Journal of African Advancement and Sustainability Studies
July, 2024 Editions
www.ssaapublications.com

JAAS
Vol.5, No.2, E-ISSN 3027-0715
P-ISSN 3027-0723
Sahara African Academic

# EFFECT OF INDIVIDUALIZED INSTRUCTION ON ACADEMIC PERFORMANCE AND INTEREST IN CHEMISTRY AMONG SECONDARY SCHOOL STUDENTS IN KATSINA STATE, NIGERIA

**ALIYU ISHAQ KAROFI**
Department of Science and Vocational Education, Faculty of Education, Umaru Musa Yar'adua University, Katsina.
*Corresponding Author: aliyukarofi074@gmail.com*

## Abstract
The study investigated the effect of individualized instruction on academic performance and interest in chemistry among secondary school students in Katsina State, Nigeria. Two research objectives guided the study. Two research questions were answered and two null hypotheses were tested at 0.05 level of significance. The study adopted quasi-experimental research design involving pretest posttest control group. The experimental group were taught using individualized instruction while the control group were taught using lecture method. The population of the study consisted of four thousand, two hundred and sixty eight (4,268) SS II chemistry students while the sample of the study consisted of one hundred and ninety (190) SSII chemistry students from two intact classes using two sampling techniques; cluster sampling and simple random sampling techniques. Two instruments namely; Chemistry Performance Test (CPT) and Chemistry Interest Scale (CIS) with a reliability coefficients of 0.91 and 0.82 respectively using Cronbatch alpha were used to collect data. Mean and standard deviation were used to answer the research questions while independent sample t-test and Mann-Whitney u-test were used to test hypotheses at 0.05 level of significance. Results from the study revealed that students taught using individualized instruction performed better and have more interest in the chemistry contents than students taught using lecture method. The study recommended that chemistry teachers should exposed students to student-centered and activity-based methods like the individualized instruction.

**Keywords:** Chemistry, Individualized Instruction, Lecture Method, Academic Performance, Interest.

## Introduction
Chemistry is a natural science that plays a vital role in scientific and economic development of nations (AgwuUdu, 2018). It is a core subject for all science students

in senior secondary schools in Nigeria. Chemistry as a science subject is universally accepted and realized not only by students but also people who are keen to know about chemicals. The subject provides a wider knowledge about what science is which is compulsory to every individual that aim to study the environment or climate change related courses (Kenni, 2020). Chemistry is one of the three main branches of pure science, the other two branches being biology and physics. Chemistry deals with the composition, properties, and uses of matter (Osie, 2013). Duvarci (2010) is of the view that chemistry improves students' thinking style in a way that they use scientific method, then, they can use these thinking styles they gained in the chemistry class to solve any problem in their life. Chemistry as an academic discipline or subject involves the teachings of theory and practical concepts. In this regard, it requires both human and material resources such as qualified teachers and instructional facilities, therefore, there is need to employ teaching strategies that are student-centered and activity-based like individualized instruction in its teaching.

Individualized instruction is a teaching strategy whereby the teacher identifies the learning needs and ability of each individual learner thereby giving a suitable instruction to each student and no classroom discussion is carried out in the class. Individualized instruction according to Olatoye, Aderogba and Aanu (2011) is an instructional strategy in which the content, instructional materials, instructional media, and pace of learning are based upon the abilities and interest of each individual learner. It considers individual students' learning needs, learning readiness and learning style and the process of implementation take into account the individual's aptitude and ability of students and students in an individualized instruction works at their own pace (Gabriel, Osuafor, Cornelius, Obinna & Francis, 2018). In the view of Omoniyi (2012), the positive effect of individualized instruction could be attributed to the learning modes. Individualized instruction method can be approached and achieved through different methods such as Programmed Instruction (PI), Computer-assisted Instruction (CAI), Independent Study (IS), Audio-tutorial Training Models (ATTM), Learner-Controlled Instruction (LCI), Personalized System of Instruction (PSI), Protocol Packages (PP), Learning Activity Package (LAP), Self-directed Individualized Instruction (SDII) (Neboh, 2009) among others. All these learning modes in individualized instruction allows for self-pacing. Thus, the individuals learn at their own pace, taking their time to understand difficult materials, ask questions, and make inquiry which will be expected to improve their academic performance.

