Science and Technology Education

Document Series No. 35

Mathematics, Education, and Society

Reports and papers presented in the
Fifth Day Special Programme
on "Mathematics, Education, and Society"
at the 6th International Congress on Mathematical Education
Budapest, 27 July - 3 August, 1988

edited by

Christine Keitel
(Chief editor)
and
Peter Damerow, Alan Bishop, Paulus Gerdes
(Chief organizers)

**Division of Science
Technical and Environmental
Education**

ED-89/WS/94

UNESCO

Paris, 1989

Table of Contents

spect, he called for the same reform in the mathematical education of women as in that of men.

Changes in all Mathematical and Scientific Education, Particularly in Elementary Schools

It is not possible to discuss here the question of whether changes in this area really took place. One can only emphasize Klein's great efforts to bring about changes in the law, in examination requirements, and curricula as well as in teacher training as the essential prerequisites for effective changes in classroom practice. Klein explained the relevant demands of the Teaching Commission in three speeches: on 21 May 1909, on 27 May 1910, and on 7 April 1911. In the first two he spoke about the existing institutions of secondary education. The third speech was dedicated exclusively to elementary schools. This special emphasis on elementary education was unusual for a university professor at that time. Klein criticized the encyclopedic training of teachers for elementary schools, asked for the introduction of courses for theoretical training, and for financial means to be made available for improving it. Klein's demands for scientifically trained teachers for elementary schools surpassed the ideas of many of his contemporaries. Klein's views corresponded in this respect to those of the German social democrats, although he was a loyal subject to the existing state. The ideas of Klein remind us of the demands of progressive bourgeois pedagogues, which were also utopian under the existing social conditions.

The activities of the Teaching Commission and Klein's function as vicepresident ended with the breakup of the German empire, but the results of their work were able to be preserved. Klein's interests in mathematical and scientific education and in education generally were not dependent on the political situation. He wrote a letter to the Ministry only a short time after the November revolution offering his help in the planning of education. The Ministry of Science, Art, and National Education answered gratefully in a letter of 18 January 1919. Among Klein's papers there is preserved a draft of a lecture entitled "Mathematical instruction at the various types of schools (and debate)." It dates from 7 January 1919 and shows his continuing determination to accomplish the demands for reform under the new regime. For this purpose he formulated a number of theses in his draft:

- Comprehensive public education should form an ideal unity, its separate areas being adequately proportionate to each other.

By this, Klein wanted to make clear the relationship between pedagogic and subject-specific instruction, between general and vocational schools.

- Klein saw the necessity for promoting such subjects as philosophy, psychology, and for creating new chairs of general pedagogics and of didactics in the various subjects of instruction at the universities.
- New ideas were to be put into practice to teach future research scientists and teacher students separately.
- Klein insisted on doing everything possible to achieve higher appreciation for mathematics and science at schools and in public.

In promoting those aims, a new institution was founded on 6 January 1921: the "Association of German Mathematical Clubs and Societies."

References

Stenographische Berichte über die Verhandlungen des preußischen Herrenhauses, 1899/1900 bis 1917/18. Berlin.

Tobies, R. (1981). *Felix Klein. Biographien hervorragender Naturwissenschaftler, Techniker und Mediziner, 50.* Leipzig: B. G. Teubner.

Tobies, R. (1989). Felix Klein als Mitglied des preußischen "Herrenhauses"—Wissenschaftlicher Mathematikunterricht für alle Schüler—auch für Mädchen und Frauen. *Der Mathematikunterricht, 35,* 1, 4–12.

The Teaching of Geometry in Italian High Schools During the Last Two Centuries: Some Aspects Related to Society

Emma Castelnuovo

My subject concerns Italian high schools during the last two centuries. As this period is very long, I will emphasize only those points which, in my opinion, are rather original.

First of all I will begin talking about a French book of the 18th century which had a great influence on our teaching of geometry. The book is *Eléments de géométrie* by A. C. Clairaut, the great mathematician and astronomer; it was written in 1741. The idea of Clairaut was to present geometrical properties in such a way, that beginners would be stimulated to investigate. He says, in his preface, that beginners are not able to follow a book like Euclid's Elements, starting with axioms and abstract properties. He bases his work on examples taken from agriculture, the economy of his country being essentially agricultural: the problem of how to measure fields of different shapes, ...

