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Problem Solving in **Math**ematics Education

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Preface

For some decades now, there has been a request for more problem-solving orientation in mathematics teaching from both didacts of mathematics and teachers associations all over the world. Yet, results of large-scale empirical studies suggest that classroom reality is, by and large, rather dissatisfying in this respect. Or, putting it more positively, there is great potential to improve mathematics classroom teaching.

ProMath (**Pro**blem Solving in **Math**ematics Education) is a group of didacts of mathematics from all over Europe who have the common aim of furthering and scientifically exploring problem-solving activity in mathematics among students, exploring the possibilities and preconditions of increased problem-solving orientation in mathematics teaching, and (by doing so) promoting it at the same time.

ProMath was founded by Günter Graumann (University of Bielefeld, Germany), Erkki Pehkonen (University of Helsinki, Finland) and Bernd Zimmermann (University of Jena, Germany). One of the many activities organised by the group are its annual conferences. Having been held in various European countries since 1999, they are above all a podium to present and discuss relevant current research projects.

The 9th conference of this kind was hosted by the Leuphana University of Lüneburg (Germany) from 30 August to 2 September 2007. This volume contains the abstracts to most of the presentations held, but also recent works by long standing ProMath members.

András Ambrus reports on first experiences of Hungarian mathematics teachers and their students with open-ended problems and formulates important consequences for an appropriate development of mathematics classroom teaching.

Maike Bremer and *Torsten Fritzlar* present a pilot study that makes an attempt to capture, by way of example, the key aspects of the conceptions that teacher students in their final year of studies have of problem solving mathematics teaching. Results of this explorative study indicate that certain educational efforts should be (further) intensified if the education of teacher students at universities is to make a sustainable contribution to a more problem solving orientation in mathematics classroom teaching.

Lars Burman's contribution is about a Nordic competition in mathematics with strong elements in problem solving. Apart from selected problems, he presents some of the competition's basic ideas as well as experiences especially from Norway and Finland.

How mathematics lessons incorporating issues of every-day life can also contribute to health education is shown in the article by *Günter Graumann*. Ingredient specifications on product labels of food products as well as different ways of body weight assessment (e.g. BMI) provide students of different ages with a large variety of possibilities of dealing with comprehensive data material and the many options of presenting it.

How do students deal with an open, realistic problem statement? *Gilbert Greefrath* reports on results of a recent study dealing with this issue. His particular focus lies on planning processes and, in the course of them, the interaction between mathematics and reality.

Dörte Haftendorn presents a mathematically highly comprehensive thematic complex in her contribution on coupled polar-Cartesian plotting of algebraic curves. It offers many suggestions on working with a problem-solving approach using computer-based support.

Anu Hellinen and *Erkki Pehkonen* give account of a large-scale empirical study in Finland that, by means of a non-routine division task, explores the mathematical argumentation skills of senior high school students.

On ProMath's special request, *Karl Kießwetter* presents some thoughts and experiences on „open problem solving". Not only does he pass exemplary criticism on certain elements of content found in large recent empirical studies, but rather does he demonstrate possibilities of dealing with these questionable issues in a constructive way. Moreover, Karl Kießwetter places high emphasis on highlighting the significance of complexity for mathematical activity (and hence also on modelling this activity), as well as the consequences for mathematical education of children and adolescents.

Hartmut Rehlich presents cyclic processes using the Fibonacci-sequence, thus discussing two thematic areas that enable both theory building processes in elementary mathematics, and, incorporated into this, tackling mathematically comprehensive problems in an independent way.

Ulrich Sprekelmeyer gives account of specific strategies to determine the area sizes of geometric shapes on a geoboard that he observed during group meetings of mathematically interested and gifted students.

In the last contribution of this volume, *Bernd Zimmermann* sketches necessities and possibilities to substantially extend well-known modellings of problem solving processes; at the same time he raises current research questions.

The papers of this volume are peer-reviewed, organized by the editor; every paper was read and commented by two anonymous peers. However, a review by the editor of this volume did not take place, which means that every author holds responsibility for the content of her/his text herself/himself. Contact details can be found under the authors' respective articles.

I want to thank all participants for their valuable contributions, as well as *Amelie Bernzen* and *Johanna Klein* for some linguistic support. However, as we are all non-native speakers of the English language, some inaccuracies of the language cannot be avoided.

I am particularly grateful to the Leuphana University of Lüneburg, the publishing house Klett and the Werum Software & Systems AG – without their support, neither our 9th ProMath conference nor the publication of these proceedings would have been made possible.

Torsten Fritzlar, Summer 2008