

Network for research on mathematics textbooks in the Nordic countries

New funding for the network

One of the workshops that were organized by the Nordic Graduate School in Mathematics Education (NoGSME) focused on research on mathematics textbooks (Grevholm, 2006). At the occasion of this workshop in May 2006 the participants decided to establish an informal network and collaborate around their common interest in mathematics textbooks. Thus a series of events at different conferences has taken place, organized by the network. One event was a discussion group at PME in Prague in 2006 (Pepin, Grevholm & Strässer, 2006), another one was a symposium on *Mathematics Textbooks, Mathematical Tasks and Pupil Identity: an International Perspective* at ECER (2008) in Gothenburg. The participants have also worked on papers for a joint book in order to expose different cases of studies on mathematics textbooks. But with little funding available the contacts were rather irregular and depending on other opportunities to meet. Thus when NordForsk in spring 2011 announced an opportunity to apply for funding for networks of researchers I took an initiative and invited all the participants from 2006 to join me in an application to NordForsk. Additionally we tried to include all Nordic and Baltic researchers we knew of, working with mathematics textbook studies.

The application was successful and NordForsk has granted funding for collaboration in the network during 2011–2014. The funding will mainly be used to organize Nordic seminars and workshops working with mathematics textbook research. The funding is probably enough for a couple of seminars and two workshops each year for the three year period. The work started with a joint seminar at University of Agder in October 2011, where all participants presented their ongoing or planned studies. The second common event will be a workshop in February 6–8, 2012 at University of Agder. The theme of the workshop is methods and methodology in textbook studies.

Barbro Grevholm

University of Agder

Background for the collaboration in the network

Since the start of research on mathematics curriculum, textbooks and teaching material, use of ICT and other tools has been one important part of such studies. When we use the notion research on mathematics textbooks in the network we use it in a wide meaning including curriculum studies (as textbooks can be perceived as the potentially implemented curriculum, Schmidt et al., 1997; Johansson, 2003) and also including teaching material linked to the printed textbooks, such as ICT-material, web-pages provided by the publishers, videos, films, laboratory and practical material and concrete objects intended to support the learning of mathematics. The use of language and texts is also an important part of such studies. Taken in this wide sense research on textbooks can have many perspectives. Classroom studies help to investigate teachers' use of the textbook and pupils' use of the textbook, curriculum studies can reveal how curriculum development influences textbooks and teachers, structure analysis can give evidence for the traditions textbook authors follow, the integration of ICT in the textbooks reveals the variation of learning opportunities for pupils, content and text-analysis can give evidence for what kind of difficulties pupils encounter in the books and so on.

In spite of the fact that research on mathematics textbooks seems to be a neglected area in Norway and the other Nordic countries it is clear that for the society it would mean much if textbooks could improve and assist pupils and students in a better way. It is challenging to reflect on the fact that if one textbook is just improved in a specific part in order to increase student learning opportunities and this effect is then multiplied by 10000 students using this book one year, and maybe other students for another ten years (the normal life-length of a textbook) we can see that even a small effect in one book might have huge impact on the level of pupils. Additionally the cost for textbooks for students is one of the more important ones for schools. Thus the relevance for the surrounding society of this kind of studies is high and supported both politically and socially. It is also highly motivated from an educational perspective.

From international studies it is well documented that the teacher and the textbook are the most influential elements for pupils' mathematical learning. The well-known TIMSS-studies (Valverde et al., 2002) have repeatedly reported that in the Nordic countries the mathematics textbook is more dominating in the teaching than in other countries.

Some concern about textbooks has also been devoted to gender issues and equity (Grevholm & Hanna, 1995) based on the fact that fewer women than men choose to study mathematics at high levels and a socio-economic bias in the recruitment of students. This concern relates to

mathematics textbooks as studies have shown that they are often biased (Areskoug & Grevholm, 1987a, 1987b; Boaler, 2008).

