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# IMPACT OF TACTILE AND VISUAL LEARNING STYLES ON SECONDARY SCHOOL STUDENTS OF BIOLOGY INTEREST IN TARABA STATE

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## ABSTRACT

*Today's generation strongly favors technology-enabled learning due to its widespread use in modern society, with meaningful learning largely dependent on learners' interest and motivation during instruction. It was based on this fact that the researchers investigated the Impact of Tactile and Visual Learning Styles on Students of Biology Interest in Taraba State. Three research questions and three Hypotheses guided the study. Quasi experimental design was used for the study. Collection of Data was by the use of Students' Interest Rating Scale (BSIRS) whose reliability coefficient was found to be 0.82 using Cronbach's Alfa. The population for the study was 5,361 out of which 110 SS 2 students served as sample of the study. Mean and standard deviation answered research questions. While the hypotheses were tested at 0.05 significant level using Analysis of Covariance (ANCOVA). Results indicate that both styles effectively enhance interest, with Visual Learning style yielding a higher mean gain (8.26) compared to Tactile Learning style (6.12). Importantly, the analysis revealed no significant difference in interest ratings between the two learning styles or across gender. The study concludes that both Learning styles can significantly foster student's interest in learning Biology. Based on these findings, it is recommended that educators prioritize visual aids, design inclusive hands-on activities, and combine both learning styles to cater to diverse student preferences.*

**Key Words: Visual Learning, Tactile Learning, Hands-on, Biology, Interest**

## INTRODUCTION

Biology is one of the subjects within the science curriculum offered in secondary schools across Nigeria. As a branch of natural science, biology encompasses the study of living entities, including their structure, growth, function, distribution, evolution, and classification. Hillis et al. (2020) described biology as the systematic scientific exploration of life, which includes studying living organisms as well as their interactions with one another and their environment. The learning of Biology is keen to students' level of interest.

Interest is a very essential factor in students' learning, Okekeokosisi and Okigbo (2021) submitted that interest is an emotionally oriented behavioral trait that determines a students' urge and vigor to tackle educational programs or other activities. This behavioral trait entails willingness to acquire skills, knowledge, attitude, and values. It is the eagerness to learn a set out task or activity for positive and near mastery of the skills and knowledge related to the activity (Unachukwu & Okoli, 2020). The researchers view students' interest in biology as recurrent positive disposition to activities associated with the learning of biology. Interest in the submission of Nworgu, et al. (2018) is a neutral or mental state of readiness, organized through experience, exerting a directive or dynamic influence upon individuals' response to all objects and situations with which it is related. The concept could be inferred from overt behavior, both verbal and non-verbal which may have its implication on the students' performance. Katcha and Babagana (2019) found that the persistent low interest, achievement and retention of concept is attributed to teachers' teaching strategies among others. Thus, teaching strategies used by teachers in teaching-learning process have significantly influenced learners' learning outcomes. There are different types of learning strategies amongst which are visual and tactile. Students of the 21st century have a strong inclination towards technology-enabled learning due to its high prevalence in modern society; consequently, the educational system need to align with their expectations. Research shows that this generation of

students no longer learns through reading or listening; they learn by doing, and it is therefore imperative to teach through movement and activity (Deng et.al, 2018). Another strategy through which students learn in the 21st century is visual.

Visual learning strategy is an educational approach that incorporates graphic aids to convey information, leveraging the innate ability to process visual data faster and more effectively than text alone. Visual learning strategy harness the innate spatial strengths of students, transforming complex theories into tangible visuals that enhance understanding and retention. Some of the interactive visual's tools include: Concept Maps, Infographics, Graphic Organizers, Videos and Simulations, Diagrams and Illustrations among others. Visual learners may take advantage from the use of diagrams, graphs, or animations, while auditory learners may prefer lectures, podcasts, or audio recordings. (Shaidullina et al., 2023). The integration of Information Visualization tools into the context of educational content adaptation provides new characteristics to Students models, thus allowing the emergence of open and intelligent models, where data can be inferred and stored to aid the individualized adaptation of educational content. Digital learning environments are becoming a typical feature of contemporary education. For the past two decades, the most prominent feature of the technology-based learning environment has become animation (Musa et al., 2015). The authors further remarked that instructive animation is an animation created to be utilized in homerooms, on instructive television programs, and in different settings where individuals need to give data to people of all ages in a clear, accessible and informative way.

