

Quantitative and Qualitative Changes in the Contents of Schoolbooks for Mathematics

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Aim and Main Idea

Given that, the policy of curricula and the research on mathematics education have always had as starting point the assumption that, the subject matter of mathematics has a uniform essence, independent of the framework and no subjective to interpretation or “reading” (Evans & Tsatsaroni, 2004), a bibliographic research is carried out with this paper, which refers to the recording of changes effected on the curriculum and its presentation in the schoolbooks for the 5th (10 year olds) and 6th (11 year olds) grade of elementary school, in three different periods. Specifically, the schoolbook of three important—with regard to the political and educational matters in Greece—periods are analyzed, as to what is taught on one hand and the form in which the curriculum is presented during each period on the other.

As a result from the study and recording of the Greek educational reforms, three important periods, regarding the Curricula and the Schoolbooks, have been distinguished, which were the consequence of the political and educational changes and became turning points in the educational and political actuality of Greece. These three periods regard to the era following Second World War (before 1950), as well as the eras before and after the Restoration of Democracy (1974).

In the period directly following WW II, persistent efforts are made in many European countries with the purpose of readjusting their educational systems to the postwar political, economical and social facts. Common point of all these efforts is the fact that, particular emphasis is laid on the principle of parity of opportunities for education, while simultaneously the optimistic conviction prevail that, school constitutes leverage towards economic growth and attaining social equity.

In Greece the process of readjustment of the educational system to the postwar facts was delayed, due mainly to the consequences of the civil war (1945 – 1949), to poor finances, as well as the political instability which prevailed following WW II.

What characterizes this period, which, as concerns this paper, constitutes the *first period* (before 1950), is the wide gap between the mathematics taught in primary school and those taught at university. On one hand, the subject matter of the primary schoolbooks (outdated and badly written) was old fashioned, having remained unchanged through many decades, while on the other hand, the rapid progress of the science of mathematics radically altered what was taught at university. School mathematics during this period were the essential and presented in a highly theoretical manner, while taught through algorithms, formulae and demonstrations, without showing their usefulness since they were disconnected from the applications on and the problems of everyday life, resulting to the impression that, they are of no use since they are fabrications of the mind, which had the effect of causing apprehension to young and old alike.

In order to change the picture which prevails at this period concerning mathematics, the need for educational reform becomes imperative. So, the *second period* (1950 – 1974), examined in this paper, is characterized by the influence of “Modern” or “New” or “Contemporary Mathematics” (in Greece they were adopted in the early 1960’s), with the introduction of the Set Theory. These titles were used to convey the spirit of the approach, which refers to a qualitative renovation of mathematics (compared with “Traditional Mathematics” taught till then), rather than the subject matter of these curricula.

One of the first requests which the new curricula were aimed to satisfy was that of meaningful learning. As opposed to the memorization, according to this approach the learning

is real, lasts longer, is carried and applied more broadly when accompanied by in depth understanding of its object. For the comprehension of the structure of a subject, the procedure starts by use of materials, so that the basic mechanisms of learning are activated, and continues to the processing of images to arrive at symbolism and full abstraction.

The introduction of “New Mathematics” admits the research and the discovery to the process of learning. The pupil is guided to research and ask him/herself questions to search for source material and finally to find out the new knowledge all by him/herself. This subject matter is based on the Set Theory. The approach of mathematics through the sets conforms to the child’s overall perception and his/her conscious effort to place his/her world and ideas among broader sets in order to comprehend them.

Unfortunately, many studies have revealed that, “Modern Mathematics” did not yield the expected results. Once again, the reform of “Modern Mathematics” failed to link the teaching of mathematics to applications and problems of the everyday life so that their usefulness might become understood and therefore the teaching acceptable. The books were criticized for excessive use of parenthesis and brackets, for overuse of equations, for lack of sums and generally for an unacceptable preoccupation with theory, which was no help to the development of the pupils’ abilities, to the execution of the four operations with natural, decimal and fractional numbers and to the solution of simple problems.

The failure of “New Mathematics” created the need (in the 1970’s) for the return to “Traditional Mathematics” formerly applied. This movement first emerged in the U.S.A. in the early 1970’s and in many other countries at different periods. As a matter of fact, it never materialized, but a combination of traditional and “Modern Mathematics” was attempted. So in Greece too a substantial effort was made to reform the curricula, which characterizes the *third period* (after 1974).

