NEW WAYS OF DEVELOPING MATHEMATICAL ABILITIES

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From informational islands to structured knowledge

According to the traditional philosophy of learning, which is still very strong everywhere in the world, information represent the essential in mathematics teaching, the mathematical thinking being just a mechanical consequence of their assimilation. The results of this philosophy are expressed in the present-day fact: the average student's failure to learn mathematics. This average student possesses, at best, just "informational islands". Researches carried out on secondary-school students reveal major flaws exactly on the level of mathematical thinking; but these flaws have their roots precisely at the beginning of the informational stairway, that is as early as the first grade. The teaching that is focused on developing mental capacities implies an extremely structured *knowledge organization.*

From problem solving to learning the generators

It is equally important to teach the child how to solve a problem and how to communicate the problem's solution, i.e. how to present a series of items of reasoning or operations accepted by *consensus* as explaining the way to get to the result. This consensus represents the accumulation of an historical experience, so it is a cultural acquisition. Therefore, how numerous must the problems be in order to ensure learning? How should these problems be dosed in a textbook so that understanding might occur without an exaggerated effort? To make learning more effective, it is necessary to have an inventory of *generative* situations and to offer children as many opportunities as possible in order to have them interfere with various learning specific environments. *Generator,* in this context, means that on its basis, *by combination, substitution, by enlarging-narrowing the domain, by varying the actions, changing the topic*, etc., a great variety of problems can be created. Generators learning as opposed to problem solving has the advantage that it structures the understanding of the mathematical phenomena hidden behind particular statements. If, together with the ability to solve problems, the student gets the ability to understand and use the generators of a class of problems, then the child's cognitive acquisition is definitely superior and it refers to the arising of an over-learning phenomenon.

From "drill and practice" to "practice and structure"

Understanding word problems is closely connected with *analyzing and transforming the problems*. The child is stimulated to create word problems using various starting points. The technique is practiced loudly, silently, in written form, maintaining the interest in exercising as many capacities as possible and stressing the passage from one type of activity to another. There is also a systematic training of *becoming aware of errors*. The teacher "hides" some errors in exercises or problems, in series of numbers, in comparisons, etc. These errors are analyzed with the purpose to eliminate the pupils' typical errors, as well as to improve the analysis ability. *Estimations and approximations* are also systematically taken into consideration. The objective is focused on understanding the significance of numbers size and on checking the computing validity. Finally, two tasks are left to be solved: raising the internalized structure to the level of formal representations and transforming the internalized structure into a dynamic one.