

Effect of Cooperative Group Learning Strategy on Secondary School Students' Achievement in Chemistry in Anambra State, Nigeria

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ABSTRACT: This study investigated the effect of cooperative group learning strategy on secondary school students achievement in chemistry in Anambra State Nigeria. 270 SS III Chemistry students were used (124 males and 146 females). The experimental group made up of 198 students (90 males and 108 females). The control group was made up of 72 students (34 males and 38 females). The study adopted quasi experimental research design. The experimental group was taught the concept of Charles' s law, Boyle' s law, and Thermodynamics using cooperative group learning strategy (C G L S) while the control group was taught the same topics using conventional lecture method (CLM). The instrument for data collection was titled Achievement Test (AT) with reliability of 0.84. The test items were obtained from past WAEC question papers. The instrument consisted of 30 objective questions from the topics taught to the sampled groups. The research questions were answered using mean and standard deviation while hypotheses were answered using mean and standard deviation while hypothesis were tested using analysis of variance. The result of the study showed that; there was significant difference in achievement between students taught chemistry with cooperative group learning strategy to those taught with conventional lecture method in favour of experimental group. There was significant difference in achievement between male and female students taught chemistry with cooperative group learning strategy then those taught with conventional lecture method in favor of males, based on the findings of this study, chemistry teachers were advice to teach chemistry concepts with cooperative group learning strategy (CGLS) especially in using it to provide knowledge in the cognitive structure of the learner before actual presentation of the concept.

Keywords: Science, Chemistry, Cooperative, Group learning

I. INTRODUCTION

Science is the concerted human effort to better understand the history of the natural world works with observable physical evidence as the basic of that understanding. It is a knowledge acquired through observation of natural phenomena, and experimentation that tries to stimulate natural processes under controlled conditions. Samuel and Uyaelumuo (2017) noted that science consists of ideas, facts principles, and theories which are embedded in knowledge that brings about product. This implies that science is the discovery of knowledge and application of the knowledge which gives birth to technology. Mbah and Leghara (2007) were of the opinion that knowledge of science is very vital for the achievement of a nation. Science as an agent of national development has lent its relevance in the areas of security, politics, agriculture, health, energy and education. In the area of security, Mallik (2016) noted that science has helped to bring peace in some parts of the world through technology. In another development, Mallik (2016) observed that the world powers popularly know as the G8 countries attained their high level of security due to their development in technological security gadgets and sophisticated weapons that are used for their country' s self-defense as a result of knowledge acquired from science. It was with the latest breakthrough in technology that US led coalition forces waged a high precision war on a distant land like Afghanistan to achieve her political and economic fame. In the area of politics, science lends its relevance in areas such a climate change, resource usage or control, conservation, species loss, energy policy, global epidemics and pandemics among others (Dunford, 2008).

Dechezlepretre and Sato (2014) noted that scientists have been helping and will continue to help politicians in the areas of policy making in climate change and other environmental issues. The working together of science and some good dividends to citizens, especially in environmental issues. Examples are manifested in combating epidemics, developing environmental friendly fuels or working out the rules on time limits for abortions and space science.

Another area that science has contributed immensely to human life is agriculture. Agriculture is not without application of science. Agriculture is associated with production of essential food crops. Presently with the help of science, agriculture has gone beyond ordinary farming. It has Improved on breeding of animals and cultivation. As a result, Mark, Michael, John, Grarene, John, Jennifer, Michael (2014) concluded that improvement in breeding and cultivation, which come as a result of scientific ideals, can yield food that is better for people in the planet earth. Science has also contributed in the area of health. Science has played important role in improving health standard, health policy, regulations and health programmes. According to Walt, Shiffman, Schade, Murrary, Brughha, Gilson (2008) science is of great importance to health in the following ways:

- i. It prepares for and responds to health risk posed by diseases environmental hazards, food and other threats;
- ii. It helps in verifying drugs, food and other medical devices and
- iii. It provides decision about people' s health.

