The role of research in mathematics education reform work

Blomhøj, Morten; Valero, Paola; Häggström, Johan

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The role of research in mathematics education reform work

Mathematics curricula seem to be undergoing constant changes – in the Nordic countries no curriculum is older than 10 years. At the moment a new curriculum for the Swedish compulsory school is in progress and, just like the curricula in Denmark, Iceland and Norway, the structure and organisation is influenced by an international trend that separates the mathematical content from aims regarding general mathematical competences. The draft versions of the new Swedish curriculum published on the web by the *Swedish national agency for education* have three sections: *Rationale and Aim of the subject*, *Central content* (for grades 1–3, 4–6 and 7–9), and *Required knowledge* (for grades 3, 6 and 9). By structuring the curricula in this way two dimensions – content and competences – become clearly separated. This can be viewed as a result of a long and gradual transformation from older curricula that in many cases were merely describing the content to be covered. With respect to curricular documents that only focused on the syllabus or list of contents, these newer formulations show a progress. The current documents are influenced by recent trends and discussions emerging in the mathematics education community. For example, the aims of mathematics instruction, as for instance in the first section of the new Swedish curriculum, are influenced by several, quite recent, reports where mathematical competencies are described and categorised. Sources of influence that can be detected include among others the *Standards* of the National Council of Teachers of Mathematics in the United States (see e.g. NCTM, 2000), and documents such as the Danish report *Kompetence og Matematiklæring* (Niss & Højgaard Jensen, 2002) and *Adding it up* (Kilpatrick, Swafford & Findell, 2001). Despite this influence, it is less clear to see in the documents a better integration and a substantial change of focus from a syllabus-oriented thinking to a competence based curricula. The introductory declarations that intend to guide the direction of the curricula very seldom infiltrate the lists of contents to learn. Since mathematics curricula in the Nordic countries are organised in similar ways, the general image that persist is that mathematical content and mathematical competences can

be regarded separately. From a mathematics education research point of view this separation can be questioned. If the educational aim is to develop mathematical competencies then the choices for content need to be justified as a suitable means for developing the target competencies. Such analyses are crucial also in relation to the process of implementation. Teachers need to develop connections between the mathematical content and the mathematical competencies in order to teach in a way that actually supports the curriculum goals.

A common way to view the mathematics curriculum is the model adopted by the IEA studies (TIMSS), which is described in three levels: the intended, the implemented and the attained curriculum. The political documents described above constitute one part of the first level – the intended curriculum – in the sense of what is prescribed by the national authorities. In that capacity they reflect the curricula that is intended on the national level and a naïve assumption is that what is prescribed will flow down in the system to be implemented in the classrooms. However, reforming curricula and reforming teaching involve complex processes. Another part of the intended curriculum is the intended curriculum of mathematics teachers and students. In a recent investigation of mathematics teaching in the compulsory school in Sweden, the *Swedish schools inspectorate* (Skolinspektionen) found that the intentions in terms of "competences to strive for", as described in the current curriculum, are quite blurred to many teachers (Skolinspektionen, 2009). This means that the teachers' intended curriculum in many cases is different from the nationally intended curriculum. Such discrepancy naturally bears consequences for the implemented curriculum and the actual teaching taking place in the classrooms.

The recent reform work in the Nordic countries raise many questions regarding the role of research in mathematics education. Does it matter to what extent the basic ideas behind the present curricula reform draw on research in mathematics education? Are the effects of the former curricula properly evaluated, and if so, in what ways are the results guiding the reform work? In what ways are the problematic implementation of a new curricula considered in the reform work? In what ways are teachers, students and parents beliefs about mathematics, and mathematics learning and teaching considered?

The editors would like to call for research articles regarding the process of reforming mathematics education for publication in NOMAD. We see a need for deepening our understanding of processes of curricular change. Research can certainly contribute to this.

About this issue

Two of the three papers published in this issue actually connect to the problematique of implementing new forms of mathematics teaching, in both cases in a Norwegian context.

