Vol. 12, No. 3, pp. 1127-1136, 2022 DOI: 10.23960/jpp.v12.i3.202211

Jurnal Pendidikan Progresif

e-ISSN: 2550-1313 | p-ISSN: 2087-9849

http://jurnal.fkip.unila.ac.id/index.php/jpp/

Effects of Learning by Analogy on Senior High School Students' Achievement in Genetics in Ilorin, Nigeria

Musa Mohammed Sulaiman*, Ganiyu Bello, Mulkah Adebisi Ahmed

Department of Science Education, Faculty of Education, University of Ilorin, Nigeria

*Corresponding email: sulaiman.mm@unilorin.edu.ng

Received: 27 April 2022 *Accepted: 12 June 2022* *Published: 03 July 2022*

Abstract: Effects of Learning by Analogy on Senior High School Students' Achievement in Genetics in Ilorin, Nigeria. Genetics has been identified in literature as one of the hard-to-learn biological concepts despite its importance to human existence. Therefore, there is the need for students to have deep conceptual understanding of the concept. **Objective:** The effectiveness of analogy on proper understanding of scientific concepts abound in literature, hence, this study examined the effects of analogy instructional strategy on senior school student s' achievement in genetics. **Methods:** The study was quasi-experimental with a sample of 112 students purposively selected from two intact classes. Data gathered were analysed using ANCOVA. **Findings:** Findings from the study revealed that a significant difference existed in the achievement of students taught genetics with analogy and those taught using the conventional teaching approach in favour of the analogy group ($F_{(1, 109)} = 20.88$, $p<0.05$). **Conclusion:** It was therefore, recommended that biology teachers should adopt the use of analogy instructional strategy in teaching genetics and other difficult concepts in biology.

Keywords: analogy, senior high school students', learning achievement, genetics.

Abstrak: Pengaruh Pembelajaran dengan Analogi pada Prestasi Siswa Sekolah Menengah di Ilorin, Nigeria pada Materi Genetika. *Genetika telah diidentifikasi dalam literatur sebagai salah satu konsep biologis yang sulit dipelajari meskipun penting bagi keberadaan manusia. Oleh karena itu, siswa perlu memiliki pemahaman konseptual yang mendalam tentang konsep tersebut.* ***Tujuan:*** *Efektivitas analogi pada pemahaman yang tepat dari konsep-konsep ilmiah berlimpah dalam literatur, oleh karena itu, penelitian ini menguji pengaruh strategi pembelajaran analogi pada prestasi siswa sekolah menengah pada materi genetika.* ***Metode:*** *Jenis penelitian ini adalah eksperimen semu dengan sampel 112 siswa yang dipilih secara purposive dari dua kelas utuh. Data yang terkumpul dianalisis menggunakan ANCOVA.* ***Temuan:*** *Temuan dari penelitian ini mengungkapkan bahwa ada perbedaan yang signifikan dalam pencapaian siswa yang diajarkan genetika dengan analogi dan mereka yang diajar menggunakan pendekatan pengajaran konvensional yang mendukung kelompok analogi ($F_{(1, 109)} = 20,88$, $p<0,05$).* ***Kesimpulan:*** *Oleh karena itu, direkomendasikan bahwa guru biologi harus mengadopsi penggunaan strategi pembelajaran analogi dalam mengajar genetika dan konsep-konsep sulit lainnya dalam biologi.*

Kata kunci: *analogi, siswa sekolah menengah atas, prestasi belajar, genetika.*

To cite this article:

Sulaiman, M, M., Bello, G., & Ahmed, M, A. (2022). Effects of Learning by Analogy on Senior High School Students' Achievement in Genetics in Ilorin, Nigeria. *Jurnal Pendidikan Progresif*, *12*(3), 1127-1136. doi: 10.23960/jpp.v12.i3.202211.

