

Psychological Dimensions of Mathematics at Early School Age

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Abstract: *The article shows the way by which mathematics influences the psychical structures of primary school pupil and its decisive contribution at forming his personality.*

The aspects presented here include the effects of mathematics upon the affective- cognitive sphere of pupils of primary school age, especially upon the cognitive and controlling processes that is memory, thinking and attention.

Key words: *mathematics, pupil, personality, psychological dimension*

1. The Importance of Mathematics in Developing the Personality of Primary School Pupil

In the new contemporary society, nothing can be achieved without a decisive and direct contribution of mathematics in the development of the other domains of the social life.

At primary school age, mathematics has an important contribution at developing personality, both in its intellectual and moral- aesthetic aspects.

From the point of view of intellectual development, the learning of mathematics develops judgement, helps the logical organization of thinking, builds up the capacities of attention, stimulates the logical memory, develops the analysis and synthesis and favours the creative imagination.

Taking into account the aesthetic aspect, mathematics encourages a taste of beauty expressed by relations, formulae, figures and demonstrations, cultivates some qualities of expressing thinking such as: clarity, order, briefness, elegance and determines the pupil to recognize and appreciate the artistic creation.

From a moral point of view, mathematics stimulates a taste of truth, objectivity and equity, creates the need for rigour, discrimination and probing hypothesis, creates the need of understanding and abilities of stimulating the will.

During the primary school the pupils assimilate mathematical elementary notions with which they operate through all their life span, they develop certain skills and abilities, and they learn certain computation skills and methods of solving problems.

Learning mathematics during the primary school follows three levels: instructive, educative and practical, all of them having as fundamental objective the development of personality of the primary school pupil.

At the instructive level, there are several aims which are to be achieved: to build up the concept of natural figures, to know the way of writing natural numbers, to understand the operations of addition, subtraction, multiplication and division and their properties, to accustom pupils with simple elements of plane geometry, to build up the concept of measuring any dimension and to know the main measuring units for length, area, volume, mass and time .

The assimilation by the primary school pupil of the system of notions and knowledge contained by mathematics, requires a scientific, educative and deductive thinking able to take over a leading role in developing the generalization and abstracting processes.

From a practical point of view, one should aim at building up the ability of using the mathematical knowledge in solving the arithmetical problems as well as in solving any current problems.

In the following lines, we shall discuss the influence of mathematics upon cognitive- affective sphere of primary school children and we shall try to analyze the psychological dimensions of mathematics upon their personality.

2. The Psychological Dimensions Of Mathematics at an Early Age

Within the frame of psychical development and building up personality, learning holds a central place due to the fact that by learning the pupil acquires new behaviours.

Mathematics is the science of the most abstract concepts, of an extreme generality which are built at different levels by induction, deduction and transduction.

The primary school children find themselves at the level of concrete operations, when they learn by intuition and direct manipulation of concrete objects and the mathematical activity reproduces the physical space in which they develop.

The first condition of intercepting and learning mathematics, is represented by the activation of attention, as this is the first condition for the effective knowledge. In this respect, one should stimulate the qualities of attention: the concentration capacity, the steadiness, the volume and distribution which manifest differently according to pupils.

Preventing the diverse forms of absent-mindedness in the mathematical activity at the primary school requires the use of efficient procedures such as: the use of concrete tasks concerning the activity of each pupil, the ensuring of varied methods in developing the activity at an optimal rhythm, the punctuating of the moments of activity by working indications and a differentiation of cognitive tasks during the respective activity.

The building up of mathematical notions is achieved for primary school children, by a gradual passage from the general to the abstract, at successive levels, where the relation between the concrete and the logical is modified toward an essential reality.

This requires the development of the ability of mental representation, of imagining the result of certain actions and of anticipating by representations the development of simple situations. Now, by means of thinking, the pupil has the possibility to simplify and to classify objects according to certain criteria (colour, form, length, size, thickness) then to advance to numeration conceptually and to learn the quantitative relations included in the numerical series .

By acquiring the reversibility of thinking, a conceptualization of the number and of the mathematical operation take place which suppose an appropriate grouping of mental operations.

