EFFECTS OF CONCEPT MAPPING AND DEMONSTRATION STRATEGIES ON ACHIEVEMENT AND RETENTION OF MOLE CONCEPTS AMONG SECONDARY CHEMISTRY STUDENTS INZAMFARA STATE

ANASO Joy N.
Department of Chemistry,
Federal University of Education, Zaria, Kaduna State.
joyanaso@gmail.com

Abstract

This study examined the effects of concept mapping and demonstration strategies on academic achievement and retention of mole concepts among secondary school chemistry students in Zamfara Central Zone, Zamfara State, Nigeria. A pretest, posttest and post-posttest experimental and control group research design was employed.The population of the study was all science secondary students in Zamfara State. A total of ninety (90) SS.II chemistry students were randomly selected from five secondary schools in the study area. The instruments used for data collection were the Mole Concept Achievement Test (MCAT), Post Mole Concept Achievement Test (PMCAT), Post-Post Mole Concept achievement Test (PPMCAT), Lesson Plans for Control Group and Lesson Plans for the Experimental Group. The data collected were subjected to statistical analysis. The findings revealed that academic achievement of subjects exposed to the concept mapping strategy were significantly higher than their counterparts exposed to demonstration method (t-cal is 10.70 while t-crit is 1.96, df= 88 at 0.05). With reference to retention level, students exposed to concept mapping showed higher levels of retention of the learnt materials (t-cal was 5.72, t-crit value obtained was 1.95, df=88 at 0.05). Also, there was no significant difference between male and female students' achievement in the experimental group (t-cal is 1.25 while t-crit is 1.96, df=43 at 0.05 level of significance.) The use of concept mapping for teaching male and female students showed to be gender friendly. In view of the conclusion, recommendations were proffered.

Keywords: Concept Mapping Strategy, Demonstration Method, Mole Concept, Retention, Gender and Chemistry Students.

Introduction

Chemistry is a branch of science that deals with the study of matter, its structure, composition, properties and the changes it undergoes. Nnoli (2017) affirmed that chemistry is one of the three major basic sciences along with biology and physics and that chemistry plays a significant role in every day activity of man. Hamid and Azita (2009) viewed chemistry as the central science, the mastery of its concepts regarding the structure of matter and how it is essential to further course work in sciences. To Anaso (2017), Chemistry is a branch of

science that deals with the behavior of matter in relation to their composition and the various changes which they undergo when combined with other elements. It has shown that the study of chemistry enables one to acquire scientific skills such as the art of handling laboratory apparatus; performing experiments with ease and also thinking scientifically.

Chemistry is the bedrock of the study of science and technology (Anaso, 2021) that has enabled man to be scientifically and technologically literate, able to communicate and relate science and technology to the society. One of the objectives of chemistry education is to help students apply the knowledge of chemistry in explaining chemical phenomena that occur in everyday life. Despite the importance of chemistry to the individual, the society and the nation, academic achievement in the subject especially at the end of secondary school national examinations, continue to be poor. Fatokun and Eniayeju (2014) pointed out that different methods have been used in teaching chemistry over the years at the secondary school level but the effectiveness of any of these methods, as measured by the performances of the students involved, has not been encouraging. This could be seen from the Chief Examiner's reports, WAEC 2021 –2023, which further revealed a decline and high failure rate.

Saouma and Attieh (2008) maintained that the abstract and highly conceptual nature of chemistry seems to be particularly difficult for students, the teaching methods and techniques do not seem to make the learning process sufficiently easy for students. Long John (2009) noted that the teaching strategies have significant effect on students' academic achievement and retention. Secondly, poor and ineffective teaching methods could be the major causes of the recorded poor achievement in chemistry. Thirdly, the use of conventional method still dominates chemistry lessons.

