

Reflection Report

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Submitted At: 2025-04-18 21:49

1. CBC, CBE, and CBA as a System

Thinking on competency-based learning CBC gave me the opportunity to identify six key principles – clear goals, practical application, cross-curricular connections, active engagement, flexibility and authentic assessment – that together paint a picture of effective learning process. The principles of equity, skill focus, clarity of purpose, individual support, deep learning, and flexible learning timing directly impact the efficiency increase in math teaching by shifting the focus from the mere acquisition of knowledge to its real-world application. CBA focuses on the ability to apply knowledge in real-world actions, rather than the mere reproduction of information. The study of relationship between CBC, CBE and CBA allowed us to understand their synergy in the formation of holistic and effective educational system focused on the development of competencies better. CBC sets the direction, CBE ensures implementation through practical activities, and CBA acts as a feedback tool, assessing the achievement of goals. Understanding the roles of each element allows us to design the educational process aimed at forming useful and applicable students' competencies in real life more consciously. At the basic level of advanced training courses for mathematics teachers of target schools, the CBE principle was implemented through the PBL "Classroom Renovation". The goal was to create tasks where teachers organize students to develop mathematical skills (perimeter, area, percentages, prices) through calculating the cost of repairs. Specific mathematical competencies and SMART goals were defined for each stage (e.g., measure the room and calculate the area by the end of the lesson). Learning activities included practical

measurements, price research, calculating the amount of materials and drawing up an estimate in groups with a presentation. The assessment was planned through observation, analysis of calculations and evaluation of presentations according to the criteria of mastering the competencies. This experience showed that PBL effectively implements CBC, CBE and CBA in mathematics, making learning more motivating and practical.

2. Curriculum Development and Learning Goals

The integration of SMART principles and Bloom's taxonomy in the formation of objectives seems valuable, emphasizing clarity of expectations, measurable progress, realism, relevance to life and depth of learning. The use of SMART ensures clarity and measurability, and the alignment with activities and assessment emphasizes practical relevance. Goals as steps to competencies, activities forming them, and assessment defining development: this creates a holistic view of effective learning. At the advanced level of advanced training courses for mathematics teachers of target schools, special attention was paid to mastering and applying the SMART approach when formulating lesson objectives. Feedback analysis and observations during the courses showed that teachers, despite understanding the importance of this approach, encountered a number of difficulties in practice. One of the most common problems was the formulation of a specific goal. Students often focused on describing the activity, rather than the learning result. Thus, goals often included formulations like "to familiarize students with figures," which do not reflect the expected learning outcome. In the process of work, teachers began to actively use action verbs based on Bloom's taxonomy: "will explain," "will solve," "will apply," etc., which allowed them to define the final learning outcome more clearly. The next difficulty concerned the measurability of goals. Abstract formulations, such as "Students will master the topic of the area of triangle," caused difficulties in assessing goal achievement. Teachers came to the conclusion on the necessity to devise tasks and criteria in advance, by which the result could be objectively recorded. For example: "students will be able to solve at least three problems using the area formula." Problem related to the attainability of goals was also identified. Some teachers tried to include an excessive amount of material in one lesson, which caused an overload for both students and teachers. As a result, participants noted the importance of adequate planning, considering the level of preparation of students and time frames.

3. Assessment Quality: Validity, Reliability, and Fairness

Reliability in educational testing is like the accuracy of scales: a student's knowledge should yield similar results upon repeated attempts or under different conditions. This requires a

