SOME FACTS AND TENDENCIES IN HUNGARIAN MATHEMATICS TEACHING

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Summary

This article briefly outlines some of the reasons behind the mathematical success in Hungary in the past century, but warns that current government dictates might lead to a significant decrease in mathematical attainment in schools, whilst other countries, using the methodology from Hungary, will be advancing.

The reputation of Hungarian mathematics teaching

For many decades, Hungarian student teams have gained distinguished places in the mathematics Olympiads. This fact shows the power of mathematics teaching in general, but mainly the power of 'élite training'. Also, the number and significance of Hungarian mathematicians known the world over indicate a good schooling in mathematics in general, but mainly the good training of outstanding ability students.

The mathematics teaching philosophy used in Hungary, the methodology and the best practice of lessons, has recently attracted a deeper international interest, especially in the United Kingdom. The experimental Mathematics Enhancement Programme [MEP] of Professor David Burghes (Centre for Innovation in Mathematics Teaching [CIMT], University of Exeter, U.K.) for secondary stages was built on the outcomes of the 'Kassel-Exeter' international comparative project, partly on the Hungarian methods and examples of lessons observed [1,4,6]. The primary extension of this project has been based directly on a Hungarian textbook series (chief editor, Sándor Hajdu) [8,9,10]. There are other countries now showing interest in the Hungarian style' lesson plans and videos of good practice.

From the past, it is surely enough to remind our readers of the work and reputation of György Pólya, Zoltán Dienes, Tamás Varga or István Lakatos. These facts are testament to a good mathematics-didactic tradition and also long lasting and effective innovations in this field in Hungary. But we should not think that Hungarian mathematics schooling necessarily has the same high standard in practice. Some of the main features of the attractive mathematics teaching - learning approach in Hungary, which is rooted in more than a hundred year tradition and developed gradually through many strategic changes, are:

* Whole class interactive teaching - pupils kept together as far as possible (but with natural ways of differentiation) - effective lessons.

* Harmonic proportion of whole class activity and individual work (which is always followed by whole class discussion again: report - reasoning - arguing, debate - feedback - agreement - feedback - self-correction - praising, evaluation - teachers' extra comments or extension) - spoken and written abilities - clear mathematical language - frequent mental calculation.

* Flexible and sensitive diagnostics by feedback questioning during both the whole class activities and the discussions after the individual work. (Who agrees/ disagrees with X? How did you think? How could you guess it? Where did you get the idea from? What did you write? Why did you think this? Who did it this/other way? Who got this/other result? Is it correct/incorrect? Why?, etc.)

* Investigations. Development of (mathematical) thinking. Manipulative and demonstrational roles, models - but less 'free playing' than in the 'new mathematics' - realistic problems.

* Focus on psychology of learning - internalization - differences between the genders in different age-cohorts - use of both sides of brain (moving or imaginal thinking of right hand side part and logic or conceptual thinking of left hand side part) - complex use of advantages of different learning theories (e.g. 'associational', 'stimulus-reflectional', mediational', 'operational', 'sign-signed', 'formal-structural, 'problem-oriented', etc. theories).

On recent tendencies of Hungarian school attainment in mathematics

On the international stage though, Hungary's position in attainment has decreased. While in the IAEP measurement in 1991 Hungary was one of the two best European countries (with Switzerland) among 20 countries, not much behind South-Korea and Taiwan, in the IEA-TIMMS measurement in 1995, Hungary's result for 13+ year old pupils was the 14th (although) among 41 countries but the 10th European country [12,13]. The 2nd place of Hungarian 14+ pupils, rather behind Singapore and near to Poland, in the Kassel-Exeter project (1996-99) cannot tell us too much since the comparison of only 8 countries was published [4].

The Hungarian school mathematics attainment has decreased in absolute value. The official monitory measurements since 1986 have shown the decline at each age of 10, 14, 16 and 18 year olds. While the result for 10 year olds increased between 1986 and 1991 it then decreased by 1995 and fell below its 1986 level by 1997. While the result for 16 year olds increased between 1986 and 1993, it had fallen back by 1995 and fallen further by 1997. The results for 14 year olds and 18 year olds gradually have fallen since 1986 [3,7,11].

A typical example from 1995:

More than two thirds of the 16 year olds could not solve a simple percentage problem.

