

Belief research in mathematics education

In volume 15 (2010) in NOMAD there was no thematic issue as has been the costume for some years. The reason for this deviation from tradition was delays in the review process on papers on belief research, which was planned as the theme for the thematic issue in 2010. However, meanwhile more papers within this theme have been prepared for publication, and now we are happy to present a double issue (1/2-2011) on belief research with five interesting research papers.

Belief research as a theme for NOMAD was originally suggested to the editors by Magnus Österholm, who organized a research symposium on this theme in 2009. There are many good reasons for choosing belief research as the theme for a thematic issue of NOMAD. It is a research area in which we find quite a few researchers from the Nordic region publishing on the international scene. In fact this is evident from reading the lists of references in this issue. The area also reflects some very important challenges for mathematics education research in general, one of them being the question of specificity towards mathematics teaching and learning of the theories developed in mathematics education research. Belief research in mathematics education has natural connections to other research disciplines such as psychology and sociology. Moreover many of the mechanisms through which beliefs in mathematics are formed and influence practices can be expected to be in play also in other subject areas. Therefore it is a challenge for belief research in mathematics education to pinpoint what is specific to mathematics teaching and learning. As a second aspect of general relevance for mathematics education research we point to the interplay between theoretical perspective and methodology in belief research. You will find food for thought and reflections in relation to these general issues in the five papers presented in this thematic issue of NOMAD.

About the papers

The first paper *The theory of conceptual change as a theory for changing conceptions* by Peter Liljedahl takes a cognitive perspective on changing teachers' beliefs about mathematics and mathematics teaching and learning. The paper starts with a general discussion of the epistemology related to the theory of conceptual change and argues that the

transition from theories of mathematical knowledge and learning to theories for education and teaching is a general challenge for mathematics education research. This transition is exactly what the paper tries to accomplish in developing a theory for changing beliefs through teaching. An in-service course with more than 50 hours of contact is conducted with the participation of 14 secondary mathematics teachers. The course is designed to change the teachers' beliefs about the nature of the following six domains: mathematics, mathematics teaching, assessment, student knowledge, student learning, and student motivation. Qualitative data from classroom observation, teachers' reflection journals, interviews and essays are analyzed for each domain and it is concluded that the *theory of conceptual change* is a viable *theory for* designing interventions for changing conceptions, and that these interventions resulted in cognitive conflict and eventually the participants' changing beliefs.

The second paper *From beliefs to patterns of participation – shifting the research perspective on teachers* by Jeppe Skott, Dorte Moeskær Larsen, and Camilla Hellsten Østergaard is a critique of the dominant approach in belief research in mathematics education since it emerged as a research field in the early 1980s. The main theoretical construct in belief research; namely that teachers' beliefs about mathematics and the learning and teaching of mathematics are relatively stable mental constructs, which have a determining influence on the teachers' practices of mathematics teaching, is challenged by the authors. In addition methodological problems related to the uncovering of the teachers' beliefs as mental constructs and the mechanisms through which these beliefs influence their teaching practice. Patterns-of-participation research is suggested by the authors as an alternative research approach to study how teachers' practices are formed.

The paper offers an in-depth case study of a primary and lower secondary mathematics teacher. The teacher was followed over a two year period from her last period in teacher education to her first year of teaching as an educated teacher. Based on interviews and video observations from her mathematics classroom the analyses show how her practice and related reflections can be understood and explained in a "patterns of participation" perspective, and without assuming the existence and significance of objectified mental constructs called beliefs. The authors end by claiming that there may be a lot to gain from doing away with the notion of beliefs altogether.

In the paper *To translate between different perspectives in belief research: a comparison between two studies*" Magnus Österholm addresses the question of how dependent the interpretation of empirical findings concerning beliefs in mathematics might be on the choice of theoretical

perspective. The paper is an analytical comparison between two different theoretical approaches identified in belief research. These are labelled "The change perspective" and "The participatory perspective", respectively. The author has chosen the two first papers published in this thematic issue as representatives for the two approaches. This has been possible due to the fact that the author has a close knowledge of the research reported in these two papers from the research symposium mentioned above, and because the author had access to preliminary versions of the two papers. For the reader this provides a unique possibility to follow the analysis based on his or her own reading of the two papers. As a method for analysis Magnus Österholm has identified eight aspects to characterise a theory or theoretical perspective in belief research, without discussing the status of "theories" in this field. Each of the two perspectives is characterized by means of the eight aspects and they are compared aspect by aspect. It is concluded that even though the two perspectives are different, for instance with respect to their main components and the methods used, the empirical findings in the two studies can in fact be translated from one theoretical perspective into the other without losing its meaning.

The fourth paper *Structure of students' view of mathematics in the Estonian Business School* by Indrek Kaldo reports on a quantitative study of university students' mathematical-related beliefs. Emphasis is put on students' view of mathematics as it is formed by their experiences as learners of mathematics. A questionnaire based survey including 93 students has been conducted and the data are analysed by means of factor analysis. The reliability of the factors are measured by means of Cronbach's alpha and the following seven factors are confirmed with values higher than 0.7: Performance - approach goal orientation, Mastery goal orientation, Attitudes to mathematics, Relevance, Personal value of mathematics, Student competence, and Cheating behaviour. A comparison between a group of students learning in English and a group learning in Estonian reveal some interesting results. However, the main finding reported in this paper is that the structure of the Estonian first year baccalaureate students' views of mathematics is coherent with the structure from earlier research. The identified seven factors explaining students' view of mathematics seems to be stable across populations.

The fifth and final paper in this issue is a paper on *Students' mathematical identity formation in a Swedish multilingual mathematics classroom* by Eva Norén. This paper reports on a case study conducted in a group of ten bilingual Arabic and Swedish speaking students in grade eight and nine. Theoretically the paper builds on Foucault's concepts of discourse and identity. The research is motivated by a critique of the dominant

public discourse concerning bilingual students' performance in mathematics. This discourse is characterised as a "deficiency discourse" where students' low achievements are explained with reference to causes outside school and the mathematics classroom, leaving little room and small responsibility and encouragement for developing teaching practices in mathematics, which can support bilingual students' learning of mathematics. The case study examines how various discourses work in parallel, e.g. a social relational and a mathematical discourse; a discourse promoting multilingualism and a mathematical discourse; a solidarity discourse and a regulating discourse, in the mathematics classroom and how such discourses can affect students' mathematical identity formation. Within the particular multilingual mathematics classroom studied the students were not defined as disadvantaged. Students were capable of making choices and act accordingly in the mathematics classroom, and the paper ends by pointing to the possibility of changing mathematics classroom practice for the benefit of multilingual students' mathematical identity formations.

The editors encourage all readers to submit, not only papers for publishing, but also ideas for future thematic issues of *NOMAD*. Information for authors can be found at our website, ncm.gu.se/nomad.