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*Dr. Hlavaty is chairman of the Department of Mathematics, DeWitt Clinton High School, New York City. The list of his professional activities in the field of curriculum reform is impressive. One activity should be mentioned here. He is director of the Commission on Mathematics Program, College Entrance Examinations Board, which just completed its work recently.

I - Fifty Years of Curriculum Reform in Mathematics

The golden age of mathematics, the nineteenth century, saw the making of more mathematics than all previous history. In the first half of the twentieth century, again more mathematics was produced than in all previous history, including the golden age. That means that the tons (literally) of clay tablets of the Babylonians, the archives of the Egyptians, the august work of the Greeks, the splendid achievements of the Hindus and Arabs, and the revolutionary advances of the age of Newton have been more than matched by relatively recent forward steps in mathematics.

In all the great ages, the growth of mathematics was accompanied by - causing and being caused by - expanding uses and applications. A demand for people to maintain the development of mathematics and for those who would utilize it also confronted these ages with the problems of mathematical education and specifically the problems of elementary and secondary education.

Editor's Note - Dr. Hlavaty does not ordinarily write out his addresses or make digests of them. However, he has submitted to us a copy of an article he recently wrote which contains essentially the same ideas as those developed at our conference and has given us freedom to use any portion of it. What follows is from this article.

Our century and our country have in particular wrestled with the problem of mathematics in secondary education. A brief review of this story is in order, if only to put into proper perspective the current feverish activity in mathematical education.

A fruitful collaboration between mathematicians and school people culminated in 1923, in the publication by the Mathematical Association of America of the report, The Reorganization of Mathematics in Secondary Education.

Hardly was the ink dry on this report than a new phenomenon interfered radically with the nascent implementation of its recommendations. This was the explosive expansion of the secondary schools. Though the report became (and even is today) the major guide in curriculum construction and textbook writing, it soon became evident that its recommendations were neither desirable nor feasible for large sections of the new secondary school population.

During the 1930's an increasing awareness of the discrepancy between the various needs and drives of the high school pupil and the largely academically oriented point of view of the report led teachers to the reconsideration of the whole problem of the high school program in mathematics. It is significant and a mark of the times that the mathematicians and the educators found it impossible to formulate a universally acceptable program. In fact, two basically different reports on the problem emerged: one, *Mathematics in General Education* (1) and the other, *The Place of Mathematics in Secondary Education*, which was the Report of the Joint Commission of the Mathematical Association of America and the National Council of Teachers of Mathematics (2).

World War II prevented any real testing of the comparative values of the two sets of recommendations and the post-war period placed the whole problem of mathematical education in such a new dimension that the whole problem called once more for a fundamental re-examination of all the premises. There was increasing dissatisfaction with the many attempts at partial and local solutions. These various attempts found a focus in the work of the Commission on Mathematics. The genesis and the operations of the work of the Commission on Mathematics were reported by Albert E. Meder,

Jr., then executive director of the Commission, in the winter of 1958.(3)

The Commission, consisting of university mathematicians, leaders in the training of teachers of mathematics, and secondary school teachers, was organized in 1955. This group spent four busy years formulating tentative proposals, discussing them, tearing them apart, rejecting some, reformulating others, and elaborating still others. Not only did each proposal have to survive the gamut of the criticisms and reactions of the individual members of the Commission, but each was made the subject of careful and critical review by the profession at large. Representatives of the Commission presented the developing program of the Commission to innumerable local, regional, state, and national conferences of teachers of mathematics, mathematicians, and educators. The reactions of the profession at large had a marked influence on the final report.

References

- (1) Progressive Education Association on Commission on the Secondary Curriculum, Committee on the Function of Mathematics in General Education, New York: D. Appleton Century, 1940.
- (2) New York: Bureau of Publications, Teachers College, Columbia University, 1940.
- (3) "Mathematics For Today", College Board Review, No. 34, pp.7-10.

