The introduction of history of mathematics in Norwegian schools

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In this paper, I will discuss recent attempts at introducing history of mathematics in Norwegian schools. After giving some general comments, I will focus on the impact these attempts have had on Norwegian textbooks.

The introduction of history of mathematics in mathematics education can be decided on several levels[1]. Of course, individual teachers (or groups of teachers) may decide to include history of mathematics in their teaching, if they have the necessary interest and knowledge. Textbook writers may introduce history of mathematics in their textbooks. This is also dependent on their interest and knowledge. Or (at least in Norway) the government may decide to include history of mathematics in the curriculum. (In Norway, "the curriculum" is stated in one big book, set and published by the government). (In theory, pupils could also demand historical information. To work, however, that would depend on the interest of both pupils and teachers, as well as a certain knowledge on the part of the teachers).

Teachers

Individual teachers with an interest in and knowledge of history of mathematics may include history of mathematics into every topic, and their ideas may inspire other teachers, creating a local "movement". Without good sources of ideas and lots of time, this will be difficult, however.

Norwegian teachers generally have little knowledge of history of mathematics. TIMSS[2] shows that 54 % of teachers in the 6th grade (pupils about the age of 13) had not studied mathematics in college/university. Very few (4 %) had studied mathematics for more than half a year in college/university. Since history of mathematics has only recently been included in the mathematics courses in high school and teacher education, we can be quite sure that most teachers do not have the necessary knowledge or interest to introduce history of mathematics in their teaching on their own.

Textbooks

Textbook writers may include lots of history of mathematics, inspiring and motivating their readers and making mathematics seem more humane.

As textbooks have to be approved by authorities before being used in Norway[3], textbook writers tend to stay fairly close to the curriculum. Moreover, I believe that teachers (and parents) tend to prefer textbooks that concentrate on topics explicitly stated in the curriculum. Therefore, I doubt that authors of textbooks will introduce history of mathematics in their textbooks on their own, to any significant degree. This view seems to be supported by the fact that earlier textbooks had little or no history of mathematics, just like the curriculums they were written for.

Curriculum

This leaves the curriculum, and in 1997, the Norwegian government included history of mathematics in the mathematics curriculum, by including knowledge of the history of mathematics (and mathematics' relation to culture) as one of the six main goals of the

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[1] For a summary of the most important reasons for including history of mathematics in mathematics education, see http://www.hifm.no/~matematikk/ansatte/bjorns/mattehist/reasons.htm.

[2] Third International Mathematics and Science Study. The numbers are from the Norwegian report Svein Lie, Marit Kjærnsli, Gard Brekke: "Hva i all verden skjer i realfagene", Oslo 1997.

[3] This will probably change soon; the publishers will be responsible for the quality themselves.

mathematics education (for ages 6-16). This was based on persuasive arguments from teacher educators. Was this the end of discussion, or only the end of the beginning of the discussion?

My fear is this: by including history of mathematics in the curriculum, teachers and textbook writers have been given a command: "include history of mathematics". What they have not been given is the persuasive arguments, nor good examples of use of history of mathematics. Their knowledge and interest have not increased. Therefore, there is a great risk that the "command" will be carried out instrumentally, and that there will be a feeling among teachers that "we have spent four lessons on roman numerals, can we go back to mathematics now?"

A study of Norwegian textbooks in mathematics

I have studied all Norwegian textbooks that have been approved by Norwegian authorities since the 1997 reform, to see what is included about history of mathematics (ages 6-16)[4]. The main pitfalls I have found so far are

- errors
- banality/jejuneness
- incredibly narrow or wide tasks/exercises
- a lack of a "canon"

The most obvious problem is numerous errors in the treatment of history of mathematics – I have found 81 errors in about 237 pages[5] of history of mathematics, that is one historical error every three pages. (I have divided these errors into different categories: errors that may cause/strengthen misconceptions, anachronism/ethnocentricity, more unimportant (factual) errors, myths and simplifications/inaccuracies). I treat the errors in more detail elsewhere. The point here is that they show that many textbook writers and publishers have a lack of both knowledge and authoritative sources in history of mathematics.