David (2012) pointed out that science has improved health facilities. Science has relevance in developing alternative energy from nuclear elements and from sunlight for solar energy (Koji, 2009). The relevance of science in the development of education cannot be overemphasized. Science has developed new innovations in teaching and learning process. Information and Communication Technology (ICT) has become a very powerful teaching and learning instrument. ICT has not only improved teaching and learning process but has also improved knowledge (Moscoso and Correria, 2015). The use of ICT gadgets in educational system is one of the relevance of scientific achievements in education.

Kola (2013) pointed out that the use of projectors and other related gadget to teach large classes, seminars and workshops have improved teaching process a lot. That is to say that science is not only dealing with living things but also with non living things, showing that science has branches. According Nwachukwu (2012) illustrated the branches of science as this;

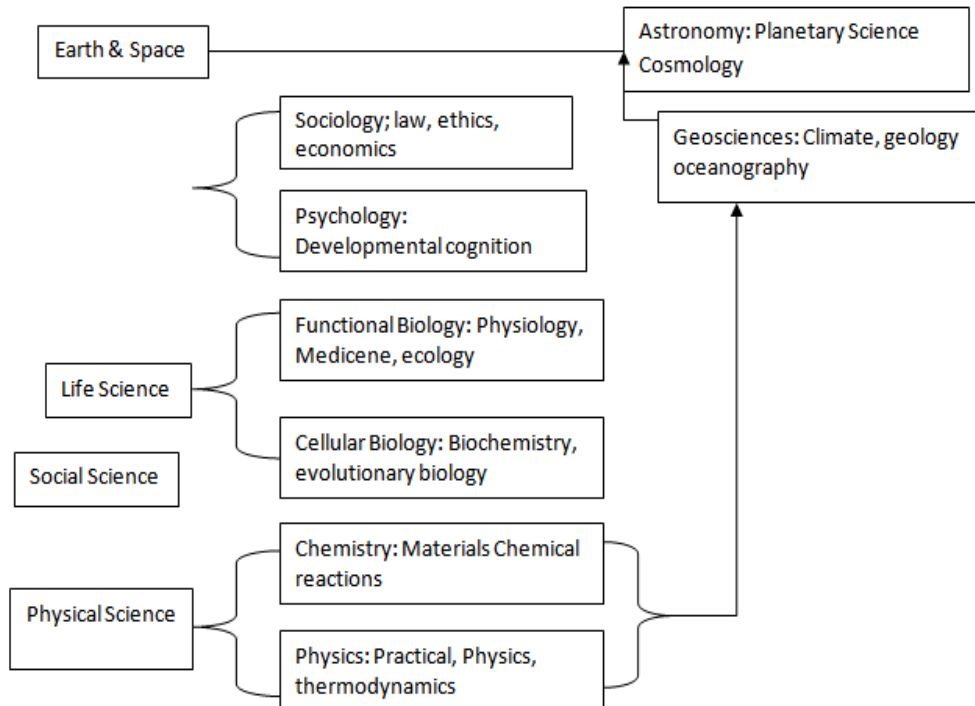


Fig 1: Illustration of Branches of Science

This study is interested in a branch of physical science known as chemistry. Chemistry is a branch of science that deals with the study of nature, composition and properties of matter, as well as the change matter undergoes under different conditions. Chemistry deals with the study of our environment, and explains things that are happening in the environment. Osei (2010) opined that chemistry offers a lot of usefulness and importance to humanity in the production of the following materials, fertilizer and insecticides used to increase food productivity and in the production of clothing. He also states that chemistry

contributes to the theoretical base for producing communications for defense and security. According to Hashimi (2018) chemical technology is also applied in the development of building materials and medicine.

In spite of the importance of chemistry to human needs, students' performance in chemistry in secondary schools has not been impressive, looking at the trends of the performance of achievement of chemistry candidates in West African Examination Council (WAEC) from 2005 – 2014 in Nigeria.

