HOME PRACTICES ANALOGY MODEL (HPAM) AS A TEACHING STRATEGY FOR ENHANCING STUDENTS' INTEREST AND ACHIEVEMENT IN BIOLOGY IN CALABAR SOUTH LOCAL GOVERNMENT AREA.

Esther Etop Ekon (Ph.D)[1]

esthyl.rhemacare@gmail.com

Alexander E. Timothy[2]

alexandertimoth@unical.edu.ng

Mathias Bebia Obi[3]

obimathias2013@gmail.com

Roland Otu Bisong[4]

rolandbisong60@gmail.com

[1,3.4] Department of Biology Education, Faculty of Science Education. University of Calabar

[2] Department of Language Art Education, Faculty of Art and Social Science Education. University of Calabar

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Abstract

The study examined the effect of home practices analogy model (HPAM) on students' interest and academic performance in Biology in Calabar South L.G.A., Cross River State. Two research questions and hypotheses guided the quasi-experimental pre-test post-test non-equivalent design. The study involved 81 SS1 students from two intact classes randomly assigned to experimental and control groups out of a population of 310 students in seven Government-owned secondary schools. Data were collected using the Biology Achievement Test (BAT) and Biology Interest Inventory (BII), both with established validity and reliability coefficients of 0.82 and 0.76, respectively (using Kuder Richardson and Cronbach's Alpha METHOD). Mean and standard deviation were utilized to address the research questions, while Analysis of Co-variance tested the null hypotheses. The results demonstrated that the experimental group displayed higher interest in the taught concepts, leading to improved academic performance compared to the control group. This finding suggested that employing familiar phenomena facilitated better understanding of the concepts, enhanced interaction with the learning environment, and facilitated knowledge retention. Based on the findings, the researchers recommended the implementation of activity-based, child-centred, and analogy models for effective teaching and enhanced academic performance in Biology.

Keywords: academic performance in Biology, biology concepts, HPAM, science instruction, students' interest

Introduction

The world is fast becoming scientific in thinking and behaviour that without good knowledge of science, there might be some difficulties for people to adequately function well in society, the more reason why the young ones are exposed to science instructions early in life. The purpose of exposing the young ones early to science instructions is to instil in them the attitude of inquiry about things that are perplexing to them and to discover facts and occurrences early in their environment. Almost all aspect of life science, both living and non-living has something to do with Biology, be it engineering, mathematics, chemistry, or physics (Adunola, 2011; Ibok & Masor, 2024). Biology is a science of life and relevant to man's successful living, occupies an important position in the life of every human being as it provides basic knowledge on how the body systems function. It is the centre for producing the resources necessary for the socioeconomic, scientific, and technological development and advancement of any nation. In Nigeria, Biology serves as one of a prerequisites for admission to most professional courses in the university such as Medicine, Pharmacy, Technological, and other applied sciences. Biology is central to Science, Technology, Engineering, And Mathematics (STEM) education in Nigerian secondary schools and is regarded as the most popular of the three science disciplines. Despite its popularity and importance, research reports reveal that the academic performance of Biology students in internal and external examinations like the West African Examination Council (WAEC) and National Examination Council (NECO) has been on the decline (Ekon, 2013; Olusa, 2019). This has generated a lot of concern among the stallholders, parents, teachers, and even the students. This trend has been attributed to the use of inappropriate teaching methods, inadequate learning resources, and lack of understanding of Biology concepts (Olotu & Ugwuanyi, 2017; Olusa, 2019; Ibok & Masor, 2024) and acquisition of Science Process Skills (Mandor & Nwosu 2004) among others.

In many Nigerian schools the conventional expository instructional method is used in teaching Biology. This method makes the learners to be passive listeners to their teachers who is seen as the custodian of knowledge. This method lacks the capacity of stimulating students' interest in science subjects, especially Biology. Furthermore, Okoli (2006) indicated that many science teachers prefer the conventional method which is teacher-centred to activity-oriented methods which are student-centred. Nwagbo (2017) observed that such teacher-oriented approaches place the teacher as the sole possessor of knowledge and students as passive recipients of knowledge and may not enhance good performance in Biology. Onwuka as cited in Ekon asserted that teachers using the conventional method spoon-feed learners and do not challenge the learners to discover new truths, rules, and methods of tackling problems as well as new values for themselves. Students in this case do not understand the concept learnt. The tendency, therefore, is for the learners to forget much of what is told them by the teachers and resort to memorizing to pass examinations.

Olusa (2019) confirmed that students' lack of understanding of some concepts results in poor academic performance of students at senior secondary school certificate examination (SSCE) and backwardness in scientific and technological advancement in our nation. Olotu and Ugwuani (2017) noted that students do not sufficiently comprehend the knowledge and the skills underlying science subjects, giving room for memorization and superficial learning of basic concepts and principles. The implication of this is that learning becomes difficult, uninteresting, and boring. Learners also complain about the abstractness of Biology concepts taught in schools.

