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DIDACTIC EXPERIMENT BASED ON INTEGRATING PROBLEM-SOLVING STRATEGIES IN TEACHING MATHEMATICS IN PRIMARY SCHOOL

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Abstract

Teaching strategies have a privileged position for all responsible factors for students' school success, highlighting the teacher's ability to choose and combine methods, processes and instruction means, types of grouping students in a certain order, to select and structure the content according to the scientific objectives, to choose some learning experience to be lived by students. Problems solving activity has the wealthiest formative valences because the student takes advantages of available mathematical knowledge for his, her intellectual development. The research was of an experimental type, using the test method. The experiment was conducted by a group of students at the primary and preschool pedagogy weeks of teaching practice. The results confirm the research hypothesis. In conclusion we can say that in order to achieve quality education and achieve the best results, you should combine classical and modern methods of teaching, learning, assessment, different forms of organization with different educational teaching aids.

Key words*:* didactic strategies, problem solving, primary school, experiment

1. Introduction

On the theoretical level there were created the conceptualised premises of the didactic strategies to solve Maths problems. Analysing contemporary theories we can detach some conclusions concerning the importance of strategies in solving Maths problems in the primary school: solving problems has a privileged position in the assembly of responsive factors for pupils' school success; the use of active and cooperative methods during Maths classes and not only has a

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beneficial impact on pupils contributing to the development of the communicative abilities and group working: active participative methods are a challenge; a curiosity both for pupils and future teachers.

In solving simple problems the following stages should be covered (Lupu, 2006):

- knowing the problem statement;
- understanding the problem statement which consists of the following stages:
  - repetition of the problem by the teacher for the primary school and writing the figures on the blackboard;
  - explaining the most difficult words or expressions;
  - pupils repeating the problem;
  - illustrating the problem through images or concrete material;
- separating the question from the content, in such a way that it should be very clear what is asked;
- selection of the appropriate operations and calculating;
- formulation of the answer to the problem.

In order to realize the passing from solving simple problems to the complex ones there will be solved two simple problems, in such a way that the result of the first problem to be an element of the second one. Once the learning of the first arithmetic operations we begin oral, simple problem solving. Another qualitative leap is passing from solving simple problems to solving complex problems.

The variety and complexity of problems "solved by the student their mental effort and the formative efficiency of their solving activity increase" (Neagu and Mocanu, 2007, p.136). Solving compound problems asks in a greater way logical thinking than simple problems. Besides solving each simple problem in a complex problem, Lupu (1998) considers that it is necessary to make correspondences between the figures of the complex problem, seizing the connections, the reciprocal dependencies in such a way that the child should establish the succession of simple problems to find the final result.

2. Research methodology

2.1. Objectives and hypothesis

The undergraduates established the following objectives:

- to demonstrate that indifferently of the domain, the creative problem solving should characterize man in any situation at school, in family, society;

- to realize a psycho pedagogical research concerning solving problems combining traditional methods with active cooperative methods and procedures;

- to promote the idea that through solving Maths problems, thinking and its operations is developed, creativity, positive feelings and attitudes too, the intellectual competitive spirit;

In order to check the hypothesis there were established a number of tasks: consulting and studying specific literature concerning the task; knowing the research methods which can be used in realising the study; choosing and establishing the number of subjects; centralising and processing the data.

The research began from the following ***hypothesis***: If active participative methods are used in the activity of solving problems of arithmetic then we contribute to learning improving, to the increasing of its efficiency and the increasing of the pupils' output in solving Maths problems.

2.2. Methods

One of the strategies is the degree of undergraduates' 'involvement in pupils' solving of tasks, through a conducted educational activity or an independent one. At this level we can notice the interaction between the organization of the form and the learning experience (type of learning) asked to the components. During the lessons, the undergraduates used one, two or more forms of organizing the form:

- *Collective-independent*-the task to be solved is known by all pupils and the undergraduates don't interfere until its end.
- *Group-independent* the form is divided into groups. Each group receives a task without help from the undergraduate who, after having given the essential explanations does not interfere until the end of the allowed time.
- *Individual-independent* this type of organisation allows for differentiated work with pupils. Every pupil receives a task whose accomplishment is done without any undergraduate's

and pupil's involvement. Such an organizing type allows giving tasks in accordance with every pupil's individual particularities.

