual. Through the bilingual teaching the pupils have the opportunity to continue being bilingual also in the school context, just as they are in the everyday context. The third paper, *Discourses and agency in a multilingual mathematics classroom*, looks at how discourses and agency work in a multilingual classroom where Swedish is the only language of instruction. The pupils in this study are 7–8 years old, 1st graders in the Swedish school system. The aim of the study is to explore how various discourses operate in a multilingual mathematics classroom and how these discourses relate to students' agency as learners of mathematics. Among various discourses mainly three are exercised, a reform-oriented mathematics discourse, a language supportive discourse and a discourse excluding student's linguistic and cultural experiences. A reflection from this case study is that as a language-supportive discourse was interwoven with a reform-oriented mathematical discourse, space was given to students' agency and communication in the classroom. Thus, a more language-oriented discourse in general, in multilingual as well as in non-multilingual mathematics classroom might affect the classrooms towards a more reform-oriented mathematical discourse. The fourth article, *Students' mathematical identity construction in a Swedish bilingual mathematics classroom* (published in this issue of NOAMD with a slight change in the title) is based on data from the same student group as articles 1 and 2. The aim of this article is to explore discursive practices in a bilingual mathematics classroom in order to understand how students' mathematical identities are constructed. An important finding in the article is that in discourses promoting multilingualism students'

possibilities to positively build upon opportunities in the mathematics classroom seem to enhance, and identity construction as engaged mathematics learners is not an obstacle. A construal of possible identities opens for broader potentials for multilingual students' learning of mathematics than pre-defined identities construed from deficiency viewpoints. The fifth paper, *Grade-eight students: discourse switch and bilingual students solving text problems in mathematics* deals with a group of multilingual pupils' work with a group task, which is an oral part of the National Test for grade 9. The purpose of the paper is to see how agency influences change of discourse in the test situation.

Cecilia Kilhamn defended her thesis with the title *Making sense of negative numbers* at the University of Göteborg on 3 March 2011. The thesis is written as a monography and the general aim of the research project is to investigate how students make sense of negative numbers, and more specifically what role models and metaphorical reasoning play in that process. The empirical data were collected over a period of three years, following one Swedish school class being taught by the same teacher, using recurrent interviews, participant observations and video recordings. This work is based on a social-constructivist view on learning where both the acquisition and the participation metaphor for learning are acknowledged. Kilhamn bases her work on the theoretical constructs by Anna Sfard, notably her construct *commognition*, as Sfard has elaborated on in her 2008 book *Thinking as communicating*. Furthermore, the so-called *conceptual metaphor theory* is an important part of Kilhamn's theoretical framework. This can be traced back to the well known book *Metaphors we live by*, by Lakoff and Johnson from 1980. More explicitly Kilhamn uses the grounding metaphors for arithmetic presented by Lakoff and Núñez e.g in the book *Where mathematics comes from* in 2000. Basic arithmetic, they claim, is understood through four grounding metaphors:

- Numbers as point locations or movements
- Numbers as collections of objects
- Numbers as constructed objects
- Numbers as length of segments

It turned out that the metaphor *Numbers as constructed objects* did not play an important role in the work with negative numbers. However, a new metaphor, *Number as relation*, is suggested as essential for the extension of the number domain. The analyses show affordances but also many constraints of the metaphors in their role as tools for sense making.

Stretching metaphors, from the domain of natural numbers to fit the domain of signed numbers, changes the metaphor, with unfamiliarity, inconsistency and limited applicability as a result. Although metaphors initially help students to make sense of negative numbers, extended and inconsistent metaphors can create confusion. Kilhamn also touches the question whether there are analogies between the way a mathematical concept has developed through history and the way pupils today develop understanding of the concept. Findings in Kilhamn's study show that for students who struggle with the concept of negative numbers, the problems they have are similar to the problems that came up during the evolution of the concept.

Kirsti Kislenko defended her thesis at the University of Agder on 1 June 2011. I said in the beginning that there were three dissertations from Sweden and three from Norway. Technically this is true but Kislenko is from Estonia, although she has completed her PhD studies in Norway. Her thesis is entitled *Exploring pupils' beliefs about mathematics: cases from Estonia and Norway*. Most dissertations in mathematics education in the Nordic countries are based on a qualitative study. Kislenko is an exception to this trend in as much as she has partly conducted a quantitative study. This thesis, like the one by Norén, is based on a collection of articles and an overview. There are five articles in Kislenko's thesis. The first article, "*Mathematics is important but boring*": *students' beliefs and attitudes towards mathematics*, (written jointly with Barbro Grevholm and Madis Lepik, and published in Proceedings from NORMA 05) includes some preliminary results from the study carried out in 2005 in Norway on pupils' beliefs and attitudes towards mathematics teaching and learning. The study was based on the use of a similar questionnaire as the one that was previously used in the so-called KIM study (Kvalitet i matematikkundervisningen – Quality in the mathematics teaching) in Norway in 1995. Kislenko compares the result from the 9<sup>th</sup> graders in her study with the result from the 9<sup>th</sup> graders that participated in KIM. In general the pupils in Kislenko's study tended to be more certain (fewer pupils were uncertain in their answer) and they acknowledged higher usefulness of mathematics. There were no notable differences in the groups' self-confidence and diligence; it was evident that pupils in both studies recognised that mathematics is difficult, and more than half of the respondents claimed mathematics to be boring. In the second article, *The Likert scale used in research on affect – a short discussion of terminology and appropriate analysing methods* (written jointly with Barbro Grevholm and presented at the Topic Study Group 30 in ICME11) the following questions are posed: What is considered to be appropriate terminology when using a Likert scale?, and What is considered to be appropriate use of