Concept mapping was advocated for by Novak and Canas (2008) and it promises to be useful in enhancing meaningful learning, improving students' understanding and academic achievement. Novak and Canas (2008) also noted that concept mapping strategy is one of the developed and innovative methods and an activity-oriented instructional strategy grounded in Ausubel's assimilation theory. Concept, as a word, means some kind of objects or events and it is also perceived as regularities in events or objects designated by some model. Concept maps are two or three dimensional spatial or graphical displays that make use of labeled nodes which represent relationship between pairs of concepts. The concept map structure parallels the human cognitive structure as it shows how learners organize concepts. Cana, Hill, Grandos and Perez (2003) have earlier outlined the usefulness of concept maps as classroom tools which help students to organize their thinking and summarize subjects of study. Concept mapping technique has a tremendous capability for helping learners cope very adequately with the demands of difficult concepts. Saouma and Attieh (2008) noted that the use of concept mapping techniques enabled students to score higher in a science achievement test than those who were taught with the conventional method. Saouma et al (2008) further in their study on the effects of using concept maps as study tools on achievement in chemistry, showed that while there were no significant differences on the achievement total score, there were significant differences favoring the experimental group for scores on the knowledge level questions.

Saouma et al. (2008) reported that students learn meaningfully when they see the nature, role of concepts and the relationships between concepts as they exist in printed or spoken instruction. A concept map therefore facilitates meaningful learning. Kinchin(2005) maintained that the strategy helps learners to organize their cognitive frameworks into more powerful integrated patterns. Oloyede and Adeoye (2009) observed that concept maps help learners to make evident the key concepts or propositions to be learned and suggest connections between new and previous knowledge .Concept maps, according to Anaso (2021), are used to clarify to both students and teachers the key ideas which they are to focus on for specific learning tasks and it provides a kind of visual pathway used in connecting concepts. Adion (2018) indicated that concept maps provide a schematic summary of what has been learned after a learning task has been completed. He further added that the concept to be learned should begin from where the learner is and what he already knows so that there is an interaction of prior concepts with the new concepts being learnt. Adion (2018) has also noted that the influence of prior knowledge on learning is very specific to the domain of knowledge involved. He further investigated the effect of students' construction of concept mapping in high school chemistry laboratories, on their comprehension of chemical concepts, and he found no differences between the experimental and control groups. Egetch (2017) noted that mapping exercises require the chemistry student to think in multiple directions and to easily switch backward and forward between different levels of abstraction. He also investigated the effect of construction of concept maps on freshman chemistry students' achievement and ability to link concepts and he found that positive results were achieved for both variables. Oloyede and Adeoye (2009) carried out a study which compared the relative effectiveness of guided discovery and concept mapping teaching strategies on senior school students' achievement in chemistry. They reported no significant difference in the mean scores of students which could be due to the method they were exposed to, being either guided discovery or concept mapping. Fatokun et al. (2014) noted that the problems of poor performance can be handled if the chemistry teacher has a good grasp of the subject matter and knows the appropriate means of communicating this, in order to be proficient in the teaching pedagogical challenges. Anaso (2021) and Itamah (2007) have independently advocated that students should have "mind on" experiences in addition to "hands on" activities.

Demonstration method was used in the control group in this study. Demonstration method is a process of presenting facts/principles or displaying something. It is usually carried out by the teachers and extended to students individually or in small groups (Anaso, 2021). A chemistry demonstration is used as an attention inducer and a powerful motivator in starting a lesson as well as bringing a lesson to an end. Very little literature exists to make generalizations on whether concept mapping strategy facilitates students' achievement in chemistry or not. This study was therefore carried out to find out the effect of concept mapping and demonstration strategies on students' achievement in mole concept, an aspect of chemistry.

The chief examiner's report for the West African Senior School Certificate examination 2021-2023, pointed out that the reason for candidates poor performance in chemistry are: inability of students to tackle most of the numerical questions; poor expressions and use of nomenclature, writing of formulae, incorrect balancing of chemistry equations, and

the abstract nature of the subject, chemistry. Based on the above observations, the researcher is prompted to look at one of the difficult areas in chemistry which is mole concept.

The area of study in chemistry adopted for this research was the mole concept. A mole is the amount of a chemical substance that contains as many elementary units as there are atoms in 12.0g of carbon-12 (Ojokuku, 2010). A mole of an element is a collection of its atoms such that the total mass in gram is numerically equal to its relative atomic mass. An atom is so small that it cannot be weighed on any chemical balance. Chemists in order to estimate the quantities of various chemical substances adopted a concept involving collection of elementary units such as atoms, molecules, ions or electrons of a chemical substance. This is called the mole concept. Due to the importance placed on stoichiometry in WAEC and NECO examinations for senior secondary education, questions on practical and theoretical chemistry usually include stoichiometry. This motivated the researcher to investigate into the effect of concept maps on chemistry students' achievement of mole concepts among secondary school chemistry students.

