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Turning mathematics for the senior secondary level into a dynamic and attractive science by exploring the hidden mathematics in modern science and technology.

1. Introduction

In our talk, we consider the complete secondary level of teaching as consisting of six years of courses, normally starting at the age of twelve and finishing at the age of eighteen; by the senior secondary level we mean the last two years (students age: 16 to 18). At that level, there are different finalities for the students. Our concern in what follows is with the kind of mathematics that may be offered to the students that are choosing the general formation finality (which in some sense may be considered as preparing for continued studies at a higher level) with a sufficient quantity of mathematics in their programme (since the amount of mathematics at the senior level is usually determined by some choosen option).

2. Proposal: awake the interest by a suitable mathematics curriculum in the senior secondary level.

Purely occasional efforts to bring the students in contact with mathematics that is somewhat diverging of what is given in the 'normal' school curricula until now, are not really succesfull to awake their interest for continued studies in some scientific discipline. It is the impression of the author, however, that by giving the students the possibility to get, in the last two years of the secondary level, INSIGHT in the interesting 'how' and 'why' of contemporary science and technology, the result will be really positive.
The underlying idea accompanying this impression is that we offer to our young students too frequently only basic techniques or only older material of mathematics. Why not offer them the possibility to LEARN and to UNDERSTAND that many things in their daily life are only possible thanks to the development of mathematics in the last decades? Then they will see and feel that mathematics is really a dynamic (and also attractive) science. One of the reasons to put the study of those topics at the end of the secondary

level, in a part of about one fifth of the complete mathematics curriculum of the last two years, is that the students then have the maturity to get insight in and to appreciate the mathematics of the modern applications.

To convince some doubtful people of the advantages of such adapted curriculum, I want to highlight the following points:

a) The mathematical training of the students will go through with at least the same deepness as in a traditional curriculum. Indeed, when we consider mathematics as "a trinity of science, art and applications", where the word 'trinity' is used to point to the fact that the three mentioned facets can not be dissociated from each other, where the word 'art' means, on the one hand, that mathematics can be an art on its own, without immediate application connected to it, and on the other hand, that also applied mathematics can be full of art with much beauty in it, and where the word 'applications' means that mathematics also can be constructed solely with the aim of applying it, then it will become clear from the applications mentioned further on that the complete trinity is in fact present in them when those applications can be treated at a strong mathematical level.

b) The applications that may be treated will create a lot of interdisciplinarity, by connecting in a natural way mathematics to other sciences such as computer science, physics, etc. It is of course intended that, due to the competencies of the mathematics teacher, only the mathematics part is treated in depth. But the mere fact that the problem has to be described in its natural context, will automatically increase the interest for the other connected sciences too.

3. Examples of possible application topics.

Material that can be used, has to be made accessible at the right level. As for subjects that may be screened for possible use, it seems to the author that we should pay attention especially to tools, gadgets, $\cdots$ that have arised during a period of, say, the last twenty or thirty years. Very recently, together with a student of mine, we investigated for use in the classroom the topic

3.1. The RSA-method for secret writing and digital signatures.

The first part of it (containing the necessary mathematical underpinning) has appeared in [1], the second part (containing the application) in [2] (both papers are in Dutch). The underlying application here has to do with the protection when doing communication with computers. As is well known, the basic mathematics that is needed for the RSA-method [5] is number theory. One of the aims in [1] was precisely to investigate if the part of number theory that is needed to build the mathematical fundaments of the RSA-method can be ordered and restricted in such a way that a substantial part of the RSA-method is accessible for the group of students that have been delineated in the present paper. To our opinion the answer is yes.
Two suggestions for other investigation are:

3.2. Positioning systems and navigation (PS & N).

GPS is probably well-known as a useful tool among young people; other positioning systems have been used (or are still in use) for ship navigation. The mathematical base of some of those positioning systems may be presented at an acceptable level. The introductory part for this topic may focus on PS & N with circles, with balls and with hyperbolas, respectively. The positioning system with hyperbolas is used in Loran-C, that is employed for marine use not only in the USA but also in Europe as part of the NELS-system (Northwest European Loran-C System), with Denmark, France, Germany, Ireland, the Netherlands and Norway as participating countries.

3.3. Different topics in image processing.

Young people of today are living in a picture-society. They are familiar with images taken from the internet, with images in video, and so on. It is sometimes necessary, however, that such images are processedfor specific purposes, and several techniques based on classroom mathematics may be used for it.

Literatur

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