Academic performance is the general overall outcome of education. Kenni (2020) sees academic performance as the degree of a student's accomplishment in his or her tasks and studies. It is the learning outcome of the child which is the outcome of determination, hard work of student in academic pursuit (Muhammad & Saleh,

2020). Academic performance can also be defined as the extent to which educational objectives are achieved by the learner. It may be used to refer to expression used to present pupils' scholastic standing within a short term (Ahmad, et al, 2017). Techniques for measuring academic performance can be continuous assessment or examinations but there is no general agreement on how it is best measured or tested. Age, gender and place of residence doesn't affect academic performance but grouping weak students with good ones increases their academic performance (Hijazi & Naqvi, 2006). Poopola (2010) stated that academic performance is an expression used to present students' scholastic standing which is a function of various factors such as method of teaching, teachers' qualification, child's home background, school environment, attitude and interest.

Interest can be defined as a psychological state characterized by increased attention, effort and effect experienced at one time, as well as an enduring propensity throughout time to re-engage with a particular item or subject (Ulfiantari, Rosnija & Supariati, 2023). It is the outcome of motivation and one of the factors affecting learning, other factors being: readiness of the learner, ability of the learner, attention, maturation, health condition, family background, teaching method etc. It could also be viewed as the feeling that stimulate an individual to activity without any external influence and it is a powerful dictator and motivator in the learning process (Aggarwal, 2010). Factors affecting interest were classified by Kenni (2019) as personal and socioeconomic/environmental factors. The personal factors include students' physical health and development, age and sex of the learner, learner's emotion etc. while the socio-economic/environmental factors include family background, cultural status, education, teachers behavior etc. It is in line with this motive the researcher investigated the effects of individualized instruction on academic performance and interest in chemistry among secondary school students in Katsina State, Nigeria.

## Statement of the Problem

Over the years, the academic performance of students in Chemistry in Nigeria secondary schools has been low. Students' academic performance in Chemistry in internal and external examination is on the decline. The WAEC Chief Examiner's Report of 2015 – 2020 and Katsina State WAEC analysis in chemistry from 2011-2021 indicated poor academic performance of students in Chemistry. Some of the factors responsible for this poor performance are: poor classroom management, use of gender biased instructional materials, lack of adequate instructional materials, lack of adequate laboratory activities, poor teaching methods employed in teaching Chemistry by the secondary school teachers and lack of competent Chemistry teachers (Uzezi & Zubairu, 2021).

According to Nwafor, Ezeanya and Onuigwe (2024), one of the key factors contributing to students' low academic performance in chemistry is teachers' use of the lecture method (LM), which does not guarantee students' engagement in chemistry learning.

**Table 1: WAEC Results (2012 – 2021) in Katsina State**

| Year | No of Students | Passed (A1 – C6) | % Pass | Failed (D7 – F9) | % Fail |
|---|---|---|---|---|---|
| 2012 | 13, 297 | 3, 550 | 26.70 | 9, 747 | 73.30 |
| 2013 | 16, 898 | 2, 674 | 15.82 | 14, 224 | 84.18 |
| 2014 | 20, 141 | 9, 941 | 49.40 | 10, 200 | 50.60 |
| 2015 | 21, 514 | 13, 302 | 61.83 | 8, 212 | 38.17 |
| 2016 | 20, 404 | 7, 790 | 38.20 | 12, 614 | 61.80 |
| 2017 | 21, 717 | 11, 692 | 53.47 | 10, 105 | 46.53 |
| 2018 | 23, 916 | 7, 188 | 30.06 | 16, 728 | 69.94 |
| 2019 | 27, 134 | 11, 850 | 43.67 | 15, 464 | 56.33 |
| 2020 | 27, 050 | 5, 968 | 22.10 | 21, 082 | 77.90 |
| 2021 | 30, 122 | 12, 167 | 40.39 | 12, 167 | 59.61 |