Retention is one of the variables in this study. It is to establish the difference in academic achievement of students. Retention is the ability to remember facts, principles, concepts, themes previously learned. Retention is generally determined by the quality of information recalled. Retention according to Anaso (2015) is the ability to remember and consequently recall things experienced or learnt by an individual at a later time. Fatokun and Eniayeju (2014) investigated the retention ability of two groups of students. The result showed that the experimental group exposed to chemistry concepts using concept mapping strategy performed significantly better and retained more of the concepts learnt than those exposed to guided discovery strategy. Anaso (2015) investigated the efficacy of guided-discovery method on academic achievement and retention of students in volumetric analysis, the result of which showed that students in the experimental group retained the knowledge and concepts learnt, much more than those in the control group. The achievement of this result could be attributed, perhaps, to the nature of the instructional strategy employed in teaching, however, this is inconclusive and worthy of further research, part of which informed the current investigation.

Gender is also another variable in this study. Gender issues in science and chemistry education in particular, have been the concern of many educators and series of researches have been going on in this area. Some people are of the view that boys perform better in science than girls. According to Njoku (2007), some researchers reported that boys perform better than girls in Science, Technical and Mathematical subjects. Uhumuavbi,Oriahi and Olusi (2003) showed that sex plays no significant role in performance in science and technology. Fatokun and Eniayeju (2014) reported significant difference in the experimental group in favor of the boys while Anaso (2015) reported no significant difference in achievement between male and female subjects in the experimental group. There has however, been inconclusive reports in this area, hence the need for further studies. This study would serve as a reference point for further studies.

Statement of theResearchproblem

This study aimed at determining the effect of concept mapping and demonstration strategies on academic achievement and retention of mole concepts among senior secondary school chemistry students in Zamfara Central Zone, Zamfara State, Nigeria. Poor achievement in science has been of great concern to educationists and researchers (Anaso, 2017; Fadokun and Eniayeju, 2014; Abubakar 2010). The concern of this study is to discover which teaching strategies, concept mapping and demonstration, would challenge students to be more actively involved in the learning process; and also the one that would improve their academic achievement and encourage them to be more active than passive in the teaching learning process. It was against this backdrop that this study was undertaken.

Objectives of the Study

The objectives of this study are to:

i. determine the effects of concept mapping and demonstration strategies on the academic achievement of secondary school chemistry students when taught mole concept.

i. find out the level of retention of selected mole concepts among chemistry students exposed to concept mapping and demonstration strategies.

ii. determine the effects of concept mapping strategy on the academic achievement of male and female chemistry students when taught mole concept.

Research Questions

The following research questions guided the study.

- What are the effects of concept mapping and demonstration strategies on the academic achievement of secondary school chemistry students when they are taught mole concept?
- Do concept mapping and demonstration strategies have any significant effect on the level of retention among chemistry students when exposed to the mole concepts?
- Does concept mapping have significant effect on the academic achievement of male and female chemistry students taught mole concepts?

Research Hypothesis

To answer the research questions the following null hypotheses were formulated and tested at 0.05 significant levels.

Ho_1: There is no significant difference in the academic achievement of students exposed toconcept mapping strategy and those exposed to demonstration method when taught the mole concept.

Ho_2: There is no significant difference in the level of mole concepts retained by students exposed to concept mapping strategy and those taught with demonstration method.

Ho_3: There is no significant effect on the academic achievement of male and female chemistry students exposed to concept mapping strategy when they are taught mole concepts.

Methodology

The research design employed was pretest, post-test, post-posttest quasi-experimental control design. The target population was the senior secondary SSII chemistry student's in Zamfara Central Zone, Zamfara State, Nigeria where there were seven secondary schools with a total number of 1011chemistry SSII students. The study employed simple random sampling technique in selecting two schools with a total number of 90 students who served as the study sample. Purposive random sampling technique was used in sorting students into the experimental and control groups since gender was one of variables considered in this study. This is in accordance with Sambo (2008) who stated that a sample size of a minimum of 30 subjects is viable for experimental study of this nature, and central limit theory which recommends (N>30) sample size.

