



LOGICAL LEARNING STYLE AS PREDICTOR OF ACADEMIC PERFORMANCE OF PHYSICS STUDENTS IN SECONDARY SCHOOLS OF KATSINA ZONAL EDUCATION QUALITY ASSURANCE, KATSINA STATE, NIGERIA

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Abstract

This study investigated Logical learning style as predictor of students' academic performance in Physics in secondary schools of Katsina Zonal Education Quality Assurance, Katsina State, Nigeria. The study was guided by two (2) objectives, one (1) research question and one (1) null hypothesis at 0.05 level of significance. The study employed Ex-Post Facto Research Design. The Population of the study comprised 5,445 SS II students from 23 Public Secondary Schools under Katsina Zonal Education Quality Assurance, out of which 357 were selected as the sample of the study using proportionate sampling technique. Data was collected using the instrument, Logical Learning Style Test (LLST); with established reliability coefficients 0.72. The research question was answered using descriptive statistics such as frequency bar chart; while the null hypothesis was tested using linear regression analysis. The study revealed that there was significant difference between academic achievement of logical learners and non-logical learners $\{p(0.000) < \alpha(0.05)\}$. Moreover, linear regression coefficients indicated that there exists strong positive association between logical learning styles and academic performance in physics hence, logical learning style could significantly predict academic performance. The researcher concluded that logical Learning style could significantly predict physics academic performance. Based on the findings of the study, it was recommended among others that only students found to be logical in the selection test and placement test should be recommended to study physics

Background to the Study

Learning styles are preferred methods of individuals in knowledge acquisition, using the and preserving (retaining) knowledge, it could be an aspect of individual differences (Okonkwo, Egolum, Samuel & Okonkwo, 2023). Teachers are generally required to pay attention to individual differences as much as possible. Field-dependence or field-independence may also be seen as individual difference in perception dimension (Ozdemir, Alaybeyoglu, Mulayim & Uysal, 2018). Learning styles are preferences and a psychological theme that significantly affect academic performance in that, students learn better when their individual learning style is

connected to favourable learning style (Ozdemir et al., 2018).. Igwe and Iweka (2019) asserts that an important variable that should be attended to during the teaching and learning process is the issue of individual differences; which include differences in mental, physical, environmental, cultural, economic and emotional aspects. Cognitive styles, otherwise known as learning styles just like motivation, gender, thinking styles and attitudes are most widely researched individual differences (Okonkwo et al., 2023). Learning styles have been shown to be pivotal in the learning process (Alhassan & Abubakar, 2020). Every student has his/her preferred learning style which will in turn determine his/her tendency to grasp, perform



and retain information (Dennis & Ndege, 2024).

Students' academic performance in Nigeria is witnessing downward slide. Poor academic performance of science students can be noticed in the rising rate of failures in external examinations of WAEC and NECO. Accordingly, Uchenna (2015) opines that teacher should help the students by taking cognizance of the cognitive styles of the students with a view to matching their cognitive styles with the teaching styles. The teachers should understudy the cognitive styles of the students and adapt their teaching strategies to align with the cognitive styles of students.

Students' academic performance in sciences and physics in particular has been topic of major researches across the globe. This is because, many students were reported to have recorded poor academic performances for reasons such as phobia toward the subject, physics and many other teacher and student factors. Over the last two decades, the rise of different learning styles theories has led to the impression that learning may take many forms; some students may rarely have a dominant learning style and utilize other learning styles, while others may choose to employ several learning styles in different contexts. Learning styles differ according to cognitive, emotional and environmental aspects. Every student is different (Nanaware & Bariskar, 2023). It is hence imperative for educators to understand the uniqueness of their students' learning styles (Dennis & Ndege, 2024). Learning styles refer to the preferential way the students observe, process and comprehend as well as retain information (Leung & Sabiston, 2020).