**Source (Katsina State Ministry of Education, 2022)**

Table 1 shows the WAEC results of chemistry students in Katsina State. It shows that there is persistent failure in the students' academic performance over the years. There is need to investigate methods of teachings that facilitates interaction between teachers and students which will improve their performance and interest. It is with this opinion that the researcher investigated the effects of individualized instruction on academic performance and interest in chemistry among secondary school students in Katsina State, Nigeria.

## Objectives of the Study

The objectives of this study are to:

1. Find out the mean academic performance of students taught Redox Reaction using individualized instruction and those taught using lecture method among secondary school chemistry students in Katsina State.
2. Find out the mean interest of students taught Redox Reaction using individualized instruction and those taught using lecture method among secondary school chemistry students in Katsina State.

## Research Questions

The following research questions were answered:

1. What is the difference in the mean academic performance score of students taught Redox Reaction using individualized instruction and those taught using lecture method among secondary school chemistry students in Katsina State?
2. What is the mean difference in the interest of students taught Redox Reaction using individualized instruction and those taught using lecture method among secondary school chemistry students in Katsina State?

## Research Hypotheses

The following null hypotheses were tested at 0.05 level of significance:

**$H0_1$:** There is no significant difference in the mean scores of students' academic performance taught Redox Reaction using individualized instruction and those taught using lecture method among secondary school chemistry students in Katsina State.

**$H0_2$:** There is no significant difference in the mean scores of students' interest taught Redox Reaction using individualized instruction and those taught using lecture method among secondary school chemistry students in Katsina State.

## Methodology

The design for this study used quasi-experimental research design, involving pretest posttest control groups design. Firstly, a pretest was administered to both the experimental and control groups, this was to measure the knowledge of chemistry and the equivalent ability of both experimental and control groups before the treatment. The experimental group was exposed to treatment in which they were taught using individualized instruction while the control group were taught the same concept as the experimental group using lecture method. Posttest was administered at the end of the treatment to find out the students' academic performance and interest.

The procedure employed for data collection was through administration of the Chemistry Performance Test (CPT) and Chemistry Interest Scale (CIS) to the sampled schools by the researcher. The data collected was processed using SPSS version 23, based on the research questions and hypotheses. Descriptive statistics involving mean and standard deviation was used to answer the research questions. Hypotheses one was tested using t-test independent sample while hypotheses two was tested using Mann-Whitney u-test.

## Results

**Table 2: Mean and standard deviation of academic performance score of students taught Redox Reaction using individualized instruction and those taught using lecture method**

| Treatment | N | Mean | SD | MD |
|---|---|---|---|---|
| Individualized instruction | 74 | 23.95 | 5.54 | 4.50 |
| Lecture method | 95 | 19.45 | 7.78 | |

In Table 2, students taught redox reaction using individualized instruction had a mean score of 23.95 and a standard deviation of 5.54 while the students taught using lecture method had a mean score of 19.45 and a standard deviation of 7.78. The mean difference of 4.50 was observed between students taught redox reaction using individualized instruction and those taught using lecture method. The difference is in favor of the students taught redox reaction using individualized instruction. This answered the research question which sought to find out the difference in the mean academic performance score of students taught redox reaction using individualized instruction and those taught using lecture method.

**Table 2: Mean difference in the interest of students taught Redox Reaction using individualized instruction and those taught using lecture method**

| Treatment | N | Mean Rank | Sum of Ranks | Mean Rank Diff |
|---|---|---|---|---|
| Individualized instr. | 74 | 92.96 | 6879.00 | 17.14 |
| Lecture Method | 95 | 75.82 | 7203.00 | |

Table 3 shows the difference in mean in the interest of students taught redox reaction using individualized instruction and those taught using lecture method. The students taught redox reaction using individualized instruction had a mean rank of 92.96 while those taught using lecture method had a mean rank of 75.82. The mean difference observed is 17.14. This difference is in favor of the students taught using individualized instruction. This answered the research question which sought to find out the mean difference in the interest of students taught redox reaction using individualized instruction and those taught using lecture method.