Table I trends of students' performance in chemistry in WAEC from 2005 – 2014 in Nigeria.

| | Registration | Credit Pass | | Fail |
|------|--------------|-------------|----------|----------|
| | | 1 – 6 | 7 – 9 | 9 |
| 2005 | 361575 | 179156 | 65804 | 116615 |
| | | (50.65%) | (18.63%) | (30.71%) |
| 2006 | 393207 | 173013 | 87645 | 132459 |
| | | (45.11%) | (22.84%) | (32.05%) |
| 2007 | 434460 | 196081 | 105602 | 132777 |
| | | (46.16%) | (24.86%) | (28.98%) |
| 2008 | 4184123 | 198621 | 121139 | 9866663 |
| | | (43.46%) | (26.50%) | (30.04%) |
| 2009 | 468546 | 20475 | 114697 | 149124 |
| | | (43.69%) | (23.41%) | (32.9%) |
| 2010 | 565692 | 236057 | 109944 | 222290 |
| | | (50.70%) | (23.61%) | (25.69%) |
| 2011 | 565692 | 2802.43 | 156357 | 129092 |
| | | (49.54%) | (27.64%) | (129092) |
| 2012 | 627302 | 270555 | 215478 | 141269 |
| | | (43.13%) | (34.35%) | (22.52%) |
| 2013 | 602201 | 243289 | 2223235 | 135677 |
| | | (40.4%) | (37.07%) | (22.53%) |
| 2014 | 505691 | 230089 | 166928 | 108674 |
| | | (45.50%) | (33.01%) | (21.4%) |

Source: West African Examination Council Nigeria cited by Bello & Oke (2015) and Sakiyo & Badenu (2015)

From Table I, the percentage pass by students who registered chemistry each year from 2005 to 2014 was not up to 50% except in 2015 and 2010 respectively. The percentage pass of P7

– P8 is equivalent to failure because it cannot give any student admission in science courses in higher education in Nigeria. P7 and P8 together with failure F9 have higher percentage value. These

indicated that performance of students in chemistry for the past decade generally has been below 50%. The poor achievement among chemistry students are centered more on some of the difficult concepts like Boyle's law, Charles law, Gas law and Thermodynamics because of their abstract nature as a result of the calculations in these chemistry topics (Agago & Onda 2014). The WAEC Examiner report (2011 & 2012) confirmed that poor achievement of students in chemistry may be as a result of abstract nature especially in physical chemistry that involves calculations.

Many reasons were adduced as to the causes of students' poor achievement in chemistry. According to Samba and Eriba (2012) one of the factors is the abstract nature of chemistry concepts as mentioned earlier and the use of popular lecture method by most chemistry teachers. Agogo and Onda (2014) were of the opinion that lecture methods most times do not get students involved in the teaching process thus making achievement difficult for male and female students. Thus, Bager and Mecoy (2009) were of the opinion that poor achievement in chemistry examination may be as a result of poor teaching method. They went further to opine that cooperative teaching method have more advantages in enhancing students academic achievement in chemistry.

Cooperative group learning is viewed as a classroom learning environment in which small group of students work together to accomplish a task for individuals and for the common goals of the group. Two elements are necessary for cooperative group learning to be effective. These elements are group goals and individual accountability. Group goals provides a powerful means of drawing students together to achieve some goals or earn rewards or recognition and the success of the group must depend on the individual learning of every member (Offiah & Okonkwo, 2011).

Individual accountability, students learn together but perform alone. This ensures that one can look on the work of others. In individual accountability, a lesson's goal must be clear enough that students are able to measure whether the group is successful in achieving them or whether individual members are successful in achieving them (Kipnis & Hofsterin, 2005). The crust of this study is to determine the extent cooperative group learning strategy can help students' achievement of chemistry concepts in secondary schools.