INTRODUCTION

Genetics, the Biology of heredity knowledge has been widely applied in areas such as tracing family lineage and ancestry, development of genetically modified organisms with the aim of making food available for the populace, disease diagnosis and characterization among others. In spite of its usefulness to human survival, the teaching and learning of Biology and particularly genetics in the nation's secondary schools has been faced with different misconception by both teachers and students basically as a result of the presence of some terminologies which sound similar but are different and terminologies whose roots are either of Greek or Latin origin.

The concept of genetics has been identified in literature to pose serious challenge to students and teachers (Cimer, 2012). While science educators are of the opinion that a conceptual knowledge of genetics will help students to recognise the importance of continuity of life, students have continued to learn genetics by memorisation (Kilic & Saglam, 2014). To corroborate this assertion, the West African Examinations Council, Chief Examiners' Reports (2009, 2010, 2015, 2017) reported that students often avoid answering questions related to genetics and that those who attempted answering displayed some levels of misconceptions. In order to enhance students understanding of genetics, several attempts have been made by researchers (Alabi, 2016; Ishaku, 2015; Busari, 2014) who separately made use of instructional strategies such as logical prose, problem solving instructional strategy and mathematics pre-teaching respectively to enhancing students' achievement in genetics.

The instructional strategy used to teach genetics is a critical factor in determining if meaningful learning of the concept is ever going to take place. This is because students often come into the class with prior knowledge and beliefs that are not consistent with the nature of scientific facts (Sodervik, 2016). This naïve understanding is what several researchers have referred to as misconceptions or alternate misconceptions. According to Abimbola (2017), these misconceptions can be a result of misunderstood words in language communication.

In the light of this, there is the need for teachers to employ strategies that can draw on students' prior knowledge as a point of departure for developing conceptual change processes in genetics. Strategies that have assumed to tap into students' prior knowledge involve the use of analogy and metaphor for meaningful learning (Mashood, Mehta & Mishra, 2018; Rundgren, Hirsch, & Tibell, 2009). Analogies has been identified in literature to be a potent tool for teaching and learning biological concepts such as Deoxyribonucleic Acid (DNA), ecology, cells and organelles (Ameyaw & Kyere, 2018; Ayanda 2016; Genc, 2013). In line with this assertion several researchers had conducted series of studies to examine the potency of analogy instructional strategy on students' academic achievement in sciences. For instance Ziyad (2020) examined the effects of analogy instructions on first grade intermediate female students' achievement and the study revealed that students that were exposed to analogy achieved significantly better than their counterparts exposed to conventional teaching method. Students that were taught different scientific concepts performed better than those that were taught using conventional teaching method (Okafor (2019); Ameyaw and Kyere (2019); Akintola and Ayanlola (2019); Lanshima, Chado, Isa and Mohammed (2019)).

No matter how effective a teaching strategy can be, the ability level with respect to their performance in class is also a militating factor against their performance; hence, researchers over the years have also examined the influence of students score levels on their achievement in sciences. Some researcher observed that the

low scoring students achieved significantly better than the high and medium scorers (Obochi, 2021; Badmus, Bello, Hamzat & Sulaiman, 2019). Some found out that the high scorers outperformed both the low and medium scorers (Olanrewaju, 2018; Ayanda, 2016), while some observed that there was no significant difference in the achievements of low, medium and high scorers (Alabi, 2022; Adesoji, 2008). The fact that there is yet to be a consensus agreement by researchers on the influence of score levels on students achievement in science makes it a variable of interest in this research.

Purpose of the Study

The main purpose of this study was to determine; The effect of analogy instructional strategy on senior school students' achievement in genetics, in Ilorin, Nigeria The difference in the achievements of high, medium and low scoring students taught genetics using analogy The interaction effect of treatment and score levels on students' achievement in genetics

Research Questions

In line with the set purpose, the following research questions were raised. What is the difference in the achievement of senior school students taught genetics using analogy instructional strategy and those taught using the conventional teaching method? Is there any difference in the achievements of low, medium and high scoring students taught genetics with the aid of analogy instructional strategy? What is the interaction effect of treatment and score levels on senior school students' achievement in genetics?

