International Conference on Mathematics Education into the 21st Century:
Mathematics for Living
Amman, Jordan, November 18-23, 2000

Report of Working Group 4: Connecting Mathematics Problem Solving to the Real World
Coordinators: Erik De Corte (Belgium) & George Malaty (Finland)

The Working Group involved the following 10 papers:

- Connecting Mathematics Problem Solving to the Real World
  Erik De Corte, Lieven Verschaffel, Brian Greer
- Advantages and disadvantages of using 'real world' problems in teaching mathematics
  Agata Hoffmann
- The problem of integration the formal knowledge of the pupil with the non-formal one (showed on the example of the similar figures)
  Ewa Swoboda
- From Mathematics for Living to Living for Mathematics
  George Malaty
- Analysis of Students' Errors in Mathematics Problem Solving
  Khattab Abu Libdeh
- About Students' Understanding and Learning the Concept of Surface Area
  Cinzia Bonotto
- Volume Measurement and Conversation in Late primary School Children in Cyprus
  Stamatis Voulgaris & Anastasia Evangelidou
- The Effects of General Mathematics in High School on College Calculus at Anadolu University in Turkey
  Nevin Orhun
- A Research Into Children's Understanding Of Multiple Representation Strand Of Number Sense In Penang, Malaysia
  Munirah Ghazali & Noor Azlan Ahmad Zanzali
- Evaluating the levels of problem solving abilities in mathematics
  Noor Azlan Ahmad Zanzali & Lui Lai Nam

The paper by Cinzia Bonotto was not presented at the conference because the author could not attend the meeting. As one can derive from the overview of the papers, they covered a variety of topics and addressed different levels of education. In this report we summarize the major conclusions that emerged from the presentation of the papers and the subsequent discussions.

In view of connecting children's learning of mathematics problem solving, the use of concrete, realistic, and authentic problem situations is recommended. But of more importance is that the problems should be meaningful for the learner; in this respect it has to be remarked that an abstract problem can be realistic assuming that it is personally meaningful for the problem solvers. Moreover, we should keep in mind the dual nature of mathematics: on the one hand, mathematics offers tools for modeling and solving problems in everyday live, but on the other hand, mathematics is a culture of formal and abstract structure. Consequently, learning mathematics implies the need for foster in students the attainment of this abstract level; in that perspective it is important to stimulate reciprocal interactions between the concrete and the abstract levels. In this regard, one should also be aware of taking into account individual differences among learners.

The previous standpoint has some further implications for the nature of the problems to be used and for the teaching of problem solving.

In addition to the features mentioned above, it was stressed that a large diversity of problem situations should be used that are as much as possible rich in context, society-based, and open-ended. Besides problem solving, problem posing or problem generating by the learners themselves should be stimulated more than is hitherto the case.

The teaching of problem solving should be more process- and strategy-oriented than product-oriented. In view of stimulating in students constructive, and progressively more self-regulated learning, a change in the role of the teacher is essential. Instead of being the sole source of knowledge and solutions, the teacher should create a classroom climate and culture that encourages and facilitates pupils own initiatives and stimulates interactive and collaborative problem solving. The teacher input in this way is becoming more essential than before as the architect of the learning process.

An important issue, however, is how such an approach to learning and teaching mathematics can be disseminated. Scaling up such an approach is a major challenge for the near future. In that perspective substantial efforts are necessary to develop instructional materials that are in line with the new conception of teaching and learning mathematics, and to introduce this conception in initial and in-service teacher education and training. To be successful it is also essential to change teachers' beliefs about mathematics and mathematics education.

Finally, it is useful in view of disseminating the new conception of teaching and learning mathematics problem solving to identify and share what might be called "success stories", i.e. cases that illustrate in a convincing way how the new approach can be implemented appropriately and effectively.