



Adequacy and Utilization of Physical Resources: Implications for Effective Teaching and Learning

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Abstract: This study examined the adequacy and utilization of physical resources with special interest in its implications for effective teaching and learning. This study looked into how well these resources are adequate and used in public secondary schools in Delta State and their impact on education. It was guided by four research questions and three hypotheses. Using a descriptive and correlational survey approach, the study aimed to analyze existing conditions without changing any factors. The study population comprised 14,745 public secondary schools' teachers. A multistage sampling technique was used to select 588 respondents. To gather information, a questionnaire titled Adequacy and Use of Resources on Teaching and Learning Outcomes Questionnaire (AURTLOQ) which was validated by experts and further subjected to reliability test using Cronbach Alpha and it yielded a coefficient of .81, and a checklist derived from the West African Examination Council (WAEC) guidelines for re-inspection/recognition of schools (1999) were used. A combination of descriptive and inferential statistical methods was employed to analyse the data. Findings revealed that physical resources in Delta State public secondary schools are inadequate. It was also discovered that physical resources are not adequate in urban and rural schools. Furthermore, the study found that available physical resources are effectively utilized in public secondary schools. Moreover, adequacy and use of resources have an impact on teaching and learning outcomes in schools. Conclusively, public secondary schools in Delta State face significant challenges with the adequacy of physical resources across both urban and rural locations, school staff have demonstrated resilience in effectively utilizing the available resources. However, the marked disparities between urban and rural schools in both resource adequacy and utilization patterns suggest an inequitable educational balance that requires urgent attention. Arising from the findings the study recommends that government should start a fund to improve physical resources in public secondary schools in Delta State, focusing on the schools that need help the most. Regular checks should be done to ensure the funds are being used properly for building and maintenance. Education officials need to create a fair plan for distributing resources that addresses the gap between urban and rural schools. This plan should provide extra support for rural schools and set basic standards that all schools must meet.

Keywords: Adequacy and Utilization, Physical Resources, Public Secondary Schools, Delta State, Effective Teaching and Learning

Introduction

Physical resources refer to the tangible materials and infrastructure essential for facilitating teaching and learning in schools. These include classrooms, laboratories, libraries, workshops, school fields, and offices. They serve as the foundation for the effective delivery of quality education by supporting both teachers and students in their academic pursuits. According to Mebratu and Marisennayya [1], physical resources play a dual role as tools for

educators and as facilitators of learning for students. Akinsanya [2] highlights that the provision and effective utilization of physical resources significantly enhance the teaching and learning processes, thereby contributing to the achievement of educational goals. The availability and adequacy of physical resources are fundamental to an institution's ability to deliver quality education. However, Dangara [3] notes that physical resources must also be properly maintained and utilized to maximize their potential. The Resource-Based View theory [4] highlights the strategic importance of resource utilization in achieving broader organizational objectives, emphasizing that competitive advantages are derived from the efficient use of available resources. In the context of education, this theory translates into optimizing the allocation and use of physical resources to improve learning outcomes. Despite global efforts by organizations such as UNICEF and UNESCO to improve education in developing countries through the provision of resources, disparities in resource distribution and utilization remain a significant challenge. For instance, while urban schools may have greater access to physical resources, their effective utilization is not always guaranteed [5].

Earlier, Imonivwerha et al., [6] investigated instructional material utilization in Mid-Western Nigerian schools, finding that teacher qualifications, experience, and gender significantly influenced resource utilization - factors that could explain the urban-rural utilization differences noted in the current study. Recent studies have significantly contributed to understanding resource adequacy and utilization in Nigerian schools, particularly in Delta State. Comprehensive assessment of instructional resources in Delta State's public secondary schools revealed that while resources were available in 64.16% of schools, they were only 40.66% adequate, highlighting a significant adequacy gap [7]. Nkedishu and Oweikpodor [8], emphasized that physical amenities influence quality assurances, particularly through adequate classrooms and multipurpose buildings. Conversely, rural schools often face resource inadequacies that hinder their ability to achieve desired educational outcomes. Delta State, like many regions in Nigeria, faces challenges in the equitable distribution and effective utilization of physical resources, which directly impacts the quality of education delivered in its public secondary schools. This study seeks to explore the adequacy and utilization of physical resources to identify gaps and propose improvement solutions.