Research Hypotheses

H_{01}: there is no statistically significant difference in the effects of analogy and conventional instructional strategy on the achievement of senior school students in genetics

H_{02}: there is no statistically significant difference in the achievements of low, medium and high scoring students when taught genetics using analogy instructional strategy

H_{03}: there is no statistically significant interaction effect between treatment and score levels on senior school students' achievement in genetics.

METHODS

Research Design and Procedure

This study adopted the quasi-experimental research of the 2 * 3 factorial design, where the 2 represents the instructional strategies (analogy and conventional) and the 3 represents the score levels (low, medium & high). The researchers in the process of data gathering ensures that all ethical issues with respect to the use of human as objects of research were strictly adhere to. The participants were initially given informed consent forms to take home to the parents with the sole purpose of seeking for permission to voluntarily take part in the research. The personalities of the respondents were also kept strictly confidential and their identities were not divulged. After, the informed consent forms were returned by the students, the response instrument (Genetics Achievement Test) was administered on the students prior to instruction to measure their entry behavior with regards to the concept of genetics. Thereafter the teachers made used of four periods of 40 minutes each for instructional delivery, after which a reshuffled version of the GAT was re-administered as the post-test. The teaching exercise was carried out at the time allotted for Biology lessons in the schools so as not to disrupt the school calendar using the class teachers as research assistants.

Participants

The population for this study was all students offering Biology at the secondary school level in Ilorin metropolis, Nigeria while

the target populations were senior school 3 students offering Biology within the metropolis since the concept to be taught is a prominent topic at that level. Two senior secondary schools were purposively selected and the schools were placed into the experimental and control group by casting of dies. From the two schools selected for the study, one intact class was randomly selected to form the sample for the study. A total number of 112 students made up of 55 and 57 in the experimental and control group eventually took part in the study.

Instruments

The Teachers Instructional Guide on Analogy and Genetic Achievement Test (GAT) served as the stimulus and response instruments utilised in the study. The GAT is a 50 multiple choice test items on genetics with options A-D designed by the researchers. The pre-test scores of the students was utilised in classifying the students into the various categories of score levels. The GAT was exposed to both face and content validity by giving it to Test and Measurement experts in the Department of Social Science Education. In order to ensure that the test instrument has a high level of internal consistency, it was administered on 30 students that had similar characteristics and shares similar attributes with the sample for the study. The test-retest method within the period of two weeks was adopted and a reliability index of 0.78 was obtained for GAT.

Data Analysis

Data gathered with the use of GAT were analysed using descriptive statistics of mean, standard deviation and percentages. The hypotheses were tested using Analysis of Covariance at 0.05 level of significance.

RESULTS AND DISCUSSION

Table 1 shows that out of 112 respondents (100%) that constituted the entire sample size for this study, 55 (49.1%) of them were in the experimental group (i.e. students taught with the use of Analogy), from which 15(13.4%) students were of low score ability level; 27 (24.1%) students were of medium score ability level and 13 (11.6%) students were having high score ability level while 57 respondents (50.9%) made up the control group (i.e. students taught with the conventional teaching method), from which 10 (8.9%) were of low score ability level; 34 (30.4%) were of medium score ability level and 13 (11.6%) were of high score ability level.

Table 1. Demographic information of the groups on the basis of gender and score levels

Groups	Score Levels	Freq (%)	Sub-Total (%)
Experimental	Low	15 (13.4%)	
(Analogy Group)	Medium	27 (24.1%)	
	High	13 (11.6%)	*55 (49.1%)*
Control	Low	10 (8.9%)	
(Conventional Group)	Medium	34 (30.4%)	
	High	13 (11.6%)	*57 (50.9%)*
Grand Total			**112 (100.0%)**

Research Question: what is the difference in the achievement of senior school students taught genetics using analogy instructional strategy and those taught the using conventional teaching method?

