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# Importance of Competency Levels in Enhancing Students' Mathematical Literacy

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**Abstract:** This article discusses the importance of competency levels in enhancing students' mathematical literacy.

**Keywords:** mathematical literacy, competency, knowledge, skills, abilities, interactive and active learning technologies.

In today's rapidly developing society, enhancing the communicative abilities of the younger generation in the context of a market economy through mathematical literacy is considered one of the pressing issues.

Mathematical literacy refers to students' abilities to identify problems that arise in reality and solve them using mathematics; express these problems in the language of mathematics; solve these problems by applying mathematical facts and methods; analyze the used methods; interpret and explain the results obtained in consideration of the posed problem; shape the results, express them, and record them.

These tasks relate to various aspects of life and provide information about real problematic situations in school life, society, students' personal lives, professional activities, sports, and more. These tasks require more or less mathematics to solve. The mathematical preparation of students is aligned with one of the following four content areas chosen based on the consensus of participating countries: quantities; space and shape; change and relationships; uncertainties.

The state of students' mathematical literacy is described not only by their possession of materials in the chosen content area but also by the level of development of their "mathematical competency."

Students' mathematical competency is assessed as a "set of knowledge, skills, experiences, and abilities" in mathematics, providing the ability to successfully solve various problems requiring the use of mathematics.

In research on the methodology of teaching mathematics, three levels of mathematical competency are identified: the level of reconstruction; the level of establishing connections; the level of reasoning.

These research studies also identify the following types of activities for determining the level of mathematical competency: a) reconstruction (repetition) of definitions and calculations; b) establishing the necessary connections and integration for solving the problem; c) mathematical modeling, logical thinking, generalization, and intuition.

These activity types are presented in ascending order. However, this does not mean that mastering the previous types is required to perform the next type. For example, mastering calculations is not a prerequisite for starting mathematical thinking.

1. The first level of competency: reconstruction, description, and calculations. Competencies of the first level are primarily tested in many standardized tests in the form of tasks such as multiple-choice questions. This level of competency includes recalling various facts, reconstructing properties, recognizing equivalent mathematical objects, implementing standard algorithms and procedures, and using standard methods and algorithmic skills.

**Problem 1:** Bicycles with two wheels and tricycles with three wheels are being sold in a toy store in equal quantities. What could be the total number of wheels for all bicycles? A) 16; B) 24; C) 25; D) 28; **Solution:** Since the number of bicycles and tricycles is equal, the total number of wheels must be a multiple of 5. The correct answer is C. 25.

**Problem 2:** A customer bought a winter coat for 300,000 som during a discount sale, which was originally priced at 750,000 som during the season. What percentage of the money did the customer save? A) 60%; B) 150%; C) 90%; D) 87.5%; **Solution:** Since the discount price is 450,000 som less than the seasonal price (750,000 - 300,000 = 450,000), we need to find out what percentage of the seasonal price this difference represents, i.e., what percentage of 750,000 is 450,000. The correct answer is A.

**Problem 3:** Three friends decided to buy a tent for their trip. The first friend paid 60% of the price of the tent, the second friend paid 40% of the remaining price, and the third friend paid the last $30. How much does the tent cost? A) $120; B) $150; C) $90; D) $125;

**Solution:** Let's assume the price of the tent is x dollars. Then the first friend paid: 0.6x, the second friend paid: - 0.4x×0.4 = 0.16x, and the third friend paid x - (0.6x + 0.16x) = 0.24x dollars. According to the condition, the third friend paid $30. Therefore, 0.24x = 30 or x = 125. The price of the tent is $125. The correct answer is D. $125.

2. The second level of competency: establishing necessary connections and integration. Competencies of the second level include identifying connections between different areas, sections, and topics of mathematics to solve posed simple problems. These tasks cannot be classified as standard tasks, but they require deeper mathematical knowledge. At this competency level, students should be able to present the information given according to the task conditions and pose the problem accordingly. Establishing connections between materials from various sections of mathematics requires students to distinguish concepts, conditions, proofs, confirmations, and examples and relate them to each other.

**Problem 1:** To expand their business, two partners allocated 50,000 monetary units. Due to changes in market prices, the first partner increased their share by 30%, and the second partner increased theirs by 70%. As a result, their total capital amounted to 81,000 monetary units. How much did each partner contribute? **Solution:** This situation can be modeled as a system of linear equations with two variables. Let's say, x is the first partner's share, y is the second partner's share. After the price increase, the first partner's share becomes 1.3x, and the second partner's share becomes 1.7y. As a result, we have the following system of linear equations:

Solving this, we find that the first entrepreneur contributed 13,000, and the second contributed 68,000 monetary units.

**Problem 2:** Three friends played a game. The game host distributed cards numbered from 1 to 8 to two players. The first player received 3 cards, and the second received 5 cards. As a result, the sum of the numbers on their cards was the same for both. The third participant made the following statements: 1) the second player has three odd-numbered cards; 2) the card with the number 2 is with the second player; 3) the card with the number 1 is not with the first player. Is he right?