Statement of the Problem

International programs like Education for All aim to get more children in school and improve education quality, especially in developing countries. In Nigeria, efforts have been made to enhance education with better resources. But research by Appau et al., [9], Osuji [10] shows that many public secondary schools still struggle with inadequate facilities and maintenance. In Delta State, while some resources exist, they often fall short or are not used effectively. Issues like overcrowded classrooms, insufficient lab staff, and small libraries are common. There's also a noticeable divide between urban and rural schools regarding resource allocation. Urban schools may deal with low enrollment, while rural ones struggle with poor facilities. This uneven distribution raises questions about resource management in Delta State's public schools. To ensure quality education for all students, regardless of location, these issues need to be addressed. This study will look at how resource availability and usage affect teaching and learning in urban and rural public secondary schools in Delta State.

Research Questions

1. Are the physical resources available in public secondary schools in Delta State sufficient?
2. To what extent are physical resources adequate in urban and rural schools?
3. How effectively are physical resources utilized in public secondary schools?
4. What impact does the adequacy and use of resources have on teaching and learning outcomes?

Hypotheses

1. The adequacy of physical resources in rural and urban schools does not significantly differ.
2. The utilization of physical resources in rural and urban schools does not significantly differ.
3. The adequacy of physical resources and teaching and learning outcomes do not significantly relate.

Material and Method

Design, Population and Sampling

This study employed a descriptive and correlational survey research method with an ex-post facto design. The approach was great for checking how well physical resources are being used in public secondary schools by relying on past data and what could be observed. This method works well for studies where it's not practical or ethical to conduct experiments, instead focusing on real-world situations. The study focused on 14,745 teachers from public secondary schools in the area, making sure to cover all the schools that needed to be evaluated. A multistage sampling

strategy was used to get a sample size that was both representative and manageable. This method involved picking participants in steps and combining various sampling methods to ensure accuracy. Out of this population, 588 teachers were sampled according to the sample size determination table of Krejcie and Morgan [29] that suggests a sample of 375 as the minimum sample to represent a population of 14745 with a 95% confidence level and a 5 percentage margin of error. Nonetheless, we increased the sample to 588 to take into consideration the possibility of non-responses and provide a sufficient coverage of the three senatorial districts of Delta State which includes urban and rural schools. This sample is about 4 percent of the total population of teachers, which is enough to conduct meaningful analysis with enough statistical power, yet is practically feasible to collect and analyze the data.

Instrument, Validity, Reliability and Data Analysis

Data was gathered using a questionnaire and a checklist. The questionnaire, called the Adequacy and Use of Resources on Teaching and Learning Outcomes Questionnaire (AURTLOQ), was designed to measure how well physical resources in schools were working. Experts in educational management checked its validity before it went through a reliability test, which showed a reliability score of 0.81. The checklist was based on guidelines from the West African Examination Council (WAEC) for inspecting schools and looked at important areas like classrooms, labs, libraries, and other facilities that are key to good teaching and learning. Its structured format made sure it was reliable and valid by sticking to recognized standards for school evaluations. Data were analysed using frequencies and percentages, charts, mean and standard deviation to answer research questions. The Kolmogorov-Smirnov Test checked for trends in resource usage, and t-tests and Pearson r were used to test additional hypotheses at a 0.05 significance level.

Bias Mitigation Strategies

We adopted a number of systematic measures during the research to alleviate the problem of internal biases in this study. First, we used a multistage sampling methodology that guaranteed representative selection between urban and rural schools in Delta State which minimized the selection bias in that we did not over-represent readily accessible schools. The sample size of 588 teachers out of 14,745 teachers improved the external validity of the results and reduced the effect of variation in responses by the individual teachers. To ensure that the instrumentation was triangulated, we used various data collection tools: a validated questionnaire (AURTLOQ) and a standardized WAEC-derived checklist to cross-check results and eliminate bias of the instruments. The questionnaire was also highly validated by professionals in the field of administration of education and the reliability coefficient was 0.81 which is satisfactory in maintaining consistency of measurement. In order to reduce response bias, we ensured that respondents were anonymous and employed structured tools with well defined and objective criteria to be evaluated. The checklist was constructed on the laid down WAEC guidelines instead of subjective evaluation that gave standard benchmarks on the evaluation of the resources.