Objectives to be achieved

The main aim of the network is to increase the Nordic and Baltic collaboration in research on mathematics textbooks with implications for teachers' teaching, students' learning, and decisions by policymakers and publishing houses. In this way we aim for reaching better quality of ongoing and new studies and for inspiring to comparative studies, longitudinal studies or replication studies to get broader evidence of the situation in the Nordic and Baltic countries. The network will support students in master and doctoral studies and help students to finalise theses in good ways through offering new opportunities to learn about research on mathematics textbooks.

Another aim is to produce anthologies on research on textbooks suitable for teacher education and to publish in scientific journals and journals for teachers. Such publications will build on the collective knowledge and insights of all members in the network. We also intend to continue cooperating with publishing houses in order to offer research based evidence for authors about valuable features, content and structures for mathematics textbooks. We want to use the advantages of shared Nordic history and culture, values and structures of society, educational systems and traditions and language bridges.

Among the possible questions to start working with in the network we could mention:

1. Comparative studies of textbooks in Nordic and Baltic countries. Such studies are missing but there exists international studies where several countries are compared when it comes to textbooks. The NorBa-group (see below) is highly interested in such studies. Peder Haug (2007) in Norway has pleaded for the necessity of such comparative studies, for example of how teachers use textbooks and how it is dealt with in teacher education.
2. Studies of how pupils use textbooks, complementary to or similar to the study done by Sebastian Rezat (2006a, 2006b, 2009) in Germany, in order to see if Nordic traditions are the same or different from the German traditions.
3. There are no deeper studies about how textbooks influence pupils' learning of mathematics and thus it would be important to try to design such studies and carry out them (Törnroos, 2001, 2005).

Knowing that teachers and textbooks are the most influential elements for learning it would be extremely important to find out the relation between textbooks and pupils' learning outcomes.

4. International studies indicate that use of textbook is more dominating in the Nordic countries than internationally (Valverde et al., 2002). What are the reasons for this situation and how does it affect the learning offered to students and their achievement?
5. The use of language and pictures is crucial both in the classroom and in textbooks and texts. What characterizes language used in textbooks and the use of pictures? Do pupils understand what they read in textbooks and how do they create meaning and make use of the text and the pictures? The subject has been dealt with by Österholm (2008).
6. Are there hidden messages in the textbooks (Jablonka & Johansson, 2010)? Are there messages dealing with questions like what is mathematics really and what is knowledge in mathematics and for what and whom can it be useful? What are the characteristics of mathematics and what does it mean to do mathematics, according to textbooks?
7. Swedish studies show that teachers in compulsory school are heavily dependent on textbooks (Johansson, 2003, 2005, 2006a, 2006b). What are the reasons for this and would it be possible to change the situation and for what purpose?

There exists no easily accessible literature on mathematics textbooks research in the Nordic countries and in the international handbooks on teaching and learning mathematics there is only one chapter about texts and use of texts (Love & Pimm, 1996) as far as we know. Thus there is a great need of such books and the network will try to produce it by using papers on research carried out by members in the network. Anthologies with more or less emphasis on research or practice can be created. Such literature would be of great help in teacher education and for practicing teachers when deciding how to evaluate textbooks and what textbooks to choose. Criticism has been directed towards teacher education for not explicitly offering insight in this area of knowledge for prospective teachers.

There is a need to develop more theorising on teachers' use of resources/materials (including textbooks), that is how teachers use those materials (in their preparation and instruction) and how the materials influence teacher knowledge in/for teaching, also for teacher education and

professional development. Through systematic reviews of earlier research it might be possible to see what theories are used and how they can be used to develop more elaborated suitable theories for studies on teachers' use of resources (see Gueudet, Pepin & Trouche, 2012).