Tailoring teaching in line with the students' learning styles is capable of bringing about the much-needed improvement in performance of the students. Okonkwo et al. (2023) assert that when teaching styles is matched with the learners' cognitive styles, teaching and learning becomes productive

and rewarding. Dennis and Ndege (2024) defines cognitive styles as the relatively stable strategies, preferences and attitudes that determine an individual's typical modes of perceiving, remembering and problem solving. Accordingly, several studies were carried out on the relationship between cognitive (learning) style and academic performance or achievement. Empirical observations reveal that many Science Teachers do not appreciate matching of students' learning styles with their teaching strategies as well as content to be taught.

The most widely investigated learning styles in current studies include reflectivity-impulsivity, field dependence-field independence, wholist-serialist, and deep-level/surface level processing as well as logical learning style (Muchamad, Amiruddin, Siti, Marwia & Pipin, 2023; Syafitri, Putra & Noviana, 2020). Field-independent learners are more analytical, better separately details from the surrounding context, whereas field-dependent people tend to depend on cues and are easily confused in situations that are interwoven. According to Shaidullina et al. (2023), individuals who acquire information and are able to perceive by distinguishing that information from other surrounding information are known to be "field-independent"; and hence exhibit more analytic abilities. Field-independent learners tend to have innate cues and are more autonomous in cognitive restructuring tasks. Likewise, Muchamad et al. (2023) asserts that, students with logical learning style could be more ready to pursue mathematics and mathematics dependent disciplines such as Physics.

Therefore, this study was prompted to be undertaken with the aim of ascertaining and establishing the whether or not students' academic performance is determined by the nature of learning (cognitive) styles possessed by the students; especially logical learning style. Along similar vein, students with Logical learning style prefer to use



logic, reasoning, and systems (Muchamad et al., 2023). Kurniawan (2017) states that someone with logical learning style will prefer activities that involve the brain, usually, students will quickly become aware of a pattern, and see connections between one piece of information with other information that many people do not easily realize. The logical students do also understand something by connecting connections from various details and arranging them in an organized manner, such as by playing puzzle. It was therefore, clear that students with logical learning styles preferred lessons that was problem-solving, and systemic; and did not rely on memorization.

Therefore, since learning styles of students according to empirical studies could influence academic performance, this present study examined whether or not logical learning styles could determine academic performance of physics students. The study to addressed the problem of physics failure of students as affirmed by several reports and examination bodies; as this could emanate from the tendency of students enrolling into sciences (physics) without being selected for it or possessing of propriate learning styles for pursuing physics. It was against this background, that this study examined whether or not physics students' academic performance was a function of (predicted by) logical learning style (cognitive styles).

Statement of the Problem

Students' academic performance in Nigeria is witnessing downward slide. Poor academic performance of science students can be noticed in the rising rate of failures in external examinations such as; WAEC and NECO. Again, Students need competencies and survival skills in facing life, as well as, 21st century skills namely critical thinking and problem solving, collaboration across networks and leading by influence, agility and adaptability, initiative and entrepreneurialism, effective and oral

communication, accessing and analysing information as well as curiosity and imagination. The researcher therefore thought of logical learning style to be tried as independent variable in order to see if it will predict students' success in Physics. Logical thinking is a way that is reasonable, coherent and based on certain objective facts (Syafitri, Putra & Noviana 2020).

Academic performance by students has always been a subject of interest to scholars. Academic performance is essentially the outcome of education and the extent to which students has achieved educational objectives. The error of mismatching their teaching with the students' preferred learning styles would no doubt stand a major factor that leads to students' poor academic performance (Alhassan & Abubakar, 2020). Again, if students' learning styles are not taken into cognizance in selecting students for a particular discipline or career (science or arts); then students' desirable academic performance would not be guaranteed (Najafabadi, Imani, Beygi, Lopes & Silva, 2022). Therefore, teachers who do not understand the diversity of their learners in a typical classroom end up embracing the same traditional teaching methods in every context, using the same material of instruction for all categories of students in a classroom, regardless of their individual differences and learning style approach

Results for West African examination council (WAEC) and the National Examination Council (NECO) indicates a high failure rate in recent times. Notably, WAEC chief examiners report (2021) summarized candidates 'weaknesses as follows:

1. Some candidates did not comprehend some of the theories of physics
2. Units were not carried out in S.I Unit by some candidates



3. Most candidates had difficulty in solving problems set on mechanics, sound, heat and electricity
4. Many candidates were not able to differentiate between concepts of motion and that of rest.
5. Candidates could not differentiate between potential differences and electromotive force.
6. Many candidates failed to define the principal focus of a concave lens.

