

Reflection Report

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Submitted At: 2025-04-19 23:59

1. CBC, CBE, and CBA as a System

CBC links curriculum content directly with competencies, focusing not only on knowledge acquisition but also on its real-life application. Learning objectives are defined through observable behaviors, shifting from “What does the student know?” to “What can the student do?”. CBE emphasizes student-centered learning, where learners progress at their own pace through active engagement. The teacher acts as a facilitator, and the student plays the role of an explorer. CBA focuses on real-life tasks and projects to assess learning outcomes, guided by the principles of validity, reliability, and fairness. In the course “Innovations and Modern Technologies in Chemistry Education”, I successfully integrated these three components. For example, the learning objective 10.3.2.4 – Investigate the effect of catalysts on the rate of chemical reactions was addressed using the PhET simulation. Participants explored how different concentrations affected reaction rates and conducted experiments aimed at developing specific competencies. Aligned with CBE, participants presented their findings via posters or video presentations, enhancing their skills in independent work, data interpretation, and visual communication. CBA was implemented through peer assessment using rubrics. Clear criteria ensured consistent and fair evaluation. The “Glow and Grow” method was used to provide structured feedback, such as: “Your hypothesis is strong (Glow), but interpretation could be deeper (Grow).” One challenge was time management, as some participants exceeded presentation limits. This revealed the need to set clear timeframes and standardize formats in future sessions. Overall, integrating CBC, CBE, and CBA provided meaningful

opportunities to develop real competencies and enhance the quality of assessment. This experience deepened my understanding of competency-based approaches in education.

2. Curriculum Development and Learning Goals

I gained a deep understanding of the importance of aligning learning objectives with actionable tasks and assessment criteria when designing a competency-based curriculum. For me, the key principle in defining learning objectives has become achieving specific and measurable outcomes by applying the SMART criteria and Bloom's taxonomy. In practice, I implemented these principles through a laboratory project on the topic "Exothermic and Endothermic Reactions." This project was based on the learning objective 10.4.2.3 and enabled participants to identify reaction types by observing temperature changes during real experiments. The participants investigated reactions between citric acid and baking soda, as well as the combustion of magnesium, collected data, plotted graphs, and drew conclusions. During the lesson, participants worked in pairs, using temperature sensors, graphic organizers, and visualization tools. They presented their results through reflective posters and oral presentations. These learning activities were aligned with the objective and focused on observable behaviors. Assessment was conducted using a rubric with clear and predefined criteria. Successes: Participants developed research competencies and functional literacy. Assessment criteria were shared in advance, ensuring fairness and transparency. Learners demonstrated cognitive and presentation skills through data visualization. Areas for improvement: Some participants encountered technical difficulties while working with graphs. To prevent this in the future, I realized the need to provide templates and guidelines for graph plotting. This project created conditions for mastering specific skills by systematically linking learning objectives and tasks. The structure of the lesson, the authenticity of the task, and the validity of the assessment system contributed to the successful implementation of the key principles of a competency-based curriculum.

3. Assessment Quality: Validity, Reliability, and Fairness

Through the lens of competency-based education, I realized that maintaining the principles of validity, reliability, and fairness in assessing authentic learning outcomes is critically important. These principles not only ensure the accuracy of assessment results but also strengthen trust in the quality of the teaching and learning process. I understood that assessment is not just a way to measure outcomes, but also a powerful tool to improve instruction. Within the professional development course, I implemented a project-based task titled "Modeling a chemical process using digital tools." This task was directly aligned with the learning objective

— to demonstrate and explain the course of a chemical reaction through digital simulation. Trainees completed the task using platforms such as PhET, Chemix, and Canva, applying their skills in practice. This confirmed the task as a valid assessment tool. A strong point was the clear alignment between the task and the learning objective, as well as its focus on practical, action-based outcomes. Trainees demonstrated high engagement and were able to showcase their functional skills through independent work. A point for improvement was that some trainees lacked full understanding of the assessment criteria and felt uncertain when evaluating their own work. This highlighted the need for future assessment rubrics to include descriptors and example-based clarifications. To ensure reliability, the trainees' work was assessed using a standardized rubric. Assessment criteria included content accuracy, realism of the model, soundness of conclusions, and presentation quality. Peer assessment was employed, with multiple individuals evaluating each project, thereby enhancing the consistency (reliability) of results. To uphold fairness, the objectives and criteria were clearly explained in advance. Trainees were given the flexibility to choose a digital platform based on their level of digital competence. Those who worked more slowly or experienced technical difficulties were provided with extra time and individual support. This experience deepened my understanding of how to professionally plan assessment tools, monitor action-oriented learning outcomes, and ensure that assessment practices uphold validity, reliability, and fairness.

