

# The Swedish Mathematics Delegation

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The Government of Sweden decided in January, 2003, to set up a Mathematics Delegation to survey the whole field of mathematics education from kindergarten to the university level. Eleven members (6 women and 5 men) were appointed in March, 2003. The chairman is Professor Said Irandoust, Rector of the University College of Borås and Professor of Chemical Engineering at Chalmers University of Technology.

The tasks of this committee are very wide. The Delegation shall, according to the directives laid down by the Government, draw up an action plan with proposals for measures to change attitudes to and increase interest in the subject of mathematics, and also submit proposals to develop teaching in mathematics. It should also aim at increasing interest in further studies in the areas of mathematics, natural sciences and technology. The action plan will cover the whole of the school system from pre-school to higher education.

The government states in the directives to the delegation that the importance of good knowledge in mathematics is undeniable. This covers a wide area from daily knowledge to creating the conditions for lifelong learning, as well as the acquisition of competence and problem solving skills required for learning in other subjects, and for actively participating in society and working life. General skills such as logical thinking, the ability to abstract, analyze arguments, communication and problem solving skills are all developed, applied and trained within mathematics. A knowledge of mathematics helps us to understand complex contexts, and is a prerequisite not only for our joint welfare but also the individual's opportunities to, e.g., be able to examine and evaluate arguments in the political debate on the use and distribution of our joint resources.

People with good knowledge in i.a. the natural sciences and technology are of vital importance for Sweden to be able to continue to develop as a leading industrial nation using resources effectively and to promote sustainable economic, social and ecological development. A good knowledge of mathematics is also needed in many other areas in order to achieve success. Mathematics and its applications contribute to development in a large number of areas such as electronics, communication, economics, biology and medicine, as well as the arts, music and film.

As can be seen clearly from the directives, the Swedish Government already from the outset puts high hopes in the role of mathematics, both from a general citizen's perspective, and from the point of view of Sweden as an industrialized nation. As to the schools, the ambition of the Government is that results achieved by Swedish pupils should be at the very top in international comparisons.

In the view of the Government, it is vital that teaching in mathematics be developed so that pupils' interest in and knowledge of mathematics increases. This applies not least to girls, who, although achieving good results in compulsory school, tend to choose more often an orientation other than mathematics and the natural sciences in their studies at higher educational levels.

It is important at an early stage in schooling to strengthen pupils' confidence in their own ability and assist them to develop positive attitudes to learning and education. This applies not least to many pupils with a foreign background. In this context mathematics occupies a special position. Students who have experienced difficulties in mathematics early in their schooling naturally do not choose educational programs in the upper secondary school or later that contain a high proportion of mathematics. Difficulties experienced earlier in i.a. the subject of mathematics represent for many people a substantial obstacle to taking up further studies in adult life.

Mathematics is a science undergoing continuous change and development. Mathematics is being used increasingly in new areas of society, whilst the subject of mathematics as taught in the school is too often and incorrectly regarded as fixed and complete. Research, development work and evaluation of learning and teaching in mathematics has during the 1990s been extensive, but findings in these areas have only to a limited extent reached the classroom. There is a need to challenge traditions, develop the contents of teaching and show that there are different approaches to changing attitudes, stimulating development and increasing interest in mathematics.

Pedagogical research into mathematics and good examples of experiences gained by teachers from pre-school, school, adult education and higher education should be exploited, e.g., through using opportunities to learn mathematics in exciting ways, and at the same time consolidate important concepts and skills.

The Government considers the enrollment to educational programs with a high proportion of mathematics to be too low for Sweden's needs. The shortage of applicants to teacher training programmes focusing on mathematics, the natural sciences and technology is a cause of concern.

The supply of qualified teachers in mathematics needs to be increased. Studies show that the competence of teachers is the most important single factor determining results achieved by pupils. To create the good learning environments necessary to stimulate pupils' and students' learning, teachers must have a very real knowledge and great interest in the subject.

At the time of writing, the Delegation has not yet finished its task. However, it seems to be clear that its action plan will focus on four areas that are all of the utmost importance for the development of mathematics education. In implementing these proposals it will be necessary to combine efforts mentioned under various headings to obtain optimal results; there is thus no strict division between the four fields. They are:

1. Qualified teachers in mathematics at all levels, from pre-school to the university.

To implement this point, stricter requirements regarding mathematics in teacher education and an extensive program for competence development of in-service teachers will be proposed. This program should apply also to university-level education, where lecturers traditionally have too little time for research and competence development. Quite generally, the status of teachers in Swedish society needs to be improved.

2. Development of local activities in mathematics as a subject from pre-school to the university.

Local and regional activities will be encouraged in an extensive mathematics initiative where funding may be applied for from all schools and institutions of higher learning.

A very important problem for mathematics education as a whole is that children often lose interest in mathematics around the age of eleven or twelve—it seems they learn mathematics cheerfully up to that age. After that, many students try to avoid mathematics and do not enroll in voluntary courses. In the view of the Delegation, a profound change in the subject area as well as in the methods of teaching is necessary. This should be implemented in locally and regionally based programs.

3. Development of mathematics as an educational subject from pre-school to the university.

A point of special concern in this area is the role of mathematics in the education of engineers and the integration of mathematics and scientific computing with technical subjects in the educational programs in engineering.

4. The interest for mathematics and understanding of the value, role and importance of mathematics and mathematical education in the society at large.

This area touches upon the all-pervasive question of attitudes and public understanding of mathematics. One or several Science Centers will be proposed to give mathematics an arena in the public's mind.

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