



Effects of Science-Text-Cards and Crossword Puzzle Instructional materials on ... Obohio, D. E., Et. al. (2026)

Effects of Science-Text-Cards and Crossword Puzzle Instructional Materials On Academic Performance in Biology among Secondary School Students in Oron LGA, Akwa Ibom State, Nigeria

OBOHO, Daniel E.¹

obohodan@gmail.com

0803 883 7845

ATABANG, Atim A.¹

atimitighise@aksu.edu.ng

0701 687 6272

AKPAN, Anyanime O.¹

yaniokop@yahoo.com

0802 331 9141

¹Department of Science Education, Akwa Ibom State University, Akwa Ibom State, Nigeria

Abstract

The study investigated the effect of Science Text Cards and Crossword Puzzle Instructional Material on Biology Students' Academic Performance in Oron Local Government Area, Akwa Ibom State, Nigeria.. To achieve the purpose of the study, three research questions and three hypotheses were formulated to guide the study. Quasi experimental research design was adopted and the study was conducted in Oron Local Government Area of Akwa Ibom State. The Population of the study consisted of all the 1423 Senior Secondary Three (SSIII) Biology students in the six public secondary schools in Oron Local Government Area of Akwa Ibom State, Nigeria during the 2024/2025 academic session. The sample size for the study was One Hundred and Fifty (150) Senior Secondary Three (SS3) Biology students selected from their intact classes. Criterion and simple random sampling technique was used for the selection of schools for the study. Biology Performance Test (BPT) was used as instrument for data collection. The instruments was duly validated and subjected to reliability analysis using Kuder Richardson 20 (K-R20). The result showed a reliability coefficient of 0.85 and was deemed appropriate for the main study. Descriptive statistics of mean and standard deviation were used in answering the research questions while analysis of covariance was used in testing the hypotheses at 0.05 alpha level. Result findings of the analyses, showed that there was a significant difference in students' academic performance when taught the concept of genetics based on science text cards, and crossword puzzles as students in the experimental groups performed better than their control group counterparts in Biology and that male and female students in the experimental groups achieved better than their counterparts in the control groups. it was concluded that students exposed to science text cards performed better than those exposed to crossword puzzle followed by the expository group. Based on the findings, it was recommended, among other, that Government should support policies that promote innovative teaching approach, including the use of interactive and visual instructional materials in science education. This can help improve overall educational quality in Biology.

Keywords: Science text card, crossword puzzle, gender, performance and Biology

Introduction

Biology has contributed to the improvement and development of new and better drugs and vaccines against many human and animal diseases and has also contributed towards the conservation of the environment and endangered species. Biology is a subject which students must pass if their overall success is to have any value. A credit pass in Biology is a compulsory requirement for any student seeking admission into all the institutions of higher learning in Nigeria. The knowledge of Biology is needed for National development and global competitiveness in the area of medicine, education, agriculture, physical and health education, especially in sports and environmental studies amongst others (Atabang, 2025; Gega et al., 2017). It will also help to perpetuate desired favorable traits in the production of high breeds of crops and animals through hybridization and cloning respectively, it can also help in the conservation of natural resources and checkmating population explosion. (Atabang, Edikpo & Akpan, 2024). It is central to many science related courses including medicine, biochemistry, pharmacy, nursing science and agriculture. Being a science of life, Biology is one of the core science subjects taught in the senior secondary schools. Hence, it occupies a very important position in the secondary school curriculum. In Nigeria, the secondary school Biology curriculum is designed and developed to prepare students to acquire adequate laboratory and field skills, meaningful and relevant knowledge in Biology and also to enable students apply scientific knowledge to everyday life in matters of personal, community, health and agriculture among others. According to Adam, Lameed and Adelabu (2023), Biology is introduced to students at the senior secondary school level as a preparatory ground



Effects of Science-Text-Cards and Crossword Puzzle Instructional materials on ... Obolio, D. E., Et. al. (2026)