Results

Research Question 1: Are the physical resources available in public secondary schools in Delta State sufficient?

The data used to answer the above question was obtained from the adequate column, item serial no. 1-12 of table 1 and Fig 1.

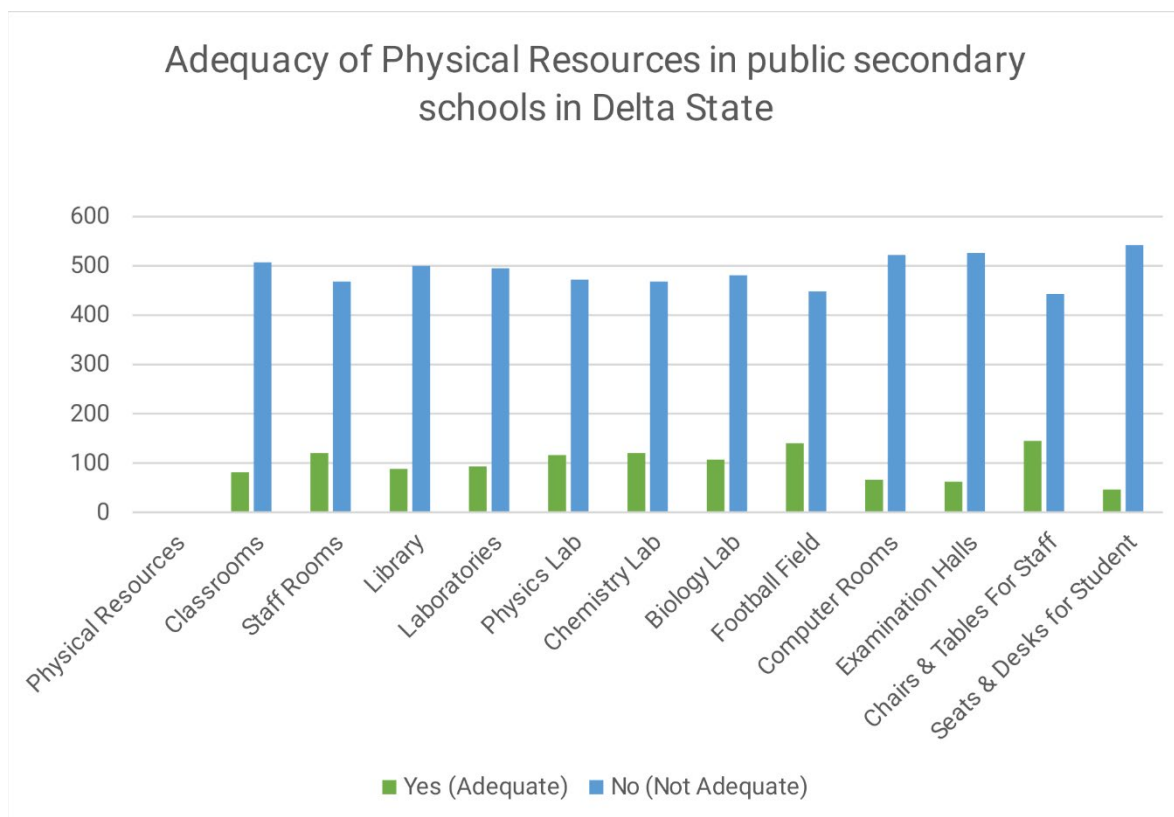
Table 1: Percentage distribution on physical resources

S/N	Physical Resources Variable	Yes (Adequate)	%	No (Not Adequate)	%	Total
1.	Classrooms	81	13.78	507	86.22	588
2.	Staff Rooms	120	20.41	468	79.59	588
3.	Library	88	14.97	500	85.03	588
4.	Laboratories	93	15.82	495	84.18	588
5.	Physics Lab	116	19.73	472	80.27	588
6.	Chemistry Lab	120	20.41	468	79.59	588
7.	Biology Lab	107	18.20	481	81.80	588
8.	Football Field	140	23.81	448	76.19	588
9.	Computer Rooms	66	11.22	522	88.78	588

10.	Examination Halls	62	10.54	526	89.46	588
11.	Chairs & Tables for Staff	145	24.66	443	75.34	588
12.	Seats & Desks for Student	46	7.82	542	92.18	588