- *Performed collectively* – the didactic task which is to be solved is one and the same for the whole grade, the undergraduate being actively involved, conducting and permanently leading the activity.
- *Performed in groups* - the form is divided into more groups which receive each a task to be solved, the undergraduate being involved in the activity, helping and leading by turn the every group activity.
- *Performed individually* -the task to be solved has different variants for the members of the group, the undergraduate is implied actively helping, by turns or when asked, all the members of the group.

These forms of organization were understood as an assembly of techniques which, through combination, will improve learning. Their great majority imply the use of the heuristic strategy, the undergraduate being in charge of establishing the objectives, the tasks and the assessment instruments. It is important that in all these organizing forms the student supervised the use of the whole differentiating system of the variables of these activities: objectives, contents, tasks, learning situations, assessment forms.

Another strategy used consisted in solving simple, family, play, every day activity problems continuing with complex ones. All these simple problems are illustrated with familiar examples. The simple problem is the one which asks one operation. The solving of the first problems is realized on the concrete level, as life situations, illustrated through images or even actions performed by the child then gradually the mental calculation is introduced.

Starting from the formulation of the hypothesis of the experiment the following variables were established:

- *The independent variable* consists of didactic strategies used by the teacher in order to determine a dynamic understanding of the contents of the Maths classes;
- *The dependent variable* envisages expected modifications as far as the improvement of the learning situation at Maths as a result of the introduction of the factor progress;

Generally, the pedagogical research is at the origin of the improvement of the theoretical explanatory and predictive contents of this branch of knowledge, to find new methods and procedures of teaching assessment, of improving educational practice corresponding to the

contemporary demands. The assembly of methods, procedures, techniques appropriate to be used in the process of research is the methodology of the research. Through the method of research we understand the way, the itinerary, structure of order or the programme according to which the intellectual actions and practices adjust in order to reach an aim (Dumitriu, 2004). *The technique* is defined generally as an assembly of methodological prescriptions for an efficient action. The research techniques are subscribed to methods and refer to the operational approach of the studied phenomena.

The procedure is the way of action, of use of the investigating instruments. In their turn the instruments are material tools used by the researcher for the scientific knowledge of the researched phenomenon [the observation sheet].

In integrating methods of knowledge in the group of pupils, it is important not only how they are chosen but also how they are used and combined. Taking into account the interdependence existing between the syntality of the group, the personality of the members we should use methods specific to both domains on condition that they are used and applied to offer enough data about the group as a whole.

The experiment took place during the second semester of the school year 2011-2012, 30 pupils being involved, coming from the primary school. All the pupils in the grades were involved, being considered experimental representatives and relevant for the objectives of the research. The experimental group consisting of 14 children (3 girls and 11 boys) in the 3rd grade from School I-VIII "M. Benedict" of Galbeni, the county of Nicolae Balcescu, considered to be a natural sample for the objectives of our research.

The control group consisting of 16 pupils (9 girls and 7 boys) from School with grades I-VIII from Onişcani, Filipeşti, Bacău, in both grades the pupils are disciplined, they do not create problems during the classes, they are communicative, sociable, and they were brought up and educated in specific rural conditions, that is why their intellectual level is similar.

2.3. Findings and results

There were three distinctive stages. *The initial assessment stage* took place between 24 January -1 February 2012 its objective was the diagnosis of the intellectual level, the preparation of the research activity to know the starting point. During the period, the initial test was applied to the two groups envisaging the pupils' level, the conditions in which they can integrate in the activity to be done. Knowing the pupils' capacity, the command of their knowledge and the necessary abilities to acquire the contents of the following stage is a decisive condition for the success of the didactic activity.

In order to measure and assess the way in which the objectives were realised the pupils were tested. The results were included in analytical and synthetic grids, frequency polygons, histograms. From the analysis of the results and graphical representations of the initial test we conclude:

Out of the 14 pupils, 6 obtained Very good 43%, 5 obtained Good 36%, 3 obtained Sufficient 21%. Analysing the pie diagram, the results of the initial test of the control group were as follows: from 16 pupils assessed, 7 got Very good (44%), 7 Good (44%) and 2 Sufficient (12%).