Table 2 reveals that the achievements of students in both the experimental and control groups in the post-test were higher than their achievements in the pre-test. In the post test, the achievement (67.49) of students in Genetics

Table 2. Descriptive statistics of students' achievement in genetics (before and after the treatments)

Groups		No.	Mean	S.D.	Min	Max	Remark
Experimental	Pre-test	55	35.24	6.38	12.00	76.00	Low
(Analogical Group)	Post-test	55	53.49	9.19	30.00	95.00	High
Control	Pre-test	57	33.06	6.29	10.00	48.00	Low
(Conventional Group)	Post-test	57	46.26	7.50	24.00	64.00	Fair

when taught with analogy instructional strategy was higher than those of students exposed to conventional teaching method (54.84).

Table 3 shows the mean gain of the students in Genetics after the treatment. Students taught with Analogy instructional strategy had a mean gain score 18.25 while students that were taught with conventional teaching method had the mean gain score 13.20.

Table 3. Mean gain scores of the students in genetic after the treatment

Groups	Pre-test	Post-test	Mean Gain Scores
Experimental (Analogical Group)	35.24	53.49	18.25
Control (Conventional Group)	33.06	46.26	13.20

Hypotheses Testing

All the hypotheses postulated for this study were tested using Analysis of Covariance (ANCOVA) at 0.05 alpha level.

H_{01}: There is no significant difference in the achievement of students taught Genetics with the use of analogies and those taught with conventional method

Table 4 reveals the *F*-value 20.88with a p-value of 0.000 when computed at 0.05 alpha level. Since the p-value (0.00) obtained is less than alpha level (0.05), the null hypothesis one is not accepted. Thus, there is a statistically significant difference in the achievement of students taught Genetics with the use of analogies and taught with conventional method ($F_{(1, 109)} = 20.88, p<0.05$).

Table 4. Analysis of covariance showing the difference in the achievement of students taught genetics with the use of analogies and those taught with conventional method

Source	Type III Sum of Squares	df	Mean Square	*F*	Sig.
Corrected Model	21290.55[a]	2	10645.28	193.18	.00
Intercept	3417.85	1	3417.85	62.02	.00
Pretest	12168.33	1	12168.33	220.82	.00
Groups	1150.48	1	1150.48	20.88	.00
Error	6006.51	109	55.11		
Total	305201.00	112			
Corrected Total	27297.06	111			

a. R Squared = .780 (Adjusted R Squared = .776)

The Pairwise Comparison Analysis was depicted in Table 5 to show where the difference lies. As shown in Table 5, students taught with analogy instructional package had higher mean score 53.49 than those taught with the use of conventional method having the mean score 46.27. The difference in the mean scores was 7.22 in favour of the analogical group.

Table 5. Pairwise comparisons analysis of the achievement of students taught genetics with the use of analogies and those taught with conventional method

Treatment	Mean	Mean Diff. (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b] Lower Bound	Upper Bound
Analogy(I)	53.49[a]	7.22*	1.58	.00	4.09	10.36
Conventional (J)	46.27[a]	-7.22*	1.58	.00	-10.36	-4.09
Grand Mean = 49.877						

* the mean difference is significant at 0.05 level

b. Adjustment for Pairwise Comparisons: Bonferroni

$H_{02:}$ There is no statistically significant difference in the achievements of low, medium and high scoring students when taught genetics using analogies.

Table 6 reveals that there was no statistically significant difference in the achievements of low, medium, and high scoring students, $F_{(2,51)}$=1.31, p =.29. Since the p-value calculated was more than the critical value of .05, the hypothesis was not rejected. This implies that there was no statistically significant difference in the achievements of low, medium and high scoring students when taught genetics using analogies.

