The Use of the Figurative Model in Solving Arithmetical Problems in Primary School

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Abstract

This article presents one of the ways to solve arithmetical problems, the figurative model, which allows the realization of an intuitive scheme, required for viewing the relations between data. In the first part, the emphasis is laid on a series of general aspects regarding the use of the figurative model of a resolvent strategy in primary school. In this respect, there is a presentation of the resolvent process and of the resolvent strategy, which allow the learning of some self guidance instructions, needed in creating and solving arithmetical problems. The figurative model offers the young pupil the possibility of observing in a unitary manner the structure of a problem and the internal organization of its contents. In the second part, the article highlights two problems, one which addresses learning by a figurative model which is previously built and the second of learning by a figurative model, which is built adhoc. The article ends with a few conclusions regarding the way of approaching the figurative model and its importance in solving arithmetical problems in primary school.

Key words: *figurative model, primary school, resolvent strategy*

1. General aspects regarding the use of the figurative model of a resolvent strategy in primary school.

Within mathematical education, the most important task of the teacher is to give due importance to the methodology of problem solving.

In this regard, we have to consider responsibly the resolvent process under its three aspects: learning process, searching process and psychological process.

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Thus, as a learning process, the resolvent process involves problem learning by problematization and discovery, or problem solving in order to form skills and consolidate abilities.

Regarding the the searching process, this aspect refers to the strategies used to restrict the heuristical area, that is to find the heuristical-algorithmic strategies needed to finalize the problem.

From a psychological point of view, problem solving involves the development of intellectual capacities in close relation to age peculiarities and psychological peculiarities.

An important part in learning problem solving strategies belongs to learning self guidance instructions that mean strategies which allow the young pupil to take part in the process of creating knowledge, ie to make him think mathematically by himself.

This strategy of self-guidance comprises those guidelines of orienting thinking, which are practiced by the teacher with the young pupil, so that he should be given only as much as necessary for the functioning of the mental activity.

However, we must not mistake the strategies which guide problem solving with resolvent strategies, which are strategies that the young pupil develop in the process of training with or without the support of heuristical search.

In this respect, we can consider as resolvent activities those obtained by heuristical procedures, by methods of solving typical problems and by inference schemes, as they are closely related to arithmetical reasoning.

Solving a problem of any kind is a psychological act with mental implications both cognitively and affectively, ie it is an act of mental construction that implies the involvement of multiple operations of thinking, including analysis, synthesis, generalization and abstractization.

Starting from these considerations, the resolvent act becomes an act of mental reconstruction, consisting of various judgments, where the essence of thinking is just the building of arithmetical reasoning.

Regarding the figurative model, this is found as a figurative model of a mathematical concept, a figurative model of a property, the symbolic model of a relation and the figurative model of a problem.

The most important is the figurative model of a resolvent strategy, which in primary school is a problem schematization, containing a series of supplementary elements, necessary to complete the resolvent act.

In primary school, the use of the figurative model has heuristical value, as it is a means of updating the previous experience and of developing the spirit of observation.

In solving an arithmetical problem, the use of the figurative model offers the young pupil the possibility to observe in a unitary manner the structure of that problem and the understanding of the internal organization of its contents.

The elaboration of the figurative model in primary school is achieved under the form of the most varied modalities, from using circles, squares and letters, up to ramified schemes. These modalities are supplementary elements in compiling the figurative model and represent a stage of thinking and a stage of entering the solving process.

In solving arithmetical problems, the figurative model appears under two forms: learning based on the model built during solving other problems and learning based on the model built adhoc.

By using the figurative model, one tests the way of understanding the logical structure of the contents of the problem, the modality of practising divergent thinking and the way of developing the abilities of composing problems.

We should not be the supporters of templates, because the achievement of robotisation is not desired and young pupils should have the opportunity to acquire those algorithms to highlight the respective model.

2. Practical aspects of using the figurative model in solving an arithmetical problem in primary school

The practical applicative part is reserved to the approach of the two types of figurative models: the figurative model which is based on previous experience and the figurative model based on being built adhoc.

For the first modality, we present how to use the figurative model by solving a particular type of problem, ie the method of double report.

The problem of double report is based on the figurative model that develops in three stages: the initial stage, the transformation stage and the final stage.

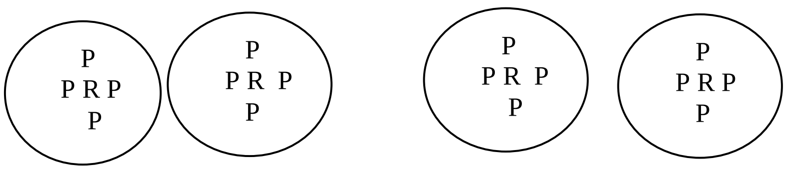
A series of methodical requirements are needed: such as the modality to divide into groups on the values of the first report, the settlement of data so that we can visualize the relations between them and the proper achievement of the transformation stage, which connects the initial stage and the final stage.