Source: Authors Computation 2024

Figure 1: Graphical Representation of percentage of Adequacy of Physical Resources in pub secondary schools in the Delta States



Source: Authors Design 2024

Table 1 shows the frequency distribution and percentages of respondents on whether or not physical resources are adequate. It revealed that 142 respondents representing 24.17% rated classrooms as 'adequate' while 446 respondents representing 75.83% rated classrooms as inadequate. The table also revealed that 154 respondents representing 26.30% out of a total of 588 respondents rated staff rooms as 'adequate' while 434 respondents representing 73.70% rated staff rooms as inadequate. The table also shows that for libraries, 161 respondents representing 27.49% out of a total of 588 respondents rated libraries as 'adequate' while 426 respondents representing 72.51% rated the libraries as inadequate. Table 1 shows that 147 respondents representing 24.88% out of a total of 588 respondents rated laboratories as 'adequate' while 441 respondents representing 75.12% rated laboratories as inadequate. Table 1 shows that 143 respondents representing 24.41% out of a total of 588 respondents rated physics laboratories as 'adequate' while 445 respondents representing 75.59% rated physics laboratories as 'inadequate'. The table shows further that 152 respondents representing 25.83% out of a total of 588 respondents rated chemistry laboratories as 'adequate' while 436 respondents representing 74.17% rated chemistry laboratories as inadequate. Furthermore, 147 respondents representing 25.12% out of a total of 588 respondents rated Biology laboratory as 'adequate' while 440 respondents representing 74.88% rated biology laboratories as 'inadequate'. The table also shows that 133 respondents representing 22.51% out of a total of 588 respondents rated football fields as 'adequate' while 455 respondents representing 77.49% rated football fields as inadequate.

Table 1 also shows that 165 respondents representing 27.96% out of a total of 588 respondents rated computer rooms as 'adequate' while 423 respondents representing 72.04% rated computer rooms as 'inadequate'. The table also

revealed that 160 respondents representing 27.25% out of a total of 588 respondents rated examination halls as ‘adequate’ while 428 respondents representing 72.75% rated examination halls as ‘inadequate’. The table shows that 137 respondents representing 23.46% out of a total of 588 respondents rated chairs & tables for staff as ‘adequate’ while 451 respondents representing 76.54% rated chairs and tables for staff as ‘inadequate’. The table also revealed that 154 respondents representing 26.30% out of a total of 588 respondents rated seats and desks for students as ‘adequate’ while 434 respondents representing 73.70% rated seats and desks for students as ‘inadequate’. The analysis shows that the twelve physical resources listed representing 100% are ‘inadequate’. This implies that physical resources in Delta State public secondary schools are inadequate.

Research Question 2: To what extent are physical resources adequate in urban and rural schools?

The data used to provide answer to this research question was obtained from the adequate column of item serial no. 1-12 of the “physical Resource” section of the research check list presented in table 2 and Fig 2.

Table 2: Cross Tabulation of percentage distribution of respondents on adequacy of physical resources in urban and rural public secondary schools in Delta State

SN	Variables	Delta												
		Rural				Sub Total Rural	Urban				Sub Total Urban	Total	Total I	Grand Total
		Yes (Adequate)	%	No (Not Adequate)	%		Yes (Adequate)	%	No (Not Adequate)	%				
1.	Classrooms	24	19.67	98	80.33	122	57	12.23	409	87.77	466	81	507	588
2.	Staff Rooms	37	30.33	85	69.67	122	83	17.81	383	82.19	466	120	468	588
3.	Library	19	15.57	103	84.43	122	69	14.81	397	85.19	466	88	500	588
4.	Laboratories	16	13.11	106	86.89	122	77	16.52	389	83.48	466	93	495	588
5.	Physics Lab	23	18.85	99	81.15	122	93	19.96	373	80.04	466	116	472	588
6.	Chemistry Lab	31	25.41	91	74.59	122	89	19.10	377	80.90	466	120	468	588
7.	Biology Lab	35	28.69	87	71.31	122	72	15.45	394	84.55	466	107	481	588
8.	Football Field	27	22.13	95	77.87	122	113	24.25	353	75.75	466	140	448	588
9.	Computer Rooms	15	12.30	107	87.70	122	51	10.94	415	89.06	466	66	522	588
10.	Examination Halls	19	15.57	103	84.43	122	43	9.23	423	90.77	466	62	526	588
11.	Chairs & Tables for Staff	24	19.67	98	80.33	122	121	25.97	345	74.03	466	145	443	588
12.	Seats & Desks for Student	13	10.66	109	89.34	122	33	7.08	433	92.92	466	46	542	588

