Specific needs in mathematics, part 3 Solving word problems

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Word problems

- By word problem we mean a task
  - which is expressed verbally (for example: I think of a number, if I subtract 7 from it, I get 15. Which number am I thinking of?)
  - which contains a real or pseudo-real context
- Successfully solving mathematical word problems requires both mental representation skills and reading comprehension skills.

Problems of pupils with reading and understanding the text

- Reading the word problem task and transcription it into the mathematical language is a problem for many children.
- Children often have difficulties with reading the whole text, understanding it, and with coping with the length of the text.

Solving word problems

- George Polya designed a four-step method to solve all kinds of problems:
  - Understand the problem,
  - make a plan,
  - execute the plan,
  - look back and reflect.

Understand the problem

- Figure out what is being asked. What is known? What is not known? What type of answer is required? Is the problem similar to other problems you've seen? Are there any important terms for which you should look up definitions?

Make a plan

- Come up with some strategies for solving the problem. Common strategies include making a list, drawing a picture, eliminating possibilities, using a formula, guessing and checking, and solving a simpler, related problem.

Execute the plan

- Use the strategy chosen in Step 2 to solve the problem. If you encounter difficulties using the strategy, you may want to use resources such as the textbook to help. If the strategy itself appears not to be working, return to Step 2 and select a different strategy.

Look back and reflect

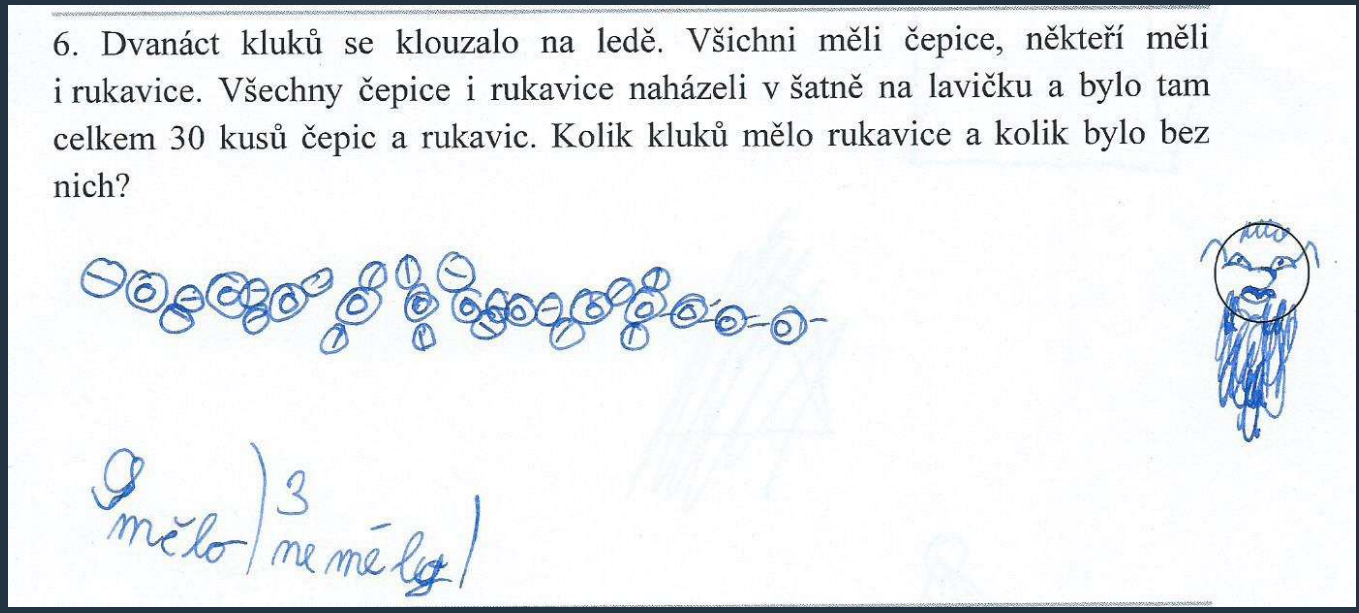
- The task is to find a way to check your answer. Another part of Step 4 is to evaluate the method you used to solve the problem. Was it effective? Are there ways you could have made it more effective? Are there other types of problems with which you might be able to use this type of solution method?

Try out which solution strategy you use

- Twelve boys were sliding on the ice. All had caps, some even gloves. They threw all the caps and gloves on the bench in the dressing room and there were a total of 30 caps and gloves. How many boys had gloves and how many had none?

Try out which solution strategy you use

- The solution of a 5th grade pupil: a solution supported by a graphic representation



Problems of pupils with word tasks

- In solving word problems and application tasks, we encounter situations in which the child solves simple tasks involving the basic operations with natural numbers without problems, but have difficulties with solving complex word problems.
- Children have problems with relations “n more (less)” and “n times more (less)”.
- Other problems are with the analysis of the task and a correct mathematization.

Problems of pupils with word tasks

- **Verbal communication**
- During verbal communication, both teachers and pupils should focus on essential phenomena, on the facts that are important for the given notion or topic.
- Children should understand the notions used.

Problems of pupils with word tasks

- **Graphic communication**
- Cultivation of written presentation is the most important means of graphic communication.
- This concerns especially mathematical notes (e.g. writing of the numbers, notation for algorithms, written operations). Nevertheless, the layout of the calculation in itself does not guarantee understanding and mastering the topic.

Problems of pupils with word tasks

- **Communication in symbolic pictures**
- Children can use pictures to model mathematical notions and relations.
- Approaches to the solution should be free of any formalism, so that the pupils have as much space for solving the problem as possible.
- If the pupils have their own insights into the task and solve it without formal notation, we accept their solution.

Principles of solving word tasks

- Analysis of the task – pupils clarify for themselves the relationships between the given facts and the ones sought.
- Graphical representation
- Mathematization
- Formal solution
- Interpretation of the results
- False–true test

Solvign strategies

- Experiment (trial and error method)
- Controlled experiment
- Artihmetic strategies
- Algebraic strategies

We will focus on these two

Simple word problems

- The problems which have one operation to make.
- A proper graphical representation can be very helpful for pupils.

1. *Patrick had 7 beads, he won 5 beads. How many beads did he have after the game?*
2. *Patrick had 7 beads, Tom had 5 beads more than Patrick. How many beads did Tom have?*

Composed word problems

- A solver needs more than one operation to solve it.

3. *Patrick had 12 beads, Tom had a third more beads than Patrick. How many beads did they have together?*
4. *Patrick and Tom had together 35 beads. Patrick had 7 beads more than Tom. How many beads had Patrick?*

Word problems with distractor

- A key word is a word that guides the pupil to the correct mathematical operation. A distractor is a word that prompts the pupil to do an incorrect operation.

5. *Roman has 15 cars, and that is three times more than Peter has. How many cars does Peter have?*
6. *Together, Roman and Peter have 20 cars. Peter has three times less cars than Roman. How many cars does each of the boys have?*

Literature

- https://happynumbers.com/blog/solving-word-problems-in-mathematics/
- https://www.opepp.org/lesson/hsdm-unit7-tool-for-field/