Coupled with the WAEC chief examiners' report (2021), the researcher having reviewed some articles came to understand that, learning styles could have relationship with students' academic performance. However, many teachers could not even assess their students' individual learning style, field-dependence/field-independence, reflectivity/impulsivity, convergence/divergence or wholist /serialist as well as logical. The table below shows the trend of students in WAEC who got five credits including mathematics and English:

Table 1: Trend of Academic Performance

S/N	YEAR	PERCENTAGE
1	2020	39.82
2	2021	81.7
3	2022	76.36

More also, this study is prompted in order to find out if logical learning style could determine students' academic performance in physics in secondary schools of Katsina Zonal Education Quality Assurance, Katsina state, Nigeria. This could help to establish either of which is compatible with learning physics in order to avert the problem of students blindly going into sciences (physics) at SS1 without properly fitting in as either field-dependent, field-independent or logical.

Objectives of the Study

The following objectives were set to guide the study, to: -

1. Identify most prevalent Learning style among Physics students in secondary schools of Katsina Zonal Education Quality Assurance.

2. Determine to what extent does logical learning style predict academic performance of students in Physics in secondary schools of Katsina Zonal Education Quality Assurance

Research Question

Based on the research objectives, the following questions were raised to guide the study:

1. Which learning styles is most prevalent among Physics students in secondary schools of Katsina Zonal Education Quality Assurance?

Research Hypothesis

The following hypothesis guided the study:

Ho: Logical learning style does not significantly predict academic performance of students in Physics in



secondary schools of Katsina Zonal Education Quality Assurance.

Research Methodology

This study employed Ex-post facto research design. This was because, ex-post facto research design is non-experimental that examines how an independent variable (in this case logical learning style) present already prior to the study affects a dependent variable (in this case, academic performance). Ex-post facto correlational research design (also known as causal-comparative design) investigates the relationship between variables without the researcher controlling or manipulating any of them. The design hence describes how variable are naturally related in the real world without the researcher attempting to alter them or assign causation between them (Bikner-Ahsbahs, Knipping & Presmeg, 2015).

The design was contextually pertinent in this study, since, already the independent variables (logical learning style) was present

in the research subjects as definitely some were field dependent whereas others were field independent, logical and non-logical. These independent variables were also not subject to manipulation by the research however, was only examined via correlation as to how to they could affect or determine physics students' academic performance (dependent variable).

The population of the study covered all the senior secondary school year II (SS2) students offered Physics and who took Physics Qualifying Examinations, 2024/2025 in Katsina Zonal Education Quality Assurance. The population therefore comprised of five thousand, four hundred and forty five (5,445) SS 2 students in twenty-three 23 public senior secondary schools in Katsina Zonal Education Quality Assurance, with one (1) not offering Physics to students making the total number of schools in the population being twenty-two (22). The schools are public, operating as day schools and offer physics as a subject. As shown in the table below: -

Table 2: Population of the Study

S/N	SCHOOL	SS2
1	GCS (DAYWING)	557
3	KCK KATSINA	656
3	GSSS MAGAMA JIBIA	112
4	GDSS KAITA	124
5	GCP KATSINA	91
6	GSSS KAMBARAWA	267
7	GSSS DADDARA	118
8	GSSS NATSINTA	151
9	GSSS K/KAURA	720
10	GSSS FOR THE BLIND	232
11	GPSSS KOFAR SAURI	245
12	GSSS JIBIA	131
13	SUNCAIS	189
14	GSSS K/YANDAKA	530
15	GSSS DANKABA	-
16	GGC (SNR) KATSINA	285
17	GSSS YANDAKI	287
18	GGSSS JIBIA	90