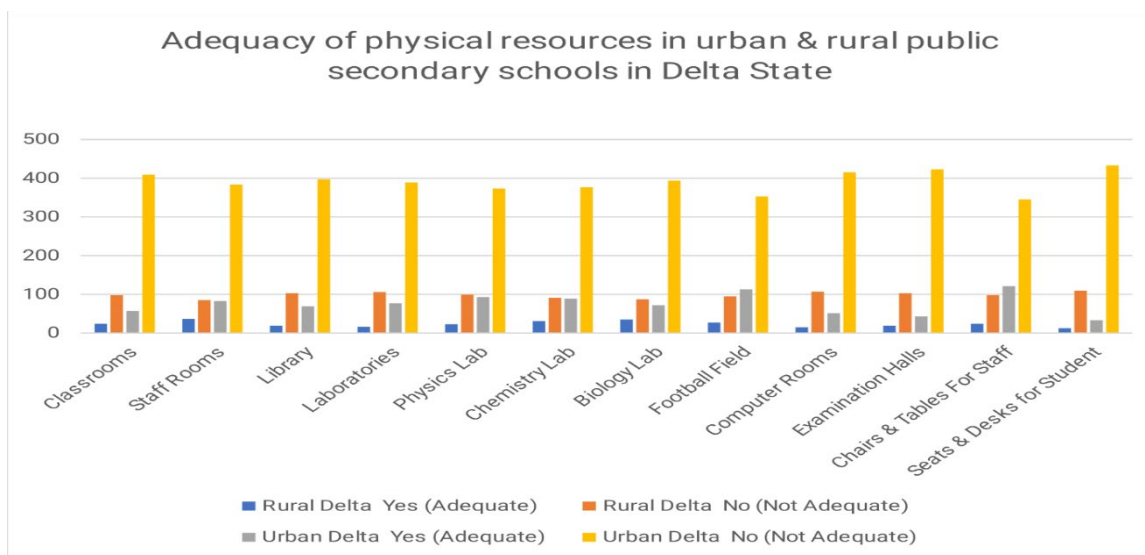
Source: Authors Computation 2024

Table Summary (Total)

- 1st category - Yes Adequate (Rural = 283, 19.33%),
- 2nd category - Not Adequate (Rural = 1181, 80.67%),
- 3rd category - Yes Adequate (Urban = 901, 16.11%),
- 4th category - Not Adequate (Rural = 4691, 83.89%)

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Figure 2: Graphical representation of percentages of adequacy of physical resources in urban and rural public secondary schools in Delta State



Source: Authors Design 2024

Table 2 displays the frequency distribution and percentages of respondents on the adequacy of physical resources in urban and rural public secondary schools in Delta State. Showing that in rural areas classrooms were 19.67% adequate, while in urban schools they were 12.23% adequate. Staff rooms in rural public secondary schools were 30.33% adequate, while in urban areas staff rooms were 17.81% adequate. Libraries in rural areas were 15.57% adequate, while in urban areas they were 14.81% adequate. In rural public secondary schools Laboratories were 13.11% adequate while in urban schools they were 16.52% adequate. Physics Laboratories were 18.85% adequate while in urban schools they were 19.96% adequate. Chemistry Laboratories in rural areas of Delta State were 25.41% adequate, while in urban public schools they were 19.10% adequate. Biology laboratories in rural public secondary schools in Delta State are 28.69% adequate while in urban areas they were 15.45% adequate. Football fields in rural public secondary schools in Delta State are 22.13% adequate while in urban schools they were 24.25% adequate, Computer rooms in rural public secondary schools were 12.30% adequate, while in urban schools they were 10.94% adequate, Examination halls were found to be 15.57% adequate in rural schools, while in urban schools they were 9.23% adequate, chairs and tables for Staff in rural schools were found to be 19.67% adequate, while in urban areas they were 25.97% adequate. The table further revealed that seats and desks for students in rural schools were rated as 10.66% adequate while those in urban areas were 7.08% adequate. The results of the analysis in the table summary, shows that physical resources in rural and urban public secondary schools in Delta State are 19.33% and 16.11% adequate respectively. It therefore implies that physical resources are not adequate in urban and rural schools.