What I call "banality/jejuneness" is the problem that some textbooks tend to treat almost only numeral systems. By treating roman numerals in almost every grade, and adding some other numeral systems in some of the grades, the goal of including history of mathematics have been reached. But the reasoning behind that goal has not been touched. If pupils, after 10 years in school, believe that history of mathematics is only about different ways of writing numerals, we are in trouble.

When looking at the problems pupils are presented with, another issue occurs: in many of the problems, pupils are supposed to perform some sort of activity concerning history of mathematics, but it's difficult to see what kind of mathematical knowledge is supposed to be constructed. I'll give just one example: "Use the Internet, encyclopaedias or CD-ROM to find out when Johann Widmann lived." The text has already given one of the years he lived, which means that it is assumed that the pupils will find it interesting to find his exact dates of birth and death. Again, it seems that the textbook writers have too little knowledge (and time) to construct meaningful problems for pupils.

From what I have said, it may seem that I think the main problem is that maths teachers and textbook writers are negligent, or have too little interest in the history of mathematics. I need to correct that impression: I think the main problem is that maths teachers and textbook writers have been given fairly little support in (and motivation for) trying to achieve the goals

[4] See my "History of mathematics in Norwegian textbooks" (presentation by distribution at ICME9) for more details.

[5] The total number of textbook pages investigated is 21613. These numbers include teacher's guides.

in the curriculum. Historians of mathematics who are interested in education and maths educators with an interest in history of mathematics, have an obligation to help in the development of good ideas for classroom use. The lack of this support is apparent in what I call "a lack of a canon". There are five or six alternative approved textbooks for each grade, but most of the subjects that are mentioned, are only mentioned in one or two of them. I think that when more work is done on history of mathematics in mathematics education, a "canon" of good ideas will be established. (In the same way that we see that "good ideas" in the presentation of for instance fractions are used in all textbooks at a certain level).

Conclusion

When trying to have history of mathematics included in the mathematics curriculum, it is important not to forget that textbook writers and teachers also need support from the communities that have knowledge and ideas. This is probably an obvious statement, but experiences from Norway seem to suggest that it deserves to be stated again.
In other parts of the world, circumstances are different, but still it will be essential to keep both teachers, textbook writers and "the official curriculum" (if there is one) in mind when trying to introduce history of mathematics. Which means that having good ideas is nice, but publishing them (where teachers may notice them) is the key to success.

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The obvious next step is to try to collect ideas/pieces of history of mathematics and make them available to teachers (with didactical comments). I will mention some of the "good ideas" that I found in the textbooks:

Florence Nightingale*:*

One very simple example of the use of history of mathematics in maths education is the story of Florence Nightingale (1820-1910). Florence Nightingale's work as a nurse in the Crimean war is well known, but her use of statistical methods is perhaps less known. By collecting statistics, and by analysis and presentation of these statistics, she managed to show that a large percentage of the soldiers died because of unsanitary conditions. Thereby she managed to gain support in the fight for reforms to reduce mortality.
The story of Florence Nightingale helps mathematics seem more humane, and gives an example of a female mathematician. More importantly, it shows that mathematics can be of vital importance to society. Moreover, it is an example where mathematics is *developed* to meet concrete, practical purposes in society. (Cooperation with other subjects, such as history or social sciences, is of course also possible).

Historical background for geometry:

Another instance where history of mathematics works as a motivation for working with mathematics is in the account of why Egyptians developed their geometry. The need to reset the borders after each flooding of the Nile is easily understood by pupils, and has it's parallel in modern day surveying.

Roman numerals

Examples where history of mathematics is not only a motivation for work with mathematics, but actually helps understanding the mathematics, are more rare. One very prominent example is roman numerals. None of the books have adopted the idea of letting roman numerals be children's first numeral system[6], but their treatment nonetheless has very interesting consequences: getting insight into more than one numeral system may make it possible for children to compare and see advantages with the different systems. (Again, this of course takes a little insight on the part of the teacher to succeed).

[6] As suggested in Dagmar Neuman: Räknefärdighetens rötter, Utbildningsförlaget, Stockholm 1989, part III.

End note

Please tell me if you know of good ideas, or even better: good sources for good ideas. If I keep working in this field, I will probably try to make a collection of such ideas available on the net. (My email address is bjorns@hifm.no)