SSR Journal of Arts, Humanities and Social Sciences (SSRJAHSS)

Homepage: https://ssrpublisher.com/ssrjahss

Volume 3, Issue 7, 2026 ISSN: 3049-0391 (Online)

# Effect of Sensory Simulation Teaching Strategy on Achievement Among Secondary School Biology Students in Genetics in Federal Capital Territory, Abuja Nigeria

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**Received:** 10.05.2026 | **Accepted:** 21.05.2026 | **Published:** 01.07.2026

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**DOI:** *10.5281/zenodo.21077752*

**Abstract** **Original Research Article**

This study investigated the effect of sensory simulation teaching strategy on interest and achievement among secondary school students in genetics in Federal Capital Territory, Abuja Nigeria. Quasi-experimental pretest, posttest experimental and control groups research design was adopted for the study. A sample of 174 SS II students comprising 82 males and 92 females in two intact classes from two secondary schools in Abuja were used for the study. One class was randomly assigned as the experimental group while the other class as the control group. The treatment lasted for four weeks, during which the experimental group was taught using Sensory Simulation Teaching Strategy. The control group was taught using conventional teaching method. Genetics Achievement Test (GAT) was used as an instruments for the collection of data in the study. The instrument was face validated by experts, pilot tested and the reliability index was obtained and the value was found to be 0.89. The value was considered high enough for the study. Two research questions and two hypotheses were formulated for this study. Means and standard deviations were used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. The findings of the study revealed that Sensory Simulation Teaching Strategy has facilitative effect on achievement of biology students in genetics, gender had no significant effect on achievement among biology students in genetics. Students taught using Sensory Simulation Teaching Strategy achieved higher than those taught using conventional teaching method. Recommendations were made which included: biology teachers should be encouraged to teach genetics using Sensory Simulation Teaching Strategy; resources and time should be made available by curriculum planners and school administrators, in order to engender the effective and efficient teaching and learning of genetics. This will enhance achievement in genetics. Seminars, conferences should be organized for biology teachers on the use of Sensory Simulation Teaching Strategy by professional bodies like STAN.

**Keywords:** Achievement in Genetics, Gender, Sensory Simulation Teaching Strategy.



## Introduction

Science and technology have been improving rapidly today. This progress of scientific technology developments can also be seen on the field of education and makes it necessary to rebuild teaching and learning environments.

The academic contents and learning paths of students are customized by the adaptive educational system, which emphasized on the need of the hour in present educational environment (Richa Bajaj, Vidushi Sharma 2018). This system results to a reduced occasion of disorientation and cognition over road problem, as a result, learning efficiency is achieved. Evidently, the present educational system lacks adaptability. They provide same resources for all users irrespective of their personal differences. Students have different learning styles, figuring this out is a very important step in enhancing e-learning and traditional education and making them adaptive. The various learning model should be explored in determining the learning style of the students.

Adaptation in learning has been proved using different Artificial Intelligent (AI) method (Richa Bajaj, Vidushi Sharma 2018). A large crowd of interconnected neurons known as neural networks works together to process Information. Studies have shown the use of artificial neural network in sampling of global personalized learning process (ICCIDS 2018). This neural network is used to classify students in certain instances. This has been used to determine learning styles of the students.

According to Vidushi Sharma 2018), there are apparently, eight learning styles which generate sixteen combinations. The four dimensions includes; active/reflective, sensing/intuitive, visual/verbal and sequential/global (Richa Bajaj, Vidushi Sharma 2018). Active learners learn best by being actively involved in the process of learning, applying the required skills, taking risks, exploring materials, initiating ideas and drawing conclusions. In contrast, reflective learners have the skill of thinking about the learning content. The sensing learners apply their sensory cells experience to learn facts and concrete materials involved.

Intuitive learners enjoy learning of abstract materials such as theories and principles with the imbedded meanings. Visual learners are skilled in the use of their sight and memories. They remember very well what they have seen in form of pictures, diagrams and flow-charts, videos. Verbal learners prefer textual materials, written or spoken. Sequential learners learn in little progressive steps, they are said to have a sequential learning progress. In contrast, global learners learn by understanding the large picture. They use a global holistic thought process (Richa Bajaj, Vidushi Sharma 2018 ).

Individuals having Read/ Write learning style prefer information in form of words, text style of input and output, reading and writing manuals, report, essay and assignments. The person with Kinesthetic learning style applies experience and practice; it may be simulated or real. This learning style involves demonstration, simulation, video, movies and case studies. (Richa Bajaj, Vidushi Sharma 2018)

The new technologies have significant effect on the academic developments of the societies. The digital transformation changes every part of science and technology in a yet unknown intensive way. Soon everybody will have access to practically infinite data, processing power and speeds. Universities play an important role, preparing students for a labour market that is undeniably moving towards the use of emerging technologies. Hsiao-Ching she, Yi Zen (2009) demonstrated how students used multimedia to represent their knowledge of mitosis and meiosis at molecular level. They employed narrative modes, simulation, animation and onscreen text to represent their facts. This method of learning improved their knowledge, interest and understanding on the topic. There was improved dept of learning on the part of the students. The majority of institutions of learning are working hard to keep up with these technological, societal and economic changes (Hsiao-Ching she, Yi Zen (2009).