Research Question 3: How effectively are physical resources utilized in public secondary schools?

This research question was answered using frequencies and percentages of respondents on the utilization of “Physical Resource”, checklist arranged in a five-point scale manner, with Column 5 as over utilized (OU), Column 4 = fully utilized (FU), Column 3 as moderately utilized (MU), Column 2 = underutilized (U), and Column 1 = not adequate for utilization (NAU), as shown in SN item 1-12 in table 3.

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Table 3: Percentage distribution of the level of utilization of physical resources in public secondary schools in and Delta state

S/ N	Human RESOURCES Variable	OU (Over Utilized)		FU (Fully Utilized)		MU (Moderately Utilized)		U (Underutilized)		NAU (Not Adequate for Utilization)		Gross Total	%
			%		%		%		%		%		
1	Classrooms	350	59.54	96	16.41	67	11.37	59	10.07	15	2.61	588	100
2	Staff Rooms	348	59.12	100	16.94	76	12.97	62	10.55	2	0.42	588	100
3	Library	227	38.68	37	6.22	21	3.61	11	1.90	292	49.59	588	100
4	Laboratories	129	21.87	49	8.35	38	6.40	26	4.38	347	59.00	588	100
5	Physics Lab	97	16.47	46	7.82	36	6.04	26	4.50	383	65.17	588	100
6	Chemistry Lab	95	16.11	43	7.29	32	5.51	23	3.97	395	67.12	1688	100
7	Biology Lab	86	14.57	37	6.34	28	4.80	20	3.44	417	70.85	588	100
8	Football Field	353	60.07	102	17.30	70	11.91	61	10.31	2	0.41	588	100
9	Computer Rooms	24	4.09	11	1.84	6	1.07	3	0.59	543	92.41	588	100
10	Examination Halls	230	39.1	62	10.55	38	6.52	26	4.50	231	39.34	588	100
11	Chairs & Tables for Staff	312	53.02	114	19.31	87	14.81	73	12.44	2	0.42	588	100
12	Seats & Desks for Student	311	52.84	107	18.13	71	12.09	66	11.26	33	5.68	588	100

Source: Authors Computation 2024

Table 3 show the level of utilization of physical resources in public secondary schools was a total of 348 with a percentage value of 59.12% (above average =50%) affirming classrooms as over utilized, based on its high percentage, while other levels of utilization (i.e. fully utilized, moderately utilized, underutilized and not adequate for utilization) had a percentage rating below 50%, implying that classrooms are over utilized. The table also reveals that staff rooms had the highest frequency of 348 respondents with a percentage level of 59.12% which is also above average affirmed weighted as over utilized. No other category of utilization (fully utilized, moderately utilized, underutilized and not adequate for utilization) had a percentage close to 50%, and therefore implies that staff rooms were over utilized. Table 3 showed that libraries had the highest frequency score of 292 (49.59%) under the Not Adequate for Utilization (NAU) category implying that approximately 50% respondents align with the fact that libraries are not adequate for utilization, as a result of this it can be concluded that libraries were not adequate for utilization. The table further showed that laboratories had the highest frequency score of 347 (59%) under the Not Adequate for Utilization (NAU) category and by implication laboratories are not adequate for utilization. The Table also reveals that physics laboratories had the highest frequency score of 383 (65.17%) under the Not Adequate for Utilization (NAU) column

inferring therefore that physics laboratories are not adequate for utilization. The table revealed that chemistry laboratories had the highest frequency of 395 (67.12%) under the Not Adequate for Utilization (NAU) category and as a result Chemistry Labs are not adequate for utilization. In addition, the table showed that Biology laboratories had the highest frequency of 417 (70.85%) under the Not Adequate for Utilization (NAU) category and by indication Biology laboratories are not adequate for utilization.

