

Mathematical Literacy Assesses Student Knowledge

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Abstract

In this article, we highlight the importance of the task creation of mathematical literacy and show that it is not always a simple process. We present that the creation of tasks from mathematical literacy is an evaluation of mathematical competencies, which the teacher knows and later on while solving problems the student can effectively use this knowledge in problematic situations. Mathematical literacy assesses students' abilities to make connections between different topics in mathematics and to integrate real information from everyday life. It's never too late to build math skills and helps students to decipher what they definitely need to understandings of mathematics in their everyday life.

Keywords: mathematical literacy, tasks for student, knowledge.

Classification: D84, M24, M65

Introduction

What does mean mathematical literacy? The process of developing literacy skills is fairly well-known during the childhood. First we learn sounds, then letters, writing, reading and at the end we have a sense create our language. During our life are very important literacy skills, especially mathematical because it helps us to solve real world problems. For the purposes of PISA 2015, mathematical literacy is defined as follows:

„Mathematical literacy is an individual's capacity to formulate, employ, and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena. It assists individuals to recognize the role that mathematics plays in the world and to make the well-founded judgments and decisions needed by constructive, engaged and reflective citizens“(1).

Finally, modeling tasks are social, reflecting real-world practices, whereby problem solving takes place via a process of interpreting, discussing, explaining, analyzing, justifying, revising, and refining ideas (2).

How to create tasks of mathematical literacy?

To create typical mathematical tasks is not a difficult process for a teacher with experiences where he/she can practice the concrete rules learned by students. While talking about

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exercises from mathematical literacy, students do not have the connection of relationships, which they need to solve, they have to find them out in the context of each particular task, have to know how to read with comprehension and link the problem with mathematical relationships. Often there is information that is not relevant with the problem and the student should be able to analyze them. Tasks from mathematical literacy should give a recipe how to react in real life situations so the student will explore the beauty of math. Each person can create tasks from mathematical literacy in terms of mathematical competencies. We can say that the creation of tasks from mathematical literacy is an evaluation of mathematical competencies, which the teacher knows and later on while solving problems the student can effectively use this knowledge in problematic situations. Mathematical literacy, it is a sum of mathematical competencies, knowledge of math, which an individual is able to use in various situations. Context of these tasks is natural for the usage of math, influence the problem solving and its interpretation in a difference when comparison with tasks which occur mostly in math textbooks, which main aim is to practice mathematical skills. We would like to show how to create or redefine typical mathematical tasks into tasks of mathematical literacy.

Task 1 is from Thematic content: Terms, functions, tables, diagrams, Thematic unit: Solving equations, systems-linear (3). The student's goal is to solve word tasks, which require solving easy equations with an occurrence of one unknown unit or a system of equations with two unknown units, which could be converted to the one equation to model real life problems with usage of mathematical language and interpret results of mathematical problem into real situations.

Task 1.1

Typical mathematics task: Solve the scheme!

$$10x + 7y = 425$$

$$15x + 14y = 783$$

Solution: $x = 13,4$ and $y = 41,6$

Task 1.2

Exhibition of typical mathematical task as context task:

Text:

The water is flowing to the reservoir with two taps. With the first one, it will flow 80 liters in hour, with the other one only 56 liters per hour. After half an hour of impregnating, the water in reservoir had a temperature of 25 degrees Celsius. If we impregnate water from one tap 45 minutes and from other tap 1 hour, the impregnated water will have temperature of 27 degrees Celsius. Determine the temperature of water of every tap (We assume that the temperature of water from taps does not change while the whole time of impregnation).

Solution: $x = 13,4$ and $y = 41,6$

Task 1.3

Exhibition of typical mathematical task as the task from mathematical literacy:

Text:

Mr. John bought a 165 liters bathtub volume. He fulfilled the bath in two-thirds of the volume with a bathing temperature of 40 °C. How many liters of hot water does he need? How many euro's he pay for whole bath? Use table 1.

Table 1:

Type of water	Price of water 1 m ³ in €	Temperature of water in °C
Cold water	2,56	12
Hot water	12,11	60

Solution: He needs 64,2 liters of hot water. He pay 0,895 €.

Task 2 is from Thematic content: Combinatory, probability, statistics, Thematic unit: Combinatory. (3) The students have a goal to use different strategies of finding out the possibilities by inscribing or systematic inscribing of possibilities or combinatory rule of sum and multiplication.

Task 2.1

Typical mathematics task:

Text:

How many six digit numbers can we create from digits 1,2,3,4,5,7,8 in a way that digits 2 and 3 cannot stand next to each other?

Solution: 480

Task 2.2

Exhibition of typical mathematical task as context task:

Text:

Guitar strings are marked as **E, a, d, g, h, e**. In which different ways is possible to order these strings if strings **E** and **e** cannot stand next to each other.

Solution: 480

Task 2.3

Exhibition of typical mathematical task as task from mathematical literacy: Text:

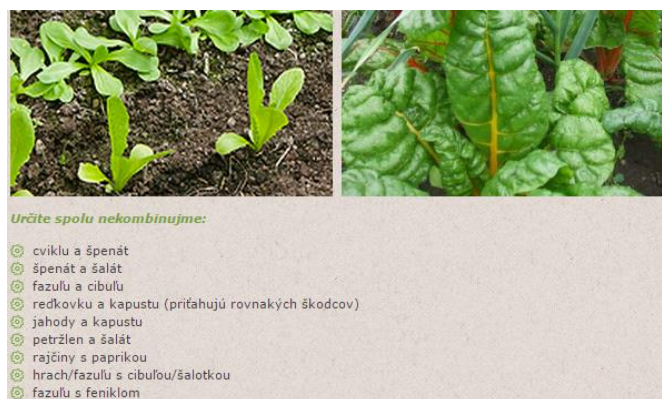


Figure 1: Vegetables in the garden (<http://www.allworks.sk/tipy-a-triky/ako-skombinovat-rastliny-v-zahrade-pri-sadeni>)

Mr. John has decided to plant his garden and wants to plant a beet, tomato, pepper, been and onion there. On the internet, he found information, which plants cannot be combined together. How many ways of ordering his plant in garden does he have if he will all plant them next to each other to rectangle ground plan and he wants to start for sure with an onion?

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Solution: 16

Conclusion

In the task, 1.1 and 2.1 students are required to solve the problem by using their memory without logical instructions. Students do not have a clue of why this memorized method is important for their life. Tasks 1.2 and 2.2 give students the opportunity to state the relational pattern in words or mathematical symbols. Questions require students to solve the question that leads to a correct answer. Last tasks 1.3 and 2.3 use mathematical literacy. Students need enough time to understand and analyze the question to be able to choose the right strategy for solving the particular problem. They have to go deep inside into their mathematical knowledge. Mathematical literacy assesses students' abilities to make connections between different topics in mathematics and to integrate information in order to solve simple problems and to make connections among the different representations. In these mathematical literacy tasks, students analyze, develop and interpret their own models and strategies and they are able to make mathematical arguments, including generalizations.

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