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Problems faced by G.C.E (A/L) students in chemical calculations

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Chemical calculations are used to enhance the students' ability of applying chemical concepts along with the mathematical concepts to solve numerical problems and thereby improve the students' thinking ability and logical intelligence. Chemical calculations are frequently used in assessing the students' achievement in the learning process.

However, it has been found that the performance of students in chemical calculations at G.C.E. (A/L) examination is generally poor. This study was, thus, designed to investigate the problems faced by the students in chemical calculations. In this study two purpose designed instruments each on chemical calculations and mathematical calculations were constructed and validated. These instruments were administered to a sample of 140 Grade 13 students selected from two provinces. The sample was limited by the availability of the students at the time of the study and selected to minimize confounding factors. Only 120 of these students (48% physical science and 52% biological science) who completed all instruments were selected for the data analysis. National schools from two provinces were selected due to their readily accessibility and the willingness of school authorities to allow the students participate in this study. Students, school teachers and national evaluators of G.C.E. (A/L) Examination were also interviewed to get their opinion on chemical calculations.

Descriptive statistics, Spearman rank correlation and two sample t-test (confidence interval 95%) have been used to analyse the student performance. Students' average mark for mathematics paper was 55.26% where as the average mark for the chemical calculation paper was 42.5%. Many students had made mistakes in addition (43.3%), subtraction (27.5%), multiplication (70.8%), division (83.3%), indices (47.5%), and logarithms (56.7%). Students have also made mistakes relating to the chemical concepts and principles such as atoms (35.7%), molecules (21.4%), molecular formula (17.9%), moles (8.9%), concentration (35.7%), molality (60.7%), mole-fraction (7.1%), stoichiometry (42.9%), Hess's law (32.1%), Born-Haber cycle (22.6%), gas laws (57.1%), Raoult's law (10.7%), pH, K_a, K_b, K_{sp} (75.0%), electrode equilibrium (25.0%), inorganic reactions (51.2%) and chemical kinetics (14.3%). More than 20% of students didn't complete calculations. The Spearman rank correlation coefficient of 0.524 showed that a positive correlation exists between the mathematical achievement and the chemical calculations achievement of the students. Students (25%) have expressed that applying chemical concepts along with mathematics is the major problem in doing chemical calculations. Teachers as well as national evaluators expressed the opinion that students made frequent mistakes in simplifying sums and linking the knowledge of chemistry with appropriate mathematical concepts.

The findings of this study suggest that existing chemistry classroom practices need to be re-evaluated with a view to using more appropriate teaching/learning methodologies and strategies to improve students' logical intelligence.

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