The instruments used were Mole concept pre-achievement test (MCAT), Post Mole Concept achievement test (PMCAT), Post-posttest Mole Concept achievement test (PPMCAT), Lesson Plan for the Control Group (LPCP) and Lesson Plan for the Experimental Group (LPEG). The five instruments were validated by two senior lecturers in science education department Ahmadu Bello University Zaria, Kaduna State, and two secondary school chemistry teachers within the study location. The reliability coefficients of the instruments were 0.78, 0.82, 0.81, 0.71 and 0.77 respectively using Gutman split half procedure and spearman brown prophesy formula. The MCAT, PMCAT and PPMCAT consist of a set of twenty multiple choice test items.

Procedure

A pretest using MCAT was administered to the subjects who participated in the study before teaching them to ensure comparability and equivalence and their mean score were 8.91 and 8.82. The experimental group was exposed to concept mapping strategy using a Lesson Plan for Experimental Group (LPEG), the content on mole concept was divided into four sub topics, set of were outlined and answered at different states; the students in the group were actively involved in forming coherent, structured, integrated, and easily accessible knowledge based anchored on a central concept for four weeks. Lesson Plan Control Group (LPCP) was used for control group with the same content as the LPEG but the teaching on mole concept was demonstrated to the students in the control group and the students were later shared into smaller groups. The treatment for both the Experimental and the Control group lasted for four weeks after which a posttest using PMCAT was administered to the subjects to determine the effectiveness of both instructional strategies. After one week of the posttest, a post-posttest using PPMCAT was administered to determine retention level of both experiment and control groups. That was to find out the extent to which the students were able to retain the content they had learnt. The scripts were collected and marked using a marking scheme developed by the researcher. Mean and standard deviation were used in answering the research questions while the t-test statistics was used in

testing the null hypotheses at 0.05 level of significance for retaining or rejecting the hypotheses.

Results

Data obtained was analyzed using mean, standard deviation and t-test statistics. The t-test statistics was considered adequate because there were two groups involved. The results are presented in Tables 1 to 6.

Research Question 1: What is the effect of concept mapping and demonstration strategies on the academic achievement of secondary school chemistry students in mole concept?

Table 1: Mean and standard deviations of post mean scores of the experimental and control groups.

Group	N	Mean	Standard Dev.	Mean Diff.
Experimental	45	11.67	1.69	4.47
Control	45	7.20	3.3	

In table 1, the mean score of the students were 11.67 and 7.20 in the experimental group and the control group respectively. The mean difference of 4.47 in the experimental is higher than those students in control group. The difference in the mean scores (11.67 and7.20) has respectively answered research question 1.

Research Question 2: Do concept mapping and demonstration strategies have any significant effect on the level of retention among chemistry students when exposed to the mole concepts?

Table 2: Mean and standard deviations of post-post mean scores of the experimental and control groups

Group	N	Mean	Standard Dev.	Mean Diff.
Experimental	45	9.98	3.27	2.97
Control	45	7.01	5.18	

Table 2 revealed that the mean scores of the experimental group are 9.98 which are greater than that of control group 7.01 with a mean difference of2.97. The experimental group recorded higher knowledge retention of chemistry contents than the control group. This result has answered research question 2.

Research Question 3: Does concept mapping strategy have significant effect on the academic achievement of male and female chemistry students taught mole concepts.

Table 3: Mean and standard deviations of post test scores for experimental male and female students.

Group	N	Mean	Standard Dev.	Mean Diff.
Experimental Male	26	33.07	3.10	1.34
Experimental Female	19	31.73	2.71	

Table 3 showed that the mean score of the experimental group was 33.07 which is greater than the control group 31.73 with a mean difference of 1.34. Research question 1 which reads thus: does concept mapping have significant effect on the academic achievement of male and female chemistry students taught mole concepts, is hereby answered by this result.

Ho_1: There is no significant difference in the academic achievement of students exposed to Concept mapping strategy and those exposed to demonstration method when taught the mole concept.

Table 4: Results of t-test Analyses of Post mean scores of experimental and control groups.

Group	N	Mean	Standard Dev.	Df	t-Cal	Remarks
Experimental	45	11.67	1.69			
				88	10.70	Sig.
Control	45	7.20	3.3			

Result from table 4 showed that t-calculated is 10.70 while t-critical is 1.96, df= 88 at 0.05 level of significance. There is a significant difference in the mean achievement scores of the experimental and control group in favor of the experimental group. The null hypothesis is therefore rejected.