There is no one right or wrong way when it comes to learning. Some learn best when taught in a specific manner, while others may find that manner is confusing and difficult to understand. Tactile learning strategy involves the use of touch and physical interaction with objects to facilitate learning and understanding. It is a key component of kinesthetic learning, where learners benefit from hands-on experiences (Pugliese, 2018). Tactile learning strategy involves touching, holding, poking, and squeezing learning materials. It gives students an opportunity to directly manipulate objects in a lesson which gives them a more dynamic, more enriched understanding (Singh & Cutting, 2018). Learners like to approach problems through "hands –on" experiences in classroom learning, such as hands-on activities with laboratory materials, building and processing models. Tactile learningb strategy in education has significant impact on students' engagement and comprehension (Sobel, et al., 2017). Tactile learning is learning by touch. It involves grasping, feeling, and manipulating objects in the environment. Tactile learning offers a much more dynamic and enriched learning experience than traditional educational practices that involve listening or observing.

The issue of gender is currently a significant topic that captures the interest of psychologists, sociologists, educators, scientists, biologists, as well as families. Okeke (2018) describes gender as the traits and roles that society and culture attribute to males and females in any community. Kessels (2015) addresses how societal expectations and stereotypes related to gender may affect students' outcomes in biology, particularly noting that girls often confront stereotypes suggesting they are less adept in STEM fields, including biology, which may adversely influence their academic success. There is consistent poor performance of students in Biology in Secondary School Certificate Examination (S.S.C.E.) which indicates that many students cannot gain admission into Biology related courses in higher institutions, hence, students' interest in learning biology is decreasing. It is hard to ignore that the generation of children now moving through our educational system is by far the most visually stimulated generation that system has ever had to teach. Having grown up with cable television, video games, computer software that educates and entertains, and the Internet, 21st Century students are truly visual learners coming of age in an increasingly visually oriented world. Therefore, it is based on this background that the researcher saw the need to investigate the impact of Visual and Tactile Learning Style on Students of Biology Interest in Taraba State, Nigeria as this strategy might boost students' interest in Biology

**Purpose of the Study**

The Purpose of this study was to investigate the Impact of Tactile and Visual Learning Styles on Students of Biology Interest in Taraba State. Specific Objectives of The Study Were To:

1. Find out the interest of students in biology when using Visual and Tactile Learning Styles.
2. Find out the interest rating of male and female students who use Visual Learning Styles.
3. Determine the interest rating of male and female students who use Tactile Learning Styles.

**Research Questions**

1. What is the mean interest rating of students in Biology who use Visual and Tactile Learning Styles?
2. What is the mean interest rating of male and female students who use Visual Learning Styles?
3. What is the mean interest rating of male and female students who use Tactile Learning Styles?

**Research Hypotheses**

**$HO_1$:** There is no significant mean interest rating of students in Biology who use Visual and Tactile Learning Styles.

**$HO_2$:** There is no significant difference on interest of male and female students who use Visual Learning Styles.

**$HO_3$:** There is no significant difference on the interest of male and female students who use Tactile Learning Styles.

**METHODOLOGY**

The Research Design Adopted for The Study Was Quasi-Experimental Design. This design was considered appropriate because variables such as Learning Styles (Visual and Tactile) used measurement procedures and materials, which yielded precision and objectivity.

The Study Was Conducted in Jalingo Education Zone of Taraba State, Nigeria. Jalingo Education Zone Is Made Up of two Local Governments Namely; Ardo-Kola Local Government and Jalingo Local Government.