The year 1987 signals for the mathematical education in Greece the start of the post “New Mathematics” period. The basic theoretical approach of writing was on one hand to rid the books of the sets theoretical symbolism, a feature of the 1960’s reform, and on the other to give a more accurate and ‘balanced’ picture of mathematics, with the ulterior purpose of connecting mathematics with the natural and social phenomena.

Methodology

Eight schoolbooks of 5th (10 year – olds) and 6th (11 year – olds) grade of elementary school mathematics were studied, covering three important, for the political and educational facts of Greece, periods. These books are:

- 1952: Practical Geometry for grades 5 and 6; Arithmetic and Problems for grades 5 and 6,
- 1976/1977: Arithmetic and Geometry for grade 5; Arithmetic Geometry for grade 6,
- 1998 (from 1987): My Mathematics for grade 5 1st part; My Mathematics for grade 5 2nd part; My Mathematics for grade 6 1st part; My Mathematics for grade 6 2nd part.

First, a list of the subject matters contained in each of these schoolbooks was made, both for arithmetic and for geometry, to show what is considered essential for the pupils to learn in each era and whether this coincides with the three eras as we study them.

Then qualitative criteria were set and the curriculum was put into groups with regard to the way it appears in the list of contents of the schoolbooks.

Finally, a common in all three periods mathematical group, that of rational numbers (fractions) was analyzed, so that the approach to its presentation and development can be shown for each of the examined periods.

Conclusions

From the study and analysis of the mathematic schoolbooks for 5th and 6th grades of elementary school of three different periods, we can see that:

- Their structure is different. Specifically, in 1952 the 5th and 6th grades have a common book for Arithmetic and another common one for Geometry, having the corresponding

titles. In 1976 there are separate books for each of these two grades, but Arithmetic and Geometry are included in one book, as their titles also show. The same happens with the books of 1987, except now, each grade's book, containing both Arithmetic and Geometry, has the title, "My Mathematics".

- In the schoolbooks of the periods 1952 and 1976, Arithmetic and Geometry appear detached one the other, while in the period of 1987 an effort is made for Geometry to appear interwoven with Arithmetic.
- In the curriculum of elementary school of the above mentioned three periods, besides the common mathematical unities (e.g. fractions, reduction to unit, angles) were included other unities which were obviously necessary in the period in question (sets, prisms, pyramids, spheres, discounts, associations etc.). We also notice that, some of the essential unities of mathematics are missing; further study has shown that, these unities are taught in previous or subsequent grades, depending on the period.
- Several Geometry subjects were moved from secondary to elementary school, as are the area of the circle, the volume of solids etc.
- Many unities on the percents and rates were moved from elementary school to secondary.
- Probability and Statistics are now introduced already since elementary school in connection with graphical representations, gradually leading to the concept of function which is introduced intuitively while at the same time they serve the transition from the operational level of learning to the pictorial.
- The subject matter was rid of the complex operations and was condensed, so that more unities were covered.
- The appearance of schoolbooks is modernized based on the latest conclusions of the educational sciences. The traditional schoolbooks have mainly a descriptive lining-up of the subject matter with not necessarily accompanying illustration and constitute those schoolbooks which correspond with the teacher – centered teaching method. The more modern books, besides the external features of the book and the internal features of the printing, such as colors, the paper's good quality, the tasteful printing types, which influence positively the pupils, they are also differently structured, in an effort to be more understandable to parents as well as to the pupils. Moreover, the schoolbook is accompanied by the Teacher's Book and together they constitute a "multifunctional package" which applies internationally in the last two decades.

Schoolbooks in our country don't seem to have a dynamic character. It seems that, the process of reviewing them is a long one, which doesn't help in the direct incorporation of new international research findings on the teaching of mathematics and accordingly dealing with possible problems.

Curricula, however, as well as schoolbooks cannot remain static. They must be continually readjusted and improved, so that they fulfill and satisfy the needs of each era.

Our aim should be to teach the pupils how to learn, because this is what will accompany them throughout their lives. The learning we give our children today may be of no use in the next ten years, but the process of dealing with and solving problems will always be useful. That is why, through the curricula and the corresponding schoolbooks, these skills should be developed.

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