In the 1997 monitory testing (published recently) 4 subtests were applied:

'*logical thinking*' [L]; '*quantities*' [Q]; '*plane - space*' [S] and '*number - arithmetics*' *[N]*.

The 10 year olds found N and Q questions the easiest, S more difficult and L the most difficult.

For 12 year olds, S was the easiest and L was the most problematic again.

For 14 year olds, S was the easiest and Q was the most difficult.

For 16 year olds, Q was the easiest and N the most difficult.

For 18 year olds, S was the easiest and L was the most problematic.

The range of means of the 4 subsets was from 35% to 52% at age 10 but by 14 this range became more narrow, from 53% to 61%. In the main, the deviation was similar in the total score of the three first age-cohorts and also in the subsets. At age 16 the range raised again but the deviation was lower than at the younger ages (despite the very different abilities and school types). At age 18 the total deviation was the lowest (but then only about 70% of the population take mathematics, in 'gymnaziums' and 'technical secondaries' with maturation exam at the end).

Some extremely negative examples:

The most difficult question for 10 year olds, which only 5% of them were able to solve, was:

> *A frog jumps 20 cm each time upwards but then slips back 10 cm each time. After how many jumps will the frog be at a height of 2m?*

Only 12% of the 12 year olds solved it. Also at age 10, in a 'closed end' problem, only 20% solved a problem where the equality of lengths of four 'terraced broken lines' (only from vertical and horizontal sections) had to be found. Only 47% of them solved a question which was based on noticing the incorrect changing of 56 days into 7 weeks.

Only 27% of 12 year olds could answer correctly this 'closed end' problem:

> *If two people start at the same time from A and B towards each other with different speeds, then at the meeting point, which of them will be farther away from A?*

It points to our big problem in the ability of the children to understand questions in context which require a significant amount of reading. At age 14 this question was solved by 38%, at age 16 by 29% (!) and at age 18 by 45%.[11]

On some other tendencies in Hungarian mathematics schooling

With the new law on education and its National Curriculum of 1997, the number of mathematics lessons were drastically cut. In the first 5 years of schooling, the 5 mathematics lessons per week were reduced to 4, although with the possibility of one extra lesson in the first four years for dealing with poor or outstanding pupils in mathematics or Hungarian [5]. In practice, in Years 1 and 2, it is estimated that about half the pupils take mathematics in this extra lesson (or mathematics and Hungarian in alternate weeks).

The new government decided to revise the National Curriculum and plan to insert a 'Framework curriculum' between the NC and the schools' local curriculums. This plan cuts the mathematics lessons again. In the first 8 years, the numbers of mathematics lessons will be as follows:

Year	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8
No. Maths lessons per week	4	4	4	3	4	3	3	3

and the possibility of an extra lesson per week also disappears.

At the same time, the numbers of Hungarian lessons in the first 4 years would remain 8, 8, 7, 7 per week. We have not heard about similar plans in other countries! A slight reduction

in the time for mathematics is also planned for secondary schools, but they have more opportunities in setting groups for extra lessons.

Thus, of course, the content of teaching-learning material of the mathematics school subject has to be reduced also. A few publishers reacted to the previous changes with revisions to their textbooks in advance, and now one of them is rewriting their textbook series year by year in accordance with the planned changes. Its authors plan to arrange the content for alternative number of lessons (e.g. for 3 +1 lessons in Y4) in hope of the miracle of returning to the former number of lessons. Anyway, since 1990, when the textbook publishing and market were opened up, mathematics textbooks, varying greatly in standard, have appeared in Hungary, mainly for the most sensitive primary years and one dangerous outcome could be seen to be the declining attainment of 10 year olds.

It is also a tendency that fewer and fewer students want to become mathematics teachers, particularly for the age-cohort of 10-14 year old pupils, while more and more of them have poorer mathematical abilities and ambitions in this vocation. In the meantime, universities, which train teachers for the 14-18 age-cohort, have begun to entice students from teacher training colleges (which train teachers for that 10-14 age-cohort) although, because of their traditions, colleges give more advanced and researched methodological and practical training in mathematics teaching.

Concluding remarks

Summarising these facts and tendencies, we can say that Hungary must face up to difficult problems in mathematics teaching in the near future, whilst several countries could adopt its best traditions, both its older and more recent good innovations.

It might yet happen that some countries will import the best Hungarian systems and methodology with resulting enhanced attainment, whilst Hungary will lag behind!

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