IJO- INTERNATIONAL JOURNAL OF SOCIAL SCIENCE AND HUMANITIES RESEARCH
(ISSN 2811-2466) Alaba Lawrence ALADEJANA*,
https://ijojournals.com/ Volume 07 || Issue 03 || March, 2024 ||

Effects of Gender on Senior Secondary Schools Students' Achievement through Mind Mapping-Based and Visual Imagery Strategies in Physics in Ekiti State, Nigeria

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Abstract
The study examined the effects of gender on senior secondary schools students' achievement in physics s through mind mapping-based and visual imagery strategies in Ekiti state, Nigeria. This study adopted a pre-test post-test quasi experimental control group design. The sample for this study consisted of one hundred and thirty three (40 males and 93 females) students selected from six (6) senior secondary schools across the three senatorial districts of the state through purposive sampling technique. Analysis of Covariance (ANCOVA) and Estimated Marginal Means (EMM) were used to analyze the data obtained at significant level of 0.05. The findings of this study revealed that there was no significant effect of gender on students' achievement in physics through mind-mapping based and visual imagery strategies. However, further EMMs showed that male students had the higher adjusted mean score in their post-achievement in physics (15.161) than female students (13.294).

Keywords: Gender, achievement, physics, mind mapping-based and visual imagery.

Introduction

Science, according to Britannica, (2024) is concerned with the body of knowledge that focus on physical world and phenomena that comprise bias-less observations and well organized experimentation, Categorically, science is grouped into applied and pure science, this pure science is made up of biology, chemistry and physics. In Nigeria, Physics is taught in senior secondary schools through various strategies such as mind mapping-based and visual imagery strategies. In executing aforementioned strategies, gender is an additional aspect that play significant role in academic accomplishment (Aladejana, 2024). Brain imaging and psycho-physiological research have shown that there is a gender difference in the visual cortex between male and female learners (Sabatianelli, Flaisch, Fitzsimmons & Lang, 2004). The discovered discrepancy has the potential to impact how physics learners conceptualize various concepts, which might improve their ability to solve problems and use their knowledge. The moderating influence of gender on academic accomplishment can account for the situation under investigation.

Trevor, Navid & Prasanna (2020) proposed that the visual cortex is the principal cortical region inside the brain that is responsible for the processing, integration, and manipulation of visual information derived from the retinas. The posterior, or furthest, region of the brain contains the occipital lobe of the main cerebral cortex. Because of functional and structural factors, the visual cortex is divided into five distinct regions, designated as V1 through V5. Before reaching the visual cortex from the retinas, visual information must first pass through the thalamus, where it forms synapses in a nucleus known as the lateral geniculate.

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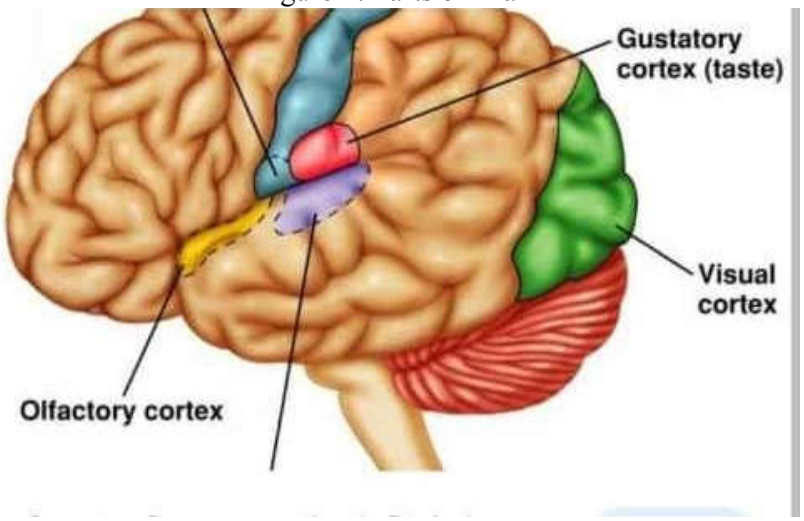
Figure 1: Parts of Brain



