

## **Difficulties in Teaching and Learning Chemical Equilibrium at G.C.E. Advanced Level**

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A review of examination reports reveals that students have difficulties in solving problems about chemical equilibrium. Hence, the purpose of this study was to find out the difficulties in teaching and learning the sub-unit, "Chemical equilibrium" in advanced level Chemistry classes.

Seven hundred and seventy six students from the 2<sup>nd</sup> year of G.C.E. advanced level classes (ages ranging from 18-19) were selected from thirty four 1AB urban schools (Schools with science advanced level classes) in the Central Province. At the end of the sub-unit, a concept-achievement test was administered to identify misconceptions and their possible sources. The test consisted of 20 open-ended items. Responses were marked and coded into four categories: no response, misunderstanding, partial understanding and sound understanding. In the second step, semi-structured interviews were carried out with sixty students according to their written responses, which reflected different perspectives. These interviews were conducted to obtain a more extensive source of data on their underlying beliefs, which affected learning. In order to understand teachers' problems in teaching "chemical equilibrium", 35 Chemistry teachers were interviewed. In addition, ten classrooms were observed to find out what was really happening during the process of teaching and learning. Data collected from multiple methods were analysed qualitatively and quantitatively.

Analysis of written responses showed that the students faced difficulty in understanding the concepts of chemical equilibrium. The results showed that many students exhibited misconceptions in all the content areas in chemical equilibrium. Many had misconceptions in areas such as changing equilibrium conditions, using Le Chatelier's principle and rate vs extent. According to student responses, misconceptions emerged through student use of rote-learning, recall, algorithmic procedures, incorrect control of the variables involved, limited use of the chemical equilibrium law, a lack of mastery of chemical equilibrium principles and difficulty in transferring such principles to new situations. Analysis of classroom observations and interviews revealed that the way teachers taught was the main cause for these difficulties. Ninety percent used only lecture method and presented facts. Instruction was based on emphasizing correct concepts without highlighting common conceptual errors using students' prior knowledge. The words used by the teachers in introducing and explaining the concepts of chemical equilibrium from everyday language also led to very different meanings. Students had no opportunity to think during learning, or to express or discuss their ideas with others. Assessments were based on recalling facts and not on applications or higher-order thinking. In order to bring meaningful understanding of these concepts in students, Chemistry teachers need to identify students' difficulties in learning and the source of their misconceptions. Then their teaching could be improved to help in student learning. Hence, the teachers should use alternative approaches in teaching Chemistry and assessing student learning where students can express and discuss their ideas and clarify their doubts and misunderstandings.