19	GGSSS D/SAFE TOWN	45
20	GGSSS DANKAMA	136
21	GSSS KAITA	155
22	GSSS GIRKA	30
23	GSSSS D/SAFE	294
TOTAL		5,445

(Source: Katsina State Education Resource Center, ERC, 2025)

As for sample, The researcher first consulted Research Advisors table (2006) table of sample size, and got advised to use three hundred and fifty-seven (357) subjects (participants) for a population, $N > 5,000$ but $< N 7,500$. Hence a sample size of 357 was deemed appropriate for this research endeavor. As for the sampling technique, the Researcher adopts multi-stage sampling approach. Accordingly, Purposive Sampling technique was initially employed to get the only secondary schools in Katsina Zonal Education Quality Assurance that offer Physics as a Science subject to students. Meanwhile, from the twenty-three secondary schools, only one (1) was isolated as non-sample as they do not offer Physics.

Thereafter, Proportionate Sampling technique was used to select correct and exact number of subjects from each of the twenty-two (22) schools of the population, leading to the total sample size of three-hundred and fifty-seven (357). Meanwhile, due to the fact that the instruments were administered once, intact classrooms were used to make up the required sample size in each school and in some cases, convenience sampling was employed.

The Logical Learning Style Test (LLST) comprises of ten (10) items adapted from Okeke, Okeke and Akande (2011). The test was an objective type of test with each item having four (4) options lettered a, b, c, and d. The test has helped in getting students with logical learning styles, such that if a subject gets 50 or above, will be considered Logical whereas that which gets below 50 will be adjudged as not having logical learning style.

This is based on the premise that, elements of measures of dispersion namely Mean and Median have midpoint or mid-term as average or that which defines all other terms. Accordingly, in a measure with total marks of 100, the midpoint should be 50. Additionally, Syafitri et al. (2020) recommends that a student score in computational task that is within the range $40 < X < 60$ could be adjudged an average logical learner. The researcher ensured face validities of the instrument employed in the study.

Pilot test was carried out on thirty students (30) from a senior secondary school that constituted part of the study population of Katsina state but from Rimi Zone and not Katsina Zonal Education Quality Assurance.

Data Analysis and Results

The researcher employed both descriptive statistics and inferential statistics to analyze the data to be collected. Research question of the study was answered using descriptive statistics whereas the null hypotheses were tested using inferential statistics. Specifically, research question was answered using simple frequency and barchart.

As for research hypothesis, H_01 was tested using linear regression analysis. Overall, all analyses were performed using statistical package for social sciences (SPSS) version 27. The hypotheses testing was done at 5% (0.05) level of significance; since the research is educational (social science).

Research Question 1:

Which learning styles is most prevalent among physics students in secondary schools of Katsina Zonal Education Quality Assurance?

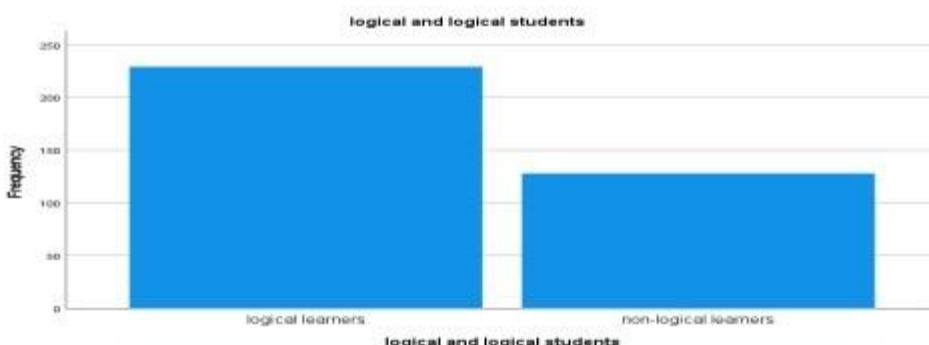


Figure 1: Barchart showing logical learning style distribution

From figures above, it could be observed that the following table summarize the prevalence of the learning styles

Table 3: prevalence of Learning Styles

Learning styles	Frequency	Percentage %	Sector (Pie Chart)
Logical	229	64.4	230.92 ⁰
Non-logical	128	35.6	129.07 ⁰

Hence, the most prevalent learning style among physics students in secondary schools of Katsina Zonal Education Quality Assurance is logical learning style (229=64.4% and 230.92⁰).