Source: Google.com

After leaving the lateral geniculate, the previously described data travels to the first region of the visual cortex, or V1. The calcarine sulcus area contains V1, also referred to as the primary visual cortex (Tran et al., 2019). A visual cortex is found in each hemisphere of the brain, and it gets information from the opposing eye. Information from the left eye is processed by the cortical regions of the right eye, while information from the right eye is processed by the cortical areas of the left eye. The reception, separation, and integration of visual information are the main functions of the visual cortex. After the visual cortex has completed processing the data, it is then sent to other areas of the brain for further examination and application. Because of its highly specialised function, the brain can quickly recognise objects and patterns without requiring a lot of conscious effort. According to Goodale (2011), one important benefit of this specialization is that it increases the amount of calculations that can be done by other brain areas. The brain areas that are being examined include those associated with executive function and decision-making. It is crucial to remember that the majority of visual processing is unconscious, which might result in incorrect interpretations of visual data. This is seen by how effective visual illusions may be. Learners' perception and comprehension of physics ideas are significantly impacted by gender differences in the visual brain.

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Figure 2: Visual Cortex of Male and Female

Source: Google.com

160 distinct pictures were examined by orientation (64 male and 84 female), and information were gathered and broke down using Land's assessment sheet and Z-test, individually. The information found that females show more clear scattering conduct (4.49583 mean, 2.32482 standard deviation, and 5.40481 difference) than males (4.90233 mean, 1.98145 standard deviation, and 3.92614), while females display more grounded visual aversion to the photos. Semela (2010) defines orientation as the organic split among males and females. Yang (2010) defines orientation as the social attributes and conceivable outcomes associated with one's recognizable proof as male or female. It additionally portrays the connections that exist among people, as well as young males and young females, and how they are mingled. Semela (2010) proceeded to say that the hole in interest between sexual orientations might be appropriately explained by the commonness of orientation generalizations held by young males and young females. These thoughts affect their scholastic exhibition and SPSiP.

Literature Review

Bello & Famakinwa (2014) stated that orientation is a significant point in science education, particularly given the growing accentuation on systems to expand the labor force for mechanical progression and increase female portrayal in science and innovation domains. In a similar line, Samtrock (2005) accepts that orientation directs the kind of role ways of behaving that people are supposed to show in their thinking, activities, and feelings. Albeit a few countries all through the world have accomplished orientation uniformity in rudimentary education, the objective presently can't seem to be by and large met in postnsecondary institutions (Agu & Omenyi, 2013; UNESCO, 2018; Oludayo et al, 2019). Orientation assumes a significant part in logical education, particularly with the increased accentuation on supplementing the labor force for mechanical forward leaps and increasing the presence of females in science and innovation fields. Orientation bias continues to be a significant issue

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in Nigeria, and perhaps in Africa in general. A few scholastics accept that there are no orientation variations in learners' exhibition in science, while others conflict. Alokan (2010) found in his study that orientation (sex) and school area have no influence on scholarly achievement. In a similar vien, Aweriale (2008) found that orientation affects Physics execution when the two males and females are shown under the indistinguishable settings.

Egwuchukwu (2007) likewise expressed that lately, a few guardians pick vocations for their children to fulfill their childish self image, make up for a shortcoming they left in their own time, because of orientation generalizations, disregarding the youngsters' interests and capacities, as well as the outcomes of such a decision on children and society at large. According to Adeyemo (2010), female learners will generally float into or are directed towards female-dominated fields of study like teaching, nursing, library, workmanship, and secretarial studies, while shying endlessly or being deterred from fields like engineering, medicine, and so on. She guarantees that this prompts minimal support in sciences, innovation, and professional education in light of the fact that these fields are exclusively for males.

Also, according to Ajao & Aina (2005), there is a critical error between certification learners attending school, which prompts variations in the courses given. Female minds are inclined toward less economically practical courses, leaving men to seek after subjects like engineering, medicine, and math. Amusat & Awoyemi (2007) recommended that distinctions in sexual orientation influence learners' intellectual achievement in school.