statistics for the analysis? The third article, *An investigation of Norwegian students' affective domain in mathematics* (published in NOMAD, no 4, 2009) presents the results from the Norwegian quantitative study on students' beliefs about mathematics. This study was carried out on 245 Norwegian students in grades 9 and 11. The definition of affect (beliefs, attitudes and emotions) is based on the classical work by McLeod, further developed by Pehkonen. The analysis included an exploratory and confirmatory factor analysis, which suggested having a structure of six factors: interest, hard-working, self-confidence, usefulness, insecurity, and mathematics as an absolute discipline. The analysis shows that interest and self-confidence in mathematics are positively related to the usefulness of mathematics. From the perspective of gender, the only significant difference appeared in the factor *insecurity* as boys in general claimed to be less afraid of making mistakes and becoming nervous in tests situations in mathematics than girls. The fourth article, *Mathematics is a bit difficult but you need it a lot: Estonian pupils' beliefs about mathematics* (published in the book *Beliefs and attitudes in mathematics education: new research results*, edited by J. Maaß & W. Schlöglmann), presents the results of the study of Estonian pupils where 580 pupils participated. The theoretical basis and analysis methods are much the same as those used for the Norwegian students. Kislenko's study also contains a qualitative part where students are interviewed. The results of this are presented in the fifth article, *What makes learning mathematics an enjoyable experience: listening to Estonian pupils' voices* (accepted for publication in *International Journal for Studies in Mathematics Education*). The questions posed are; What are pupils' reasons for liking or disliking mathematics and its learning?, Does the mathematics teacher influence pupils' beliefs about mathematics?, and What are pupils' reasons for liking or disliking the mathematics teacher? To answer the questions 23 semi-structured interviews with students in grades 7, 9 and 11 were carried out. The results are presented as four major groups of reasons for liking mathematics, and four major groups of reasons for disliking mathematics.

Guri Anne Nordtvedt defended her thesis with the title *Norwegian grade 8 students' competence in understanding and solving multistep arithmetic word problems* at the University of Oslo on 16 June 2011. Incidentally, also Nordtvedt's study involves quantitative methods. It is described by herself as a mixed methods study. Despite the fact that two of the studies reported on here, involved quantitative methods, I will maintain my assertion that they constitute exceptions. The quantitative part in Nordtvedt's work consists of a correlation analysis and answer patterns on national tests in reading comprehension and numeracy for a sample of grade 8 students. The qualitative part consists of a task-based



interview with grade 8 students working on a collection of eight multi-step arithmetic word problems. The issues under investigation are the interaction between reading comprehension and mathematical proficiency, students' strategy use when solving word problems, and scaffolding patterns observed when students' solving of word problem was being scaffolded by a more competent other. A positive relationship was observed between students' reading comprehension level and multistep arithmetic word problem solving. However, students at all ability levels made processing errors. Below-average numeracy students were found to work with erroneous or simplified situation models for all non-scaffolded word problem solutions. They needed scaffolding to execute basic operations, whereas proficient students primarily required scaffolding to help monitor solving unfamiliar word problems. Analysis of answer patterns indicated that students with above-average numeracy skills and below-average reading skills compensated for low reading comprehension by recognising stereotype word problems to a larger extent than other above-average numeracy students.

Frode Olav Haara defended his thesis *Unveiling teachers' reasons for choosing practical activities in mathematics teaching* on 23 June 2011 at the University of Bergen. The thesis is based on three qualitative studies. In the first study the topic is to investigate the relation between teachers' reasons for using practical activities and their knowledge about the subject and the teaching of the subject. In the second study Haara looked at how a new way of teaching, supported by use of practical activities, over time could have an impact on the teacher's beliefs about the use of practical activities. In the third study teachers' experiences were compared to an established hierarchy of impact factors. In the thesis three categories of reasons for using practical activities are identified: The importance of the teacher's subject knowledge and didactical knowledge, compromises that the teacher feels compelled to make, and practical dilemmas experienced by the teacher. This hierarchy can be seen as parallel to Bateson's logical hierarchy of learning. A distinction is made between impact factors that are teacher related and those stemming from sources external to the teacher. Data for the studies come from responses to a questionnaire as well as from interviews with teachers.