In his paper *Nokre spesielle trekk ved arbeidet med matematikkfaget i begynnaropplæringa* Leif Bjørn Skorpen reports on the findings from an investigation of the format of the teachers' and the pupils' activities in Norway in 27 classes at grade 1–4 (age 6–10 years). The background motivation for this investigation was that, in the latest decade, the curriculum and the guidelines for mathematics teaching in the lower grades have undergone a change in direction of placing more emphasis on the connections between mathematics and the pupils' activities with games and practical investigations in the teaching situation as well as the connection to pupils daily life experience. In this reform process the ideal is to place in the centre of mathematics teaching the pupils, activities with solving meaningful problems using mathematics. A main responsibility for the teacher in the prescribed form of teaching is to help structuring and organising the pupils' learning to form a common mathematical knowledge in the classroom. Against the background of this intended curriculum the findings in this paper are quite depressing. The author have fund, that although there are large variations among classes and teachers and although some very nice and interesting pupil activities has been observed, the overall picture shows that more than 2/3 of the time in class are spent on the pupils individual work with textbooks drill exercises or on the teacher's presentations of how to do the exercises. These findings are in line with what was found in a similar investigation in 1997; thus the research documents a strong impact of the tradition of mathematics teaching on practice. The dominant form of mathematics teaching found in this investigation is not in agreement with the intended curriculum and in this way the paper pinpoint the need for research on teachers professional development in relation to curriculum reforms.

The second paper *Practical activities in mathematics teaching – mathematics teachers' knowledge based reasons* by Frode Olav Haara and Kari Smith also addresses the state of affairs in Norwegian mathematics teaching in compulsory schooling. Here the focus is on the use of practical activities in mathematics and the teachers' reasons for using such activities. Eight acknowledged mathematics teachers have been interviewed about their use of practical activities and these qualitative interviews have been analysed hermeneutically. From the interviews it appears that pupils' practical activities do not play a very prominent or well integrated role in the teachers' organisation of mathematics teaching. Less

experienced teachers may use practical activities but they do not give very clear and specific reasons related to the intended learning for their use of practical activities. Their reasons are mostly of a general pedagogical nature such as positive affects or variation of the teaching format. More experienced teachers tend to give more specific and mathematical content related reasons for using practical activities, and some of the experienced teachers also express some doubts as to whether the time spent on practical activities is worthwhile.

The findings are related to the research literature in the field of mathematics teacher education and in particular to research on the interplay between different forms of teachers' knowledge – i.e. mathematical, didactical or pedagogical knowledge – and their beliefs about mathematics and mathematics teaching and learning.

Taking together, the two papers concerning mathematics teaching in Norway indicate that there might be an imbalance between the intended curriculum and the actual mathematics teaching taking place. From a mathematics education research point of view the situation invites to further investigations of the reform process that have led to the current curriculum and on possible ways of supporting teachers' professional development in the process of implementing the curriculum.

The third paper in this issue addresses a more general theoretical issue. Diana Stentoft and Paola Valero, in *Identities-in-action. Exploring the fragility of discourse and identity in learning mathematics* examine the notion of identity, a concept that has been adopted recently in mathematics education research in relation to diverse socio-cultural and discursive readings of mathematical learning. The notion has gained acceptance as a good tool for linking individual and social understandings of mathematical learning. The authors review existing research using the notion of identity, and point to some of the strengths and weaknesses in the ways the notion of identity is being constructed. Based on observations in an empirical setting of initial teacher education in Denmark, the authors propose a conceptualization of the notion which points to the fragility and instability of identification processes. Drawing on post-structural theories, the contention they put forward is that a notion of identity emphasising the dialectic relationship between identification and discourse offers interesting possibilities for interpretations of mathematical learning as a fragile process characterised more by discontinuities and disruptions than by continuity and stability. Such discontinuities and disruptions seem to grasp the observation that people's engagement in mathematical learning is a much more discontinuous process than what our theoretical lenses assume it to be. Therefore, the authors argue that a poststructuralist notion of fragile identities in action allows bringing

to the fore what research in mathematics education normally constructs as ”noises” or ”impossibilities” in the analysis and understandings of mathematics education and classroom interaction.

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