Table 3 further showed that Football Fields had the highest frequency of 353 (60.07%) under the Over Utilized (OU) category indicating therefore that Football Fields are Over Utilized. In addition, the table revealed that Computer Rooms had the highest frequency of 543 (92.41%) under the Not Adequate for Utilization (NAU) category was a clear indication that Computer Rooms are not adequate for utilization. The table 3 unveils that examination halls having the highest frequency of 231 (39.33%) under the Not Adequate for Utilization (NAU) category, was closely trailed by the frequency of 230 (39.1%) under the Over Utilized (OU) category, which infers that examination halls are not adequate for utilization, adding that the ones that are available for utilization are being over utilized. Furthermore, the table revealed that chairs and tables for staff had the highest frequency of 312 (53.02%) under the Over Utilized (OU) category indicating that chairs and tables for staff are Over Utilized. The table conclusively, showed that Seats & Desks for Student had the highest frequency of 311 (52.84%) under the Over Utilized (OU) category indicating that Seats & Desks for Student. In conclusion, five (5) items (Classrooms, Staff rooms , Football Fields, Chairs & Tables For Staff, Seats & Desks for Student), out of the total twelve (12) items were Over utilized, while six (6) items (Library, Laboratories, Physics Lab, Chemistry Lab, Biology Lab, and Computer Rooms) were Not Adequate for utilization, leaving one (1) item (Examination Halls) falling between the minimum and maximum borderline range of Not Adequate for utilization (39.1% and Over Utilized 39.33). In summary the two dominant levels of utilization of physical resources are Not Adequate for utilization and Over Utilized, as a result physical resources are not adequate for utilization and those that are available are being over utilized. Thus, available physical resources are effectively utilized in public secondary schools.

Research Question 4: What impact does the adequacy and use of resources have on teaching and learning outcomes?

Table 4: Mean rating on impact does the adequacy and use of resources have on teaching and learning outcomes

S/N	Impact of adequacy and use of resources on teaching and learning outcomes	Mean	SD	Decision
	Availability of teaching materials (e.g., textbooks, educational software) directly impacts the quality of student learning.	3.20	0.70	Agree
	Adequate classroom facilities (e.g., seating, lighting, ventilation) contribute positively to students' learning performance.	3.30	0.60	Agree
	The use of modern technology (e.g., computers, smartboards) enhances the effectiveness of teaching and learning.	3.50	0.50	Agree
	Sufficient access to learning resources, such as libraries and online materials, improves students' academic achievement.	3.40	0.60	Agree
	Inadequate resources negatively affect teachers' ability to deliver quality lessons.	3.10	0.80	Agree
	The availability of teaching aids and equipment in the classroom makes lessons more engaging for students.	3.30	0.60	Agree
	Lack of instructional resources leads to lower student engagement in the learning process.	2.90	0.90	Agree
	Inadequate resources for teachers, such as professional development opportunities, hinder the quality of instruction.	3.00	0.80	Agree
	The availability of extracurricular resources (e.g., sports equipment, arts materials) enhances overall student learning outcomes.	3.20	0.70	Agree
	A well-resourced school environment has a direct correlation with improved academic performance in students.	3.50	0.50	Agree
	Average mean score	3.24	0.67	Agree

Source: Authors Computation 2024

The table reveals that respondents generally agree that the adequacy and use of resources positively impact teaching and learning outcomes, with mean ratings ranging from 2.90 to 3.50 on a 4-point scale. Strongest agreement is observed for the role of modern technology and a well-resourced school environment in enhancing academic performance. Moderate agreement is seen for various resources, including teaching materials, classroom facilities, learning resources, and extracurricular materials. However, slightly lower agreement is noted regarding the negative

impact of resource inadequacy on student engagement and instructional quality. Variability in responses, as indicated by standard deviations ranging from 0.50 to 0.90, suggests differing perceptions on the significance of certain resources, with more uniform agreement on the importance of technology and overall school resourcing. An average mean scores 3.24 revealed that adequacy and use of resources have an impact on teaching and learning outcomes in schools.

Hypothesis 1: The adequacy of physical resources in rural and urban schools does not significantly differ.

