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Interesting textual tasks as creative tools

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Abstract

This study aims to promote the use of interesting textual tasks during everyday mathematics classes, especially during solving exercises. Consequently, this should contribute to the possibility for students to obtain long-lasting knowledge while stimulating the process of creative thinking and understanding. Further to encourage students to investigate mathematical concepts on a deeper, more creative level, we use rich and interesting problems that can be explored on a variety of levels. This process should be well planned, though-out and specified. Well-chosen tasks and discussion can not only improve and empower the process of individualisation and differentiation during doing mathematics but also stimulate the process of creative thinking and motivate students in their current learning. These interesting tasks can be solved in a variety of ways and students should be given a chance to explain their reasoning to each other. One interesting task can be used as a springboard for several others.

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1. Introduction

Thinking is a process of complex information processing, the end-results are 'concepts—words' and 'thinking—sentences'. The teaching process involves empirical and theoretical thinking, being a complete cognitive process through which students acquire the social and historical experience of humanity. Understanding that students adopt this experience in a short, generalised, structured and systemised form during the process of learning, is a problem for the corresponding part of empirical and theoretical thinking of learning through which this basic task of schools can be achieved. Dialectical and bidirectional transition between the empirical and theoretical, the concrete and abstract takes place during the educational process. This dialectical transition encompasses the educational process as a bidirectional process, and the educational activity as a cognitive activity, which flows into the students' cognition.

Understanding is of great importance when trying to solve a teaching task. It is an active, multifaceted cognitive activity aimed at stating and discovering abstract connections between the new in the task and imminent from the various subsystems of knowledge. Because of this process, a new configuration of subsystems is born, which recognises (aha-moment) the adoption of the new from the given task.

Development of thinking and in particular, the development of mental qualities—width, depth, independence, logic, mobility, concreteness, criticism, speed, creativity, target orientation, generalisation, insight, etc., is one of the most important and consistent goals and objectives of the teaching.

School mathematics, due to its specificity, possesses great opportunities for scholar's intellectual development which can be fully accomplished through prior organisation of the educational process. From this point of view, the conclusion of Vygotsky–Leontev's school of psychology according to which the child's development occurs in a process of adopting historically created mathematical knowledge, skills and habits is extremely important.

2. Interesting logical tasks

Instead of a definition of interesting logical tasks, I would use—Every task designed to stimulate critical parts of the brain including the areas that affect cognitive development.

Mathematical tasks are intertwined with the educational aims, intentions and interactions between the teachers and the students begin in the moment they enter the classroom. Therefore, tasks should not be considered as problems written in math textbooks or in the teachers' preparation, but should be considered as a classroom activity as well. Defined as activities, mathematical tasks in the educational process become connected and included in both training and teaching. I propose puzzles, problem solving tasks and tasks for promoting mathematical thinking.

2.1. Puzzles

Solving a puzzle requires you to think, process and learn. A puzzle is a problem or an enigma that challenges ingenuity. On one hand, they are a form of entertainment, simply having fun, but on the other hand, they can stem from serious mathematical or logical problems, which give the brain a chance for a tough challenge. Solutions to puzzles may require recognising patterns and creating a particular order.

Bulleted lists may be included and should look like this:

- First point

- Second point
- And so on

2.2. Problem solving tasks

In problem solving games, the greater the choice of creative concepts, the better is the chance to find an answer. If your first idea fails to solve the problem, you can always try another. It is important to avoid mental walls known as conceptual blocks, which can prevent us from finding even the simplest and most obvious answer. Sometimes we create those conceptual blocks, while other times, they stem from incomplete information with emphasis on the wrong detail or deliberately misleading directions.

2.3. Tasks for promoting mathematical thinking

Tasks for promoting mathematical thinking include:

- Symmetry tasks
- Logical tasks
- Tasks using negation in the formulation
- Open-ended problems

3. Textual tasks

The topic of textual tasks is a fundamental topic in mathematics teaching and we have to use functions of textual tasks for the following purposes:

- Encourage mathematical thinking
- Stimulate curious children who want to explore
- Provide a mathematical record of problem situations and formation of mathematical models
- Foster love for mathematics and problem situations
- Encourage interest in challenges and assessments
- Stimulate creative thinking and students' motivation in their learning
- Acquiring long-lasting, structural knowledge among students

3.1. Stages in solving textual tasks, Didactical scheme according to George Polya

The following are the stages involved in solving textual tasks:

Stage 1: Understand the task (read the entire task or parts of it, drawing, sketch, symbolic representation of the task). This is the invisible stage and teachers usually skip it.

Stage 2: Build an idea and devise a plan to solve the task (this stage is connected with understanding the task).

Stage 3: Practical implementation of the devised plan (mathematical operations and solving the equation).

Stage 4: Examine the obtained solution (creative and interesting questions related to the task are asked additionally) such as: Is the obtained result correct? Why?

3.2. Examples

Example 1: Marko has got three balloons and Mila has got five balloons. How many balloons do they have together?