Therefore, the conventional method neither helps most learners to be active participants in the classroom nor allows learners to develop appropriate Science Process Skills (Mandor & Nwosu, 2005; Ibok & Masor, 2024) for better understanding, retention of concepts, and application of scientific concepts in the outside world. The need to inculcate into the learners' creative abilities, improve their self-esteem, eliminate difficulties while learning, and make them active participants in the classroom has given rise to tremendous interest by researchers towards developing appropriate and innovative teaching methods which include inquiry (Ekwueme, Ekon & Ezenwa, 2015); and constructivism (Ekon, 2013 and Eze, 2005). Schwab as cited in Ekon (2013) found out that constructivism not only helps students learn and retain information but has positive effects on the students' attitude towards studying science subjects.

The theoretical framework guiding this study is that of Vygotsky's social constructivist learning theory. Vygotsky (1968), being a social constructivist theorist, believed that learners can actively construct their knowledge through shared problem-solving experience with the guidance of an adult, the teacher. Vygotsky emphasized that the teacher is to encourage learners to develop creative thinking through several activities and exploration of their environment. This implies that Biology teachers should act as facilitators by gradually withdrawing explanations, giving students the opportunity to interact with one another to find out meaning and knowledge themselves through guided instructions, rather than dictating meanings to students for regurgitation during examinations. The interaction encourages students to employ their previous knowledge and experiences they had from their homes (home practices) to build and construct new knowledge (Biology concepts) in the classroom as a community of learners. This means that in constructivism, a learner constructs meaning for new information because of interaction between the learner's prior conception and his or her current observation. Constructivism is problem-solving oriented, allowing students to explore and work in groups, and solving problems that may be perplexing to them.

Vygotsky's social constructivism emphasizes that learning is fundamentally social and that students' prior home experiences serve as essential building blocks for classroom learning. For the HPAM study, this theory justifies using home practices and analogies as teaching strategies because students construct biological knowledge by connecting classroom concepts with familiar home experiences such as food preparation, plant growth, disease prevention, and domestic activities. However, the application requires more explicit theoretical development clarifying how home practices and analogies specifically function as cognitive bridges that enhance students' interest in biology and improve their academic achievement, and how the HPAM teaching strategy operationalizes social constructivism principles within biology instruction in the area.

Previous studies have not explored the impact of HPAM on students' learning outcomes in biology in this specific context, leaving a knowledge gap that needs to be addressed. The study aims to fill this gap by examining the effectiveness of HPAM in improving students' interest and achievement in biology in Calabar South Local Government Area, and providing insights into the potential of HPAM as a teaching strategy for enhancing biology education.

Chijioke and Okoli (2019) asserted that the constructivist process is one which allows learners to become active participants, drawing upon their personal experiences and their interaction with

others to construct new understandings in school. This learning strategy believes that learners are not empty slates but that they bring to the classroom ideas that may affect new ideas received in teaching and learning processes. Several constructivists' instructional models may be effective tools for teachers to provide learners with the opportunity to interact with themselves and learn materials in a social setting. Among them is the Analogy model.

The analogy model of instruction is characterized as discourse in which a familiar situation similar to the unfamiliar phenomenon to be explained is used. Johnson as cited in Ekon (2013) defined analogy as a process of identifying similarities between two concepts. Eze (2015) defined analogy as a teaching strategy which bridges between two concepts, one which is familiar and the other, which is new and unfamiliar. Ekon termed the unfamiliar phenomenon the TARGET while the familiar situation, the SOURCE. This implies that there is a need for the teacher to learn about the students' background and culture so that chosen analogies would be familiar to many of the learners in the classroom. See Fig 1 for further illustration.

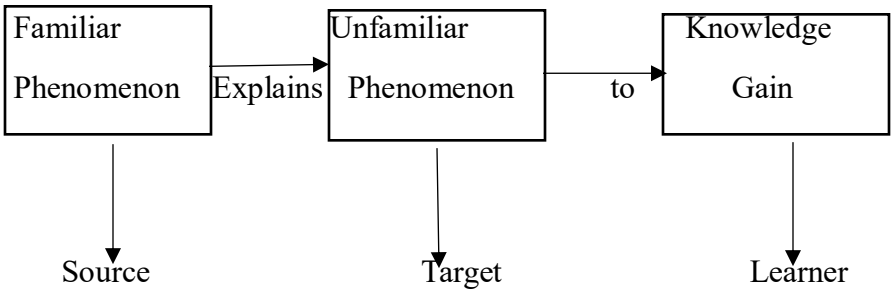

Fig. 1

Source: Analogy Model of Instruction (Ekon, 2013)