The population of the study consists of all secondary school II biology students from 44 secondary schools within Jalingo Education zone of Taraba state. There are four thousand and thirty-five (4,035 male students and one thousand three hundred and twenty-six (1,326) female students summing up to five thousand three hundred and sixty-one (5,361) students.

The Sample of the Study comprises a total of 110 students for the study, 50 male and 60 females From Jalingo Education Zone. The Multi-Stage Random Sampling Were Used in Constituting the Sample for The Study. Jalingo education zone was selected for the study through simple random sampling by using hat and draw technique. A school was selected with intact classes from each of the two Local Government Areas that made up Jalingo Education Zone using purposive sampling and were assigned experimental group 1 and the other Experimental Group 2.

The Instruments that was used for the Study was adapted and organized by the researchers named Biology students interest Rating Scale (BSIRS). The Biology Students Interest Rating Scale (BSIRS) is made up of two Sections: A and B. Part A solicited information from the respondents on the demographic variable. Part B elicited information on students' interest towards Biology. The Part B of the Biology Students' Interest Rating Scale (BSIRS) was made up of 30 items. Each of the items on the Part B was rated on a four-point scale thus: Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) which will be scored 4, 3, 2 and 1 respectively.

Cronbach alpha was used to establish the reliability index of BSIRS. Reliability index obtained was 0.82 which makes the instrument very reliable for the study.

Mean and Standard Deviation was employed to answer the research questions 1-3 while Analysis of Covariance (ANCOVA) was used to test the Null Hypotheses 1-3 At 0.05 level of significance. The use of ANCOVA is considered appropriate for testing of the null hypotheses formulated in the study because it accounts for the initial between and within group differences which are the covariates that will be obtained from the pre-test data.

## Results

### Research Question One

What is the mean interest rating of students in Biology who use Visual and Tactile Learning Styles?

Table 1: Mean and standard deviation of students' mean interest ratings by Learning style

| Leaning Styles | | PreBSIRS | PostBSIRS | Mean gain |
|---|---|---|---|---|
| | Mean | 84.55 | 92.81 | 8.26 |
| Visual Learning Style | N | 58 | 58 | |
| | Std. Deviation | 2.08 | 1.12 | |
| | Mean | 84.73 | 90.85 | 6.12 |
| Tactile Learning | N | 52 | 52 | |
| | Std. Deviation | 2.90 | 1.55 | |
| Difference | | | | 2.14 |

The table above shows that at pre-test, students in the visual learning group had a mean interest rating of 84.55 with standard deviation of 2.08 and at post-test, this mean interest rating increase to 92.81 with standard deviation of 1.12. The students in this group showed a mean gain of 8.26. Students in the tactile learning group had a mean rating of 84.73 and standard deviation of 2.9 at pre-test but this figure increased to 90.85 and standard deviation of 1.55 at post-test. This change indicates a mean gain of 6.12.

### Research Question Two

What is the mean interest rating of male and female students who use Visual Learning Styles?

Table 2: Mean and standard deviation of students' mean interest scale in visual learning based on gender

| Gender | | PreBSIRS | PostBSIRS | Mean gain |
|---|---|---|---|---|
| | Mean | 86.08 | 91.00 | 4.92 |
| Male | N | 25 | 25 | |
| | Std. Deviation | 18.71 | 9.37 | |
| | Mean | 83.20 | 94.18 | 10.98 |
| Female | N | 33 | 33 | |
| | Std. Deviation | 13.61 | 7.69 | |
| **Difference** | | | | 6.06 |

The table above depicts that at pre-test, male students exposed to Visual learning style had a mean interest rating of 86.08, standard deviation of 18.71 and at post-test, the mean interest rating increased to 91.00, standard deviation of 9.37. This indicates mean gain of 4.92. Similarly, at pre-test, female students exposed to Visual learning style had a mean interest rating of 83.20, standard deviation of 13.61 and at post-test, the mean interest rating increased to 94.18 standard deviation of 7.69. This indicates mean gain of 10.98.