What is known in the task? Marko has got three balloons and Mila has got five balloons.

What is unknown in the task? How many balloons do they have together?

How do we find the unknown? By addition

How do we write down the calculation? 3 + 5

How do we calculate? 3 + 5 = 8

How do we write down the answer to the given question? Marko and Mila have got eight balloons together.

Example 2: There are eight swallows in the apple tree and four in the plum tree. How many more swallows are there in the apple tree than in the plum tree?

What is known in the task? There are eight swallows in the apple tree and four swallows in the plum tree.

What is unknown in the task? How many more swallows are there in the apple tree?

How to we find the unknown? By subtraction

How do we write down the calculation? 8 − 4

How do we calculate? 8 − 4 = 4

How do we write down the answer to the given question? There are four more swallows in the apple tree than swallows in the plum tree.

Example 3: Maja has got three balls, whereas Iva has got two more than her. How many balls do they have together?

What is unknown in the task? Maja has got three balls, whereas Iva has got two more than her

What is unknown in the task? How many balls do they have together?

How to we find the unknown? By addition

How do we write down the calculation? 3 + 5 = (3 + 2 = 5)

How do we calculate? 3 + 5 = 8

How do we write down the answer to the given question? Maja and Iva have got eight balloons together.

Example 4: Is 25% of 15 more, less or equal to 15?

S: It is less than 15.

T: How do you know? Wrong explanation for right answer, deserves discussion.

S: By subtracting: 25% − 15 = 10, and 10 is less than 15. Really? Can you give me another explanation, please?

3.3. More unsolved examples

Example 1: Which number is four times greater than 16?

Example 2: Five balls cost 85 denars. How much does one ball cost?

Example 3: Nela has got 564 denars. She got 236 more denars from her mother. She wants to buy a bag that costs 1,000 denars. How much more money does she need?

Example 4: 246 letters and 85 more postcards than letters were received in the post office. 110 fewer packages than letters were received. How many total items (letters, postcards and packages) were received in the post office?

Example 5: Calculate the sum of the number 5 and its predecessor.

Example 6: Find the difference between the number 9 and the predecessor of 3.

3.4. Mathematical tricks

Think of a number. x

Add 5. $x + 5$

Multiply it with 2. $2(x + 5) = 2x + 10$

Subtract 8. $2x + 10 - 8 = 2x + 2$

Divide it with 2. $(2x + 2) : 2 = x + 1$

'Tell me the number you got, and I'll tell you the number you started with'.

3.5. Asking students to explain and justify their mathematical thinking

Students who are required to explain and justify their own thinking achieve greater success compared to students who are not asked to explain how they solve the task. Here is an example of how a student can explain and justify his thinking:

$23 + 28 + 25 + 24 = 100$

23, 28, 25 and 24 are four numbers that are close to 25, the sum of which is 100. If I take away 2 from 28 and add them to the number 23, I get 25. If from the remaining 26 I take away 1 and add it to the number 24 I get 25. Now I have four 25s, i.e. $25 + 25 + 25 + 25 = 100$.

Also, the student's explanation enables us to observe whether he/she understands the implemented procedure and whether he/she can replace it or connect it to another procedure.

3.6. Tasks involving thinking

Example 1: There are six people in a room. Each and every person shakes hands with each other only once. How many handshakes will there be?

Example 2: There are 470 students going to a play. One teacher is assigned for every 30 students. How many tickets are needed? How many tickets will be needed if 21 students are absent? Why? Explain your answer.

3.7. Goals

Students should know how to solve the task, and also, they should be able to modify new tasks, changed conditions or other parts of the solution to the task. Students think and successfully solve not only math problems but also other real, problem situations.

- Students learn to communicate mathematically
- Students think mathematically and creatively
- Students learn to value mathematics and seek it in their surroundings
- Students gain self-confidence that they are successful and know mathematics

3.8. Homework

Example 1: Write down a number between 10 and 19. Add 70. Multiply it by 10. Add 2.

Add up the digits of the obtained number. If you have added correctly, you should get the number you thought of at the beginning. Using what we have learnt so far, prove that this property is valid for any number from 10 to 19.

4. Conclusion

In conclusion, the degree to which this aim is fulfilled determines the level and effectiveness of the teaching process for the overall development of the student's personality. An important psychological and pedagogical condition for the development of quality of thinking is students' reflexive understanding of thinking as a process and their own mental capabilities. Admittedly, this complex mental activity is not only intellectual, but also personal, and 'serves' the overall development of the individual and leads to the formation of intellectual reflection.

Tasks classified as interesting tasks should be used during mathematics lessons, but after the lessons too. The main purpose is to provide students with increased possibilities for thinking, reasoning, mathematical communication and solving problems. We cannot expect the learning in the classroom to become more extensive or richer unless students are regularly, actively and productively become a part of solving cognitively challenging tasks.

Interesting tasks have to be an optional choice, but we need more mathematics magazines, logical computer games, open-ended problems, homework, because knowledge is more valuable if we can implement it under different conditions and in different situations i.e. new situations.

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