The reversible mental operations are coordinated under operating structures of classes by inversion and under operating structures of operations by reciprocity.

During the first grade, on a basis of the theory of multitudes, of composition, and of decomposition of numbers, there occurs a passing from the reproductive imagination to the probabilistical one, from the forms of the concrete mental operations to the abstract ones although at this age the symbols do not come off their objective supports.

In building up[the concept of the natural number, the action precedes intuition and the didactic model undergoes three stages: operational-concrete, imaginative-concrete and symbolical. During the evolution from the intuitive to the logical, from the concrete to the abstract, the relation between these stages changes gradually.

The building up and the acquisition of the notion of addition and subtraction begins by operations with multitudes of concrete usual objects- the perceptive stage, is continued by effectuation of operations with representations which have the tendency to generalize the representation stage and is finalized by the shift to the mathematical concept of addition and respectively subtraction.

In teaching and learning the operation of multiplication, intuition does not hold a prominent role anymore since the pupils have acquired certain knowledge and built up skills and abilities in relation to the operation of addition, which stands as a starting point for multiplication

As the determination of the product of two numbers by means of a repeated addition becomes slow if the numbers are big, the results will be found out by grouping the factors and using commutativity, the final stage being the conscious learning-learning by rote the multiplication of each number.

The teaching and learning of the division of the natural numbers must be related to practical situations in life, only after the pupils have acquired the notion of division in equal parts and by inclusion.

The language accompanies any mathematical acquisition and constitutes the necessary support of any representation, of their novel combination, easing the analysis and the learning of significant information.

The participation of language is a necessary condition in building up the skill of the mathematical computation and the exercise, by its repetitive mode, constitutes the fundamental condition.

The language has an important role both at the level of perception and at the level of transposing the action on the representation plane and its participation is a necessary condition in building up the skill of mathematical computation.

Thus, mathematical language which has an important function in cognition, is introduced gradually and quietly and the pupils use it without difficulty.

Memory is present in all the moments of the learning process since it rivets information or the initial operations, permits the understanding act and finally the fixing and keeping of new acquisitions.

The capacity of a logical memorizing of mathematical data, relations and operations is present in all mathematical activities and it is highly important that pupils should perceive and understand the content of the mathematical tasks.

Consequently, memory has an important role in acquiring mathematical information, in keeping, reproducing and even recognizing the respective information.

Another complex cognitive process which appears after the building up of representations, the acquisition of language, the development of intelligence and the improvement of life experience is imagination.

Being the most important component of creativity, imagination holds an important role in solving and composing the mathematical problems. However, during this activity we cannot give up reproductive imagination in favour of the creative one, as without understanding certain abstract relations, putting forward hypotheses, inventing new solving ways and methods would not be possible.

In the activity of composing problems we must take into account the pupils' capacities by gradual tasks while the pupils' thinking and imagination can be directed towards suggestive examples used as models through rational requirements.

Consequently, the way of constituting its bases holds a very important role in the acquisition of mathematics. The building up of the concept of the number points out a certain side of the objective reality, the number reflecting the quantitative relations of the objective world. The taking off of these relations supposes a complex abstracting and generalization activity which is build up gradually following a long process of intellectual development of the child.

3. Conclusions

The aspects presented above underlined the fact that mathematics has a great influence upon the cognitive and controlling processes and has a decisive contribution to improving the efficiency of educational activities and respectively to the didactic process.

The competences in solving the problems aims at the capacities of the subject in summoning and integrating a set of cognitive, affective and psycho-motor neurone resources, necessary in the solving process.

As a result, mathematics has a great influence over the psychical structures of the primary school child and getting acquainted to these ones leads to the improvement of pupils' performances and contributes to the buiding up of their personality.

As a conclusion, the importance of mathematics lies in the fact that it offers applicable methods for a large category of problems, it gives the possibility to know fundamental structures and especially the relations among such structures.

Due to its utilization in all domains of the social life, by the mutual language used, we can consider that a permanent mathematical reference of all sciences is a necessary stage of knowledge.

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