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## ELEMENTARY MATHEMATICS IN THE U.S.A.

The present program in mathematics for youth age 6 years to 15 years in the U.S.A. can best be described as average when compared to that in other countries.<sup>4)</sup> Up to about 1925, the teaching was for the most part a rote-manipulative-tool developing type of instruction. From 1925 to 1940, a social utility program was introduced whereby arithmetic and geometry were to be learned when and as they arose in social problems in the life of the youngster. This method of teaching proved a complete failure. Beginning around 1940, a meaning theory of teaching was advocated and is rapidly gaining favor. This theory stresses the teaching of arithmetic as an ordered structure of number, and geometry as a systemic structure of space, which is abstracted from physical objects and the world around us through the study of their characteristics and properties. In Arithmetic all learning is rationalized; the concepts of numerosity, order, numeration, and the fundamental operations are developed intuitively and used before any attempt is made to systematize the fundamental relations and facts.

Once the concept of counting is developed, the children discover, write, then memorize through drill, all the fundamental facts needed for the four fundamental operations with numbers. The commutative, associative, and distributive laws are used in learning the facts and the algorisms of the fundamental computational processes. Since subtraction is conceived fundamentally as removing a known subset from a given universe, and then the problem is to find the complement of the subset, we teach the take-away exchange algorism and not the Austrian Method. We have found, that for rationalization, this method pays real dividends, and we reserve the Austrian Method for the time when we introduce the new system of positive and negative numbers. Long division is used to introduce division with whole numbers using one, two or three digit divisors, and

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<sup>4)</sup> *The Development of Arithmetic as an Elementary School subject since 1900.* Sydney Tompkins. Unpublished Doctoral Study — Teachers College, Columbia University. 1957.

short division is reserved for the 7th and 8th school years when simplification and rationalization can be made. In general, we teach no mathematical operation that is beyond a genuine understanding and rationalization by the pupils, and we teach this mathematics by building a structure, based on the laws of number, and by abstracting from physical models. In the later years, grades 8 and 9, we produce models in which the ordinary arithmetic and geometry do not hold up, so that the pupils will understand there is other mathematics than that which they have learned, and that this other mathematics is useful.

The geometry of the 5th to 9th grades is entirely informal and intuitive and covers the ordinary study of shape, size, and position. The one really significant change that is occurring is in the 9th school year (age 15 years). Here the entire year will be devoted to developing elementary algebra from a modern point of view. The concepts, language, and symbolism of sets (Mengen, Ensembles) is introduced at the very start of the study. A variable is conceived as a symbol which may be replaced by any element (number) of its domain. We stress that we must always know the domain in which we are working. We talk of expressions, set-builders, and also refer to the roots of equations as the solution set. We are convinced that through this approach, using the five fundamental laws for a *Ring* (but not the word *Ring*), the algebra will achieve unity, clarity, meaning, and challenge to the intellect, that it never had before. Our approach to *function* from the start will be a mapping exhibited by a set of ordered pairs of numbers, and defined by a relation, that makes it single-valued. With these ideas we can introduce elementary methods of proof in algebra comparable to those heretofore reserved for geometry alone. We believe our experiment is well worth watching by all countries.

#### CONCLUSION.

Previously, it has been said, that all reports indicate a trend towards teaching for meaning. But meaning has different connotations to the different reporters. This report closes on a note of the necessity, because of our world culture today, of