Testing Research Hypothesis

Inferential statistics such as linear regression was employed; which are all parametric

tools. All testing were carried out at 5% level of significance; 95% confidence level and using SPSS V27.0.

Ho1: Logical learning style does not significantly predict academic performance of students in Physics in secondary schools of Katsina Zonal Education Quality Assurance.

Table 4:Model Summary for Regression analysis for Ho1

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.738 ^a	.545	.543	9.13124

Table 4. logical learning style factor Standardized coefficient is Beta = 0.738 denoting a strong prediction power of logical learning style for Physics Students'

academic Performance. Also, the R squared value of 54.5% denotes that the constant accounts for 54.5% of the variations observed.

Table 5: ANOVA for Regression analysis for Ho1

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	22654.520	1	22654.520	271.704	.000 ^b
	Residual	18927.139	227	83.379		
	Total	41581.659	228			

From tables 5 and the p-value ($p=0.000$; $F=271.704$) is less than alpha ($\alpha=0.05$) hence, the hypothesis is rejected and therefore, alternate hypothesis is adopted “ Logical learning style could significantly predict

physics students’ academic performance” and that logical learning style has significant relationship with physics students’ academic performance in secondary schools of Katsina Zonal Education Quality Assurance

Table 6: Coefficients for Regression analysis for Ho1

		Unstandardized Coefficients		Standardized Coefficients		95.0% Confidence Interval for B		
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	19.474	3.054		6.377	.000	13.456	25.491
	logical learning style	.741	.045	.738	16.483	.000	.652	.829

From the table 6, the observed unstandardized coefficient (b) of 0.741 indicates that Physics students’ academic performance increase by 0.741 per unit increase in logical learning style factor as expressed in term score obtained in LLST.

positive relationship between logical learning style and academic performance of students in Physics

Summary of Major Findings

From the results of data with respect to answering research questions and testing of hypotheses; the followings were the major findings of the study:

1. Among the three learning styles, logical learning style is the most prevalent learning style among physics students in secondary schools of Katsina Zonal Education Quality Assurance.
2. Logical Learning Style can significantly predict students’ academic performance in Physics and that there exists strong

Discussion of Findings

From the findings in this study, logical learning style prediction of academic performance in physics, the finding is in congruence with Siftiyari et al (2020) and Deborah, Sathiyaseelan, Audi than and Vijayakumar (2015) who carried out a study titled “fuzzy-logic based learning style prediction in e-learning using web-interface information” and found that e-learners’ excellence can be improved by recommending suitable e-contents available in e-learners’ servers that are based on investigating their learning style. However, their study acknowledges the fact, knowledge about the learners used for learning style prediction is uncertain in nature. Similarly,



the findings of the study agree with Muchamad, Aminuddin, Siti, Marina and Sumarni (2023) who got that average logical thinking ability of students with 61.9.

In congruence, this study agrees or reinforces the assertions in Dunn and Dunn theory of learning styles as stated in Ozdemir et al. (2018) that, identifying and matching students' learning styles well as with instruction and consent is consequential for the students' attainment of learning objectives.

Conclusion

Based on the analyses, the researcher concludes that logical learning style could predict academic performance of students in Physics in secondary schools of Katsina Zonal Education Quality Assurance, Katsina state.

Recommendations

Based on the findings of the study, the following were recommended;

1. Other researchers (future researchers) should carryout studies on effect of convergence/divergence, reflectivity/impulsivity with academic performance in physics.
2. Other researchers (future researchers) should carryout studies on effect of field dependence and field independence with academic performance in other science subjects.
3. Other researchers (future researchers) should carryout studies on effect of kinesthetic, auditory and visual learning styles on academic performance in physics.

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