Visions for continued cooperation beyond the grant period

There is a clear intention that this network of researchers will be a long-lasting cooperation in research and interventions on mathematics textbooks in a wider sense. We are convinced that this is possible because the kernel of the new network is the network that was started in 2006 and it has achieved to survive without extra resource and be productive. The importance of such a network is evident as the researchers are rather few and isolated in their home environments. The need for studies on textbooks is obvious because of the lack of such studies in the Nordic countries and the high importance of textbooks in just the Nordic countries (Valverde et al., 2002). The synergy effects will be of value if there is a greater opportunity to collaborate under good conditions. Our vision is that the deeper collaboration will enable us to carry out and produce important research projects based on our collective knowledge and insight in the area of textbooks research. The network may also contribute to make research on mathematics textbooks more visible and accessible for both teachers and researchers.

In relation to textbook studies the Nordic culture and shared Nordic history is important. The values and traditions in the Nordic educational systems show similarities that make comparative studies, longitudinal studies or replication studies interesting. The language issue is important for textbooks and there exists a Nordic cooperation in the production of textbooks, which will be in focus for some of the studies. The inter-Nordic communication is crucial to the success of the Nordic network of researchers and both established and new ways for such communication will be used (video-conferences, web-based platforms, Skype, Internet etc.)

Participants in the network

The network currently consists of groups of researchers from six Nordic and Baltic universities and some international partners. Both master students, doctoral students and more senior researchers are involved. We welcome new participants. A first contact can be made with the group-leader in your country and here we list the partner universities and group-leaders: University of Agder, Barbro Grevholm, University of Iceland,

Kristin Bjarnadóttir, University of Oulu, Vesa-Matti Sarenius, Luleå University of Technology, Monica Johansson, Sør-Trøndelag University College, Birgit Pepin, Tallin University, Madis Lepik. The international partners come from Germany, The Netherlands and UK.

Participants' interest in mathematics textbooks studies

Barbro Grevholm has been the leader of the doctoral programme at University of Agder from 2004–2010 and is currently supervising 5 doctoral students. Two of them, Randahl and Kongelf, are doing research on textbooks at different levels. She has also been the supervisor of one master student and three Swedish doctoral students who studied textbooks (Brändström, 2002, 2005; Jakobsson-Åhl, 2006, 2008; Johansson, 2003, 2006a, 2006b) and also the mentor of another doctoral student Bremler (2003). Her interest for studies on textbooks started already at the end of the 1980s when she was asked by the Swedish State Institute for Teaching Material (SIL) to investigate mathematics books for compulsory school in Sweden. The report (Areskoug & Grevholm, 1987a) created much public discussion on textbooks (Anderberg, 1987; Areskoug & Grevholm, 1987b) and had clear impact on the activities of the publishing houses. Revision of all seven textbooks series took place based on the report. Grevholm also wrote an overview of mathematics schoolbooks from the Second World War up to the 1990s together with two colleagues and this became part of a Swedish governmental study (Grevholm, Nilsson & Bratt, 1988).

For a couple of years (1987–1990) she worked in a publishing house designing new textbooks and learnt the industry from inside and the practical conditions for production of mathematics textbooks. Later she took up the research interest again in the work together with her doctoral students. As the director of the Nordic Graduate School in Mathematics Education (NoGSME, 2004–2010) she initiated and organized the workshop on research on mathematics textbooks in 2006, mentioned above. This early network is now the kernel of the NordForsk-funded network.

Another of her doctoral students, Per Sigurd Hundeland (2007, 2010), wrote his thesis on what upper secondary mathematics teachers value in planning their teaching. In the study he made some interesting findings on teachers' professional language. These findings are now reinvestigated for a paper together with Grevholm on the use of metaphors when teachers talk about teaching, material, tasks and examination.

Ragnhild Johanne Rensaa (2007, 2009a, 2009b) at Høgskolen i Narvik is a member of the network and also external supervisor at University of Agder for Mira Randahl, together with Grevholm. She participates in the textbook study in Narvik done by Mira Randahl. Randahl's study is

on prospective engineers' use of the textbook and the learning opportunities offered to them by the book (Randahl, 2011, in press; Randahl & Grevholm, 2010). Kongelf has done a very careful investigation of the heuristic approaches used in Norwegian textbooks for lower secondary school (Kongelf, 2011).