for human development, where career abilities are groomed, potentials and talents are discovered and energized. Today, Biology pervades literally every field of human endeavors and plays a fundamental role in educational advancement (Atabang, Edikpo & Akpan, 2024). Duru (2025), highlights the importance of Biology to include helping individuals to understand the parts of his/her body and their functions; enabling one to question superstitions due to sustained interest arising from comprehension of the cause of events; understanding and appreciating life; bringing into focus the need to maintain good health; inculcating the individual scientific skills and attitudes in his approach to personal and societal problem; imparting factual knowledge and stimulating scientific reflective thinking so as to produce a better informed individual; promoting the individual for career choice. The study of Biology in senior secondary schools is expected to equip students with useful concepts, principles and theories that will enable them face the challenges before and after graduation. The subject aims at equipping the learner with knowledge, skills and attitudes that are necessary for controlling and preserving the environment; enabling the learner to appreciate humans as the broader community of living organisms (Duru, Uko, & Utibe 2024; Umoke & Nwafor, 2014). Some of the topics taught in Biology that students perceive as abstract are genetics, evolution, physiology, micro-organisms, skeletal system among others (Fasasi & Oladejo, 2022; Akpan, 2022). Research studies have shown that a number of concepts in Biology which include Genetics posed difficulty for students to understand and grasped (Atabang, Edikpo & Akpan, 2024; Esiobu & Soyibo, 2018). Also, some students have the notion that the concept of genetics in Biology is abstract and extremely technical and require only rote memorization to pass (Ogunbanwo, 2019). However, many teachers and students regard the topic of Genetics as very difficult, both to teach and to learn (Okebukola, Ige, Oyeyemi, Olusesi, Owolabi, Okebukola & Osun, 2016). Fasasi and Oladejo (2022), referring to these difficulties, argued that as the revolution in the field of Genetics continues, the web of abstract concepts becomes increasing complex. According to Akintola (2019), students' understanding of fundamental of genetics concepts suggest that current instruction in genetics leaves students with insufficient understanding of the technological advances in genetics that they may encounter in their everyday lives, such as genetics counseling and screening. Nor are students informed enough to understand and participate in current debates involving genetic issues such as genetically modified foods, cloning and gene therapy. Conversely, teachers neglect from teaching this topic because of its complexity; students find it difficult because it is perceived as being difficult, abstract and boring hence; students may perform low in academic success in examinations (NERDC, 2015; Akpan & Akpan, 2017). Furthermore, the West African Examination Council (WAEC) Chief Examiners, report 2021, 2022, 2023, 2024, 2025 confirm that students performance in Biology is poor (WAEC, 2025). According to the report, the poor academic performance of students in Biology is attributed to difficulty in interpreting data and graphs, particularly in the objectives test section, lack of understanding of key biological concepts such as genetics, photosynthesis and respiration, poor laboratory skills including difficulties with measurement and observation and above all poor teaching methods adopted by teachers. According to reports, teachers should adopt more interactive and engaging teaching methods to help students better understand key concepts, teachers should place greater emphasis on innovative instructional approaches to help students develop practical skills, and that students should practice more objective tests to improve their interpretation and analytical skills. Also, the high rates of failure recorded by Biology students in schools and colleges in Nigeria have been a major concern to researchers. Consequently, the low performance in Biology in external examinations had been traced to the use of conventional teaching approach and other factors that does not put into consideration the students' activities in teaching and learning processes (Oluwaseun, Onovroghene & Avodele, 2018). It has been shown that Biology concepts such as heredity among others pose strong resistance to the conventional teaching approach used by teachers and this hinders the realization of Biology objectives and as well as lesson objectives. This is because, conventional approach may lack student to student help, interaction and cooperation needed for effective teaching and learning of difficult concept (Oladejo & Ebisin, 2021). The use of appropriate instructional materials in teaching heredity could help to assuage this poor academic performance. Instructional materials are those materials used in the classroom and science laboratory for instructions and purposes of demonstration by teachers and students. The term instructional materials is used to denote resource materials/methods, anything which can help to transmit learning experiences through any of the senses of touch, sight, smell, taste and hearing (Umanah & Atabang, 2025; Atabang, 2024; Akpan, 2022). They are adopted by teachers in classroom to aid in the attainment of specific learning objectives set out in classroom plans (Umoetuk & Akpan, 2023; Etop, Iboro & Obogo, 2023; Moses, 2020). Studies have shown that the use of instructional resources has improved performance (Itighise, 2024; Okori & Jerry, 2017). The teaching of Biology without appropriate instructional materials may certainly result in poor academic performance. According to

Effects of Science-Text-Cards and Crossword Puzzle Instructional materials on ... Obolio, D. E., Et. al. (2026)