The home Practices Analogy Model (HPAM) is an adapted form of Glynn's (2005) Teaching-With-Analogy Model (TWAM) with five steps: -

- Introducing the Concept to be learned as contained in the curriculum (as the target)
- Recalling and selecting appropriate events or objects (home Practices) which are familiar to the students. Students may contribute their ideas.
- Identification, mapping, and presenting relevant home activities (as the source) to the students as an analogy.
- Matching the similarities of the source with the target where the teacher facilitates and explain the intrigues of the learned concept (target) through experimentation and guided instructions.
- Summarizing and drawing conclusions
- Evaluation and assignments.

In recent times, Brookman-Byrne (2022) observed that analogies can be powerful tools to help students understand new concepts better and that analogy increases comprehension and reduces misconception in learning scientific concepts.

Several studies have been conducted on analogy and have shown that it enhances students' achievement in science. Owolobi (2013) conducted a study on the use of analogy as a vehicle for achieving effective physics delivery in some selected senior secondary schools in Lagos, Nigeria and discovered that the experimental group who were taught using an analogy strategy performed significantly better and retained more of the concepts than the control group after post-test. Sani (2006) in a study on the effect of problematic analogy on conceptual understanding of chemical equilibrium among SS2 students in Minna metropolis, Niger State, Nigeria found out that the experimental group students taught with analogy performed significantly better than the control group students. Okafor (2019) conducted a study on the kitchen-explanations analogy model as a strategy for enhancing secondary students' achievement in chemistry in Lagos State, Nigeria revealed that the group taught with kitchen-explanation analogy had a higher mean score as compared to their counterparts who were taught using explanations. In another study done outside Nigeria, Gelar and Mubasyiroh (2018) investigated the effectiveness of Teaching with Analogy (TWA) on students' Mathematical representation of derivative concept in Depok city, Indonesia. Quasi-experimental design was employed, and the result revealed that the students taught Mathematical representation with TWA had higher scores than those taught the concept without TWA. Other studies on home-based teaching resources were reviewed. Such included that of Antipatia (2023) who investigated the Home-based enrichment activities for grade 9 (science) students in Phillipines during the first quarter of 2022-2023 school year. The study employed both descriptive and quasi-experimental research design. The instruments included the validated pre-test and post-test assessments, and a survey sheet for students. 60 biology students were sampled from180 students. The data gathered were statistically analysed using mean, percentage, independent T test. The result revealed that the control group exhibited lower mean scores (4.33 and 29.33) in the pre-test and post-test compared to the experimental group (13.97 and 38,20) indicating a significant improvement in performance of the students further affirming the positive impact of the developed home-based enrichment activities on students' academic performance. The experimental group students also expressed a high-level science learning engagement and preparation to study science as manifested by the grand weighted mean of 3.88. Another study is that of Obomanu and Akporehue (2012) who investigated on the effect of home related science activities on students' performance on Basic Science in Bayelsa State, Nigeria. The sample consisted of 240 basic Junior Secondary two (BJSS11) students drawn from a population of 5,076 students in 2 Local Govt Areas. A quasi experimental with a pre-test post-test control group design was adopted. The data was analyses using mean, standard deviation, t-test and analysis of variance (ANOVA). The result showed that home related science activities enhanced students' performance in Basic Science concepts better than utilizing only school or classroom activities. So far, A critical assessment of the literature reveals no study centring on an analogy model in Biology is carried out in Cross River State, Nigeria. Therefore, using this strategy on the interest of students vis-à-vis achievement in Biology in the state is expected to fill the existing gap in previous studies.

Types of homes practices

Okafor (2018) emphasized that students' struggles with acquiring basic science process skills and achieving academic success can be attributed to various factors within the classroom environment. These factors include the presence of irrelevant illustrations, inadequate explanations, and a lack of integration of scientific concepts into daily home activities. The home can be regarded as a workshop of various practices where the learner is involved in several experiences in the various science subjects taught in schools. Snobgrass (2001) opined that the home is a familiar reference point and that when students participate in activities and discussion of home science, they perform better.