sufficient number of questions covering various aspects of the topic and clear, unambiguous questions. It is important that the test actually measures the knowledge and skills we intend to assess. This principle, known as validity, means that math test should measure math ability, not, say, reading ability. That tasks should be carefully designed to match learning objectives so that test results are a reliable reflection of the level of mastery of particular subject area. Along with reliability and validity, fairness of assessment plays a key role. Testing should be honest and provide everyone with equal opportunities to demonstrate their knowledge and skills. Test tasks on the topic "Efficient Methods for Solving Trigonometric Equations and Inequalities" for mathematics teachers that I developed as part of the advanced training course represent a practical case for analyzing key principles such as validity, reliability, and fairness. One of the priorities was to ensure content validity. This was expressed in a thorough correlation of the content of test tasks with the module program, which covered a wide range of effective methods for solving trigonometric equations (including algebraic, graphical, and using universal substitution) and inequalities (such as the interval method, introducing an additional angle, introducing a new variable, and using function properties). With regard to reliability, measures were taken to ensure internal consistency by including a sufficient number of tasks and their clear formulating. Fairness was ensured by using accessible professional language and focusing on the mathematical context, and using tasks of different formats (with a choice of one answer, multiple answers, and detailed ones). There was no preliminary piloting of the test, which did not allow us to identify and correct incorrectly formulated or overly complex tasks.

4. Grading and Standard Setting

At courses of "Combinatorics and theory of probabilities" for formative evaluation I developed the test of 5 tasks and checked its reliability among 10 teachers using Cronbachs Alpha. Teachers answers were as follows: dispersions for each task $=0,24+0,21+0,23+0,26+0,22=1,16$ dispersions on total grade $=0,36$ Cronbachs $\text{Alpha} = 5 / (5 - 1) * (1 - 1,16 / 0,36) = 2,75$ The data proofs high reliability according to Cronbachs Alpha. Using the same test tasks, I calculated the tasks complexity index (P-value): Analysis of P-values showed that questions 1 and 3 have optimal (average) complexity for differentiation, question 5 is complicated, and questions 2 and 4 are easy. Now let us define limits for 5 test tasks: For simple scale "Satisfactory/Unsatisfactory": Threshold point for "Satisfactory": 3 correct answers (60%). For basic understanding it is necessary to complete the major part of tasks correctly. Considering P-value (I have the information on complexity of tasks) Threshold point for basic level: 2 correct answers. Completed one easy and one medium task, or two medium ones. Threshold point for medium level: 3 correct answers. Completed easy and medium tasks. Threshold point for high level: 4 correct answers. Completed the majority of

tasks, including some of complicated ones. "Excellent": 5 correct answers. Successful completion of all tasks, including the complicated ones. The grading process involves determining the number of correct answers on a 5 question test, mapping this number to established cut-off scores for different performance levels, and considering the difficulty of individual questions (P-values) when setting these cut-off scores for a more differentiated assessment.

5. Use of Rubrics

The rubrics proved particularly valuable when organizing training by levels: basic, intermediate, and advanced. This approach proved particularly effective when developing PISA-format assignments, where I successfully applied it at the basic level of advanced training courses for mathematics teachers in target schools as part of the project. At the basic level, teachers created assignments focused on solving typical problems using standard algorithms, which helped build a solid foundation of mathematical skills. The intermediate level required participants to delve deeper into the thinking process: they had to justify their choice of solution method, explain the course of reasoning, and analyze the result. At the advanced level, attention was focused on creative and critical thinking; they solved complex problems and justified their actions, as well as developed their own assignments. In teaching practice, this approach could be found in the module on integrating digital tools into teaching mathematics, where I developed an interactive assignment with the topic of "Trigonometric equations". An important element of this assignment was the use of an assessment rubric, which allowed to structure the development process, and to approach consciously the creation of the assignment. The rubric became a convenient tool for peer assessment, allowing participants to analyze their work, compare approaches and receive feedback. As well, I used rubrics for formative assessment on digital platforms such as Desmos and GeoGebra. Working with rubrics, participants created digital resources, as well as consciously approached their methodological validity, practical value and focus on results. It is important to note that rubrics are not limited to assessment only, but also play a significant role in differentiating learning, which contributes to more personalized approach to the learning process. Quality rubric includes criteria, levels of performance, and detailed descriptors, allowing students to understand clearly what is expected of them. Creating a rubric involves defining the task, assessment criteria, achievement levels and their descriptions, and also requires effective feedback: timely, specific, and useful for further development.

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