Duru (2025) the teaching of Biology cannot be done effectively without interaction between the teacher, students and the environmental resources. The Biology curriculum is planned and designed to enable the teacher use activity oriented, student-centered approach to teach (Oluwaseun, et al., 2018). However, evidence from research has shown that most teachers in Nigeria use verbal exposition of scientific principles, facts and concepts thus, academic performance of Nigerian students in ordinary level Biology is persistently poor over the years (Adam, et al., 2023). This has been a major source of concern for researchers, the school administrators, parents and the government at large. In an attempt to facilitate the teaching of such content, teachers must adopt resources, analogies, contextualization, multimedia resources (slides), games and physical models (cards or plastic models to represent elements). The combination of these approaches/resources can make learning concepts more significant, easy and meaningful to students and increasing the interest of the students in Biology. Utilizing appropriate teaching resources has proven over time to improve students' academic performance and how they retain what was taught. However, research suggests that students face challenges in comprehending complex biological concepts, leading to lower academic performance rates in the subject (Uko, et a 2025; Duru, 2025). To address these issues, educators have been exploring innovative instructional materials to enhance students learning experiences in Biology. One instructional material considered germane for this study that may improve students' academic performance in Biology is the use of science text cards instructional material. Science text card is a paper containing a picture and name of the picture." Science text card" is small cards that have picture, word, text or symbol for individual to study a particular topic or describe something (Brady & Fisher, 2016). Science text cards are potable, concise resources that contain key information, definitions, and explanations of Biology concepts. Research has suggested that the use of science text cards instructional material can help students reinforce their understanding of important concepts and enhance performance of crucial information (Wordu & Atabang, 2024; Jones & Peterson, 2018). By presenting information in a structured and organized format, science text cards serve as valuable study aids that can help students reinforce their knowledge and review essential concepts in Biology (Montgomery & Richards, 2018). The researcher further maintains that science text cards are widely used as a learning drill to aid memorization by way of spaced repetition. Science text cards are useful for drilling new letters, syllables, words, and other information. Itighise (2016) comment that it is an innovative teaching resources that are normally used in a classroom, but can also be used more informally. Science text cards can bear vocabulary, historical dates, formulas or any subject matter that can be learned via a question-and-answer format. In addition to science text cards, another instructional material that have been shown may impact on student' academic performance in Biology is the use of crossword puzzle instructional material.

Crossword puzzle is an interactive resource material that challenges students to apply their knowledge of Biology terms and concepts in a problem-solving format. Wordu and Atabang (2024) opined that among many resources, crossword puzzle instructional material seems to be more attractive than others. In order to finish a crossword puzzle instructional material, the learner has to accurately fill in all the blank squares with letters that form words. The words are based on the clues provided, which can be complete sentences, phrases, or words (Ukah, Atabang & Eden, 2025). Apart from motivating student learning, these puzzles can help students to extend their understanding of concepts and terminological knowledge. Crossword puzzle instructional material can be used to teach terminology, definitions, as well as pairing key concepts in Biology. Since students need to spell items correctly to complete the puzzle, they gain greater performance and development of positive attitude towards learning as this makes the concept taught more simple than complex. Gender has attracted the attention of many researchers. For this reason, gender and academic performance were investigated in this study. Gender is a socially constructed definition of male and female. Gender is the range of characteristics pertaining to and differentiating between, masculinity and femininity (Atabang & Umanah, 2025; The issue of gender and gender stereotyping permeate all aspects of human endeavors (Umanah & Sunday, 2022). Akpan, (2024), defined gender as the amount of masculinity and femininity found in a person and obviously while there are mixtures of both in most human beings, the normal male has a preponderance of masculinity and the normal female has a preponderance of femininity. However, in other studies carried out by Oyakhirone and Akpan (2024); Akpan, (2022); revealed that female students are academically superior in Biology and the sciences. They showed that despite the discrimination that the female child faced, they were able to navigate successfully academically through maintaining a positive definition of themselves. Depending on this context, the discriminating characteristics vary from sex to social role to gender identity. Gender differences in Biology performance ability has remained a source of concern as scientists seek to address the under-representation of women at

Effects of Science-Text-Cards and Crossword Puzzle Instructional materials on ... Obolio, D. E., Et. al. (2026)

the highest levels of mathematics, physical sciences and engineering (Atabang, et al., 2024). Academic performance in Biology encompasses the mastery of biological concepts, skills, and competencies as demonstrated through assessments and evaluations (Uko, Duru, Babayemi, & Atabang, 2025). Wilson (2020) conducted a study on the effectiveness of innovative instructional approach, including the use of science text cards and crossword puzzle instructional materials, in enhancing academic performance in Biology. The research findings highlighted that incorporating these tools into classroom practice resulted in improved student success and comprehension of Biology content, leading to enhanced academic performance. The cognitive load theory by John Sweller in (2011) was used for this study. The theory states that learners have limited cognitive resources available for processing information, and the way instructional materials are employed can either facilitate or hinder learning. The theory distinguishes between three types of cognitive load: intrinsic (related to the complexity of the material being learned), extraneous (related to ineffective instructional design), and germane (related to the construction of schema and long-term learning). In the context of the study on the use of science text cards and crossword puzzle in Biology education, cognitive load theory is relevant as it highlights the importance of presenting information in a way that minimizes extraneous cognitive load, allowing students to allocate their cognitive resources effectively towards understanding and achievement of Biology concepts. Despite the growing interest in using science text cards and crossword puzzle instructional materials in Biology education, there is limited research on the specific impact of these instructional materials on students' academic performance in Biology. Therefore, this study seeks to investigate the effect of science text cards, crossword puzzle instructional materials on students' academic performance in Biology in Oron Local Government Area, Akwa Ibom State, Nigeria.