**Solution:** Since the sum of the numbers on the cards is the same for both players, they must each have half the sum of all numbers from 1 to 8. Therefore, the sum of the numbers on their cards is equal to half of (1+2+3+4+5+6+7+8=36), which is 18. Therefore, the first player, who has three cards, could have the cards numbered 5, 6, and 7 or 3, 7, and 8. Because in other cases, the sum of the numbers on the cards would be less than 18. Then the second player could have cards numbered 1, 2, 3, 4, and 8 or 1, 2, 3, 5, and 7 or 1, 2, 4, 5, and 6. Thus, the first statement is incorrect, the second is correct, and the third is also correct. Answer: 1) no, 2) yes, 3) yes.

**Problem 3:** A mathematician witnessed a road accident and remembered the following: The guilty car's number is a four-digit number that is a multiple of 19 and ends with the number 19. How many cars do the traffic police need to check to find the culprit?

**Solution:** Let's say the car number is represented by the number A. Then A is also a multiple of 19. On the other hand, A - 19 = k × 19 = b × x × 100. Since 19 and 100 are coprime numbers, the hundreds digit must also be divisible by 19. There are only five such numbers: 19, 38, 57, 76, and 95. Therefore, only five cars with the numbers 1919, 3819, 5719, 7619, and 9519 need to be checked.

3. The third level of competency: mathematical modeling, logical thinking, generalization, and intuition. At the third level of student competency, mathematical modeling of the presented situation is required: analyzing and studying the information given in the problem condition, independently interpreting the mathematical model, using mathematics to solve the problem, and finding a solution through mathematical reasoning, including necessary mathematical proofs, evidence, and generalizations. This activity involves critical thinking, analysis, and reflection.

**Problem:** Bank A exchanges 1 dollar for 3000 dinars (a hypothetical currency unit) and retains a service fee of 7000 dinars regardless of the amount exchanged. Bank B exchanges 1 dollar for 3020 dinars and retains a service fee of 1 dollar. A traveler determined that it makes no difference to him which bank he uses to exchange a certain amount of money. How much money does he want to exchange?

**Solution:** Let's assume the traveler wants to obtain x dollars from the bank. In that case, he will give Bank A (3000x + 7000) dinars, and to Bank B, he will give 3020(x + 1) dinars. According to the condition, we have the following equation: 3000x + 7000 = 3020(x + 1), Solving this, we find that x = 199. Thus, the traveler wants to exchange a total of 3020×200=60400 dinars. Answer: The traveler wants to exchange 60400 dinars, for which he will receive 199 dollars.

Based on the above analysis, the following requirements can be set for the development of students' mathematical competencies: searching for and using definitions, formulas, and other mathematical facts from textbooks and reference materials; applying knowledge, skills, and graphical skills related to algebra in various life situations; collecting, analyzing, processing, and synthesizing data; using mathematical formulas, independently creating formulas expressing the relationship between quantities based on the generalization of specific cases; applying acquired algebraic substitutions and functional graphic representations and visualizations to express and analyze relevant objects in the surrounding environment or other subjects; being able to justify their point of view, participate in its discussion, and make logically correct conclusions; working with mathematical texts (analyzing and extracting necessary information), clearly and correctly writing their thoughts using mathematical terms, symbols, and symbols, expressing them orally and in writing; solving practical life problems, using necessary reference materials and calculation tools when necessary; analyzing real numerical data and statistical descriptions presented in tables, diagrams, and graphs; using modern information technologies as a tool for solving practical mathematical problems.

Mathematics teachers are advised to pay attention to the following to solve the current situation: correctly and accurately forming mathematical speech; distinguishing and applying mathematical content and methods in solving textual problems and applying them to new situations; converting problem conditions from textual form to mathematical language and revealing the content and essence of these transformations; creating problematic situations to develop students' creative working skills and active mental activities; creating tiered individual engagement trajectories for students during the educational process; appropriately using interactive and active learning technologies in the classroom - project method, game technologies, problem-based teaching, working with text, cluster, poster, cinquain, KWL (Know, Want to know, Learned), fishbone diagram, lotus flower, and other methods.

What should competency-oriented tasks look like? Mathematical problems are considered the primary means of developing logical thinking skills in students. In a typical mathematical problem: any mathematical problem consists of conditions and conclusions; the condition part provides certain quantities, and the conclusion part requires finding unknown quantities; unknowns are found using known quantities. Standard problems: in the condition of a standard problem, the details given are neither too many nor too few for finding the unknowns: standard problems are usually solved in class; standard problems are solved using standard methods seen in textbooks. Non-standard problems: in the condition of a non-standard problem, the details given may be in a non-standard form; there may be more details than necessary for finding the unknowns, or there may not be enough; there are no standard methods for solving non-standard problems, each requires a unique approach; non-standard problems are rarely solved in class. The second component of the mathematical education content consists of activity methods, i.e., skills and abilities. A skill is a mastered method of an activity, while an ability is an automated form of that skill. Students acquire skills through the following stages: identifying the work methods that make up the skill; repeatedly performing these work methods; applying them in practice; checking the results. In conclusion, a mathematics teacher should have a clear understanding of the mathematical skills and abilities included in the curriculum, and deeply understand the stages of their development in students.

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