Table 6. Summary of analysis of covariance (ANCOVA) of mean scores of low, medium and high scoring students taught genetics with analogy

Source	Type III Sum of Squares	df	Mean Square	*F*	Sig.
Corrected Model	10577.34[a]	3	3525.78	45.72	.00
Intercept	446.76	1	446.76	5.79	.02
AnalogyPre	921.36	1	921.36	11.95	.00
AnalogyScore	202.57	2	101.29	1.31	.29
Error	3932.66	51	77.11		
Total	146565.00	55			
Corrected Total	14510.00	54			

a. R Squared = .729 (Adjusted R Squared = .713)

H_{03}: There is no significant interaction effect of analogy instructional strategy and score levels on the achievement of students taught Genetics

Table 7 reveals the F-value 3.38 with a p-value of 0.04 when computed at 0.05 alpha level. Since the p-value (0.04) obtained is less than alpha level (0.05), hence the null hypothesis three is rejected. Thus, there was a statistically significant interaction effects of analogy instruction and score levels on the achievement of students

taught Genetics ($F_{(2, 105)} = 3.38$, $p>0.05$). This implies that there was a statistically significant interaction efect of treatment and score levels on senior school students' achievement in genetics.

Table 7. Analysis of covariance showing the interaction effects between treatment and score levels on the achievement of students taught genetics

Source	Type III Sum of Squares	df	Mean Square	*F*	Sig.
Corrected Model	21659.42[a]	6	3609.90	67.23	.00
Intercept	931.01	1	931.01	17.34	.00
Pretest	1577.01	1	1577.01	29.37	.00
Treatment	785.45	1	785.45	14.63	.00
Scorelevel	42.84	2	21.42	.40	.67
Treatment * Scorelevel	363.02	2	181.51	3.38	.04
Error	5637.65	105	53.69		
Total	305201.00	112			
Corrected Total	27297.06	111			

a. R Squared = .793 (Adjusted R Squared = .782)

The profile plot in Figure 1 shows that the lines are not perfectly parallel to each other and hence when further stretched had the possibility of meeting at a point thereby indicating an interaction between treatment and score levels.

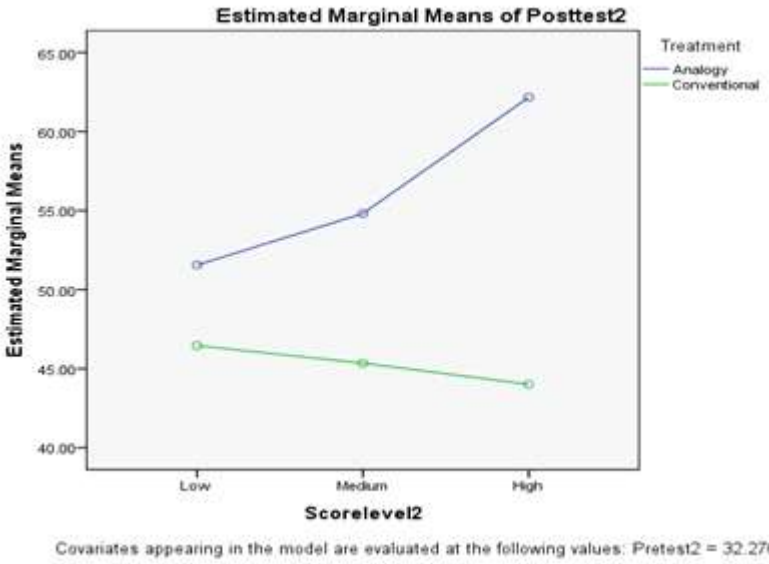

Figure 1. Profile plot of the Interaction effect between treatment and score levels

Discussion

The study investigated the effect of teaching with analogy on senior school students' achievement in genetics. Findings from the study revealed that students exposed to instruction with the use of analogy achieved significantly better than their counterparts that were taught genetics using the conventional instructional strategy. This finding could be attributed to the fact that analogy instructions allow students to relate abstract genetic concepts with concepts they are familiar with

thus bringing about better understanding of genetics. The implication of this is that analogy instructional strategy can be employed to bring about conceptual change and enhance meaningful learning of genetics and by extension other hard-to-learn and hard-to-teach Biology concepts. This finding is in line with those of Ziyad, (2020); Akintola and Ayanlola (2019); Ameyaw and Kyere (2019); Okafor (2019) who in their separate studies observed that students that were exposed to analogy instructions achieved significantly better than their colleagues that were taught scientific concepts using the conventional teaching method.

