

Problems with Successive Addition of Logical Conditions

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1 Introduction

Mathematics is very important for the development of logical thinking of pupils. Some objects in the real life and also in mathematics can be characterized by some logical conditions. The problems with successive addition of logical conditions can help the pupils to get oriented in the world of objects in the real life and in mathematics.

In such situations it is preferable to use a constructivist type of teaching. For the constructivist type of teaching it is typical that the students are more active in the teaching process. They construct new instructions from their investigations. The aim of the constructivist method in this project was to find solutions for the problems. The teacher had a position of a presenter who presents and guides the discussion.

This project was carried out in a group of students, who will be teachers at primary schools. The project was carried out from October 21 to November 1, 2002 and took 4 teaching lessons. The group had 11 students all being in the last year of their studies at the university.

The project aimed at goals in three fields:

- teaching: to show the students that the problems with progressive addition of logical conditions is one of the forms of the constructivist type of teaching, which develops the ability of pupils to find the object satisfying the required conditions;
- ability: to discuss problems, to formulate own opinions, to learn to appreciate other students' solutions, to simulate the situations in the class;
- experimental: to analyse the students' solutions from the qualitative viewpoint, to observe how the students estimate and predict the expected reaction of pupils.

The first three problems in the experimental lessons 1 and 2 are given by teacher. Students solve the problem and discuss other students' solutions.

For the experimental lessons 3 and 4 one half of the students prepare problems dealing with objects located in the classroom and suitable for five years old children. The rest of students prepare problems suitable for ten years old pupils and dealing with natural numbers. In this article we describe experimental lessons 3 and 4.

Every student gives his problem to other students and the students discuss their solutions and the solutions which they expect from the pupils. Using field notes from the lessons, I would like to present how the students discuss the problems and what kind of emotional influence on students has this type of lesson. Field notes are the instrument of the qualitative research (see [4]).

2 Field notes

Experimental lessons 3 and 4

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The students prepared the following problems:

Problem 1 (Mária)

- Find some orange object in the class.
- Find some small orange object in the class.
- Find some small soft orange object in the class.
- Find some object in the class, which is similar to a small brick.

Problem 2 (Lucia V.)

- Find some small object in the class.
- Find some small object in the class, which must be light.
- Find some small object in the class, which is in the fore part of the class.
- Find some small object in the class, which is in the fore part of the class and which is white.

Problem 3 (Marianna)

- Find some object in the fore part of the class.
- Find some small object in the fore part of the class.
- Find some small object in the fore part of the class, which is similar to a block.
- Find some small object in the fore part of the class, which is similar to a block and which is used for the informations for the director of the school.

Problem 4 (Miroslava K.)

- Draw some object from your room.
- Draw some toy from different objects in your room.
- Draw some toy in your room, which is yours.

d) Draw more liked toy from different objects in your room, which is yours.

Problem 5 (Júlia)

a) Find some object, which you use in the school.
b) Find some object, which you use in the school and which you use for writing.

c) Find some object, which you use in the school which you use for writing, and the object has a wooden part.

d) Find some object, which you use in the school which you use for writing, the object has a wooden part, and the largest part of which is red.

These five problems are for children of age 6. The students discuss how the children in the first grade will solve such problems.

Problem 1 — The students think that the pupils will speak about object, which they see in the class. Júlia: Sponge or case; Mária: Orange chalk; Jana: Eraser or desk; Irena: Orange pencil or mandarin; Lucia G.: Wall-gazette; Gabriela: Placard; Lucia V.: Door.

Júlia explains that the problem was oriented to the orange sponge in the class.

Problem 2 — This is a similar problem as Problem 1. Lucia V. explains that the problem was oriented to white chalk, but other students said that there is a possibility for other solutions, for example socket (Angelika), switch (Jana). Marianna explains that it is sometimes a problem for children to decide, what is big and what is small.

Problem 3 — The students talk about things that the pupils would use in the parts of the problem. For example: a) blackboard, picture, symbol of the state; b) chalk, sponge, blackboard; c) stage pocket, switch, chalk, the school radio; d) the school radio.

Problem 4 — This problem is oriented to things which the pupils have in their room. An advantage of this problem is in the possibility of emotional experience when solving this problem. The students talk that children use in their answer the names of subjects which they often use in their games and with which they have an emotional relationship. The students discuss which things are liked by boys and which are liked by girls.