Objectives of the Study

1. Determine the mean performance scores of Biology students' taught the concept of heredity using science text cards, crossword puzzle instructional materials and those taught using expository method.
2. Compare the mean performance scores of male and female Biology students taught the concept of heredity using science text cards, crossword puzzle instructional materials and those taught using expository method.
3. Find out the interaction effect of treatments and gender on the mean performance scores of Biology students' taught the concept of genetics (heredity).

Research Questions

The following research questions raised and answered in the course of the study.

1. What difference exist in the mean performance scores of Biology students' taught the concept of heredity using science text cards, crossword puzzle instructional materials and those taught using expository method?
2. What is the difference in the mean performance scores of male and female Biology students taught the concept of heredity using science text cards, crossword puzzle instructional materials and those taught using expository method?
3. What is the interaction effect of treatments and gender on the mean performance scores of Biology students' taught the concept of heredity?

Hypotheses

The following hypotheses were formulated to guide the study.

1. There is no significant difference in the mean performance scores of Biology students' taught the concept of heredity using science text cards, crossword puzzle instructional materials and those taught using expository method.
2. There is no significant difference in the mean performance scores of male and female Biology students taught the concept of heredity using science text cards, crossword puzzle instructional materials and those taught using expository method.
3. There is no significant interaction effect of treatments and gender on the mean performance scores of Biology students' taught the concept of heredity.

Methodology

This study employed quasi-experimental pretest posttest nonequivalent control group design. This design is chosen because the participants were not randomized hence intact classes was used for data gathering. This study in the context of this design employed two experimental groups and a control group. The study was carried out in Oron Local Government Area of Akwa Ibom State located at approximately 4.75° North latitude and 8.20° East longitude situated in the southern part of Nigeria, along the coastline of the Atlantic Ocean, Akwa Ibom State, Nigeria. Population of the study consisted of all the

Effects of Science-Text-Cards and Crossword Puzzle Instructional materials on ... Oboloh, D. E., Et. al. (2026)

1,423 students with males accounting for 724 and females 699 of Senior Secondary Three (SSIII) Biology students during the 2024/2025 academic session. A sample size of One Hundred and Fifty (150) senior secondary III Biology students drawn from three schools in their intact classes through criterion and simple random sampling techniques was used for the study. Biology Performance Test (BPT) was used to gather data for the study. The items are expected to test students' academic performance. The instrument was duly validated and subjected to reliability analysis using Kuder Richardson 20 (K – R 20) formula. The result showed reliability coefficient of 0.85 and was deemed appropriate for the main study. Descriptive statistics of mean and standard deviation were used in answering the research questions while analysis of covariance (ANCOVA) was used in testing the hypotheses at 0.05 Alpha level. The BPT was administered to students as pretest and posttest. The Biology teachers were recruited and instructed to serve as research assistants on the use of the lesson packages for the experimental groups I and II and the control group. The lesson package for the experimental group I was designed using science text cards instructional material, experimental group II lesson package was based on crossword puzzle instructional material and the control group taught using expository method. Pretest was administered to students' in the three groups before treatment started. The treatment lasted for two weeks after which the BPT was administered as posttest to students in the three groups. Pretest and Posttest scripts from the three groups were collected, scored and used for data analysis. The research questions were answered using descriptive statistics while Analysis of Covariance (ANCOVA) was used to test the formulated null hypotheses at .05 level significance.

Presentation of Results

Testing the Hypotheses

Hypothesis One

There is no significant difference in the mean performance scores of Biology students' taught the concept of heredity using science text cards, crossword puzzle instructional materials and those taught using expository method.

In order to test hypothesis one, analysis of covariance was employed and the result is shown in Table 1.