Nja and Neji (2013) supported the idea that young learners grasp tangible concepts more readily when they are accessible and familiar to their senses. Nja and Ideba (2021) further stressed that, teaching of science subjects involving demonstrations in home science serves as appetizers for students' involvement. Furthermore, Helmenstine (2010), opined that harnessing home resources into the classroom can make science experiments fascinating to the students. As numerous scientific activities take place within the home environment, teachers must carefully identify and organize these practices to effectively teach relevant Biology concepts. Schreiner, (2012) opined that, teachers who are adapt at improvisation would likely be more successful in impacting scientific information to students. In light of this, it is essential to identify and utilize home practices and activities that inherently contain scientific elements/ connotations to enhance learning in the classroom. For instance, the simple act of keeping local birds, such as hens and cocks, could serve as a valuable tool to teaching the process of reproduction in organisms. From courtship behaviors to genetic inheritance, this real-life example can bring abstract concepts to life in the minds of students(Ibok, Anam, Akpa, Ekon, Obeten, Ogar, Inah, Unamba, Obi, Amos, Edet, Swem, Patrick, Unimna, Ameh, Bessong, Bessong, Olenye, Njoku, Odok, Obeten, Ekeng, Ani, Afiene & Omini,2026).

Similarly, the observation of insects' eggs, like those of butterflies, as they transform into adulthood can serve as an analogy to teach developmental cycles in insects. This hands-on experience with natural processes allows students to better understand the intricacies of insect growth and development. The smell of fish caught immediately do not have an odour at all but after being kept for sometimes, (even though preserved under low temperature) the fishy smell develops, as a result of chemical reactions that occur on the surface of the skin. This can be used to teach enzymes in biology (Chris, 2012; Ibok & Masor, 2024).

The preservation of seeds like melons, okra, and corn in calabashes and air-tight containers using local spices, such as dry pepper, offers yet another opportunity to teach essential concepts related to food production, storage, and the impact of pests on crops. By relating these processes to everyday experiences at home, students can grasp the relevance and significance of scientific principles in their lives.

Moreover, children often engage in activities involving seeds, planting them and witnessing their germination into radicles. This offers a perfect opportunity for the teacher to introduce lessons on seed germination, distinguishing between epigeal and hypogeal germination. Also, simple acts such as dipping tea bags during breakfast preparation can be harnessed as practical demonstrations

to teach the concept of Osmosis. Similarly, activities like the spreading of insecticides and perfumes can serve as real-world examples to introduce the concept of diffusion to students.

In conclusion, the integration of relevant home practices and activities into science education can significantly enhance students' understanding and appreciation of scientific concepts. By leveraging everyday experiences and using them as teaching tools, educators can bridge the gap between abstract theories and real-life applications. This approach not only fosters better academic performance but also nurtures a deeper interest in science among students, as they can see how the subject impacts their daily lives.

Fig. 1. Sliced tomatoes in an aluminium plate (Source: Esther Ekon)

The integration of home practices into science education has the potential to significantly enhance students' learning experiences. By incorporating familiar and accessible materials from everyday life, educators can bridge the gap between abstract scientific concepts and practical applications. This approach offers a more engaging and enjoyable learning environment for students, promoting better academic performance in science. The approach aligns with the indigenous ways of learning which are characterised by informality (Uguma & Timothy, 2015; Ibok, *etal,* 2026)

One aspect of this integration involves utilizing various home practices as analogies for teaching specific scientific principles. For instance, the slicing of tomatoes and oranges into different shapes at home can serve as practical illustrations for teaching dissections, specifically longitudinal and

transverse sections. This hands-on approach allows students to better understand the anatomical structures of organisms by relating them to tangible examples they encounter in their daily lives.

Similarly, the use of *akang* (potash) to alter the colour of palm oil, commonly observed when serving visitors at home, can be used as an analogy to illustrate the use of reagents in food tests. By demonstrating how a familiar substance can be employed in a scientific context to detect specific substances in food items, students can grasp the concept of chemical reactions and their applications.

Furthermore, home practices involving butchery of hens and rabbits offer opportunities to display different organs and serve as analogies to teach about vertebrate digestive systems, excretory mechanisms, and morphological features. Students can gain insights into vertebrate anatomy and physiology by examining real-life examples of internal structures.

In addition, utilizing actual bones from butchered vertebrates can aid in teaching about bone locations in an organism's body (skeletal vertebrates) and the various types of joints in vertebrates. This tangible approach to teaching skeletal structures can enhance students' comprehension and retention of anatomical concepts.

Another valuable resource from home practices is the observation of molds on spoiled bread, oranges, or leftover food items like garri and *fufu*. This natural occurrence can be utilized to teach students about the growth and behaviour of microorganisms. By conducting observations and experiments on mold development, students can gain practical knowledge of micro-biology and the factors influencing microbial growth.

Research has shown that using analogies effectively in education can foster connections between students' prior knowledge and new concepts, leading to improved academic performance. The incorporation of home analogies in science education aligns with this research, as it allows students to relate scientific principles to their existing understanding of everyday experiences.

In conclusion, integrating home practices and analogies into science education presents an innovative and effective approach to enhance students' learning experiences. By using familiar materials and tangible examples, educators can promote active engagement, deeper understanding, and improved academic performance in science. This approach serves as a bridge between theoretical scientific concepts and practical applications, making learning more meaningful and relevant to students.

