

EFFECT OF COMPETENCE IN MATHEMATICS ON NIGERIAN SECONDARY SCHOOL STUDENTS' PERFORMANCE IN MOLE CONCEPT PROBLEMS IN CHEMISTRY

By

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Abstract

The study investigated the effect of Mathematical knowledge on of Nigerian Secondary School Students' performance in mole concept problems in Chemistry.

The sample comprised of Senior Secondary one Students, purposively selected from four secondary schools in Ilorin West and South Local Government Area of Kwara State. 120 students (60 males and 60 female were selected from two schools each serves as experimental and control groups respectively. The content scope of the study was restricted to mole concept of the Senior School Chemistry curriculum.

A quasi experimental, non-randomized, non-equivalent pretest post test control group was adopted for the study. The instruments used were a researchers developed Mathematics Competence Test (MCT) and a problem solving in mole concept Test (PSMCT). These Instruments were validated by three experts (three experienced Secondary School Chemistry Teachers who have been WAEC and NECO examiners) Two research questions were raised to guide the study. The data were analyzed using Pearson Product Moment Correlation Coefficient Analysis of covariance (ANCOVA) and Duncan Multiple Range Test. The findings showed that there is a high significant relationship between students performance in mathematics and their performance in mole concept in chemistry, Students who scored very high in mathematics also scored very high in the mole concept in Chemistry.

Based on these findings it was recommended that teaching mole concept with mathematics emphasis can be used to enhance the performance of students in solving mole problems.

INTRODUCTION

Science, Technology and Mathematics play an important role in the development of any nation. Hence, more advancement in technology needs an increase in the science, technology and mathematics competence in day to day activities of all citizen (Jegade, 1983).

The inclusion of chemistry as a core subject in the sciences in the 6-3-3-4 educational system in Nigeria is justifiable considering its importance in other major disciplines or fields such as medicine, Pharmacy, Geology, Engineering, Agricultural Science and Science Education.

The study of the physical aspect of chemistry cannot be understood without a solid background in mathematics. This might have been the rationale for making mathematics compulsory and that no student can transit to the Senior Secondary School without passing it at the Junior School Certificate Examination (Ojerinde 1999). No nation can develop scientifically and yet neglect the mathematical component of the school curriculum. In fact, mathematics is the central intellectual discipline of all sciences and technological societies. Mathematics cannot be separated from the rest of the sciences and especially chemistry because without a credit in the two subjects, students cannot gain admission into courses such as Engineering, Computer Sciences and Medicine which require chemistry.

Unfortunately over the years the performance of students in the science subjects in the West African Senior School Certificate Examinations is not encouraging despite all the efforts of the Federal and State Government.

Literature Review

In chemistry, researchers like Adeyegbe 1993; Igwe, 1994; Olorundare, 2005; dossier, 1990, have identified poor performance of students in West African School Certificate Examination as due to the inability of students to understand some quantitative aspects of chemistry topics identified as difficult by Finley, Stewart and Yarnoch (1982). These include writing of chemical formulae, chemical equations,

mole concept, atomic structure, the arrangement of electrons in atoms and stoichiometry. Also Abdullahi and Aninyei (1983) observed that mole concept, electro chemistry, chemical equilibrium and solubility were difficult for students. Akinmade and Adisa (1984), Onwu and Ahiakwo (1986) reported that the mole and ions in solution were difficult for students to learn.

Furthermore, Friedel and Maloney (1992) showed that students had difficulties when working with chemical formulae and the mole concept. This shows that mole concept has been one of the difficult concept identified both within and outside Nigeria. Among the reasons given by students generally in Nigeria were poor background in mathematics, difficulty in recalling and representing or writing ionic equations, (Ahiakwo, 1984; Onwu&Moneme, 1986).

As a result of continuous poor performance in the sciences, the Nigerian Education Research and Development Council (NERDC) conducted a national workshop on difficult concepts in the sciences and Mathematics in Lagos in 1993. The first topic identified as difficult in chemistry by the members of the chemistry panel at the workshop was the mole concept (Ivowi, 1993). Among various reasons given for the difficulty were communication skills, students inability to read for understanding and to express themselves clearly, misconceptions of the mole by students because of their mathematical background, socio cultural values, abstract nature of the mole concept, technical language and terminologies and mathematical orientation of the mole concept and inadequate problem solving skills. Adeyegbe (2004) and Okebukola (2005) also identified mole concept as one of the topics that recent chemistry education graduates found difficult to teach.

The mole is a basic topic that requires students understanding of mathematics before problems can be solved in it. For instance, ratio, logarithms, fractions, substitution in formula equations, variations and percentages are some of the basic concepts in mathematics that students need to know very well before they can solve problems in mole concept. These topics are taught in the Junior Secondary School Mathematics for students to perform well in the sciences, especially chemistry at the

Senior Secondary Level. Out of these topics, logarithm, ratio and proportion had been identified as difficult topics by the mathematics panel at the workshop on difficult concepts in science and mathematics (Ivowi, 1993).

In addition, the mole concept is a foundation concept in chemistry that acts as a unity concept linking many aspects of the subject throughout the syllabus. For instance, other topics that the mole concept links to are chemical formulae, balancing of chemical equations, law of chemical combinations, reaction stoichiometry and quantitative aspects of electrolysis etc.

Considering the different topics, which the mole concept can help students to understand, it is proper to conclude that the concept of mole is a basic topic to successful learning of chemistry in the Senior School Chemistry curriculum. It involves solving of problems, students have to be competent in mathematics before they can perform very well in solving mole concept problems. Considering the importance of chemistry in all round development, there is need for fundamental topics like the mole concept to be properly understood and mathematical skill is necessary to make this understanding a reality.

The WAEC Chief Examiners reports (1996, 1997, 2002, 2003) observed that students have poor understanding of the mole concept, chemical arithmetic, inability to write the formula of atoms, molecules or ions as appropriate and balancing of equations correctly. They also show incompetence in handling numerical data and poor expression of chemical terms and calculations. Students tended to avoid questions on the mole concept and those who attempted them, usually performed poorly in them because of their abstractness and quantitative nature. Knowledge of mole concept helps to solve many problems. Kenni (2001) findings showed that there was a correlation between students' performance in mathematics and chemistry. However, the author failed to specify the nature of this correlation.

Etukudo and Nnaobi (2002) results showed that there was a positive correlation between the mathematics skill and learning of practical chemistry.

Furthermore, Ifamuyiwa (2004) findings showed that a significant correlation