But Clairaut's Elements never influenced the teaching of mathematics in France. On the contrary, this book, translated into Italian, was used for many years as a textbook in some technical schools of Lombardia, a region in northern Italy. Without any doubt the book was used because of a strange coincidence: The governors of Lombardia thought that Clairaut's book would be very suitable for the technical-agricultural

schools because many examples were connected with the measurement of fields. It is interesting to observe that Clairaut had foreseen this misunderstanding; in his preface he says, with humor: "I do hope that people do not think that this book has been written for students of agriculture; the problems of measuring fields only represent a stimulus to investigate further." However, Clairaut's Elements, interpreted rightly or wrongly, were widely used in our country in the first half of the last century.

The unification of Italy in 1861 led to the establishment of national curricula in our schools. The curricula of mathematics in secondary schools were published in 1867 by three distinguished mathematicians: Cremona, Betti, Brioschi. The ideas inspiring these curricula are clearly described by their preliminary directives; they say: "The fundamental aim of mathematics is to accustom pupils to reasoning and deduction." It is clear that the application of mathematics were excluded. I would like to underline that, even without an explicit declaration, these curricula were conceived for students of a high social level. But a very unusual fact happened in Italy: In 1881, that is 15 years after the publication of new curricula, a very open-minded Minister of Education, a doctor named Guido Baccelli, declared that the curriculum of geometry was too abstract for pupils 11 to 14 years old. He succeeded in convincing the mathematicians to introduce into the junior secondary school the so-called "Intuitive Geometry." He thought, particularly, of lower social level children. Thanks to this Minister, Italy was the first country to introduce Intuitive Geometry. But this new course was not very original: It reproduced the senior course of geometry leaving out the traditional proofs.

At the same time, curricula of senior schools have always been inspired by Euclid, even if, at the beginning of this century, some mathematicians declared the absurdity of such a purism in a modern society. I would like to quote the declaration of Guido Castelnuovo, pronounced in 1912 during a national congress on the teaching of mathematics. He says:

> In our schools we drive students to idolize a perfection which is illusory, instead of encouraging them to work with approximations. We must accustom them to compare theory with practise in order to prepare people able to participate in the life of our country.

But voices like this always remained unheard at the political level.

After the last war many initiatives flourished on education. For what concerning the teaching of geometry in junior secondary schools, a critical study of Clairaut's old book gave brilliant ideas. The examples on fields of different shapes and their measurement were replaced by up-to-date examples and problems, and geometry was strictly connected to the other branches of mathematics in order to investigate practical and theoretical problems. In 1979 a new reform of the first secondary cycle officially recognized the value of these experiments. A geometry motivated by various real problems became a part of a brilliant and widespread course of mathematics. A "dynamic" course whose principal aim is to sensitize pupils to the function concept.

I have to point out that teachers have always had full freedom in their teaching. It is this freedom, perhaps, that saved us from the so-called "modern mathematics."

When, in the 60s, most countries were introducing at all levels mathematics inspired by set theory, Italy was continuing with its curricula and methodology, completely oblivious to a fashion which was invading the world. Why? Some foreign mathematicians say that our behavior was due to the influence that Galileo's thought has had on Italian people: Galileo never proceeded without experimenting or without foreseeing the result which one experiment could produce. I really should like to think that this interpretation reflects the truth!

Some Reflections on the Role of Associations in Mathematics Education

Michael H. Price

My interest in this topic springs from some research I am currently undertaking to produce a commissioned history of the Mathematical Association in England, from 1871. This project is developing along the lines of a case study in a growing field of educational inquiry: the history of the curriculum. Investigating the role of associations generally in the shaping of curriculum is one aspect of curriculum history. Thus, my interests now embrace not only the Mathematical Association but all forms of association having a significant stake in English mathematics education, as well as comparisons *across* the curriculum, and particularly in the case of science education. There may also be some interesting comparisons to be made with other countries, where national patterns of educational organization and curriculum development may vary considerably. Furthermore, the patterns in one country may change dramatically over a comparatively short time, as is the case in England under the present Conservative Government.

In relation to mathematics education, this short paper will only consider the following aspects of the development of associations and their roles:

(1) Variety of forms;
(2) A framework for investigating associations;
(3) Growing complexity.

Variety of Forms

The roots of the Mathematical Association are to be found in the establishment of the Association for the Improvement of Geometrical Teaching (AIGT) in 1871. This was the first of the academic *subject*