Another finding from the study revealed that there was no difference in the achievement of low, medium and high scoring students that were exposed to analogical instruction. The similarity in the achievement of the students in the different score level strata might be because the students were able to relate genetic concepts with familiar concepts by engaging themselves in critical thinking. The implication of this finding is that Biology teachers can consciously utilise analogy instructional strategy in a mixed score level classroom. However, the teachers must always endeavour to state the limitations of the analogy so that the students would be able to identify when the analogy breaks down when they are processing the information in their cognition. This result is in line with the findings of Alabi (2022) and Adesoji (2008) who also observed in their studies that there was no significant difference in the achievements of low, medium and high scoring students.

The study also showed that a significant interaction effect existed between treatment and score level. This finding implies that the students' improved achievement in genetics cannot be attributed solely to any of the two independent variables (treatment and score levels). This finding implies that treatment and students' score levels both had a joint effect on students achievement and as such there is the possibility that not all instructional strategies are suitable for all categories of students with different score levels. This finding is contrary to the findings of Alabi (2022); Badmus, Bello, Hamzat and Sulaiman (2019) who submitted that there was no significant interaction effect of treatments and score levels on students' achievement. It is also not in conformity with the findings of Olanrewaju (2018) who observed that there was no significant interaction of Webquest, gender and score level on Chemistry students' performance.

CONCLUSIONS

The study examined the effects of analogy instructional strategy on senior school students' achievement in genetics. The study concluded that the use of analogy as an instructional strategy is a potent tool for evoking conceptual change and also improves students' academic performance. The pedagogical implication of this conclusion is that Biology teachers and students offering Biology in schools should employ the use of analogy in teaching genetics and other hard-to-teach and hard-to-learn biological concepts. It was also concluded based on the findings that analogy can be conveniently used as an instructional strategy for lesson delivery in a mixed ability classroom since all the students in the different score level benefitted without discrimination. The implication of this conclusion is that irrespective of the differences which might exist in the scoring ability of the students, if analogy is consciously used and areas where the analog and the target breaks down are pointed out, the students are going to experience meaningful learning.

REFERENCES

Abimbola, I. O. (2017). Theories of learning and their implications for biology teaching. In I. O. Abimbola (Ed), *Biology teaching*

methods. Ilorin: Haytee Press and Publishing Company Nigeria Ltd

Adesoji, F. A. (2008). Students' ability levels and effectiveness of problem-solving instructional strategy. *Journal of Social Science, 17*(1), 5-8.

Alabi, H. I., & Abimbola, I. O. (2022). Score level, text structures and senior secondary school students' achievement in genetics in Ilorin, Nigeria. *International Journal of Educational Research Review, 7*(4), 198-209.

Alabi, H. I. (2016). *Comparative effects of text structures on achievement in genetics of senior secondary biology students in Iloirn, Nigeria.* (An unpublished Ph.D. Thesis) University of Ilorin, Ilorin, Nigeria

Akintola, D. A., & Ayanlola, G. O. (2019). Effects of analogies strategy on senior secondary school students' achievement in biology in Nigeria. *Al-Hikmah Journal of Education,6*(2), 7-12.

Ameyaw, Y., & Kyere, I. (2019). Comparative effects of three teaching methods on students' performance in human blood circulatory system concepts and their retention rates. *International Journalof Innovative Science, Engineering and Technology (IJISET), 6*(6), 182-200.

Ameyaw, Y., & Kyere, I. (2018). Analogy-based instructional approach a panacea to students' performance in studying deoxyribonucleic acid (DNA) concepts. *International Journal of Science.* https://doi.org/ 10.18483/ijSci.1644

Ayanda, M. O. (2016). *Effects of analogies and concept maps on senior school students' achievement in ecological concepts in Kwara South, Nigeria.* (Unpublished doctoral dissertation) University of Ilorin, Ilorin, Nigeria.

