

TEACHING MATHEMATICS: UNDERDETERMINED PROBLEMS THAT INSPIRE PUPILS

Nikolai Zimakov¹, University of Tashkent, nikolai.zimakov@maxinetti.fi
Pavel Shmakov, University of Helsinki, Finland, pavel.shmakov@helsinki.fi

This work represents an intermediate stage of study of CheCha method's influence: math problems are for the pupil at the same time **Cheerful** (funny, cool) and **Challenging**. Research question, considered in the paper, is: *How to construct and develop problems that inspire pupils?*

The method is based on three integrated educational approaches: promoting positive affect in math learning (Hannula, 2006), using humour in teaching (Grecu, 2008) and use of open problems in math teaching (Pehkonen, 2004). Over a few years the method has gradually developed into a teaching approach that assumes: in the same problem entertainment is combined with a set of difficulty levels; during problem solving there are conditions for emotions to rise; all pupils can participate actively in problem solving regardless of their abilities. We shall describe the method of creating such problems. Math basis of these specially designed problems is arrayed in far from math plot form, e.g., fantastic or paradoxical type (See Appendix). A distinctive feature is their focus on creativity, emotionality. On the one hand, the standard school math tasks are useful for acquiring knowledge and skills. On the other hand, their effectiveness' decrease happens quite often. According to the PISA, in developed countries pupil's interest in math is falling. "Guilt" for this negative process, at least partially, lies upon the teaching material. So, CheCha problems are presented as a tool, which is able to correct afore-mentioned phenomenon. The problem's contents creation by the author implies the creation of fantastic condition, using of humoristic and amusing aspects. Descriptive, literary condition allows me to show the phenomenological side of math. Underdetermined condition brings about shades of meaning of IM-problem in pupil's mind. Really it means reflections' and solutions' plurality, both of formal and informal nature. The purpose is to put pupils in the position of co-authors, creators and to create a situation in which children can invent their own variants of answers. Thus, the model with additional parameters and data is constructed. The phenomenon of such problems lies in the fact that in the process of problem solving the communications of math with other sciences: logic, physics, geography, chemistry and with real life are realized.

Key words: affect, creativity, entertainment, problem solving

REFERENCES:

- Grecu, J. (2008). *A doctoral thesis in Pedagogy. Universitatea pedagogica de stat "Ion Creanga". Chisinau, Moldova.*
- Hannula, M. S. (2006). *Affect in Mathematical Thinking and learning. In J. Maaß & W. Schölglmann (Eds.), New mathematics education research and practice (pp. 209-232). Rotterdam: Sense.*
- Pehkonen, E. (2004). *State-of-Art in Problem Solving: Focus on Open Problems. In H. Rehlich & B. Zimmermann (Eds.), ProMath Jena 2003. Problem Solving in Math Education (pp. 93-111). Hildesheim: Verlag Franzbecker.*

APPENDIX: Example of CheCha problem

There are two sets: A & B. $1/3$ part of the set A is equal to $1/5$ of the set B. Which of the sets is larger?

Case A Look at the left – here are mathematicians. $1/3$ of them are so ugly and horrible, they are real gorillas! Look to the right – here are gorillas. $1/5$ of them are so clever and logical, they are genuine mathematicians! Which number is larger: the number of mathematicians or the number of gorillas?

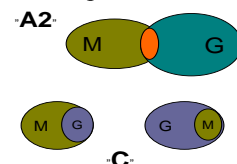
Case B: Look at the left - here are mathematicians. Look to the right - here are gorillas...

Case C: ...Look to ...far, far away, here are gorillas. You need a telescope; they live on another planet...

Solution A1: $M / 3 = G / 5$, hence $M / G = 3 / 5$.

Solution A2: Solution B: mathematicians / 3 = gorillas / 5. It is clear that in the Real World there is no mathematicians and gorillas too. Thus, the number of mathematicians = 0 = 0 / 3, the number of gorillas = 0 = 0 / 5. So, 0 = 0.

Solution C: Since the mathematicians and the gorillas live on different planets,



there is no answer, or different answers are possible.