Kristin Bjarnardottir (2006, 2007, 2010) wrote her dissertation on Icelandic textbooks from historical time and has continued to research mathematics textbooks in Iceland also together with her colleagues. Guðný Helga Gunnarsdóttir (2009) and Rannveig Halldórsdóttir are studying mathematics textbooks and Gunnarsdóttir has also experience from writing textbooks (Gunnarsdóttir & Pálsdóttir, 2010).

Vesa-Matti Sarenius and his colleagues are doing research on mathematics textbooks for younger pupils and investigating design of specific content areas in mathematics (Keranto & Sarenius, 2009, 2010).

Monica Johansson did her doctoral study on mathematics textbooks for compulsory school (Johansson, 2003, 2005, 2006a, 2006b) and is now supervising a master student working on textbooks studies (with a sociological perspective). At her department in Luleå we also find Eva Jablonka, who has studied mathematical literacy which is of interest for textbooks studies. Together with Johansson she wrote an overview of textbook studies done in Sweden (Jablonka & Johansson, 2010).

Birgit Pepin is well-known internationally for her studies on mathematics textbooks (Gueudet, Pepin & Trouche, 2012; Pepin 2007; Pepin, Grevholm & Strässer, 2006; Pepin & Haggarty, 2001) and has been part of the informal network since 2006. Together we organized several events in different conferences (e.g. NORMA05, PME 2006, ECER 2008) to gather researchers interested in mathematics textbooks and curriculum studies. She has since moved to Norway and has supervised a master student on textbooks research. Petter Skjervold (2011) worked with the research question: "Hvilke læreplanressurser bruker matematikklærere i sin planlegging og undervisning, og hvordan blir de brukt?" [Which curriculum materials do teachers use in their planning and teaching, and how are they used?] In this study seven mathematics teachers have been observed and interviewed, in order to find out what kinds of curriculum materials teachers use (including textbooks), and to explore the nature of their use. Using Trouche's Instrumental Genesis framework, he investigated how the curriculum materials turn from tool to artefact to instruments for the teacher. In the process the teacher shapes the artefact (the curriculum materials), and at the same time the artefact shapes the teacher's use through its affordances and constraints.

Madis Lepik has initiated a research group called NorBa (Nordic Baltic group) and one main interest of this group is comparative studies of

curricula and textbooks. Together with Antti Viholainen from Finland and Kirsti Hemmi from Sweden he has carried out the comparative study on proof and proving. The next step for the group will be analysis of textbooks. Doctoral student Regina Reinup and Tiiu Kaljas are also participating. The textbook group met once in 2010 in Tallin to start discussing the work. Also Vesa-Matti Sarenius from University of Oulu participated in this meeting and is still working on textbooks and now participating with others from his university. Another doctoral student Ingrida Weilande from Latvia is a PhD student whose topic is connected with textbook studies. Madis Lepik did his doctoral work on aspects of mathematics textbooks (Lepik, 1990, 1993) and he has already carried out studies on textbooks and published a number of papers (one of them together with Tiiu Kaljas) (Lepik & Kaljas, 2010).

Conclusion and future direction

Already in 1987 Swedish State Institute for Teaching Material (SIL) wrote in their message about the evaluation of mathematics textbooks: "Ett entydigt resultat av granskningen är att förbättrade läroböcker vore en av de viktigaste satsningarna för att förstärka matematikundervisningen." (An unequivocal result of the evaluation is that improved textbooks would be one of the most important initiatives for strengthening of mathematics education. (Author's translation)).

The fact that the network of researchers interested in textbooks exists and facilitates collaboration between researchers interested in mathematics textbook studies might contribute to a raised interest for the area and for initiatives to improve textbooks. It might also lead to the production of publications that could help increase the level of quality of mathematics textbooks and teachers' critical interest in textbook research. New perspectives on mathematics textbook research might emerge? Anyone interested in the network is challenged to contact us.

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