Students' interests cannot be ignored in academic achievement in the classroom. Interest is defined by Hornby (2010) as something that attracts attention and curiosity. Interest in Biology as a subject refers to a learner's reactions towards wanting to learn the subject and knowing it and being able to apply the knowledge in everyday experience. Interest is strengthened when a learner/person experiences a learning activity as enjoyable, pleasant, and stimulating. Ekwueme, et. al. (2015) recommended interest-boosting hands-on, minds-on activities while Ekon (2013) endorsed the use of appropriate strategies which are related to the learners' immediate environment. Since analogy is of the constructivists' model, it is interactive, socially oriented, learner-centred, and activity-

based; it is expedient to investigate its efficacy not only on students' academic performance but on their interest in Biology as a subject.

The study problem

The problem under investigation revolves around the poor performance of Biology students in external examinations, as evidenced by the WAEC Chief Examiners' Reports from 2017 to 2022. The existing issues have been attributed to several factors, including the use of inappropriate teaching methods. To address this concern, there is a need to implement an innovative, activity-based, and student-centred method of instruction in Biology classes.

Another significant factor contributing to the poor performance is the students' lack of understanding of Biology concepts, leading to a perception of the subject as difficult, uninteresting, and abstract. As a result, students tend to resort to rote learning, memorizing information without true comprehension, which leads to forgetfulness over time. Previous research has highlighted the importance of employing innovative, activity-based teaching strategies focused on promoting students' understanding of Biology concepts, with one such approach being the use of analogy strategy.

Therefore, the central question posed for this study is as follows: Can the implementation of the Home Practices Analogy Model (HPAM) as a teaching strategy enhance students' interest in Biology and improve their academic achievement? By exploring the effectiveness of HPAM in engaging students and facilitating a deeper understanding of Biology concepts, the study seeks to address the challenges of poor performance and lack of interest in the subject, with the ultimate goal of improving Biology education outcomes.

To investigate the efficacy of the Home Practice Analogy Model (HPAM) in improving the academic performance and interest of Biology students in the study area, two research questions and two hypotheses were formulated to guide the study.

Research questions

1) Is there any difference in the mean academic performance score of Biology students taught using the home practice analogy model (HPAM) and those taught using the conventional method?

2) Is there any difference in the mean interest score of Biology students taught using the home practice analogy model (HPAM) and those taught using the conventional method?

Research hypotheses

H_{O1}: There is no significant difference in the mean academic performance score of Biology students when taught using the home practice analogy model (HPAM) and those taught using the conventional method.

H_{O2}: There is no significant difference in the mean interest score of Biology students when taught using the home practice analogy model (HPAM) and those taught using the conventional method.

Methodology

A non-equivalent pre-test, post-test, control group quasi-experimental design was adopted where intact classes were employed for the study. The population of the study comprised all the 2021/2022 academic session of government-owned secondary school (SS1) students in Calabar South Local Government Area, totalling up to three hundred and ten (310). The choice of SS1 is that they are not an examination class, and the topic (Relevance of Biology to Agriculture) is derived from the National Curriculum for SS1 Biology. A simple random technique was employed to select two schools from the population where one was randomly assigned to the experimental group and the other to, control. The schools were randomly selected, but the students themselves were not randomly assigned to the experiment or control group, instead, the intact classes from the selected schools were assigned to the conditions. The use of intact classes introduces threats to internal validity, including selection bias, maturation effects, history effects, and instrumentation effects, which can be addressed by administering pre-tests, reporting descriptive statistics, using statistical controls, and documenting teacher implementation fidelity. The sample size of 81 students, which is 26% of the population of 310. The sample size is considered sufficient to detect the expected effect size, and practical constraints such as resources, time, and access to participants should also be taken into account. The study uses two intact classes. The use of intact classes provides several benefits, including authenticity, minimized disruption, realistic classroom dynamics, logistical efficiency, and enhanced generalizability. By studying students in their natural learning environments, researchers can obtain valuable insights that contribute to a deeper understanding of educational practices and outcomes.

Two instruments developed by the researchers were used for data collection; one is the Biology Achievement Test (BAT) with 25 multiple choice items of the same difficulty level with four options, A, B, C, D. The second, is the Biology Students' Interest Inventory (BSII) with 25 item-scale based on four-point Likert scale ranging from Strongly Agree (SA), Agree (A), Disagree (D) to strongly Disagree (SD). These instruments underwent face and content validity by two Biology educators in the Department of Science Education and two other experts in Measurement and Evaluation at the University of Calabar. The validators were requested to clarify if the items were ambiguous or out of place. The instruments were trial tested on an intact class of forty-three (43) SS1 Biology students outside the target sample. The reliability indices obtained for BAT and BSII were 0.82 and 0.76 respectively using Kuder-Richardson (KR-21) and Cronbach's alpha method.