Problem 5 — In the first year the writing is a very important subject for the pupils and so the student choose objects of this area. Students think that the pupils will use objects with which they write every day. So in the answers the children would opt, for example pen, eraser, pencil, and seldom chalk. Júlia thinks, that in d) the pupils answer „red pencil” and seldom „red pastel”, because they use the red pencil in the first year and the red pastel in the second year.

Problem 6 (Irena)

- Draw a window.
- Draw a window, not having the same sides.
- Make from this figure two triangles.
- Make from this figure in part b) four triangles.
- Which figure you can get when you „open” these triangles?

Problem 7 (Lucia G.)

- Draw a circle.
- Draw a circle greater than first and mark it by „a”.
- In the right upper corner draw a great circle and mark it by ascender b.
- In the opposite corner draw three small circles.
- In the remaining corners draw great circles, one in each corner.

Problem 8 (Angelika)

- Write three consecutive numbers.
- Write three consecutive numbers. Their sum is greater than 10.
- Write three consecutive numbers. Each of them is less than 10 and their sum is 24.

Problem 9 (Jana)

- Write a natural number.
- Write a natural number greater than 50.
- Write an even natural number greater than 50.
- Write an even natural number greater than 50 which is divisible by 5.

Problem 10 (Miroslava D.)

- Write a natural number with three digits.
- Write a natural number with three digits such that the sum of its digits is 9.
- Write a natural number with three digits such that the sum of its digits is 9. The first and the third digits are even.
- Write a natural number with three digits such that the sum of its digits is 9. The first and the third digits are even. The number is divisible by 2, 3 and 4.

The students explain, which form of solution they expect from pupils.

Problem 6

— I think, that in part a) the pupils will draw the windows which they see in their class. (Miroslava K.).

— The pupils will draw a rectangle in part b) (Jana).

— They will draw a rectangle with one diagonal (part c), Miroslava D.).

— They draw a rectangle with two diagonals (part d), Gabriela).

— I think, they can become a star in d) (Irena).

Problem 7 — Students discuss the location on paper where the pupils draw the circles and the size of the circles.

— I think, that they draw the circle in the beginning of the paper since they know that it is a beginning of the work (Angelika).

— I think, they draw it in the middle (Gabriela).

— In my opinion, they draw a small circle (Marianna).

— Some pupils draw a great circle (Jana).

— I think, that in part b) the pupils draw the circle apart from the first circle (Angelika).

— They can draw it around the first circle (Júlia).

Problem 8

— I think, that in part a) the pupils write 1, 2, 3, because this is the easiest (Miroslava D.).

— They write the numbers until 10 and in the part b) 11, 12, 13 (Angelika).

— In my opinion, they write 13, 14, 15 and so they need not calculate (Miroslava K.).

— I think in the part c) if they choose 7, 8, 9, than calculations are easier and more intuitive (Jana).

Problem 9 — The students think that in the part a) pupils write small numbers - 1 (Miroslava K.), 2 (Lucia V.). In the part b) and c) pupils write the numbers near 50 - 51 (Miroslava K.), 52 (Lucia V.). In the part d) pupils write the numbers until 100 - 55 (Miroslava K.), 100 (Miroslava D.), 60 (Lucia V.).

Problem 10 — The students expect that the numbers written by pupils are special. Most numbers have consecutive digits (123, 234,...). a) 333 (Miroslava K.), 325 (Jana), 123 (Lucia V.); b) 333 (Miroslava K., Jana, Lucia V.); c) 252 (Miroslava K.), 234 (Jana), 432 (Lucia V.); d) 252 (Miroslava K.), 432 (Jana), 432 (Lucia V.).

3 Conclusions about the project

All students took part in the discussion about problems and formulated their opinions in the field, what they expect as a future teacher form pupils. They will see the problems from the viewpoint of the real life. Their explanation was mostly not exact, because they would formulate solutions from the viewpoint of pupils.

In my opinion, two of problems prepared by students are very good for pupils. The first is Problem 4, because here it is possible to use emotion of pupils. Pupils like to speak about that, how they play in the free time.

The second is Problem 11, because it is good for teaching the divisibility. Pupils can find intuitively the rule for divisibility by 2,3,4.

Generally, I think that this project was very interesting and inspiring for me as well as for the students. I believe that in the future I will use this type constructivist teaching in my lessons. More information about the education of mathematics at primary school is in [1], [2] and [3].

References

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