

MATHEMATICAL COMPETITIONS IN FINLAND

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0. Introduction

In this talk, I shall briefly describe the present status of mathematical competitions and their role in the education of mathematically talented children in Finland. It is not my aim to examine the real significance of these endeavours (which of course can be questioned). Finland is not one of the countries where mathematics is generally held in high esteem, but on the other hand mathematics is not completely neglected there. So we may regard Finland as a case example of a country where mathematics has to fight for its existence among the manifold forces shaping a modern society.

1. School system and mathematics teaching in Finland

The school system in Finland was thoroughly reformed in the early seventies. Before that, the schools differentiated after the fourth year, with a choice of a five year secondary school leading to high school or a four year secondary school leading eventually to vocational schools. At present, compulsory and comprehensive basic school in Finland lasts nine years. Most students continue after that either at the three year high school leading to university

or at vocational schools. The school system is centrally administered. The curricula are prescribed by the Central Board of Schools.

The prevailing philosophy of education has emphasized equal educational opportunities for everybody. On the general level, this has led to the school reform outlined above. In mathematics, this has led to unified teaching during the first nine years of school is now completely uniform. In the first decade following the school reform, there was a choice of three curricula on grades 7, 8 and 9, with only the two longer alternatives possible for those wishing to continue to high school, but in the most recent curriculum reform the longest and shortest alternatives were removed, the protests of mathematics teachers notwithstanding. In high school, there has traditionally been a choice between a curriculum in which languages are emphasized and one with more mathematics and science (in any case Finland, a bilingual country, has to spend a lot of energy on teaching languages).

The subject matter in high school has now been divided into courses of 39 hours duration each; in the wide curriculum there are 11 of them. A list of their titles gives an overview of the kind of school mathematics currently taught in Finland: 1. Real numbers. Introduction to statistic. Computer science. 2. Equations, inequalities. 3. Vectors. Geometry. 4. Analytic geometry. 5. Functions.

6. Limits. Continuity. The derivative. 7. Differential calculus. 8. Probability and statistics. Sequences and series. 9. Integral calculus. 10. More about vectors. Solid geometry. Complex numbers. 11. A review of courses 1 to 10.

The wide scope of the curriculum is of course somewhat illusory. The treatment of subject matter cannot be very deep. The courses are packed with information, but its understanding is not always achieved, not to speak about abilities to use mathematics in situations not described in the textbook.

An important role in the high school teaching is played by the national matriculation examination at the end of high school. The examination consists of four to six parts, of which Finnish, Swedish and one foreign language are compulsory as well as either mathematics or a mixed examination comprising history, religion and the various natural sciences. The importance of the results of the matriculation examination to the future of the student as well as the general belief that the mathematics examination is the more difficult choice tend to guide the high school students to direct their studies to other subjects than mathematics. Also, the mathematics examination comes in two versions, the easier one meant for those who have studied the shorter high school course. This is a further factor in diminishing the popularity of mathematics among the students.

Also, the matriculation examination works as a guide for teachers: in reality, good showing at the examination is what the school and parents expect, not learning the subject matter stated in the curriculum. Of course, this influence of the examination is often a very healthy one. At least the examination means solving a set of problems, and so problem solving in an elementary sense is not completely lost to the often useless teaching of the structures of mathematics towards which the curriculum tends to guide.

2. Talented children

The uniformizing trends in education have in recent years been counterbalanced to a certain extent by more attention to groups possessing special talents. The talents appreciated, however, have been almost exclusively artistic and to a certain extent athletic. Especially music has managed to get the upper hand of the official line advocating equal education to all: there are numerous schools with special programs in musical education and some high schools expressly devoted to music. The general opinion is that the pupils' performance in the ordinary subjects is even above the average level despite the demanding extra work in music.

There are no special schools or special classes devoted to mathematics, and such institutions have not been seriously proposed. On the other hand, a high school specializing in computers as well as one specializing in long dist-

ance skiing have been proposed!

3. Mathematical organizations in Finland

Since the school system as such does not take mathematically talented children into account, one must ask whether there are other organizations that will do so.

Finland has one of the oldest mathematical societies in the world: Suomen Matemaattinen Yhdistys was founded in 1868. The society's interest has been in research mathematics and its activities have mostly taken place around the University of Helsinki. The society has, however, been a partner in publishing the semi-popular quarterly *Arkhimedes*.

Traditionally the teaching of mathematics, physics and chemistry at schools have been combined to the same teacher. (A specialized teacher is in charge of mathematics from the 7th grade onwards.) This is the background to the formation of the Matemaattisten Aineiden Opettajien Liitto (MAOL) or the Association of Teachers of Mathematics, Physics and Chemistry. It was founded in 1935. The Association is rather active, as are other teacher's associations, representing the various subjects. The relatively unstable situation in schools often gives rise to a competition of the limited resources between the subjects and even to controversies in which various groups of teachers can feel their interests threatened. So all teacher organizations are to

some extent compelled to "sell" their subject to the society. Fortunately, fostering mathematical talent is one of the strong arguments used by the mathematics teachers' organization.

4. Mathematical competitions

Almost all mathematical competitions in Finland have been related to the teachers' association MAOL. In the mid-fifties, MAOL organized its first high school mathematics competitions. The problems were published in the journal of the association, and the participants were supposed to work with the (rather difficult, olympiad-style) problems at home. The participation was very low, around ten each year.

A much more popular competition was started in 1960. At that time MAOL started a 13 year collaboration with the savings bank organization; the idea actually came from a bank director who was worried of the general inability of those applying for bank jobs to calculate with percentages. The savings bank competition was meant for the last grade in the then secondary school. The competition was administered at the same time in all participating schools, and local savings banks provided for the prizes. In some years, there was even a national final competition in the Savings Bank Institute. The problems were not very difficult, and of an entirely practical character. The number of partici-

pants was large, exceeding 30000 in some years. The aim of the competition was to support education in economical matters and promote simple computing skills. However, at least among the winners of the final round one finds people who later have made a career in mathematics. The competition was revived two years ago in collaboration with another banking group.

Since 1973, Finland has been a regular participant in the IMO. The need to select a team and to give it some preparation have had a positive influence on the national competitions. A definite goal like the membership in the team has added to the number of participants and recurrent stories of the olympics in the teacher's journal and newspapers have spread information about the competition. Of course, those who have qualified for the training group or the team have gained most. Also, the IMO has been a point of contact between the educational bureaucracy and the voluntary teachers and mathematicians working with the talented children: the government has covered the expenses arising from the IMO participation, and it will also be the main financier of the 1985 IMO to be arranged in Finland.

The participation in the high school competition has steadily increased. Compared to most countries, the number of participants is still very low, less than 600. On the

other hand, the easier and more practically oriented basic school competition is a true mass event. Last year the number exceeded 40000.

For four years now, the American AHSME-competition has also been arranged in Finland, although in a small scale, with at most 600 participants. The results achieved have been comparable to the American ones.