Research Hypotheses

The following hypotheses were formulated and tested at 0.05 level of significance:

Ho1: There is no significant main effect of gender on learners' achievement in physics through mind mapping-based and visual imagery strategies

Ho2:There is no significant difference in mean scores of male and female learners' post-achievement in physics through mind mapping-based and visual imagery strategies

Research Design

The study used a pretest-posttest conventional group quasi-experimental design.

Selection of Participants

The population for the study comprised all Senior Secondary Schools(SSS) II learners offering Physics in Ekiti state. Six SSSs were randomly selected across the three senatorial districts that make up the State.

Research Instruments

Physics Achievement Test (PAT), training manual for MMbS strategy, training manual for VIS strategy, Instructional Guide for the Conventional Method were the instruments used for this research work to obtain the data.

Methods of Data Analysis

Analysis of covariance (ANCOVA) and estimated marginal means(EMMs) were utilised in analysing the obtained data.

Results and Discussion

Ho1: There is no significant main effect of gender on learners' achievement in physics through mind mapping-based and visual imagery strategies.

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Table 1: Analysis of Covariance (ANCOVA) of Post-Achievement by Gender

Source	Type III SS	df	MS	F	Sig.	Partial Eta Squared
Corrected Model	1355.761	17	79.751	5.104	0.000	0.430
Intercept	1832.675	1	1832.675	117.280	0.000	0.505
Pre Achievement	106.628	1	106.628	6.824	0.010	0.056
Treatment	485.200	2	242.600	15.525	0.000*	0.213
Gender	10.604	1	10.604	0.679	0.412	0.006
Error	1797.051	115	15.627			
Total	26496.000	133				
Corrected Total	3152.812	132				

R Squared = 0.43 (Adjusted R Squared = 0.35) * denotes significant p<0.05

The results shown in Table 1 showed that there was no significant main effect of gender on learners' achievement in physics ($F_{(1, 132)}$ = 0.68; p>0.05, partial η^2 = 0.01). Therefore, hypothesis 1 was not rejected. This means that students' gender had no effect on their achievement in physics through mind mapping-based and visual imagery strategies.

Ho2: There is no significant difference in mean scores of male and female learners' post-achievement in physics through mind mapping-based and visual imagery strategies

Table 2: Estimated Marginal Means for Post achievement by Gender

Gender	X	SD	95% Confidence Interval Lower Bound	Upper Bound
Male	15.161	.811	13.555	16.767
Female	13.294	.693	11.921	14.667

Table 2 revealed that male students had higher adjusted mean score in their post-achievement in physics (15.161) than female learners (13.294). this means that male students outperformed their female counterparts post achievement in physics through mind mapping-based and visual imagery strategies

Discussion of Findings

The result showed that there was no significant main effect of gender on learners' achievement in physics through mind mapping-based and visual imagery strategies. This shows that the learners' sex had no effect on their achievement in physics. This means that gender difference in the visual cortex of male and female does not resultantly aid their achievement in physics. This result is in support of earlier findings of Agommuoh & Nzewi (2003); Arigbabu & Mji (2004); Abakpa & Iji (2011) and Ogunleye & Babajide (2011) that revealed that effect of gender on learners' achievement in science and mathematics was not substantial. However, the result contradicts the findings of Sabatinelli, Flaisch, Fitzsimmons and Lang (2004) that brain imaging and psychophysiological studies revealed that difference in the visual cortex of may affect visulization of various concepts in the mind of learners. Also, the finding is in disagreement with the findings of ; Akinsola & Awofala (2009); Awofala (2010) & Awofala (2011a) that showed gender's effect on learners' achievement in science was substantial with boys outperforming their girls counterparts.

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Conclusion

Gender has no significant effect on senior secondary school students' achievement in physics through mind mapping-based and visual imagery strategies. However, male students outperformed their female counterparts post achievement in physics through mind mapping-based and visual imagery strategies.

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