Ho_2: There is no significant difference in the level of mole concepts retained by students exposed to concept mapping strategy and those taught with demonstration method.

Table 5: t-test statistics of the post-post mean scores of the experimental and control groups.

Group	N	Mean	Standard Dev.	Df	t-Cal	Remarks
Experimental	45	11.67	1.69			
				88	10.70	Sig.
Control	45	7.20	3.3			

Table 5 revealed that t-calculated was 5.72, t-critical value obtained was 1.95, df=88 at 0.05 significant level. There is a significant difference in the mean scores of the post-posttest in favor of the experimental group. The null hypothesis is therefore rejected.

Ho_3: There is no significant effect on the academic achievement of male and female chemistry students exposed to concept mapping strategy when taught mole concepts

Table 6: t-test statistics of the post mean scores of the experimental male and femalestudents.

Group	N	Mean	Standard Dev.	Df	t-Cal	Remarks
Experimental Male	26	33.07	3.10			
				43	1.25	NS
Experimental	19	31.73	2.71			

Female

Result from table 6 showed that t-calculated is 1.25 while t-critical is 1.96, df=*43* at 0.05 level of significance. There is no significant difference in the mean achievement scores of the experimental male and female subjects. The null hypothesis is therefore retained.

Discussion of the Findings

From tables 1 – 3, mean scores of the groups were shown and used in answering the three (3) research questions. The results showed that the experimental groups had higher mean scores than the control groups. This is an indication that the concept mapping strategy enhanced the academic achievement of chemistry students.

Results in tables 4 indicated significant difference in the post-test mean scores of subjects (students) in the experimental and control groups. The results revealed that subjects exposed to concept mapping strategy performed significantly better than their counterparts taught with demonstration method. Concept mapping strategy could be a potential viable tool for enhancing students'understanding and increasing the academic achievement of students in chemistry. The findings from this study gave credence to the results of Fatokun and Eniayeju (2014), who reported significant difference in academic performance in favor of the experimental group, taught with the concept mapping guided discovery integrated approach. Saouma and Attieh (2008) also reported significant differences favoring the experimental group for scores on the knowledge level questions in their study on the effects of using concept maps as study tools on achievement in chemistry. On the other hand, Nicoll, Francisco, and Nakhleh (2001) found that positive results were achieved for both variables when they investigated the effect of construction of concept maps on freshman chemistry students' achievement and ability to link concepts. Students' understanding of concepts was enhanced and the academic achievement of the students was improved by employing concept mapping strategy in teaching. Contrary to the result of this study, Adion (2018) and Oloyede and Adeoye (2009) in their separate studies reported no significant difference in the mean scores of the experimental and the control groups.

Results from Table 5 revealed that a significant difference exist between the mean scores of the post-post test scores of the students exposed to concept mapping strategy and those taught with demonstration method in favor of the experimental group. This result supports the outcome of earlier studies by Fatokun and Eniayeju (2014) who reported that concept mapping strategy enabled students to retain more knowledge of chemistry concepts than their counterpart taught with demonstration method.

Result from table 6 showed no significant difference in the mean achievement scores of the experimental male and female subjects. The use of concept mapping strategy was gender friendly. The result revealed that both male and female subjects achieved equally, both male and female subjects benefited from the use of concept mapping strategy. Null hypothesis 3 was therefore retained. This finding is in agreement with the results of Odion (2018) who reported no significant difference between the achievement of boys and girls when taught

with the same method. Anaso (2015) in earlier studies also reported that boys performed better than girls in volumetric analysis.

Conclusion

Based on the findings from this study, it has been empirically reported that there were improvements in academic achievement with the introduction of concept mapping strategy. It has shown that the use of concept mapping is an effective teaching strategy capable of enhancing cognitive restructuring and linking ideas to existing knowledge structures. Adopting concept mapping strategy could, therefore, be a solution in tackling the issue of poor performance of students in chemistry; secondly, it will help in reducing the problem of teaching chemistry in secondary schools and in the long run, uplift chemistry education. The findings emanating from this study conclude that employing concept mapping strategy in teaching chemistry in secondary schools, would help chemistry students to achieve academic excellence in internal and external examinations.

Recommendations

The following recommendations are made on the basis of the findings and conclusion emanating from this study:

i. Concept mapping strategy should be emphasized by chemistry teachers in schools.
ii. Students should be trained on the use of concept mapping strategy to enhance their interest, attitude and achievement in the subject.
iii. Concept mapping strategy should be included in the chemistry curriculum to enhance effective teaching and learning of the subject.

