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VIEW ON SOME THEORIES OF MATHEMATICS EDUCATION

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Abstract. In this article we present some theoretical approaches in mathematics education, especially in Poland and Hungary, with practical examples. We also describe some aspects of using ICT in mathematics education and cooperative learning.

1. Introduction

Didactics of mathematics is very young research field which will find its position in the system of research subjects. According Szendrei [10], didactics of mathematics is a specific research field which develops actual questions of mathematics education, understanding and character of mathematical notions in teaching process. A lot of questions are connected with other research subjects such as psychology, pedagogy, sociology, philosophy and so on. For this reason we can use in didactics of mathematics the results and methods of other research subjects. Szendrei formulates the following goals for research in mathematic education:

- Theoretical background of teaching and learning mathematics.
- Construction and structure of mathematics and their influence on process of gaining knowledge in mathematics education.
- Difficulties of the process of gaining knowledge in mathematics education.

- Education of mathematics as a cognitive process.
- Heuristics and discovering as a tool of knowledge and process of education.
- Relationship between mathematics, culture and community.
- Social processes in teaching and learning mathematics.
- Behavior, attitudes and thinking of pupils in mathematic education.
- Modern technologies, their possibilities and borders in mathematics education.

2. View of Tamás Varga

Tamás Varga in his work [12]:

- would like to find suitable models for teaching set theory, algebra, functions and logic,
- would like to find complex view by building of notions,
- recommends to use open problems in which a pupil tries to find suitable model for problem solving,
- recommends that the teaching process must be based on the internally motivation of pupil through the suitable motivational tools (games, problems of real live, using history of mathematics and so on).

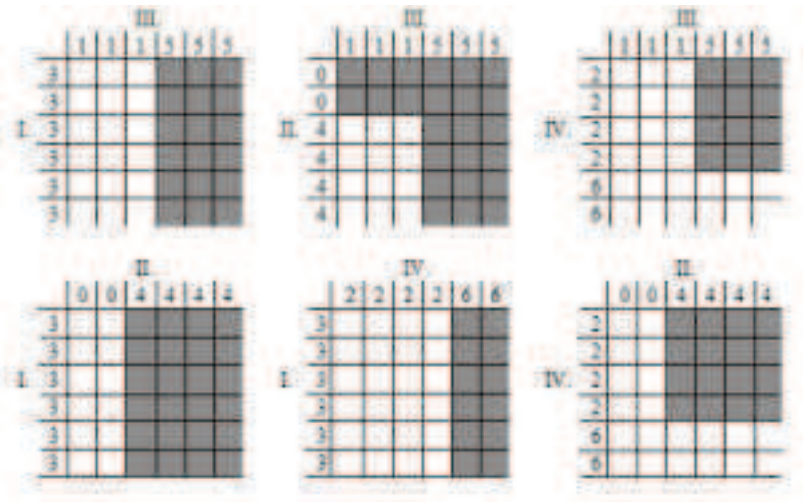

Figure 1

Pálfalvi [7] shows one example used by Tamás Varga from school probability: We have four cubes with following signing of the walls:

I: 3, 3, 3, 3, 3, 3
II: 0, 0, 4, 4, 4, 4
III: 1, 1, 1, 5, 5, 5
IV: 2, 2, 2, 2, 6, 6

We have now the game for two players. The player wins, if he throws the bigger number. Game situations according to different cubes can be shown by the following schemata (the grey squares are for the situations when cubes in columns win, see Figure 1).

From the tables we see that the cube IV is "better" than the cube I and the cube II is "better" than the cube IV, but the cube I is "better" than II. (The relation is not transitive). The relations between cubes are shown by the following schema (the arrow is oriented to the "better" cube):

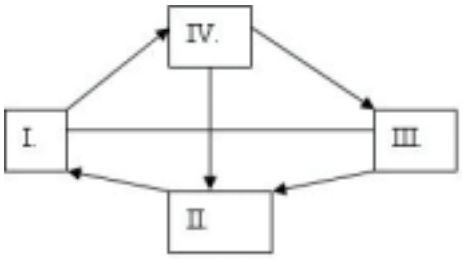

Figure 2

This example illustrates how it is possible to meet paradoxes in stochastics, which was also shown by Płocki [8].

3. Cooperative learning in mathematics education

Cooperative learning has many applications in mathematical education. According to Jablonský [3], this learning has five essential principles:

1. Development of positive interdependence.
2. Assurance of face-to-face promotive interaction.
3. Strengthening of individual accountability and personal responsibility.
4. Improvement of interpersonal and small groups skills.
5. Reflection of group processing.

Nowadays this type of learning is very important for development of social skills of pupils. Some educational projects concerning creation of teaching materials for GeoGebra Wikipedia can be realized in effective way only in the case if these materials are prepared by groups of pupils.

4. ICT in mathematics education

According to Oldknow and Taylor [6], we can identify at least three reasons for promoting the integration of Information and Communication Technologies (ICT) in mathematics teaching at schools:

Desirability: From the students side, the use of ICT may stimulate their motivation and curiosity; encourage them to develop their problem-solving strategies. From the teachers side, the use of ICT may improve their efficiency, release more time to address students individually, stimulate re-thinking their approach to teaching and understanding.

Inevitability: Many fields of publishing have moved from printing to electronic form. This applies to conference proceedings, reference works such as encyclopaedias, small-circulation textbooks, special journals, etc.

Public policy: In Slovak National Curriculum ISCED 1, 2 and 3 there is defined that Mathematics as a subject belongs to the group "Mathematics and Working with Information".

According Gunčaga, Fulier and Eisenmann [2], implementation of ICT in education brings more open questions which are common for mathematics education:

- The use of which technological tools in learning mathematics are important and relevant to different groups (primary schools, high schools and universities)?
- What role can different ICT instruments play in making education more efficient?
- What effects do the new tools and technologies have concerning the cognitive processes?
- What has to be changed in the curriculum of school mathematics?
- How has the use of ICT changed the curriculum of school mathematics so far?

In last years the open source software GeoGebra has been often used. Nowadays it is accessible in 50 language versions. This system joins together the computer algebra system, dynamical geometrical software and spreadsheet. Its big advantage consists in user friendly character and possibility to create dynamical HTML WebPages with interactive pictures (see www.geogebra.org). Teaching materials developed by this software is possible to find on the GeoGebra Wiki. Its Slovak version is step by step created now, and we are interested in cooperation in this developing process with teachers in schools, pupils and students – future teachers at universities. Some examples can be found in [1, 4, 5, 11].

5. Conclusions

In the teaching process, the teacher plays an important role. ICT does not change this, because the computer and software are only tools, not goals. Pólya [9] formulated the following ten practical rules for the mathematics education. The teacher should

1) have interest in professional character of his teaching.

2) know professional character of his teaching.

3) know the center of attraction of teaching and the fact that the best way for the teacher is the way which he finds himself.

4) know the images of the pupils. What do they expect? What is difficult for them?

5) not only give the pupils professional knowledge, but also develop their working abilities (correctness of the algorithm and its steps).

6) teach pupils how to discuss.

7) teach pupils how to prove.

8) develop using by pupils heuristic methods for problem solving, find non-visible general rules.

9) not show the pupils the solution of the problem, but motivate them to find their own solution.

10) not overextend the pupils by the lot of teaching material, but motivate them to learn with understanding.

Acknowledgements

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