4. Grading and Standard Setting

In a competency-based assessment system, grading should reflect the extent to which the learner has achieved the intended learning outcomes. It is not merely assigning a numerical score but rather describing learning progress in a qualitative manner that demonstrates actual skill acquisition. A grade should serve not only as a result but also as a tool for feedback that guides further development. During the course I conducted titled "Innovations and Modern Technologies in Chemistry Teaching", I used rubrics and threshold-based descriptors to assess participants' project tasks. For each assignment, clear evaluation criteria were developed and divided into four performance levels: "Excellent," "Good," "Satisfactory," and "Needs Improvement." The criteria included such components as content accuracy, model precision, validity of conclusions, and quality of visual presentation. Before the assessment, all participants were introduced to the rubric and informed about the expected outcomes. This ensured transparency in the assessment process and supported its validity. During project evaluation, my co-trainer and I used the same rating scale, maintaining reliability in assessment results. The threshold levels were determined based on the cognitive levels of Bloom's Taxonomy: $\geq 70\%$ – Basic, $\geq 85\%$ – Proficient, and $\geq 95\%$ – Advanced. Participants compared their work with the rubric and were able to conduct self-analysis, which helped them identify their personal development goals. One strength of the process was the structured

nature of grading, clarity of criteria, and use of the “Glow and Grow” method for feedback. A challenge that emerged was that some participants struggled to provide sufficient justification when grading their own work. This indicated the need to strengthen the reflective component of the assessment. In future courses, I plan to enhance the efficiency of grading by implementing automated threshold calculation through Google Forms or LMS platforms. In conclusion, grading within a competency-based education system should reflect not only the degree of goal attainment but also the result of observable performance and learning progress over time. For participants, a grade becomes not just an outcome, but a meaningful tool for guidance and improvement.

5. Use of Rubrics

As a trainer, I guide participants in structuring their learning activities, clarifying expected outcomes, and organizing assessment objectively through the use of assessment criteria. Each criterion is based on specific skills and describes observable behavior. Within the course, an assessment rubric was developed for the learning objective 8.4.2.5 – Explain the importance of the ozone layer on Earth. The rubric included the following criteria: functions of the ozone layer, substances that affect it, consequences of its depletion, protection measures, use of scientific terminology, and evidence-based communication. Through the rubric, participants learned to: –Identify alignment between learning objectives and assessment criteria; –Formulate criteria in clear, action-oriented language; –Construct descriptors that are specific, evidence-based, and measurable; –Adapt the rubric for both self- and peer-assessment; –Uphold principles of validity, reliability, and fairness in assessment. Rubric effectiveness: –Participants gained a deeper understanding of the relationship between learning and assessment; –The structure enabled the evaluation of key skills such as functional literacy, scientific language use, and logical reasoning; –The rubric supported the development of higher-order thinking skills (according to Bloom’s taxonomy: analysis, synthesis, evaluation). Course project outcome: Participants integrated the rubric into their short-term lesson plans, aligning learning tasks with assessment requirements. This enhanced their professional thinking, reflective skills, ability to differentiate instruction, and to provide targeted feedback. Strengths: –Alignment of the rubric with the learning process; –Effective use of the rubric as an assessment tool by participants. Areas for improvement: Some participants encountered difficulties when developing descriptors. In future courses, additional practical exercises focused on writing effective descriptors will be introduced. The assessment rubric became an essential tool in the professional development of participants, contributing to improved teaching and assessment quality. It also strengthened understanding between teacher and student and helped clearly demonstrate learning achievements.

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