The BAT items were marked based on right or wrong answers, the correct answer attracted one (1) mark while the incorrect one was scored zero (0), and a percentage score was determined for each student. BSII was scored based on 4 point Likert Scale of Strongly agreed, Agreed, Disagreed, strongly Disagreed assigning 4,3,2,1 respectively to the statement, a percentage score was determined too.

Experimental Procedure

Students in the two groups were exposed to the topic 'Relevance of Biology to agriculture.' The Biology concepts in the topic comprised: agricultural classification, identification, dissection of fruits, food preservation, and storage. The experimental class teacher was coached on how to use

HPAM. The experimental group students were taught by means of the note of lesson prepared by the researchers to fit with the HPAM as treatment while the control group was taught, conventionally. Both groups were taught by their teachers. Before the experiment was carried out, the two groups were pretested to ascertain their level of knowledge on the topic. After the treatment, the two groups were post-tested.

Administration of the Instrument

Research assistants, who were Biology teachers in the sampled schools, were trained by the researcher on how the teaching was to be conducted. A pre-test was administered to subjects in both groups (experimental and control) to determine their academic performance and interest in Biology. The control group was taught Biology concepts for four weeks using only the conventional method, while the experimental group was taught Biology concepts for four weeks using the HPAM approach. At the end of the four weeks, the POST was administered to all subjects. The researcher, with the help of research assistants, administered the research instruments (PRE and POST to the subjects. The total scores were computed and analyzed using Analysis of Covariance (ANCOVA).

Specific Home Practices and Biology Concepts

Agricultural Classification: Home practice analogy involves students organizing family kitchen ingredients (grains, vegetables, spices, condiments) by type, function, and storage requirements, directly analogous to classifying organisms by characteristics, habitat, and ecological roles. Students sort items, explain classification criteria, and compare their organizational system with biological taxonomy.

Fruit Dissection: Home practice analogy involves students dissecting fruits available in their homes (pawpaw, mango, orange, banana) to identify seeds, flesh, skin, and internal structures, directly analogous to understanding fruit anatomy and reproductive functions. Students sketch dissected fruits, identify parts, and explain functions before classroom formal dissection.

Food Preservation and Storage: Home practice analogies involve students observing and documenting family food preservation methods (salting fish, drying vegetables, fermenting foods, refrigerating leftovers, smoking meat) and explaining how each method prevents spoilage, directly analogous to understanding microbial growth, decomposition, and cellular respiration. Students interview family members, record preservation techniques, and explain biological principles underlying each method.

Student Activities and Teacher Implementation of HPAM Stages

Stage 1 (Activation): Teacher displays images of home practices and asks students to share personal experiences with these practices, activating prior knowledge and establishing relevance.

Stage 2 (Exploration): Students perform hands-on activities—sorting kitchen items, dissecting fruits, documenting preservation methods—and record observations in activity booklets, developing concrete understanding before abstract biological concepts.

Stage 3 (Explanation): Teacher explicitly connects home practice observations to biological concepts using visual aids, diagrams, and guided discussion, helping students transfer understanding from familiar contexts to formal biology terminology and principles.

Stage 4 (Elaboration): Students complete comparison charts linking home practices to biological concepts, answer guided questions explaining mechanisms, and create concept maps showing relationships between home analogies and biology principles.

Stage 5 (Evaluation): Teacher assesses student understanding through practical demonstrations (students explain how their home practice analogy relates to the biology concept), written explanations, and achievement tests measuring conceptual understanding and interest in biology.

Fig 2. Experimental procedures performed by the students with guided instructions. (Source: Ekon, 2023)

Data analyses

The quantitative data obtained were analysed using IBM SPSS version 25. Mean and standard deviation were used to answer the research questions whereas Analysis of Variance (ANCOVA) was used to test the hypotheses at .05 level of significance.

Results

Research question one

Is there any difference in the mean academic performance score of Biology students taught using home practice analogy model (HPAM) and those taught using conventional method?

Table 1

Mean academic performance scores and standard deviation of Biology students taught using home practice analogy model (HPAM) and those taught using conventional method.