Cooperative Group Learning Strategy (CGLS) is an organized and structured way to use

small group to enhance students' learning and interdependence. Students are given a task, better known as an assignment, and they work together to accomplish the task. Each individual has responsibilities and is held accountable for aiding in the completion of the assignment; therefore, success is dependent on the work of everyone in the group. CGLS is a learning process that helps to activate team spirit among individual learner (Cartsmith & cooper, 2002). Cooperative group learning strategy is an instructional method in which students or individuals work together in small heterogenous group to complete a problem project or other instructional goal, while teachers act as guides or facilitators (Johnson, Johnson & Smith, 2001).

Ayhan and Yasemin (2006) added to that CGLS is a method of teaching that promotes social activities and experience which can shape the cognitive processes of individuals in a learning situation. Furthermore, they believe that the construction of knowledge and the transformation of various points of view into personal thinking resulted from cooperative group learning strategy. With the numerous benefits of cooperative group learning strategy, the researcher sought to investigate its effect on the achievement of chemistry students when taught certain chemistry concepts with it.

Purpose of the Study

The main purpose of this study is to determine the effect of cooperative learning strategy on secondary school students' achievement in chemistry.

Specifically, the study is aimed at determining;

1. The effect of cooperative group learning strategy on secondary school students' achievement in chemistry.
2. Effect of cooperative group learning strategy on gender and achievement in chemistry among Anambra State Secondary Schools

Research Question

Two research question guided the study

1. To what extent does cooperative group learning strategy affect secondary school students achievement in chemistry?
2. To what extent does cooperative group learning strategy affect boys' and girls achievement in chemistry in secondary school.

Hypotheses

The following hypotheses were formulated to guide the study.

1. There is no significant difference in achievement between students taught chemistry using cooperative group learning strategy and those taught with conventional strategies at 0.05 level of significance.
2. There is no significant differences in achievement between male and female students taught chemistry using cooperative group learning strategy at 0.05 level of significance.

II. METHOD

Quasi experimental research design was adopted for this study. Quasi experimental design emerged from the need to conduct research where random assignment of subjects to experimental and control groups is not possible. Here, pre-existing or intact group are utilized in the study. The population of the study was 195 co-educational secondary schools in the Anambra state, four co-educational schools were stratifically sampled from the rural areas of the state because the urban areas of the state have more government co-educational schools than the rural areas. The sample schools were assigned to experimental and control group. The sample consisted of 270 SS III chemistry students (124 males and 146 females). The study covered a period of eight weeks. First week was used to sought permission from the principals of selected schools and orientation of the chemistry teachers in the selected schools who formed the research assistants, pretest was administered to the students in the respective schools by their chemistry teachers and the scores were obtained before the actual study began this was done in second week. The experimental groups were taught Charles' s law, Boyle' s law, General Gas Equations (The Gas Laws) and Thermodynamics using cooperative learning strategy. The experimental groups were grouped into six small groups. A group consisted three girls and three boys, some groups consisted of two boys and four girls. A total of 33 groups were formed from experimental group. The group has leader and assistants. At each chemistry class, the group members learn cooperatively by taking assignment through contributions from every member and arrived at a conclusion after which the leader or secretary presents the groups conclusion to the teacher. The lesson continued for three weeks, after which the test items (AT) was administered to the students to test their achievement. The

conventional talk and chalk method was used to teach the control group using the lesson note prepared by the researcher based on the same chemistry concepts used for the study.

The teaching was carried out for three weeks using the official chemistry period in the selected time table in control group. Both the experimental and control group teaching ran concurrently. At the end of the three weeks (AT) was administered to both experimental and control group to test the students achievement. The scores of students in each administration of (AT) were collected.

