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## **PRESENTATIONS, MADE FOR LEARNING MATHEMATICS IN MULTIGRADE SCHOOLS**

We used Bruner's representation modes in mathematics learning of pupils age 6-10. In this short article we focused on the iconic mode. We designed picture series for the pupils, which were presented by PC-s, as a main element of narrative learning environment.

### **The didactic problem**

In small schools, in multigrade schools the pupils' results are not good enough. These small schools are in remote areas of the country, the family background of the pupils does not give enough aid for the children to prepare for school - this is a complex problem, problem of health service, of region development, of permanent working place, etc. In this situation, how schools can help the student?

We think, teachers should recognise the problems of learning, in this case mainly communication gapes of the learning, and they should minimalise them.

### **Theoretical background**

In our research we use Bruner's theory focused on representation modes, which include:

1. enactive (concrete - actions on objects) mode,
2. iconic (pictorial - visuals/images) mode,
3. symbolic (abstractions - words, numerals) mode.

One of the first Bruner's publications was talking about mathematics learning: Representation and Mathematics Learning (Bruner, 1965). Bruner conducted a research on mathematics education in a laboratory. There were 6 students (age 9) and 8 „teachers”, one of them was Z. Dienes. Pupils learnt abstract algebra, solving quadratic equations and so on by hands-on activity, visualisation and symbolisation.

To built mathematics education on this theory is a big task for nowadays researches. Nakahara in 2007 read a keynote paper: Cultivating

Mathematical Thinking through Representation (Nakahara, 2008). He made a detailed list of representation modes:

S2. Symbolic representation

Representations used in mathematical notation, such as numbers, letters, and symbols

S1. Linguistic representation

Representations that use everyday languages, such as Japanese or English

I. Illustrative representation

Representations that use illustrations, figures, graphs, and so on

E2. Manipulative representation

Representations such as teaching aids that work by adding the dynamic operation of objects that have been artificially fabricated or modelled

E1. Realistic representation

Representations based on actual states and objects (Nakahara, 3. p.)

Illustrative or iconic representation could play central role in learning process. We used the results of researches are going in our department about traditional and computer based tool for teaching little children. (Vasárhelyi, 1999, Berta, 2003). Pictures help deep understanding, they give examples of hands-on activity and they give strong motivation to speaking about: What happened at the lesson? In the early childhood narrative learning environment is the way toward to paradigmatic thinking (Bruner, 1991).

Social background of students affects their school results - we know it from everyday experience and from big statistical studies. But what about mathematics? Some very poor children became famous mathematician, but in the same time the mathematics is the biggest gape of finishing the school for low SES pupils. They have special education need, even they are gifted (Bishop, 1994). Intensive usage of iconic mode can help low SES pupils (Murray, 1995).

## **Experiment**

In the framework of international researches<sup>1</sup> we started to work with multigrade schools at Eötvös University (ELTE), Hungarian head of the projects is Andrea Kárpáti from ELTE.

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<sup>1</sup> NEMED, <http://www.nemed-network.org/>

Hungarian multigrade schools have four grades of elementary school, where two grades learn together in one classroom.

### *Population*

We started to work with 16 multigrade schools. We sent proposals of this program over 800 schools, and 18 schools answered that they want to participate. At the end 16 was encountered. It was almost a random list, because the motivation of the teachers was so different: some of the teachers were very interested in new methods of education, some of them were sent by their head of the school, somebody wanted to do anything before closing her school. We organised in-service trainings in these schools and also at the university. We organised a half year long developing program for the 16 schools. In the second part of the project we were worked with four schools, which were chosen by university.

Number of pupils was 243 in the 16 schools and 83 in the 4 schools. The pupils age was between 6-10. Every teachers had academical degree of education.

### *Learning by picture series, The stories of a teddy bear family*

Presentations are constructed by me and are designed by Ákos Schlosser and Judit Schlosser helped the work, too. They are saved at university homepage.

In the first part we had four presentations

- a. Glasses, about measuring
- b. Excursion, practising spatial orientation
- c. In the past, about Egyptian number writing
- d. Travelling, about data handling

In the second part of the developing program we made new presentations. One of them is about polyhedrons.

### *Data collection*

We collected pupils' feedback, teachers' reports and we visited sometime the schools.

### *Discussion*

The pupils and the teachers are waiting very much the next PowerPoint presentation on teddy bear family The pupils like solving the tasks and the problems given by pictures, the teacher integrate our supplement learning

material in their classroom work. These are the elements of our success, but our picture series are not examples for the teachers. Teachers learnt making PC presentation, they made nice shows on social life of the school, but they do not do learning material, they are waiting for our work. We think, using independently Bruner's representation modes is a too hard task for the elementary teachers. The teachers need continuous help to solve didactic problems of teaching of low SES gifted pupils.

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