Group	N	Pre-test		Post test		Mean gain
		Mean	SD	Mean	SD	
Experimental	41	50.756	12.093	66.024	8.822	15.268
Control	40	45.750	8.749	59.050	10.208	13.3
Total	81	48.253	10.842	62.537	9.515	

Table 1 shows that the mean academic performance score of Biology students taught using Home Practice Analogy Model (HPAM) is 50.756 with a standard deviation of 12.093 at the pre-test stage, but their mean academic performance score at the post-test stage is 66.024 with a standard deviation of 8.822 with a mean gain of 15.268. While the Biology students taught using conventional method has mean academic performance score of 45.750 with a standard deviation of 8.749 at the pre-test stage. But at the post-test stage, their mean academic performance score is 59.050 with a standard deviation of 10.208. This, by implication shows that, the mean academic performance scores by Biology students in the experimental group was 66.024 with a moderate standard deviation of 8.822. The higher mean score and a moderate standard deviation indicate that these students understood the concept taught better and gained higher marks in which the students' inter- individual marks were close to one another indicating the efficacy of the teaching strategy. On the hand, those taught Biology using conventional method obtained a lower mean score 59,050 with a higher standard deviation of 10.208 indicating a marked difference in the students' inter-individual mean achievement scores which were far apart. Thus, Biology students taught using HPAM out- performed their counterparts taught using conventional method.

Research question two

Is there any difference in the mean interest score of Biology students taught using home practice analogy model (HPAM) and those taught using conventional method?

In Table 2, the data reveals the mean interest scores and standard deviations of Biology students taught using the home practice analogy model (HPAM) and the conventional method. At the pre-test stage, students taught with HPAM obtained a mean interest score of 51.512, with a standard

deviation of 13.761. However, at the post-test stage, their mean interest score significantly improved to 81.439, with a reduced standard deviation of 6.779.

On the other hand, students taught using the conventional method had a mean interest score of 48.075 at the pre-test stage, with a standard deviation of 10.550. After the intervention, their mean interest score increased to 63.300 at the post-test stage, accompanied by a standard deviation of 11.781.

Comparing the two groups, it becomes evident that Biology students taught with HPAM achieved a higher mean interest score of 81.439, with a moderate standard deviation of 6.779, representing a substantial mean gain of 29.927. This significant gain indicates the efficacy of the teaching strategy in enhancing students' interest in Biology.

In contrast, students taught using the conventional method obtained a lower mean interest score of 63.300, with a moderate standard deviation of 11.781 and a gain score of 15.228. This comparatively lower gain score implies that their inter-individual mean achievement scores varied widely.

Therefore, the results suggest that the implementation of the home practice analogy model (HPAM) as a teaching strategy has been successful in fostering students' interest in Biology, as evidenced by their notably improved mean interest scores in comparison to those taught using the conventional method.

Table 2

Mean interest scores and standard deviation of Biology students taught using home practice analogy model (HPAM) and those taught using conventional method.

Group	N	Pre-test		Post test		Mean gain
		Mean	SD	Mean	SD	
Experimental	41	51.512	13.761	81.439	6.779	29.927
Control	40	48.075	10.550	63.300	11.781	15.225
Total	81	49.794	12.156	72.370	9.28	

Thus, Biology students taught using home practice analogy model (HPAM) had a better interest in Biology than those taught using conventional method.

Hypothesis 1

There is no significant difference in the mean academic performance score of Biology students when taught using home practice analogy model (HPAM) and those taught using

conventional method. To test this hypothesis, Analysis of Covariance (ANCOVA) was used. The result of the analysis is presented in Table 3.

Table 3

Analysis of Covariance (ANCOVA) on the difference in the mean academic performance score of Biology students taught using home practice analogy model (HPAM) and those taught using conventional method.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected model	2242.309	2	1121.154	15.862	.000
Intercept	10336.352	1	10336.352	146.237	.000
Pre-test	410.800	1	410.800	5.812	.018
Teaching Strategies	1361.185	1	1361.185	19.258*	.000
Error	5513.198	78	70.682		
Total	338125.000	81			
Corrected total	7755.506	80			

R. Squared = .289 (Adjusted R. Squared = .271) *Significant at $P < .05$

The information in Table 3 indicates a significant difference in the mean academic performance score of Biology students when taught using home practice analogy model (HPAM) and those taught using conventional method $F(1, 78) = 19.258$, $p < .005$, partial $\eta^2 = .342$. This result suggests that 34.2% of the variance in posttest scores was explained by the intervention, after accounting for pretest of students academic performance. Additionally, the model explained 27.1% of the variability in students' posttest scores ($R^2 = .289$, adjusted $R^2 = .271$), indicating that approximately 27% of the variance in students' engagement was accounted for by the model.

Hypothesis 2

There is no significant difference in the mean interest score of Biology students when taught using home practice analogy model (HPAM) and those taught using conventional method.

To test this hypothesis, Analysis of Covariance (ANCOVA) was used. The result of the analysis is presented in Table 4.

Table 4

Analysis of Covariance (ANCOVA) on the difference in the mean interest score of Biology students taught using home practice analogy model (HPAM) and those taught using conventional method.