III. INSTRUMENT

The main instrument used for data collection was objective standardized test titled " Achievement Test (AT). The test was standardized because they were picked from WAEC questions papers. The instrument was organized by the researcher based on the topics used for the study namely; the Charle' s law, Boyle' s law, general gas equation (The Gas Law) and the Thermodynamic. The (AT) has two sections A and B. Section ' A' elicited responses from participants on their personal data with particular reference to gender and location while Section ' B' contained thirty objective test items obtained from past WAEC questions papers based on the selected topics in chemistry used in the study.

The AT was validated by experts in chemistry from department of science education Chukwuemeka Odumegwu Ojukwu Uli Campus Nigeria and Educational Foundations Nnamdi Azikiwe University Awka Nigeria. Comments and Suggestions made by them were used in the production of the final test items of AT. The test was scored according to the marking scheme developed by the researchers by ticking the right option A – D.

To ensure the reliability of the instrument, 30 objective question were administered a trail testing of 30 students (14 boys and 16 girls) who were not part of the main study. The result of pretest and posttest obtained in the administration was subjected to spearman Rank – order correlation method to correlate the rearranged two sets of test scores. A coefficient of 0.84 was obtained, indicating that the instrument was reliable. The data obtained from experimental and control group were analyzed using mean, standard deviation and Analysis of Variance (ANOVA).

IV. RESULTS

The results are presented in answer to research questions and hypotheses. **Research**

question 1: To what extent does cooperative group learning strategy affect secondary school students' achievement in chemistry?

Table 2: Mean and Standard Deviation of Students' Achievement Score from AT

| Group | Mean | SD | N | 90% confidence Interval | |
|--------------|-------|------|-----|-------------------------|-------------|
| | | | | Lower Bound | Upper Bound |
| Control | 14.92 | 6.12 | 72 | 13.48 | 16.35 |
| Experimental | 16.76 | 6.38 | 198 | 15.87 | 17.66 |

Table 2 show that the control group had a mean score of 14.92 and a standard deviation of 6.12. The experimental group had a mean of 16.76 and a standard deviation of 6.72.

This implies that experimental group who were taught with cooperative group learning strategy

performed better than the control group taught with the conventional learning strategy.

Research Question 2: To what extent does cooperative group learning strategy affect boys and girls achievement in chemistry in secondary school?

Table 3: Mean and Standard Deviation of Achievement Scores by Gender in AT

| Group | Mean | SD | N | 90% confidence Interval | |
|-------|-------|------|-----|-------------------------|-------------|
| | | | | Lower Bound | Upper Bound |
| Boys | 21.02 | 5.12 | 90 | 20.11 | 21.93 |
| Girls | 12.24 | 4.11 | 108 | 11.57 | 12.91 |

In the achievement test as shown in table 3 above indicate that the boys had a mean of 21.02 and a standard deviation of 5.12 while the girls had a mean of 12.24 and a standard deviation of 4.11. this shows that boys achieve better than girls.

HO_i: There is no significant difference in achievement between students taught chemistry using cooperative group learning strategy and those taught with conventional strategies at 0.05 level of significance.

Table 4: Analysis of variance (ANOVA) Results of the Achievement Test of students taught chemistry using cooperative Group learning strategy and conventional strategy.

| Source of Variation | sum of square | DF | Mean square | F | Sig |
|---------------------|---------------|-----|-------------|----------|------|
| Corrected model | 5445.364 | 3 | 1815.121 | 89.340 | .000 |
| Treatment group | 226.580 | 1 | 54857.311 | 2701.281 | .000 |
| Gender | 3596.019 | 1 | 226.580 | 11.157 | .001 |
| Treatment group | 69.194 | 1 | 69.194 | 3.407 | .066 |
| Gender | | | | | |
| Error | 5401.899 | 266 | 20.38 | | |
| Total | 82323.00 | 270 | | | |
| Corrected total | 10847.263 | 269 | | | |

Significant at 0.05 alpha level

The analysis in table 4 showed a significant difference in the achievement of students' taught chemistry with cooperative group learning strategy and those taught with conventional learning strategy in favour of cooperative group learning strategy. ($F - Cal = 11.157, P = 0.001$) thus the null hypothesis which

states that there is no significant difference in achievement between male and female students taught chemistry using cooperative group learning strategy at 0.05 level of significance rejected. This implies that cooperative group learning strategy significantly affected students' academic achievement in chemistry concepts.