II - What Mathematics is of Most Worth?

The Commission succeeded in formulating and proposing a nine-point program for college-capable students:

1. Strong preparation, both in concepts and in skills for college mathematics at the level of calculus and analytic geometry.
2. Understanding of the nature and role of deductive reasoning - in algebra, as well as in geometry.

3. Appreciation of mathematical structure ("patterns") - for example, properties of natural, rational, real, and complex numbers.
4. Judicious use of unifying ideas - sets, variables, functions, and relations.
5. Treatment of inequalities along with equations.
6. Incorporation with plane geometry of some coordinate geometry, and essentials of solid geometry and space perception.
7. Introduction in Grade XI of fundamental trigonometry - centered on coordinates, vectors, and complex numbers.
8. Emphasis in Grade XII on elementary functions (polynomial, exponential, circular).
9. Recommendation of additional, alternative units for Grade XII: either introductory probability with statistical applications, or an introduction to modern algebra.

This nine-point program was elaborated in the first volume of the Report of the Commission on Mathematics, Program for College Preparatory Mathematics, which was published in the spring of 1959.

To give a concrete illustration of the point of view that should guide the creation of a new curriculum in mathematics, and to provide teachers with some of the new subject-matter material which is proposed in the program, the Commission found it necessary during the four years of its work to issue a number of small publications in the form of pamphlets. These materials were improved, others of a similar nature were written, and the whole was incorporated in the second volume of the Report, the Appendices.

III - Implementing Curriculum Proposals

An increasing segment of persons responding to the Report is made up of tough-minded administrators who are working on the implementation of a new program in mathematics. Local school boards and state departments of education have strengthened, or in some cases initiated, programs of supervision in mathematics. They have been brought face to face with the concrete problems of teacher-training and retraining in service: organizing and subsidizing inservice programs and finding people to conduct these

training courses. Often, they ask the Commission for speakers and instructors. State departments of education are reviewing their certification requirements and they also ask for advice. It is clear that the fifth chapter of the Commission's Report ("Implementation: the vital role of teacher education") is becoming increasingly pertinent for all concerned, from individual teachers to state-wide systems. The schools of education are undertaking serious reviews of their programs for future teachers and for teachers now in service. The growing program of the National Science Foundation is a part of this major activity in teacher education, and recently, the American Association for the Advancement of Science decided to use Chapter 5 of the Report in its regional conferences on the Teacher Preparation-Certification Study.

In the beginning stages of this experiment in mathematical education it was easy to distinguish the role of the Commission from that of the quite different but contemporaneous Advanced Placement Program and the Illinois Plan. The Commission assumed an important position at the yearly summer and inservice training institutes through the use of its pamphlets and particularly of its Introductory Probability and Statistical Inference, an experimental text used and reviewed very extensively, perhaps because they were the only materials available.

Today the role of the Commission is still quite distinctive and an important source of the swelling stream fed also by the massive work of the School Mathematics Study Group, the growing influence of the Illinois Plan, and the innumerable attempts sponsored by local, state, and federal bodies. The Report gave explicit and concrete form to what has emerged as a consensus of the many seemingly different approaches to the problem of a new curriculum in mathematics. This conclusion was underlined by the publication of The Secondary Mathematics Curriculum, the Report of the Secondary School Curriculum Committee of the National Council of Teachers of Mathematics, in May 1959. While the National Council's recommendations do not agree in every detail with those of the Commission, they do agree in major outline and emphasis.

The School Mathematics Study Group (Yale Project) accepted in essence the recommendations of the Commission. In its tremendously

productive writing project in the summer of 1959, the SMSG produced sample textbooks for Grades VII through XII. In only one instance - geometry - did it significantly depart from the recommendations of the Commission. In this case it produced an updated and relatively rigorous textbook in Euclidean geometry, which however includes a treatment of solid geometry and a unit on coordinate geometry. In all other areas it strove deliberately to implement Commission recommendations.