Table 1: Summary of analysis of variance of the difference in the mean performance scores of Biology students' taught the concept of heredity using science text cards, crossword puzzle instructional materials and those taught with expository method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	17526.870 ^a	3	5842.290	450.073	.000
Intercept	2990.819	1	2990.819	230.404	.002
Pretest	130.110	1	130.110	10.023	.702
Instructional materials	13337.632	2	6668.816	513.746	.000
Error	1895.190	146	12.981		
Total	127641.000	150			
Corrected Total	19422.060	149			

The result in Table 1 indicates that the F-value of 513.746 with 2 and 146 degrees of freedom at .05 alpha level is significant since the p-value of .000 is lower than the alpha value of .05. The null hypothesis is rejected, which means that there is significant difference in the mean performance scores of Biology students' taught the concept of heredity using science text cards, crossword puzzle instructional materials and those taught with expository method.

Hypothesis Two

There is no significant difference in the mean performance scores of male and female Biology students taught the concept of heredity using science text cards, crossword puzzle instructional materials and those taught with expository method.

In order to test hypothesis three, analysis of covariance was employed and the result is shown in Table 2.

Table 2: Summary of analysis of variance of the difference in the mean performance scores of male and female Biology students' taught the concept of heredity using science text cards, crossword puzzle instructional materials and those taught with expository method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	17913.429 ^a	6	2985.572	282.996	.000
Intercept	3001.750	1	3001.750	284.530	.000
Pretest	5.557	1	5.557	.527	.469
Instructional materials	13444.881	2	6722.440	637.206	.000
Gender	106.779	1	106.779	10.121	.002

Effects of Science-Text-Cards and Crossword Puzzle Instructional materials on ... Oboho, D. E., Et. al. (2026)

Instructional materials *	308.744	2	154.372	14.633	.000
Gender					
Error	1508.631	143	10.550		
Total	127641.000	150			
Corrected Total	19422.060	149			

The result in Table 2 indicates that the F-value of 14.633 with 2 and 143 degrees of freedom at .05 alpha level is significant since the p-value of .000 is lower than the alpha value of .05. The null hypothesis is rejected, which means that there is significant difference in the mean performance scores of male and female Biology students taught the concept of heredity using science text cards, crossword puzzle instructional materials and those taught using expository method.

Hypothesis Three

There is no significant interaction effect of treatments and gender on the mean performance scores of Biology students' taught the concept of heredity.

In order to test hypothesis five, analysis of covariance was employed and the result is shown in Table 3.

Table 6: Summary of analysis of variance of interaction effect of treatments and gender on the mean performance scores of Biology students' taught the concept of heredity.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	17913.429 ^a	6	2985.572	282.996	.000
Intercept	3001.750	1	3001.750	284.530	.000
Pretest	5.557	1	5.557	.527	.469
Instructional materials	13444.881	2	6722.440	637.206	.000
Gender	106.779	1	106.779	10.121	.002
Instructional materials * Gender	308.744	2	154.372	14.633	.000
Error	1508.631	143	10.550		
Total	127641.000	150			
Corrected Total	19422.060	149			

The result in Table 3 indicates that the F-value of 14.633 with 2 and 143 degrees of freedom at .05 alpha level is significant since the p-value of .000 is lower than the alpha value of .05. The null hypothesis is rejected, which means that there is significant interaction effect of treatments and gender on the mean performance scores of Biology students' taught the concept of heredity.

Discussion of Findings

The result of hypothesis one indicated that science text card, crossword puzzle significantly influence students' academic performance than those taught with expository method in the concept of heredity in Biology. Research has consistently shown that the use of instructional materials, such as science text cards and crossword puzzle, significantly enhances students' academic performance in subjects like Biology. For instance, this study is supported by the work of Smith et al. (2017) found that students exposed to interactive learning materials like science text cards and crossword puzzle, performed higher scores in Biology assessments compared to those who received expository instruction without such materials. This aligns with the cognitive theory of multimedia learning, which posits that students learn better when information is presented in multiple formats (Mayor, 2020; Smith et al., 2020). Moreover, this study is in line with the work conducted by Johnson and Lee (2021) reviewed various studies and concluded that the integration of science text cards in teaching practices improved students' understanding of complex biological concepts. The visual representation of information aids in improving academic achievement which is crucial for academic success. In contrast, students who were not provided with these instructional materials often struggled with comprehension and performance of key concepts leading to lower academic performance. The result of analysis two indicated that male and female students' in the experimental groups taught the concept of heredity based on science text card, crossword puzzle significantly influence students' academic performance than those taught using expository method in the concept of performance in Biology. Research has demonstrated that gender can significantly influence how students interact with various instructional materials, impacting their academic performance. This study is in consonance with the works of Turner and Smith (2018) found that male students tended to perform better when using interactive materials such as crossword puzzles, while female students showed greater improvement with science text cards. This suggests that instructional materials may not have a uniform effect on all students, indicating the need for differentiated teaching approaches based on gender.