To be future-ready and relevant in this volatile, uncertain, complex and ambiguous (VUCA) world, in an ever more competitive global landscape, Secondary education has embraced the use of multimedia as a powerful technological learning tool. Materials are presented in form of pictures such as ,illustration, graphics, simulations, animations, photos videos and words as on screen texts, narrations Mayer 2001 in Hsiao-Ching she, Yi Zen (2009).

Biology is a branch of natural science that deals with the study of living organisms, their structures, functions, evolution, distribution and interrelationships. Biology occupies a unique position in the secondary school education curriculum because of its importance as science of life. In Nigeria, the secondary school Biology curriculum is designed to enhance students' investigation into natural phenomena, deepen students' understanding and interest in biological sciences and to encourage students' ability to apply scientific knowledge to everyday life (Federal Ministry of Education, 2009). Biology is an important science subject and stands as the bedrock to the learning of other science courses like Medicine, Pharmacy, Nursing, Biochemistry, Genetics and Agriculture that are of great economic importance to the nation. Besides the importance of Biology as the science of life, it is one of the science subjects that are mostly preferred by many students in secondary schools. For this reason, Biology has a very high enrolment of students in the external examination (West African Examination Council, 2011).

Biology is a unique discipline where experiments with living organisms can take place both in the laboratory and in the field. How do students regard biology compared with other subjects? Do boys and girls prefer different topics?

Achievement is the action of accomplishing an academic task successfully. Its purpose is to find out the stand of a student at a given moment (Akani, 2017). It has to do with testing the knowledge acquired by the student which helps the teacher and the student to evaluate and predict the degree of learning attained. It is useful in testing the retention of information and skill. It is also a determinant of the efficacy and efficiency of a given instruction (Kabutu, Oloyede & Bandele, 2015).

Learning is said to have occurred when what is learnt remains relatively permanent in the mind of the learner. Hence, it is pertinent for students to retain what is learnt.

It has been rightly noted that this disparity between the high-tech and socially relevant perception of science held by students and the more theoretical, decontexualized version of school science promulgated by teachers, identifies a major gulf between teachers and their students that may impede effective communication of the sciences especially biology. In essence, the vision that school science offers is a backward-looking view of the well-established scientific landscape, whereas, in contrast, what appeals to and excites students is the 'white heat' of the technological future offered by science. In short, to capitalize on students' interests, school science needs to be less retrospective and more prospective. (Osborn et in Trumper 2010).

The vestibular system is the sensory system specifically involved in the development of the middle and inner ear and recognized mostly for its critical role with balance, equilibrium and motor development. When we move our heads, the fluid in these organs moves and shifts, constantly providing us with information about the position of our heads and bodies in space, known as spatial awareness (Braley, 2014). However, this system, which is the base to the other two, holds another important responsibility as it combines with the other senses (namely the eyes and ears) in filtering through environmental stimuli and providing responses. Movements such as jumping, swinging, rolling, crawling, and climbing are responsible for developing the vestibular system, thus aiding in the more appropriate analyzation and response of sensory information.

On the other hand, when a student has a well-developed sensory system, information from the eyes, ears, balance, and movement organize more efficiently and filter in the brain quicker, allowing the brain to provide appropriate responses to environmental stimuli. To accomplish this, much research suggests activities that promote brain integration be performed frequently until movements are fluid and coordinated and the eyes are converging efficiently. Likewise, a growing body of mainstream scientific research clearly points to the critical role that sensory/motor neural

development through the vestibular system (balance/inner ear system) plays in the learning process (MIM, 2012).

Simulation strategy can quickly enrich visual perceptual problems in offspring with vestibular dysfunction. In fact, children respond more quickly than adults because of their greater neural plasticity – the ability to move quickly compensate for and adapt to vestibular deficits (Cronin, 2014). With an individualized approach, exercises addressing eye-movement control, balance, and body movement functions could have an immediate and dramatic positive effect on the academic achievement and classroom behavior of students. According to Cronin (2014), teachers and occupational and physical therapists are excellent professionals to integrate the vestibular training into activities for learning, movements, and behavior.

Simulations are tools that facilitate learning through representation and practice in a repeatable, focused environment. They help students to identify and understand factors which control the system and or predict the future behavior of a system. Umoke and Nwafor (2014) and Ezeudu and Ezinwanne (2013) observed that the use of simulations to teach science gives positive results over time and permits the learner to manipulate variables or parameters and then observe the consequences of their actions.

The brain stem is the most protected area of the brain, and has a very close relationship to gravity, safety, survival, arousal, and attention (Greutman, 2014). When a child has an underdeveloped vestibular system, the brain is not getting the correct information from the eyes, ears, and the sense of gravity or movement of the body. This in turn makes the brain and body feel unsafe. When not feeling safe, arousal level, attention, and survival mode responses kick in (Gruetman, 2014).