### Testing Hypotheses

**$HO_1$:** There is no significant difference in the mean scores of students' academic performance taught redox reaction using individualized instruction and those taught using lecture method.

**Table 4: Independent t-test analysis of academic performance score of students taught Redox Reaction using individualized instruction and those taught using lecture method**

| Treatment | N | Mean | SD | MD | Df | t-value | p-value | Decision |
|---|---|---|---|---|---|---|---|---|
| Ind. Instr. | 74 | 23.95 | 5.54 | 4.5 | 167 | 4.205 | 0.000 | Reject $HO_1$ |
| Lecture Method | 95 | 19.45 | 7.78 | | | | | |

Table 4 presents the independent t-test analysis of the difference in the performance of students taught redox reaction using individualized instruction and those taught using lecture method. There is significant difference in the academic performance score of students taught redox reaction using individualized instruction and those taught using lecture method. This is because, the p-value (0.000) obtained for which the null hypothesis was tested is lower than the alpha value (0.05) for which the null hypothesis was tested. Hence, the difference is in favor of students taught redox reaction using individualized instruction. Hence, the null hypothesis which states that, there is no significant difference in the mean academic performance score of students taught redox reaction using individualized instruction and those taught using lecture method is rejected. Students taught redox reaction using individualized instruction significantly performed better than their counterpart taught the same topic using lecture method.

**$HO_2$**: There is no significant difference in the mean scores of students' interest taught redox reaction using individualized instruction and those taught using lecture method.

**Table 5: Mann-Whitney U-test of students' interest taught Redox Reaction using individualized instruction and those taught using lecture method**

| Treatment | N | Mean Rank | Sum of Ranks | Mean Rank Diff | U-value | P-value | Decision |
|---|---|---|---|---|---|---|---|
| **Ind. Instr.** | 74 | 92.96 | 6879.00 | 17.14 | 2345.50 | 0.019 | Reject $HO_2$ |
| **Lecture Method** | 95 | 75.82 | 7203.00 | | | | |

Table 5 presents the Mann-Whitney u-test analysis of the difference in the interest of students taught redox reaction using individualized instruction and those taught using lecture method. The analysis indicated that, there is significant difference in the interest of students taught redox reaction using individualized instruction and those taught using lecture method. The U-value obtained is 2345.50 while the p-value is 0.019. The p-value is less than the alpha value (0.05) for which the null hypothesis was tested. Therefore, the null hypothesis which states that, there is no significant mean difference in the interest of students taught redox reaction using individualized instruction and those taught using lecture method is rejected. This means that, students taught redox reaction using individualized instruction had better interest than students taught the same topic using lecture method.

## Discussion of the Findings

One of the major findings of this study is that, there was significant difference in the academic performance score of students taught redox reaction using individualized instruction and those taught using lecture method in favor of those taught using individualized instruction. This finding agrees with the findings of Oladayo and Nwankwo (2014), Gambari, et al (2016), Nnamani and Oyibe (2016), Agwu Udu (2018) that individualized instruction has significant effect on students' academic performance. Many other previous studies conducted on individualized instruction proved the effectiveness of this method of teaching (Gabriel, et al, 2018; Oladehinde, 2020 and Olatoye, et al, 2011). This may be as a result of the fact that earlier studies on the individualized instruction have found out that the treatment enhances academic performance of students and the instruction is tailored to the need and ability of individual learners. This performance could be attributed to the fact that the method is student- centered and activity-based which enable students to actively participate in teaching and learning, unlike the lecture method which is teacher-centered. The findings of this study contradicts with the findings of Yusuf and Afolabi (2010) in biology which reported that students taught using computer supported instruction performed better than those taught using computer assisted instruction in individualized settings. It also contradicts with the findings of Yusuf, Gambari and Olumorin (2012) who reported that cooperative learning facilitates greater improvement on students' academic performance than the individualized learning.