### Research Question Three:

**What is the mean interest rating of male and female students who use Tactile Learning Styles?**

Table 3: Mean and standard deviation of Male and Female students' mean interest rating in tactile style by gender

| Gender | | PreBSIRS | PostBSIRS | Mean gain |
|---|---|---|---|---|
| | Mean | 83.20 | 90.48 | 7.28 |
| **Male** | N | 25 | 25 | |
| | Std. Deviation | 21.68 | 10.29 | |
| | Mean | 86.15 | 91.19 | 5.04 |
| **Female** | N | 27 | 27 | |
| | Std. Deviation | 20.49 | 12.14 | |
| **Difference** | | | | 2.24 |

The table above depicts that at pre-test, male students exposed to Tactile learning style had a mean interest rating of 83.20, standard deviation of 21.68 and at post-test, the mean interest rating increased to 90.48, standard deviation of 10.29. This indicates mean gain of 5.04. Similarly, at pre-test, female students exposed to Tactile learning style had a mean interest rating of 86.15, standard deviation of 20.49 and at post-test, the mean interest rating increased to 91.19 standard deviation of 12.12. This indicates mean gain of 5.04.

**Research Hypotheses**

**Null Hypothesis One:** There is no significant mean interest rating of students in Biology who use Visual and Tactile Learning Styles.

Table 4: ANCOVA result of interest ratings of students in the Visual and Tactile groups
Dependent Variable: Interest

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Corrected Model | 171.105[a] | 2 | 85.553 | .877 | .419 |
| Intercept | 44580.092 | 1 | 44580.092 | 456.975 | .000 |
| Intpretest | 65.324 | 1 | 65.324 | .670 | .415 |
| **Groups** | **104.966** | **1** | **104.966** | **1.076** | **.302** |
| Error | 10438.359 | 107 | 97.555 | | |
| Total | 939259.000 | 110 | | | |
| Corrected Total | 10609.464 | 109 | | | |

Table above shows that F (1,107) = 1.076; p = 0.302 > 0.05. This means result of test of significance is higher than the benchmark 0.05; consequently, the null hypothesis is accepted. This implies that there is no significant mean interest rating of students in Biology who use Visual and those who use Tactile Learning Styles.

**Null Hypothesis Two**: There is no significant difference on interest of male and female students who use Visual Learning Styles.

Table 5: ANCOVA result of interest of male and female students taught using Visual Learning Styles.

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Corrected Model | 144.680[a] | 2 | 72.340 | .996 | .376 |
| Intercept | 16731.020 | 1 | 16731.020 | 230.268 | .000 |
| Vintpretest | .675 | 1 | .675 | .009 | .924 |
| **Gender** | **141.327** | **1** | **141.327** | **1.945** | **.169** |

| | | | |
|---|---|---|---|
| Error | 3996.234 | 55 | 72.659 |
| Total | 503739.000 | 58 | |
| Corrected Total | 4140.914 | 57 | |

Table above shows that F (1,55) = 1.945; p = 0.169 > 0.05. This means result of test of significance is higher than the benchmark 0.05; consequently, the null hypothesis is accepted. This implies that there is no significant difference on interest of male and female students who use Visual Learning Styles.

**Null Hypothesis Three**: There is no significant difference on the interest of male and female students who use Tactile Learning Styles.

Table 6: ANCOVA result of interest of male and female students taught using Tactile Learning Styles.

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Corrected Model | 89.315[a] | 2 | 44.658 | .349 | .707 |
| Intercept | 26928.361 | 1 | 26928.361 | 210.329 | .000 |
| Tintpretest | 82.860 | 1 | 82.860 | .647 | .425 |
| **Gender** | **10.123** | **1** | **10.123** | **.079** | **.780** |
| Error | 6273.454 | 49 | 128.030 | | |
| Total | 435520.000 | 52 | | | |
| Corrected Total | 6362.769 | 51 | | | |

Table above shows that F (1,49) = 0.079; p = 0.780 > 0.05. This means result of test of significance is higher than the benchmark 0.05; consequently, the null hypothesis is accepted. This implies that there is no significant difference on the interest of male and female students who use Tactile Learning Styles.