The formative stage (the introduction of the progress factor) took place between 2 February 2012 and 31 May 2012. This stage consisted in planning, organizing and displaying at Maths, introducing the progress factor (the use of active participative methods in solving Maths problems), in which all the pupils were engaged in the process of their own formation. Continuous assessment was used with the aim of insuring systematic and continuous learning. It was realised along the whole learning programme in the learning units and at their end.

Knowing the level acquired by the pupils helped the undergraduates to determine the positive aspects the gaps, in accordance with the objectives. Thus they specifically noticed how every pupil solved the problems, the difficulties they had in solving them in order to improve them or even eliminate them through the help of learning situations organized during the Maths lesson. There were used active cooperative methods.

As forms of organisation there were used frontal, pair, group and individual activity. As learning strategies, there were used a great variety of didactic means: real objects (sticks) to solve simple problems through multiplication and division; images, posters, graphics (figurative demonstration); drawings on the blackboard; technical didactic visual aids video projector, computers.

The strategies of teaching through didactic means specific to active, cooperative learning include brainstorming, mosaic, grape, I know, I want to know, I've learnt, the quadrant method, the Cube, were used during the Maths classes successfully.

The final assessment stage took place in June. There was a test for the learning unit Final Round UP in order to establish the level of pupils' acquisition the way they evolved from the initial test. The final assessment test took place on the 18th of June. The results were included in analytical, synthetic grids, frequency polygons, diagrams. The final test was conceived in the same way as the initial one in order to compare the results, the knowledge in the curriculum being defined as operational objectives codified in items.

The results were as follows: from 14 pupils assessed, 9 obtained Very good (64%), 4 obtained Good (29%), 1 obtained Sufficient (7%). At the final assessment the control group obtained the following results: from 16 pupils, 7 obtained Very good (44%), 6 obtained Good (37%) and 3 obtained Sufficient (19%).

To emphasize the obtained progress in improving the relation as a result of the experiment and of the used method, a comparative analysis was done. Compared, the results obtained at the predictive test and the final one demonstrated that along the whole term, through the systematic use of the differentiating learning the pupils' progress was both qualitative and quantitative. This thing was deduced from the easiness and pleasure with which the pupils acquired a great volume of knowledge which they used in solving problems and problem-situations (knowledge acquired especially through their own efforts), the pleasure throughout the whole year. The comparative analysis of the grid and of the frequency polygon we can see the progress of the experimental group. Thus if in the stage of the initial test 6 pupils obtained Very good representing 43% in the stage of final evaluation their number increased to 9 and the number of those who obtained Good, diminished and so did the number of those who obtained Sufficient.

The average of the two tests and the comparison indicate an increase in the school output in the experimental group. Compared to the obtained results in the initial and final tests, it was demonstrated that the systematic use of active methods throughout the whole school year led to a qualitative as well as quantitative progress in learning. This was deduced from the easiness with which they acquired new knowledge from solving problems and situation problems throughout the year.

Thus the progress factor which was interfered in the activity of solving Maths problems contributed considerably to forming efficient intellectual working skills and implicitly improved school performance at Maths. The results obtained reinforced the idea of the research that the use of the methods I know, I want to Know, I've learnt, The Quadrants, The Cube, The Grape, The Venn Diagram during the Maths classes contributed to the development of investigating skills, to an increase of the pupils' motivation and of the school output.

Conclusions

As a result of the use of the active cooperative methods, the undergraduates realised that their appropriate use led to satisfactory results such as: the pupils overcame their communicative barriers; they formed skills to solve Maths problems; they had an adequate behaviour in their

group; there was a better collaboration between children; they became more tolerant; the joining of the working group (frontal, group, individual) created possibilities for multiple and varied mobilization for pupils; the pupils learnt that in order to accomplish a group task they need others.

To conclude we can say that to realize a good quality teaching system and to obtain the best we should combine classical and modern methods of teaching, learning, assessment, organizing and didactic means. From a pedagogical point of view this means that the teaching process should obey age and individual particularities because perception, understanding, memorisation, mental operation are not identical with all pupils. Organizing varied learning activities adapted to the individual needs of the pupils. The teacher stimulates collaboration, interest, motivation to solve Maths problems and to use it in different contexts.

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