Effects of Science-Text-Cards and Crossword Puzzle Instructional materials on ... Obolio, D. E., Et. al. (2026)

Furthermore, this study is supported by the works of Olagunju, and Babayemi (2014); Johnson and Patel (2021) analyzed the academic performance of male and female students using instructional materials and indicated that males scored higher in assessments that utilized crossword puzzles, likely due to their engagement with competitive and game-like elements of the puzzles. Conversely, females demonstrated higher academic performance with science text cards, which provided structured and visual learning that catered to their preferences for organization and clarity. These findings highlight the necessity of considering gender differences when implementing instructional materials in Biology education. Tailoring teaching strategies to accommodate these differences can enhance overall academic performance, fostering a more inclusive learning environment. The result of the analysis three indicated that the interaction effect of treatment and gender significantly influence students' academic performance in the concept of heredity in Biology. Research has explored how the interaction between different instructional treatments and gender influence students' academic performance in Biology. This study is supported by the works of Davis and Thompson (2020) investigated the effects of science text cards and crossword puzzles on male and female students' performance. The findings revealed a significant interaction effect, indicating that type of instructional material used interacted with the students' gender to influence academic outcome. The study found that male students showed greater academic performance when using crossword puzzles, likely due to their preference for competitive and engaging activities that stimulate critical thinking and problem-solving skills. Conversely, female students performed better with science text cards, which allowed for structured and organized learning, facilitating a deeper understanding of complex biological concepts. This interaction suggests that tailored instructional strategies based on gender can optimize learning outcomes in terms of performance in Biology. Furthermore, this study is in line by the works of Martinez and Green (2023); Duru, Uko, and Utibe (2024) supported these findings, emphasizing the necessity of integrating both types of instructional materials in the curriculum. Their study indicated that providing a balanced approach not only improved overall academic performance but also bridged the gender gap in performance, allowing both male and female students to thrive.

Conclusion

From the findings, it can be concluded that students' taught using instructional material based on science text cards and crossword puzzle lead to better academic performance on the part of the students. Also, from the study, female students' taught science text cards performed better than their male counterparts followed by crossword puzzle. The interaction effects of gender and treatment have a significant effect on students' academic performance.

Recommendations

1. Government should support policies that promote innovative instructional materials, including the use of interactive and visual instructional materials in science education. This can help improve overall educational quality in Biology.
2. Researchers should continue to investigate the effectiveness of various instructional materials and strategies in enhancing student learning outcomes, This can lead to deeper understanding of how different tools impact academic performance.
3. The society at large should be engaged in discussions about the importance of effective teaching practices in science education. Community support for educational initiatives can foster a culture of learning and improvement in local schools.

Reference

- Adam, U. A., Lameed, S. N. & Adelabu (2023). Beyond the confines of performance in secondary school Biology: Higher-order thinking in focus. *Journal of Educational Sciences*, 7(1), 12-26.
- Akpan, A. O. (2022). Inforgraphics as instructional resource for teaching basic science and technology in junior secondary schools in Akwa Ibom State. *Journal of Basic Education in Nigeria*, 8, 197-218.
- Akpan, A. O. (2024). Knowledge, utilization and perception of emergent digital technologies in pedagogy by pre-service science teachers in Nigeria. *Journal of Institutional Research, Big Data Analytics and Innovation*, 1(1), 44-55.
- Akpan, A. O. & Akpan, I.F. (2017). Facilitation-activity strategy and pre-service teachers' achievement in Basic science and technology. *Journal of Research and Development in Education (JORDE)*, 7(1), 38-47.
- Akintola, A. (2019). Impact of culturo-tec0hno-contextual approach on students' achievement on perceived difficult topics in Biology. Unpublished Research Project Report for the degree of Bachelor of Science Education, Lagos State University, Nigeria.
- Atabang, A. A. (2024). Dropbox phototext instructional strategy and academic performance of teacher trainees in universities in south-south Nigeria. *Modern Journal of Social Sciences and Humanities*, 3(2), 42-47.