Badmus, S. T., Bello, G., Hamzat, A., & Sulaiman, M. M. (2019). Effects of webquest on secondary school biology students' acheivement in cell division in Ilorin. *Humanities and Social Science Letters, 7*(2), 64-73.

Busari, F. M. (2014). *Effects of pre-teaching the mathematics component of genetics on senior school students' genetics achievement in Oyo State, Nigeria.* (An unpublished M. Ed. Thesis) University of Ilorin, Ilorin, Nigeria

Cimer, A. (2012). What makes biology learning diffcult and effective: Students' views. *Educational Research and Reviews, 7*(3), 61-71.

Genc, M. (2013). The effect of analogy-based teaching on students' achievement and students' view about analogies. *Asia-Pacific Forum on Science Learning and Teaching, 14*(2), 1-17.

Ishaku, C. (2015). *Effects of problem-solving and discussion teaching methods on students' achievement in genetics.* An M. Ed. Thesis submitted to the Department of Science Education, Faculty of Education, University of Nigeria, Nnsuka. Retrieved 15 September, 2016 from www.unn.edu.ng>publications>files17867_effects_of_problem-solving_and_discussion_teaching_methods_on_students'_achievement_in_genetics_Pdf

Kilic, D., & Saglam, N. (2014). Students' understanding of genetics concepts: the effect of reasoning ability and learning approaches. *Journal of Biological Education, 48*(2), 63-70.

Lanshima, E., Chado, A. M., Isa, F. M., & Mohammed, B. (2019). Effects of problematic analogy strategy on students' achievement and retention in balancing chemical equation concepts of secondary

school chemistry. In A. S. Ifamuyiwa (Ed) *Innovation in STEM education. Proceedings of Science Teachers Association on Nigeria (STAN)* (pp 378-385). Nigeria: The STAN Place Ltd

Mashood, K. K., Mehta, R., & Mishra, P. (2018, January 04). To see a world: using multiple metaphors in science education. *i wonder .... Rediscovering School Science* 04, pp 48-52

Obochi, M. U. (2021). Effects of problem-solving strategy on academic performance of senior secondary students in biology in Kaduna State, Nigeria. *Journal of Science Technology and Education, 9*(1), 179-188.

Okafor, N. (2019). Kitchen-explanations analogy model (KEAM) as a strategy for enhancing secondary schools students' achievement in chemistry. In A. S. Ifamuyima (Ed.) *Innovations in STEM education: 60thr Annual Conference Proceedings of Science Teachers Association of Nigeria* (pp 425-435) Abuja, Nigeria: The STAN Place Ltd.

Olanrewaju, Y. B. (2018). *Comparative effects of webquest and blended learning instructional strategies on students' performance in thermochemistry in Ilorin, Nigeria* (Unpublished Ph.D. Dissertation) University of Ilorin, Ilorin, Nigeria

Rundgren, C., Hirsch, R., & Tibell, L. A. (2009). Death of metaphors in life science? A study of upper secondary and tertiary students' use of metaphors in their meaning-making of scientific content. *Asia-Pacific Forum on Science Learning and Teaching, 10*(1), 1-21.

Sodervik, I. (2016). *Understanding biological concepts at university - Investigating learning in medical and teacher education.* (Doctoral Thesis) University of Turku

WAEC. (2009). *Chief examiner's report in biology SSCE* . Lagos: WAEC.

WAEC. (2010). *Chief examiner's report in biology SSCE.* Lagos: WAEC.

WAEC. (2015). *Cheif examiner's report in biology SSCE.* Lagos: WAEC.

WAEC. (2017). *Cheif examiner's report in biology SSCE.* Lagos: WAEC.

Ziyad, H. S. (2020). The effect of analogy strategy in teaching science on achievement and development of creative thinking skills of the first grade intermediate female students. *Journal of Educational and Psychological Sciences, 4*(19), 20-54.