The second major findings of this study is that, there was significant difference in the interest of students taught redox reaction using individualized instruction and those taught using lecture method. Students taught redox reaction using individualized instruction had better interest than students taught the same topic using lecture method. This finding is in line with the findings of Oladehinde (2020) that, individualized instruction arouse greater student's interest. This may be as a result of the fact that in individualized instruction learners learns at their rate, taking their time to understand difficult materials, ask questions, and make inquiry and the needs and problems of individual learner is considered and the instruction bridges the gap between fast and slow learners. The findings of this study contradicts with the findings of Abdullah and Abass (2006) which concluded that the performance, attitudes, interest and eagerness towards the learning of students exposed to computer instructional approach in cooperative learning settings was better than their counterparts in the individualized settings.

## Conclusions

In view of the findings of this study, the following conclusions were made:

1. Individualized instruction improves chemistry students' academic performance in Redox Reaction.

2. Individualized instruction improves chemistry students' interest in Redox Reaction.

## Recommendations

Based on the findings of this study, the following recommendations were made:

1. Chemistry concepts should be taught using strategies or methods like individualized instruction that are student-centered and activity-based methods of instruction and also encourages active engagement and self-motivation among learners.
2. Since lecture method was found less effective in this study with respect to students' academic performance and interest, teachers should be discouraged from using it in teaching chemistry in secondary schools.
3. Chemistry teachers should be encouraged to use individualized instruction in teaching chemistry in order to improve students' academic performance and interest.

## REFERENCES

Abdullah, S. & Abas, M. (2006). The Effect of Inquiry-Based Computer Simulation with Cooperative Learning on Scientific Thinking and Conceptual Understanding. *Malaysian Journal of Instructional Technology*, 3(2), 1-16.

Aggarwal, J.C. (2010). *Essentials of Educational Psychology*. New Delhi: Vikas Publishing House, PVT Limited (2nd Ed).

AgwuUdu, D. (2018). Comparative Effects of Individualized and Cooperative Learning Instructional Strategies on Senior Secondary School Students' Academic Achievement in Organic Chemistry. *Electronic Journal of Science Education,* 22(2), 1–14.

Ahmad, Y., Sabo, A. & Ibrahim, U. (2017). Effect of Guided-Discovery on Performance in Basic Science among Upper Basic Level Students in Zaria Education Zone, Kaduna, Nigeria. *UMYU Journal of Educational Research,* 7(2), 160-165.

Duvarci, D. (2010). Activity-based Chemistry Teaching: A case of 'Elements and Compounds'. *Procedia - Social and Behavioral Sciences,* 2(2), 2506–2509. Retrieved from https://doi.org/10.1016/j.sbspro.2010.03.362

Gabriel, I. A., Osuafor, A. M., Cornelius, N. A., Obinna, P. P., & Francis, E. (2018). Improving Students' Achievement in Chemistry through Cooperative Learning and Individualized Instruction. *Journal of Education, Society and Behavioral Science,* 26(2), 1–11. Retrieved from https://doi.org/10.9734/jesbs/2018/42873

Gambari, A. I., Shittu, A. T., Daramola, F.O. & James, M. (2016). Effects of Video-based Cooperative, Competitive and Individualized Instructional Strategies on the Performance of Senior Secondary Schools Students in Geometry. *Malaysian Online Journal of Educational Sciences,* 4(4), 31–47.

Hijazi, S.T. & Naqvi, S.M. (2006). Factors Affecting Students' Performance: A Case of Private Colleges. *Bangladesh E-journal of Sociology,* 3(1), 65-99.