## DISCUSSIONS

The research examined The Impact of Tactile and Visual Learning Styles on Students of Biology Interest in Taraba State**.**

The results indicate that both Visual and Tactile Learning Styles positively influenced students' interest in Biology, with the Visual Learning Style yielding a higher mean gain compared to Tactile Learning style. This suggests that students responded better to visual methods like diagrams and videos, aligning with Ojo and Ojo (2019), who noted that visual strategies enhance retention of complex concepts. While Tactile Learning was also effective, it may require more structured implementation to engage students fully, as noted by Afolabi (2020). The ANCOVA results showed no significant difference in mean interest ratings (F(1,107) = 1.076, p = 0.302), indicating both styles are equally effective. This contrasts with Kharb and Samanta (2019), who argued that tactile methods can generate higher engagement. The study suggests that both learning styles foster interest in Biology, likely influenced by intrinsic motivation, teacher enthusiasm, and content relevance, rather than the learning style itself, as supported by Nguyen et al. (2020). Furthermore, the findings reveal that female students initially had lower interest levels but showed a greater increase in interest after utilizing Visual Learning Styles. This aligns with prior research indicating that female students often benefit from interactive, visually engaging methods. For instance, Okwor and Okwor (2019) noted that female students demonstrated higher engagement with visual aids compared to traditional approaches. The significant difference in mean gain suggests that visual

learning strategies effectively enhance female students' interest in Biology. Akinola and Akinola (2020) also found that female students had greater improvements in interest and performance with innovative teaching methods. However, the ANCOVA results ($F(1, 55) = 1.945$, $p = 0.169$) indicated no significant difference in interest levels between male and female students taught with visual learning styles. The p-value exceeding the 0.05 threshold leads to accepting the null hypothesis, suggesting gender does not significantly influence interest when using visual methods. This is consistent with literature highlighting the universal effectiveness of visual learning strategies for engaging all students. Studies by Gholami and Bagheri (2018), Chan and Yuen (2020) support the idea that visual aids diminish gender differences in learning preferences, while Mayer (2021) emphasizes the cognitive benefits of visual learning across demographics. Similarly, the study on mean interest ratings of male and female students using Tactile Learning Styles reveals that both genders experienced increased interest from pre-test to post-test, with male students showing a higher mean gain compared to females. This suggests tactile learning may resonate more with males, as previous research indicates that they thrive in hands-on learning environments (Akinola & Akinola, 2020). While female students also benefited, their lower mean gain could imply a different level of engagement with this instructional method. However, the post-intervention interest ratings were relatively close (90.48 for males and 91.19 for females), suggesting both groups found value in the approach. The ANCOVA result ($F(1, 49) = 0.079$, $p = 0.780$) indicates no significant difference in interest between genders, supporting the null hypothesis. This outcome aligns with findings from Derakhshan and Hashemi (2019) about the inclusive nature of tactile learning styles, highlighting their ability to engage all learners through active, hands-on experiences.

## CONCLUSION

The study demonstrates that both Visual and Tactile Learning Styles effectively enhance students' interest in Biology, with Visual Learning yielding a slightly higher mean gain compared to Tactile Learning style.

## RECOMMENDATIONS

1. Educators should prioritize the use of visual aids, such as diagrams, videos, and interactive multimedia, to enhance students' interest, particularly for female students who showed a significant increase in interest with these methods.
2. Hands-on activities should be designed to cater to diverse learning preferences and ensure inclusivity.
3. Combining visual and tactile learning strategies could provide a balanced approach, catering to the strengths of both styles and addressing the preferences of a wider range of students.

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