References

Abubakar, S. (2010). Beyond the NECO Disaster.Daily Trust. Tuesday, 23rd March, pp.56.
Achievement in Chemistry. *Journal of Science Teachers Association of Nigeria* 44 (1-2) 85-92.

Adion, A. D. (2018). An Evaluation of Peer Led Team Learning. *Journal of Science.* Vol. 88, 501-507.

Anaso J. N. (2017). Chemistry Laboratory Equipment and Senior School Students' Performance in North-Western Nigeria: Implications for counseling. *Journal of Curriculum and Instruction.* 10(2), 258-270.

Anaso J. N. (2021). Critical Elements of Science Education. Reprinted and published by Concept+ Designs & Prints, Zaria.

Anaso, J. N. (2015). Efficacy of Guided Discovery Method on Academic Achievement and Retention of Students in Volumetric Analysis. *International Journal of Research in Science, Technology and Mathematics Education*. 3(2) 15-25.

Cana, A.J. Hill, A. Granados J.D & Perez C.C (2003).The Network Architecture of Cmap Tools. Technical Report IhmcCmap Tools 93.

Egetch, A.G.(2017). Concept mapping and Achievement. *Journal of Research in Science Teaching*. 22(7) 65-70.

Fatokun, K.V.F. & Eniayeju P.A. (2014). The Effect of Concept Mapping-guided Discovery integrated teaching approach on chemistry students' achievement and Retention. *Education Research Review* 9 (22) 1218-1223.

Hamid, R. A. & Azita R. H. (2009). The Effects of Educational Factors on the Academic Performance of University Students in Chemistry in Chemistry. *Chemical Education Journal* 13 (2) 1-15.

Itamah, D. A. (2007).Functional Science, Technology and Mathematics Education for National Economic Empowerment and Development. A Key Note Address delivered at the Federal College of Education Zaria 2007 school of Science Conference. April 2nd – 5th 2007.

Kinchin I. M. (2005). Writing to be Published or Writing to be Read. *Journal of Natural History* 39, 3223-3233.

Longjohn I. T. (2009).Effect of Game Methods of Teaching on Students. New York Practice Hall.

Nicoll, G., Francisco, J., & Nakhleh, M. (2001). An investigation of the value of using concept maps in general chemistry. *Journal of Chemical Education,* 78, 1111-1117.

Njoku, Z.C. (2007).Engendering Learning Equity in Science and Technology Classrooms for Sustainable development.*Proceedings of the 50th Anniversary Conference of Science Teachers Association of Nigeria* (STAN) 2007.pg. 24-31.

Nnoli, J. N. &Okafor. C.U.(2017).Enhancing Students' Academic Achievement and Retention of Knowledge Through the use of Chemistry Instructional Materials: Implication for STEM Education in our society. Science Teachers Association of Nigeria Conference Proceeding 2017 Pp 267-271

Novak, J.D &Canas A. J. (2008).The Theory Underlying concept maps and How to construct and use them.Technical report IHMC CMCP Tools.Institute of Human and Machine Cognition http://cmcp.ihmc.us.

Ojokuku, G.O. (2010). Understanding chemistry for senior secondary schools press-on Chembooks.

Oloyede, O. & Adeoye F. A. (2009).Comparative effect of guided discovery and concept Mapping Teaching Strategies on Senior Secondary School Students Chemistry Achievement in Nigeria. Eurasian Journal Physical Chemistry Educ. 2 86-92

Sambo, A. (2008) Research Methods in Education, Oyo State Nigeria.Stirling-Horeden Publishers, Nigeria Limited, Ibadan.

SaoumaB. &Attieh, M. (2008).The Effects of Using Concept Maps as Study Tools on Achievement in Chemistry. Eurasia Journal of Mathematics, Science and Technology Education 4 (3) 233-246.

Uhumuavbi, P.O, Oriahi, C.I. &Olusi, F.I. (2003).Science Technology and Mathematics (STM) Education: Catalyst for women development and Empowerment. *The Nigerian Academic Forum* Vol. 5 No.1 October 2003. PP 20-26. West African Examination Council (WAEC) (2021-2023) Chief Examiners report for May/June Examination.