Mathematics education: a key for success in a globalised world?

In 2006 the Danish government set up a commission with the task of analysing Denmark's situation in the global scene, identifying current problems and suggesting a course of action for securing Denmark's growth, competitiveness and security in a global economy. The report *Progress, Innovation and Cohesion. Strategy for Denmark in the Global Economy*[1] by the Globalisation Council emphasises the need of strengthening education in general and in particular citizens' mathematical and scientific competencies and education. The report has placed mathematics education high in the political agenda. A series of initiatives with accompanying resources have followed and are still under design now and in the years to come. Hopefully, this political initiative will open new possibilities for practitioners and researchers to engage in activities aiming at the betterment of mathematics education in the country.

The focus on mathematics education in 2007 and in the future, as a result of the recommendations of the Globalisation Council, seem to be in conflict with the results of the implementation of previous, yet very recent reforms in two main sectors of the Danish educational system. The reform of the structure of high schools (gymnasium) intended, among others, increasing the amount of students who will choose the mathematical and scientific string by offering a compulsory, interdisciplinary basic course where all students had the opportunity to do mathematics and science. The result until now has been a clear decrease in the numbers of students who choose the mathematical and scientific path in high school; what is quite worrying given the already low numbers of students who are qualified for and who actually decide to follow mathematics and science-based studies at university levels. The reform of teacher education intended, among others, to extend the actual time that primary and lower secondary teachers dedicated to their preparation for teaching mathematics, science and Danish. More focus on the subject areas (instead of on general pedagogical processes in school) was a central interest of the reform. The results until now of the brand-new

implemented structure show an alarming low amount of students having choosen mathematics as a central area in their teaching education. The numbers are even worse for science. These trends are highly problematic in a context with a shortage of interested youngsters, qualified mathematics teachers in schools, and a population of school and high school teachers close to retirement age. If these tendencies continue to be the case, they can easily threaten the intention of strengthening mathematics education as a key for improving citizens' competencies for action and participation in a globalised Denmark.

Are these happenings in Denmark of relevance for the Nordic Region? All Nordic countries have been engaged recently in educational reforms impacting on the actual teaching and learning of mathematics in different levels of schooling. Despite of differences among countries, policies and structures, similarities can be fund in these reforms. The overall political goal has been clearly stated: we need to increase the percentages of the youth cohorts that enrol in mathematics, science, engineering and the technical branches at a higher educational level. This goal has primarily been pushed through structural changes in the educational systems and/or through the installation of new assessment systems. Discussions of how to improve the quality in the teaching and learning of mathematics at the different levels of the educational system typically play a very limited role in the reform process. Accordingly research findings and experiences from developmental projects are seldom used to inform the political decisions.

The state of affairs poses a double challenge for the research community in mathematics education. We need to improve our communication with politicians and policy makers about the type of research findings that can be useful in a reform process, and we need to investigate more directly how to develop mathematics teaching and learning at different school levels in order to empower the students to meet the mathematical challenges of a gobalised world. It remains to be seen whether the initiatives that are being launched nowadays will involve research for the development of practice, and whether they will be able open possibilities for mathematics and science to play a decisive role in the formation of not only economically active citizens but also democracy-aware people under globalisation.

A new member at the editorial board

This year Nomad started a process of renewal and expansion of the editorial committee. It is now a pleasure for us to inform that Kristín

Bjarnadóttir, from Iceland University of Education, has joined the editorial committee. We would also like to express our gratitude to Anna Kristjánsdóttir who for many years has served NOMADS editorial committee.

About this issue

This issue brings together four quite different papers. The first paper by Keiko Yasukawa, rather than a research report, is an essay of relevance for the continuous discussion about what is the role of mathematics and mathematics education in society. It provides a meta-discussion that invites researchers and practitioners to question the intentions behind mathematical instruction in a time in history where sustainability has become more important than ever. The other two papers are research reports of two studies with two quite different methodological designs and areas of study. While the paper by Olof Bjorg Steinthorsdóttir and Bharath Sriraman presents a screening study on a group of 53 students' proportional thinking, the paper by Lil Engström and Thomas Lingefjärd presents a study on how dynamic geometry systems are used in three high school classes in two different countries. The fourth paper by Uffe Jankvist is something between a book review and review paper on empirical investigations of the effects of including the history of mathematics as part of the teaching of the subject. All papers highlight important issues about the practices of teaching and learning of mathematics in the Nordic region.