Table 5: Analysis of Variance (ANOVA) of Result of the Achievement Test of male and female students taught chemistry using cooperative learning strategy

| Source of Variation | sum of square | DF | Mean square | F | Sig |
|---------------------|---------------|-----|-------------|-------------|-------------|
| Corrected Model | 5615.167 | 3 | 1871.722 | | 94.775 .000 |
| Intercept | 55657.969 | 1 | 55657.969 | | 288.252.000 |
| Treatment Group | 209.593 | 1 | 209.593 | 10.613 .000 | |
| Gender | | | | | |
| Error | 5253.263 | 266 | 19.749 | | |
| Total | 8316.000 | 270 | | | |
| Corrected Total | 10868.430 | 269 | | | |

The analysis in table 5 shows a significant difference in the achievement of male and female students taught chemistry with cooperative group learning ($F - cal = 10.613, P = 0.001$). Hence, the null hypothesis which stated no significant difference in achievement between male and female students taught chemistry using cooperative group learning strategy at 0.05 level of significance is rejected.

V. DISCUSSION

The result of this study had shown that there exist a significant difference in achievement between students taught chemistry using cooperative group learning strategy and those taught using conventional lecture method in favour of cooperative group learning strategy. The finding showed that the cooperative group learning strategy enhanced students achievement in chemistry than using conventional lecture method. In other development the study shown that boys achieve better than girls. The above findings were in consistent with Agogo and Onda (2014) which are in opinion that lecture method most times do not get students involved in the teaching process thus making achievement difficult.

VI. CONCLUSION

Based on the finding of the study, it was concluded that students who were taught chemistry concepts with CGLS had higher mean achievement scores than those students taught with conventional lecture method (CLM). The use of CGLS have

served as an instrument for consolidation of knowledge. From the study, there is a significant difference in achievement between students taught chemistry using cooperative group learning strategy and those taught with conventional lecture method. Also there is a significant difference in achievement between male and female students taught chemistry using cooperative group learning strategy. The use of CGLS in the teaching and learning of some chemistry concept as used in this study facilitate teaching and learning process. Teachers adopting the use of cooperative group learning strategy in chemistry concepts will enhance the efficiency of teaching – learning of chemistry concepts.

VII. RECOMMENDATIONS

Based on the findings and their implications, the following recommendations were made:

1. Since the study had revealed that cooperative group learning strategy (C G L S) facilitates meaningful learning, achievement of chemistry concepts, the strategy should be employed
2. Chemistry concepts will not be perceived as difficult if teachers of chemistry subjects use good and appropriate approach to it especially when using it to provide knowledge in the cognitive structure of the learner before the actual presentation of the concept.

REFERENCES

- [1]. Agogo, P.O., & Onda, M. O. C. (2014). Identification of students perceived difficult