Problem 1

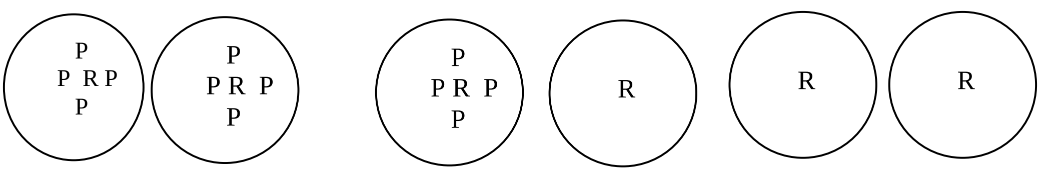
A pupil has 4 times more pigeons than rabbits. If he bought two more rabbits and sold 4 pigeons, then he would have 3 times more pigeons than rabbits. How many rabbits and how many pigeons has the pupil?

Solution

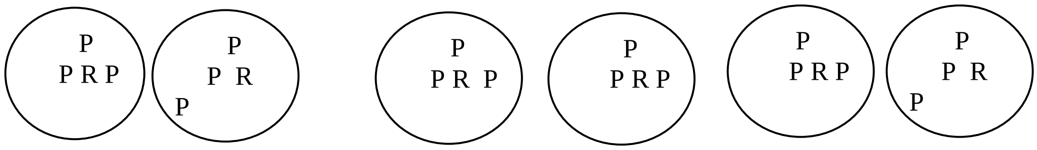
I. Initial stage



II. Transformation stage



III. Final stage



By studying the given scheme, we notice that in the transformation stage, there appeared two more groups which contain a rabbit each and there are 4 pigeons which disappeared from the last group.

If the distribution is done differently, then according to the final report, in each group there are three pigeons which appear at each rabbit. In the transformation stage, there appears three free groups which contain no pigeon. That is why, from each group in the transformation stage, one pigeon is taken and then it is set in the three empty groups, ie there will be brought 3p x 3 = 9 p.

Therefore, in front of the three empty groups, there are 9 : 1 = 9 groups. Thus, in the transformation stage there are 9 + 3 = 12 groups. But initially, there are only 12 – 2 = 10 groups.

Then we have 1 x 10 = 10 (rabbits) and 4 x 10 = 40 (pigeons)

Verification

If two more rabbits were taken, then we would have 10 + 2 = 12 (rabbits) and if 4 pigeons were sold, we would have 40 – 4 = 36 (pigeons).

36 : 12 = 3 (times)

The following practical aspect is a specially built figurative model, whose scheme can provide us with the relations between the data of the problem that carries several variants of solving.

Problem 2

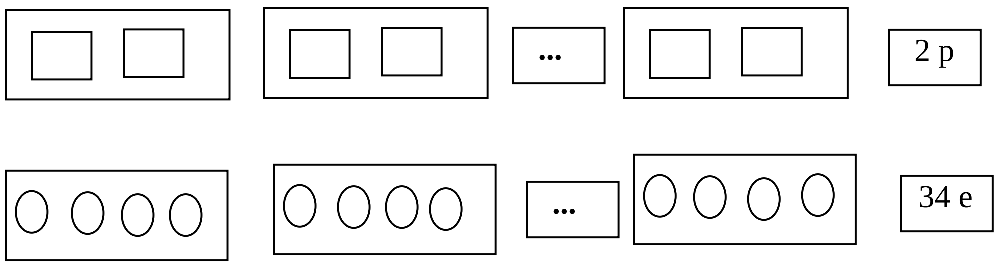
The pupils of the IV-th grade who go to the maths contest have to solve five times more exercises than problems. Till the contest, solving two problems and four exercises every day, pupils remain with two unsolved problems and thirty-

four unsolved exercises. How many pupils take part in the contest and how many problems should have been solved?

Solution

Method I

We represent every solved problem by a rectangle and every exercise by a little circle, distributed per days. Thus, there will be two unsolved problems and 34 unsolved exercises.



It is known that they have to solve five times more exercise than problems, and with every two problems four exercises are solved.

With every two problems, each pupil is given 10 exercises, out of which he solves only four exercises. So every pupil remains with 6 unsolved exercises per day.

If each of them remains with two unsolved problems, 10 exercises will correspond to them and then there will be 34 – 10 = 24 unsolved exercises.

Knowing that every day there is a difference of 6 unsolved exercises, then we have 24 : 6 = 4 (pupils). The number of problems is 2 x 4 + 2 = 10.

Method II

The two remaining problems will be given to an imaginary pupil and then we will have a student more.

Then we will add the difference of six problems for the two notebooks, then we will have for the new situation 34 + 6 = 40 (exercises)

Knowing that for two problems we have 10 exercises, there is a difference of 10 – 2 = 8 exercises every day, so we have 40 : 8 = 5 (pupils). Having an imaginary pupil, their number will be 5-1 = 4 (pupils) and the number of problems is 2 x 4 + 2 = 10.

3.Conclusions

From the presentation of the two examples, we can assert that the recognition of a figurative model, in the case of the first problem, leads to finding the solving idea and decreases the problematic area very much.

The use of some supplementary problems which have certain central properties in their solving modality is extremely useful in reducing the degree of difficulty and in enabling the young pupil to complete them.

All elaborated figurative models constitute modalities of transfer for other problems, like the second example, where there is a transfer of heuristical procedures that facilitate the formation of intellectual capacities and of some cognitive schemes.

References

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