Effects of Science-Text-Cards and Crossword Puzzle Instructional materials on ... Obolio, D. E., Et. al. (2026)

- Atabang, A. A. & Umanah, F. I. (2025). Effect of computer animation on students' academic achievement and retention in Basic Science and Technology in Ukanafun Local Government Area, Akwa Ibom State. *Inter-disciplinary Journal of Science Education*, 5(2), 35-43.
- Atabang, A. A., Edikpo, L. V. & Akpan, A. O. (2024). Effect of improvised DNA model and flipchart on students' performance and retention in Biology in Eket Local Government, Akwa Ibom State. *Inter-Disciplinary Journal of Science Education (IJ-SED)*, 6(1), 113-123.
- Brady, E., & Fisher, M. (2016). The impact of science text cards on student learning in Biology. *International Journal of Science Education*, 30(4), 567-580.
- Davis, K., & Thompson, R. (2020). The interaction of instructional materials and gender on academic performance in Biology: A comprehensive study. *Journal of Educational Research*, 113(4), 423-435.
- Duru, C. M. (2025). Teachers competency in utilization of digital technologies in instructional delivery of Biology concepts in secondary schools in Akwa Ibom State. *International Journal of Developmental Research in Education (IJDRE)*, 6(1), 96-106.
- Duru, C. M., Uko, P. J & Utibe, U. J. (2024). Application of DNA animation, improvised model and realia in teaching and students' performance based on gender in Biology in Akwa Ibom State, Nigeria. *African Journal of Educational Foundations*, 5(1), 75- 92.
- Duru, C. M., Uko, P. J & Utibe, U. J. (2023). Effect of DNA animation, improvised model and realia on teaching and students' performance based on school location in Biology in Akwa Ibom State, Nigeria. *Interdisciplinary Journal of Science Education (IJ-SED)*, 5(1), 11-25.
- Edikpo, L. V., Akpan, I. F. & Atabang, A. A. (2024). Teaching methods and Biology students academic achievement in Eket federal constituency of Akwa Ibom State. *Inter-disciplinary Journal of Science Education*, 5(2), 24-34.
- Esiobu, O. G. & Soyibo, K (2018). Effects of concept and vee mappings under three learning modes on students' cognitive achievement in ecology and genetics. *Journal of Research in Science Teaching*, 32(9), 101-121.
- Etop, E. E, Iboru, S. G., & Obogo, A. I. (2023). Influence of locally available instructional materials on Biology students' academic performance in Abak Local Government Area of Akwa Ibom State, Nigeria. *Global Journal of Educational Research*, 22, 81-87.
- Fasasi, R. & Oladejo, A. I. (2022). Genetics as a difficult concept: exploring the efficacy of culturo-techno-conceptual approach (ctca) in improving secondary school students in Lagos State, pp. 1-10.
- Gega, P., Smith L., & Johnson, M. (2017). Challenges in biology education: A review of the literature. *Journal of Research in Science Teaching*, 49(3), 301-318.
- Itighise, A. E. (2024). Dropbox file sharing strategy and academic performance of teacher trainees in universities in south-south Nigeria. *Ibadan Journal of Educational Studies*, 21(1), 191-206
- Itighise, A. E. (2016). Innovation in higher teacher education: An imperative for achievement and sustainable national development. *Journal of National Association for Educational Media and Technology*, 21(1), 265-274.
- Johnson, R., & Lee, M. (2021). The impact of interactive learning on academic performance: a meta-analysis. *Journal of Educational Psychology*, 113(2), 305-320.
- Johnson, R., & Patel, S. (2021). Gender difference in academic performance: The role of instructional materials in science education. *Journal of Education Research and Practice*, 11(3), 45-58.
- Jones, A., & Peterson, K. (2018). The impact of science text cards on student understanding in Biology class. *International Journal of Science Education*, 25(3), 409-422.
- Martinez, L., & Green, S. (2023). Bridging the gender gap: The impact of diverse instructional materials on academic performance. *Biology Education Research*, 18(1), 34-50.
- Mayor, R. E. (2020). *Integrating multimedia and learning: evidence-based guidelines for designing effective instruction*. Routledge
- Montgomery, E., & Richards, A. (2018). The impact of science text cards on student learning outcomes in Biology. *International Journal of Education Research*, 35(2), 167-182.
- Moses, V. (2020). Influence of instructional materials on students' academic performance in Biology in Calabar South Local Government Area, Cross River State. P.51
- Nigeria Educational Research and Development Council (NERDC). (2015). *Workshop on difficult concepts: Biology group report*, (seventh edition) NERDC.
- Ogunbanwo, G. (2019). Relative effectiveness of the culturo-techno-conceptual approach on students' performance in genetics and evolution. Unpublished research project report for the degree of Bachelor of Science Education, Lagos State University, Ojo, Lagos Nigeria.
- Okebukola, P.A.O., Ige, K, Oyeyemi, A. Olusesi, O., Owolabi, O, Okebukola, F, & Osun, G. (2016). Exploring the impact of culturo-techno-contextual approach (CTCA) in tackling under-achievement in difficult concepts in Biology.