There is an abundance of literature on how sensory simulation effects certain populations, very similar to vestibular stimulation. However, according to several studies involving elementary school students, regular physical activity breaks during a school day may enhance academic performance focus and behavior in the classroom (Trost, 2019). According to Mahr, Murphy, (2016) students with a daily 10-minute physical activity break increase on-task behavior significantly while a break without physical activity experience decrease on-task behavior. Also, students perform better on reading comprehension, math and spelling when they have a 20-minute period of physical activity immediately preceding the test (Pontifox, 2013).

Reynolds, (2020) Opined that sensory integration is distinctly effective in improving a child with learning disabilities development.

Although sensory integration has been a popular and highly supported subject with babies in the womb, infants, and special populations, some professionals considered sensory integration approaches to be "demonstratively ineffective" models of intervention. This is particularly true for elementary students who do not fall in a special population.

BRAIN GYM, a program consisting of 26 activities recalling the movements naturally done during the first years of life when learning to coordinate the eyes, ears, hands, and whole body, is committed to the principle that moving with intention leads to optimal learning. To date, there are over twenty years of research studies on the effect of this program in different diversified settings. Marpaung, Sareharto, Purwanti, and Herm awati (2017) studied the effect of the BRAIN GYM towards academic performance of children aged 10-12 years and found that the program can increase academic performance of children in the above mentioned age group. Ready Bodies, Learning Minds is a comprehensive approach to understanding how sensory integration and motor control drives learning and performance in children in view of these aforementioned, the researcher sought to investigate the effects sensory simulation teaching strategy on achievement among secondary school biology students in genetics in Federal Capital Territory, Abuja Nigeria.

## Statement of the Problem

The primary purpose of teaching is for students' learning. It is expected that students who are taught well will go in for public examination like Senior Secondary School Certificate Examination (SSSCE) and perform credibly well. It is unfortunate that the reverse is the case with the teaching of genetics in biology. The importance of genetics as a concept in biology has positive impact on human life and national development. The concept therefore requires to be taught by competent biology teachers who can guide students towards attaining the desired educational goal. But there is a serious decline in students' achievement in biology which has be necessitated by their misconception of this major area (genetics) in biology. The reports attributed the cause of the students' poor achievement to the lack of knowledge of the subject matter, non-commitment and poor method on the part of teachers. Poor method of teaching could be as a result of persistent use of conventional methods that do not engender students' achievement. Conventional teaching method appears to have rendered the students passive and encouraged rote memorization of the curriculum contents. Lack of success in academic achievement can result to inappropriate behaviour and frustration on the part of students. It could be observed that rote learning does not foster transfer of knowledge which occurs as a result of retention of information learned. The foregoing therefore underscores the need to explore other innovative, learners' centered teaching strategies that would enhance students' cognitive achievements and possibly motivate students to commit themselves in learning genetics. In addition, teachers being the implementers of any educational policy on school curriculum are required to be highly committed in guiding the students towards achieving the desired educational objectives.

Several researches carried out by researchers have opined that constructive-oriented methods foster teachers' commitment and students' active participation in teaching/learning process. Also, students can learn effectively by the use of Sensory Simulation Teaching Strategy. On this basis, it becomes worthwhile to investigate the effect of Sensory Simulation Teaching Strategy on Achievement Among Senior Secondary School Students in Genetics in Federal Capital Territory, Abuja Nigeria.

## Objectives of the Study

The general purpose of this study was to find out the Effect of Sensory Simulation Teaching Strategy on Achievement Among Senior Secondary School Students in Genetics in Federal Capital Territory, Abuja Nigeria.

Specifically, the study sought to:

i. determine the mean Achievement Scores of students taught Genetics using Sensory Simulation Teaching Strategy and Conventional Teaching Method.

ii. determine the mean Achievement Scores of students taught Genetics using Sensory Simulation Teaching Strategy based on gender.

## Research Questions

The study was guided by the following research questions:

ii what are the mean Achievement Scores of students taught genetics using Sensory Simulation Teaching Strategy and Conventional Teaching Method?

iv what are the mean Achievement Scores of students taught genetics using Sensory Simulation Teaching Strategy based on gender?

## Research Hypotheses

$H_{O1}$: There is no significant difference in the mean Achievement Scores of students taught Genetics using Sensory Simulation Teaching Strategy and conventional teaching method.

$H_{O2}$: There is no significant difference in the mean Achievement Scores of students taught Genetics using Sensory Simulation Teaching

Strategy based on gender.

## Conclusion

Based on the findings of the study, the following conclusions are made:

i. Using metacognitive scaffolding strategy in teaching algebra in mathematics facilitated achievement of higher mean scores in algebra in mathematics.
ii. There is no sex differential in using metacognitive scaffolding teaching strategy. This means that using metacognitive scaffolding teaching strategy male and female students achieved equally.

## Recommendations

Based on the findings of this study the following recommendations were made;

i. Government should sponsor workshops and researches on metacognitive scaffolding teaching skills.
ii. STAN, MAN and other professional bodies should seek ways of integrating the funding of similar studies in education and science.
iii. Girls should be encouraged to study mathematics by all and sundry.
iv. Girl child education should be encouraged by the government and non- government organizations.

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