- concept in senior secondary chemistry in Oju local government area of Benue State, Nigeria. *Global Educational Research Journal* 2(4), 44 – 49
- [2]. Ayhen, D & Yasemin, Y. (2006). The effect of cooperative learning on the abilities of pre-service art teacher candidates to lesson planning in turkey. *Australian Journal of Teacher Education* 31 (2), 9 – 11.
- [3]. Barger, R.H., & Mc Coy, A.C. (2009). Sacred cows make the best hamburger. *Journal of Chemistry Teacher*, 102 (6), 414 – 418
- [4]. Bello, M.A., & Oke M.G. (2015) An appraisals of candidates achievement in the West African Senior School Certificate Examination (WASSCE) among WAEC member countries. WAEC HQ, Accra and Lagos
- [5]. David (2012). The importance of life – science to health and wealth. *Cancer Research U.K.* Retrieved from <http://www.scienceblog.cancerresearchuk.org/2012/06/14/devid-willets.on> 8 june 2016 at 4am
- [6]. Dechiezlepretre, A., & Sato M. (2014). The impacts of environmental regulation on competitiveness. Granthen Research Institute on climate change and the Environment. Retrieved from [http://www.ise.ac.uk/.../impacts-of-science/.../... org.](http://www.ise.ac.uk/.../impacts-of-science/.../...) on 2nd June at 2:45pm
- [7]. Dunford, M. (2008). The role of science in politics. A plea for activism. Retrieved at <http://www.scienceblogs.com/authority/2008/02/18/the-role-of-science-in-politics> on 3rd March 2015 at 11am
- [8]. Hashimi, M.A (2018) challenges of educational development in Nigeria; Issue of Chemistry Science. *Journal of chemistry and materials research*. Retrieved from <http://www.iiste.org> on 11 fed, 2020 at 2:14pm
- [9]. Johnson, D. W., Johnson, R.T., & Smith, K (2001). Active learning: Cooperation in the college classroom, 34 (9) 67 – 87
- [10]. Kola, A. T (2013) Importance of Science Education to National Development and Problem Militating against its development *American Journal of Education Research* 31 (7) 225 – 229
- [11]. Koji (2009) Alternative energy for transportation. *Issues in science and technology* 25 (4), 4 – 8. Retrieved from <http://www.issues.org/22-4/omi>.
- [12]. Offiah, F. & Okonkwo, C. (2011). Cooperative learning strategy and students academic achievement in chemistry *Unizik Journal or STM Education* 5(2) 63 – 65
- [13]. Osei, A (2010). *New School Chemistry*, 6th edition. Onitsha, Nigeria; African first publishers plc Nigeria
- [14]. Mallik, N. (2016). EBA day 2016: Setting a vision for the future of the European payments industry. From http://www.finextra.com/new_sarticle/28850/ebaday-2016-setting-a-vision-for-the-future-of-the-European-payments-industry. On 11th December, 2016 at 2:02pm
- [15]. Mark, C., Micheal, R. John, F., Grarene, B., John, B., Jennifer, A., Michael, W. (2014). Steps to sustainable livestock. *Agricultural Journal*, 22 (6) 34 – 35. Retrieved from <http://www.nature.com/new/agriculturesteps-tosustainable-livestock-14796on12june2015at9:48am>
- [16]. Mbah, N.C & Leghara, B. N. (2007). Science Education in Nigeria current curriculum practice and Implementation for National Development 48th National Conference of STAN proceedings page 98
- [17]. Sakiyo, J., & Badau K.M (2015), Assignment of the trend of secondary school students academic performance in the science, Mathematics and English: Implications for the attainment of the millemium development goals in Nigeria. *Advances in social science Research Journal* 2(2) 5 – 7 doi: 10.14738/assrj 22.805
- [18]. Samba, R. M. O., Eriba, J.O (2012). Background Information on Teaching Difficult Science concept. In Samba, R. M. O and Eriba, J.O (Eds). *Innovative approaches in teaching difficult science*
- [19]. Samuel, N. N. C & Uyaelumuo, G.C (2017) problem facing the teaching and learning of chemistry in secondary schools in Anambra State *journal of science education and allied discipline* 2(1) 24 – 42
- [20]. Walt, G., Shiffmen, Schneider, h., Murray, S., Brugh, R., & Gilson, L. (2008). Doing health policy Analysis Methodology and conceptual Reflection and chanllenge. Retrieved from [http:// www. M. heapol. Oxfordjournals.org/content/22/5/308/full](http://www.M.heapol.Oxfordjournals.org/content/22/5/308/full). On 21 May 2016 at 5:30pm