Ihekwoaba, C.C., Nzewi, U.M., Ifeagwu, N.A., Chinweuba-Eze, V.O. & Nduji, C.C. (2020). Improving Students' Achievement in Biology: The Use of Peer-tutoring. *European Journal of Training and Development Studies,* 7(5), 1-15.

Kenni, A. M. (2019). Attitude of Female Students towards Learning of Chemistry in Selected Secondary Schools in Ikere Local Government Area of Ekiti State , Nigeria. *International Journal of Research and Analytical Review,* 6(2), 365–376.

Kenni, A. M. (2020). Analysis of Students' Performance in Chemistry in the West African Senior School Certificate Examination (WASSCE) and National Examination Council (NECO) from 2015-2018. *International Journal of Research and Analytical Review,* 7(1), 35–49.

Muhammad, J. & Saleh, I. (2020). Effect of Concept-mapping Strategy on Performance in Digestive System and Circulatory Systems among Senior Secondary Biology Students' in Kankia, Katsina State, Nigeria. *UMYU Journal of Science Management and Vocational Education.* 1(1), 62-71.

Neboh, O.I. (2009). Effect of Learning Activity Package (LAP) on Students' Achievement and Retention in Senior Secondary School Biology. Unpublished Thesis. Department of Science Education, Faculty of Education, University of Nigeria, Nsukka.

Nnamani, S. C. & Oyibe, O. A. (2016). Effect of Individualized Instructional Method on Secondary School Students' Achievement in Social Studies. *British Journal of Education,* 4(3), 110–120.

Nwafor, S.C., Ezeanya, M.C. & Onuigwe, B.U. (2024). Effect of Class-wide Peer-tutoring on Senior Secondary School Students' Achievement in Chemistry. *Journal Inovasi Pendidikan,* 3(1), 35-45.

Oladayo, O. T. & Nwankwo, O. C. (2014). Effect of Individualized and Conventional Instruction of Low-Achievement Students. *Asian Academic Research Journal of Multi-disciplinary,* 1(23), 279–293.

Oladehinde, A. A. (2020). Effect of Individualized Instructional Strategy and Academic Achievement of Senior Secondary School Students in Biology. *Journal of Educational Realities,* 10(1), 1–9.

Olatoye, R.A., Aderogba, A.A. & Aanu, E.M. (2011). Effect of Co-operative and Individualized Teaching Methods on Senior Secondary School Students' Achievement in Organic Chemistry. *Pacific Journal of Science and Technology,* 12(2), 310–319.

Omoniyi, T.T. (2012). Effect of Tele-video Individualized and Group-Controlled Attitudes of Students in Educational Technology. *Ilorin Journal of Education,* 3(1), 1-7.

Osie, Y.A. (2013). *New School Chemistry for Senior Secondary Schools.* Onitsa. Africana First Publishers Limited (6th Ed).

Poopola, A. (2010). Teachers' Mathematics Anxiety as a Correlate of Pupils Attitude to Mathematics. *Journal of Research in Curriculum Studies,* 3(2), 35-46.

Ulfiantari, F., Rosnija, E. & Supariati (2023). The Use of Field Trip Method to Engage Students' Interest in Writing Descriptive Text. *Journal of English Education,* 5(2), 126-136.

Uzezi, J. G. & Zubairu, H. I. (2021). Influence of Gender on Secondary School Students Achievement, Retention and Attitude in Chemistry using 4MAT Teaching Model. *Journal of Education in Developing Areas,* 29(2), 82-104.

West African Examination Council, (2015-2020). Chief Examiners' Report. Retrieved from https://www.waeconline.org.ng/e-learning/chemistry.

Yusuf, M. O. & Afolabi, A. O. (2010). Effect of Computer Assisted Instruction on Secondary School Students' Performance in Biology. *The Turkish Online Journal of Educational Technology,* 9(1), 62-69.

Yusuf, M.O., Gambari, I.A. & Olumorin, C.O. (2012). Effectiveness of Computer-Supported Cooperative Learning Strategies in Learning Physics. *International Journal of Social Science and Education,* 2(2), 94-109.