Source	Type III Sum of Squares	Do	Mean Square	F	Sig.
Corrected model	6704.616	2	3352.308	36.278	.000
Intercept	21837.696	1	21837.696	236.325	.000
Interest	42.892	1	42.892	.464	.498
Teaching Strategies	6382.966	1	6382.966	69.076*	.000
Error	7207.606	78	92.405		
Total	439451.000	81			
Corrected total	13912.222	80			

R. Squared = .482 (Adjusted R. Squared = .469) *Significant at P < .05

The information in Table 4 indicates a significant difference in the mean interest score of Biology students when taught using home practice analogy model (HPAM) and those taught using conventional method $F(1, 78) = 69.076$, $p < .005$, partial $\eta^2 = .43.2$. This result suggests that 43.2% of the variance in posttest scores was explained by the intervention, after accounting for pretest of students interest. Additionally, the model explained 46.9% of the variability in students' posttest scores ($R^2 = .482$, adjusted $R^2 = .469$), indicating that approximately 47% of the variance in students' interest was accounted for by the model.

The result of the analysis as presented in Table 4, revealed a significant F-ratio of 69.076 for teaching strategies (home practice analogy model and conventional method) on Biology students' interest at P (.000). Since P (.000) is less than P (.05) with a degree of freedom of 1, the null hypothesis is rejected while the alternate hypothesis is accepted which means that there is a significant difference in the mean interest score of Biology students when taught using home practice analogy model (HPAM) and those taught using conventional method.

Discussion of the findings

The findings of the study showed a significant difference in the mean achievement scores of students in the experimental group exposed to Home Practices Analogy Model (HPAM) and those in the control group taught using the conventional method. The difference was in favour of the experimental group students. This showed a clear indication that the treatment (HPAM) helped the

students in the experimental group to perform significantly better than their counterparts in the control group.

The enhancement of achievement of Biology students in the experimental group was due to their familiar practices at home that were transferred or transported to the classroom through the utilization of HPAM of instruction. The students in this group were able to link the Biology concepts taught in the classroom to the real world and everyday experience. The HPAM strategy is activity-oriented, student-centred, interactive, and familiar which enabled the students to understand the concepts easily and were able to gain knowledge through exploring and manipulating the different activities they were engaged in. The active involvement of the students in the experimental class gave rise to more effective learning vis-à-vis better academic achievement as was propounded by Jerome Brunner who encouraged learning by activity, exploration, and discovery methods. Vygotsky also emphasized that learners should be encouraged to develop creative thinking through several activities and exploration of their environment.

The result of this finding is similar to what was reported in other science subjects like chemistry and physics for instance, Sani (2006), Owolabi (2013), Ibok, *etal,* (2026), Gelar and Mubasyiroh (2018) and Okafor (2019) in their independent studies found out a higher mean score and significant differences in the mean achievement scores of students exposed to analogy model of instruction as compared to those exposed to conventional method.

The findings of this study also revealed that there was a significant mean interest score of Biology students when taught Biology using Home Practice Analogy Model (HPAM) as compared to those taught Biology using conventional method. The interest built up in the students could be attributed to the method of instruction, which was familiar, activity-based, and student-centred oriented. A similar report was made by Lagoke (2006) that the use of analogy in the class arouses students' interest and imagination and therefore lead to understanding of concepts in science subjects. It was also observed that the experimental group students had better attendance, participation and showed enthusiasm in the class activities than those in the control group.

Conclusion

Evidence from this study shows that using analogy models especially, home practices analogy model has significant effects on Biology students' academic achievement and interest in the subject. With this strategy (HPAM), learners tend to understand Biology concepts easily. Therefore, when students are exposed to familiar terrain, they tend to relax, see Biology as fun rather than abstract and complex subject. They get more interested in the concepts taught; this eventually leads to better academic performance in the subject.

Recommendation

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

1) Biology teachers should adopt the use of analogy model especially Home Practices as a variety tool in Biology classrooms.

2) Teachers should make available instructional activities that are familiar and challenging the students to be actively involved in the classroom.

3) Biology teachers should be given opportunities to attain in-service training programmes and workshops to update their knowledge in current, activity-based, and innovative teaching strategies.

4) Curriculum planners should adopt constructivist-based instructional approaches to learning Biology since the use of these instructional strategies enhance better academic performance in and outside the classroom setting.

Ethical considerations: All the participants in the study provided signed parental consents and individually gave their verbal consents to participants in the study. Since the study involved human subjects, the Research Ethics Committee, Faculty of Science Education, University of Calabar reviewed the study settings and methodology and gave a written approval that the study would not breach the participants' rights and anonymity. Therefore, the pictures in Fig 2 used in the study are those of actors and not of the participants.

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