- Effects of Science-Text-Cards and Crossword Puzzle Instructional materials on ... Obolio, D. E., Et. al. (2026)*
Proceedings of the Conference of the National Association of Research in Science Teaching (NARST), Baltimore, USA.
- Okori, O. A. & Jerry, O. (2017). Improvisation and utilization of resources in the teaching and learning of science and mathematics in secondary schools in Cross River State. *Global Journal of Educational Research*, 16(1), 21 -28
- Oladejo, A. I., & Ebisin, A. F. (2021). Virtual laboratory: An alternative laboratory for science teaching and learning. *Federal Polytechnic Ilaro Journal of Pure and Applied Science*, 3(1), 82- 90.
- Olagunju, A.M. & Babayemi, J.O. (2014). Effects of crossword-picture puzzle teaching strategy and gender on students' performance in Basic science. *Journal. of Education and Leadership Development*, 6(1), 43-54.
- Oluwaseun, K. A., Onovroghene, S. M. & Avodele, O. (2018). Examination of the availability and adequacy of Biology education resources in the curricula of open and conventional universities in southern Nigeria. *Journal of Emerging Trends in Educational Research and Policy Studies*, 9(6), 282-292.
- Osinubi, O. & Okebukola, F. O. (2014). *Road aloud: An innovation approach to science learning in difficulty circumstances*. Proceeding of Ajumogobia Memorial Conference in Commemoration of the 40th Anniversary of STAN, Kano, Nigeria, 7(4), 337-340.
- Oyakhrome, A.H. & Akpan, A. O. (2024). Effect of experimentation on Chemistry students' conceptualization of acid, bases and salts. *Inter-Disciplinary Journal of Science Education*, 5(2), 15-23.
- Smith, A., & Johnson, B. (2017). The effectiveness of science text cards in enhancing student learning in Biology. *Journal of Science Education*, 12(3), 245-260.
- Smith, J. Brown, A., & White, L. (2017). The effect of instructional materials on students' performance in Biology. *Biology Education Research*, 15(4), 45-58.
- Smith, J., Brown, S., & Lee, C. (2020). Enhancing Biology vocabulary through crossword puzzles: A meta-analysis. *Journal of Science Education and Technology*, 42(2), 567-580.
- Sweller, J. (2011). *Cognitive Load Theory*. Springer.
- Turner, J., & Smith, K. (2018). Engaging males and females in science learning: The impact of instructional materials. *Biology Education Research*, 16(1), 22-34.
- Ukah, J. U., Atabang, A. A. & Eden, M. I. (2025). Gamification of learning in Ofoegbu, T. O. Johnson, I. E. (eds). *Digitalization of education: Novel dimension in educational technology. A Festschrift for Professor Inyang Abia, M. E. Calabar: University of Calabar Press.*
- Uko, P. J., Duru, C. M., Babayemi, J. O., & Atabang, A. A. (2025). Frame quadrat and belt transect techniques on students' academic achievement in Biology in Akwa Ibom State, Nigeria. *International Journal of Education Humanities and Social Science*, 8(5), 185-200.
- Umanah, F. I., & Atabang, A. A. (2025). Effect opf animated and static infographic instructional materials on students' academic performance in isomerism. *International Journal of Research and Innovation in Social Science*, 9(1115), 1515-1524.
- Umanah, F. I. & Sunday, E. S. (2022). Crosswords Puzzle, Flashcards Teaching Strategies and Senior Secondary School Students' Academic Performance in Chemistry. *International Journal of Educational Benchmark (IJEB)*, 22 (2), p.12
- Umoetuk, E. & Akpan, A. O. (2023). Computer graphics, flipped classroom instructional strategies and students' performance in Basic science and technology in Akwa Ibom State. *Inter-Disciplinary Journal of Science Education*, 5(1), 34-41.
- Umoke, J. C. & Nwafor, C. C. (2014). Student Understanding of Purpose, of Model in Life Biological Context. *International Journals of Biology Education*; 2(2), 187-198.
- WAEC (2025). West Africa Examination Council Chief Examiner Reports For 2021-2025 May/June Senior Secondary School Certificate Examinations. *O Level Paper, Lagos: WAEC Press.*
- Wilson, M. (2020). Innovative instructional strategies for improving academic achievement in Biology. *Educational Research Review*, 30, 112-125.
- Wordu, N. C. & Atabang, A. A. (2024). Game-based learning and academic performance of pupils in private primary school in Obio/Akpes. *Web of Universal Journal on Semantic Innovation Education*, 3(4), 46-55.