At a time where discussions about the state of our planet are part of daily news, Yasukawa's paper *An agenda for mathematics education in the decade of education for sustainable development* presents an important challenge for mathematics educators and mathematics education researchers: Does mathematics education have something to do with education citizens for sustainable development? That the mathematical education of students at different levels of schooling fulfils important functions in society is a recognized fact of policy makers, educators, researchers, the labour market and the public in general. However, which kinds of functions is a less clear issue. Yasukawa argues that mathematics, being a powerful tool to describe, model and act in the world, can be connected to the development of a critical capacity in students for judging the effects of development on the world. The arguments of critical mathematics education, partly emerging from Scandinavian contexts, are brought in relation to the perception that youngsters and, in general, people have about themselves and their world currently. One of the main points

in an attempt of relating mathematics education and the possibilities of contributing to sustainable development is the need to concentrate on how students construct their identities and how they adopt different values about themselves and the world.

In the paper *Gender and strategy use in proportional situations: an Icelandic study* by Steinthorsdottir and Sriraman, we find a detailed report on an empirical study on 53 Icelandic eight graders' strategies for solving missing value proportion problems of the mathematical form: $\frac{4}{12} = \frac{x}{18}$. The students have been interviewed while solving 16 different problems spanning a variation of four categories of the contextual structure in the formulation of the problems and four categories of the numerical structure of the problem according to the integer/non-integer nature of the involved proportions and the answer. The authors' analyses show that both types of structures influence the students' choice of strategy and their success rates. The gender differences found in the study are quite subtle but still interesting. In accordance with other findings in the literature, it seems that girls have stronger tendency to make use of a context familiar to them than boys. In general the results of the study are an argument in favour of systematic variation in context and numerical structure when teaching proportional reasoning. The design of the study invites to carry out follow up studies where negative integers, rational numbers and more than one variable are introduced in proportional problems.

The paper *Posing problems using Cabri* by Engström and Lingefjärd presents some of the major findings from the first author's PhD dissertation. The teaching of geometry with dynamical geometry software (DGS) in three upper secondary classes – two from Sweden and one from Switzerland – is studied in detail. Based on extensive classroom observations, the students' problem solving activities using DGS and the related dialogues between the teacher and the students are analysed. The teachers' objectives for using DSG and their general beliefs about teaching and learning of mathematics are explored with a questionnaire and used in the analysis. The main result in the study is that the way in which the teachers formulate the tasks for students and ask questions during their problem solving activities are the most important factors for the potential learning outcome of using DGS. Quite small differences in the questions asked during the students' computer-based activities can make a difference between the students' instrumental use of DGS for finding right answers to unrelated tasks or the students' engagement in mathematical investigations using DGS as an instrument for learning mathematics.

As a non-standard type of contribution this issue also includes the paper *Empirical research in the field of using history in the teaching of mathematics* by Jankvist. The paper is something between a book review and a

literature review of the reasons for including the history of mathematics in the teaching in the subject, and of empirical investigation of its effects. The point of departure is the author's reading of the extensive proceedings from the *International study group on the relations between the History and Pedagogy of Mathematics (HPM) 2004* and the *European Summer University on the history and epistemology in mathematics education (ESU) 4*, and in particular his review of the four papers reporting empirical studies in these volumes. The purposes for including the history of mathematics in the four papers are discussed in relation to the guidelines for teaching history of mathematics in the Danish gymnasium. The paper concludes with an argumentation for the need of more empirical research on the possible effects of including the history of mathematics as an integral part of the teaching of mathematics.

The editors

Notes

1 Available at http://www.globalisering.dk/