Table 5: Kolmogorov-Smirnov (K-S) Test for significant similarity in the adequacy of physical resources between rural and urban public secondary schools in Delta State

Parameter	Value
H ₀	There is no significant similarity in the adequacy of physical resources between rural and urban public secondary schools in Delta State
H ₁	There is a significant similarity in the adequacy of physical resources between rural and urban public secondary schools in Delta State
Kolmogorov-Smirnov statistic (D)	0.9167
P-value of Test (p)	0.0001
p < 0.05 (α)	Reject H ₀

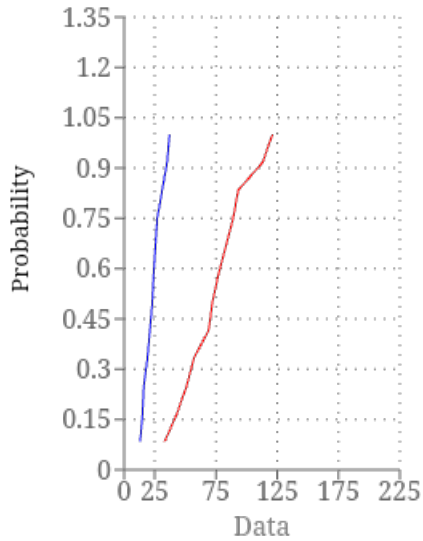
Source: Authors Computation 2024

Table 5 shows the Kolmogorov-Smirnov Test, (K-S Test) for significant similarities in the adequacy of physical resources between rural and urban public secondary schools in Delta State. The result reveals the KS D value of 0.9167, at a P-value of Test (p) of 0.0001, at 0.05 level statistics. The table revealed a p-value that is less than the 0.05 statistics, implying that the null hypothesis is rejected and the alternate hypothesis accepted, which indicates that adequacy of physical resources in rural and urban schools significantly differ.

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Figure 3 Graph showing the Empirical Distribution Function (EDF) of the adequacy of physical resources between rural and urban public secondary schools in Delta State

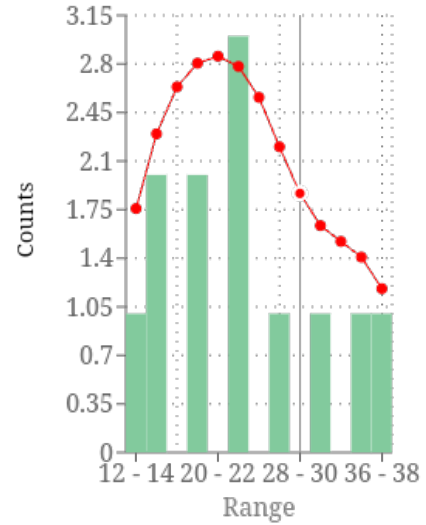
Empirical Distribution Function (EDF)



Source: Authors Design 2024

Figure 4 Histogram of adequacy of physical resources in rural public secondary schools in Delta State

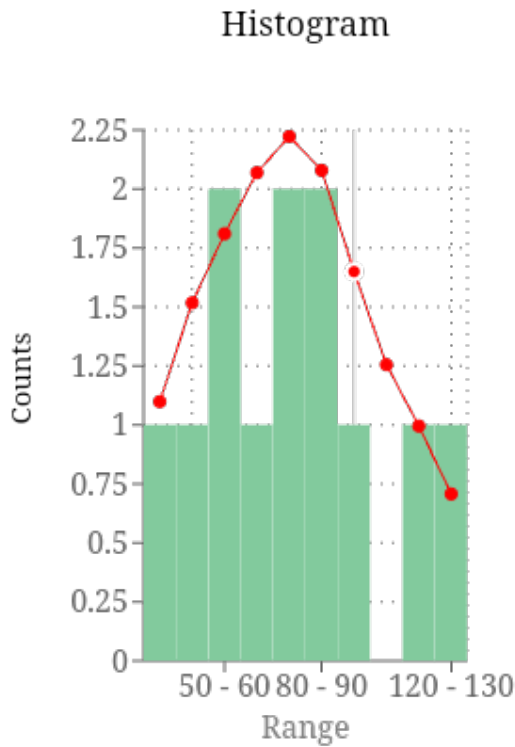
Histogram



Source: Authors Design 2024

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Figure 5: Histogram of adequacy of physical resources in urban public secondary schools in Delta State



Source: Authors Design 2024

Hypothesis 2: The utilization of physical resources in rural and urban schools does not significantly differ.

Table 6: Independent Samples t-Test for Utilization of Physical Resources Between Rural and Urban Schools

Group	Mean Rating for Utilization of Physical Resources	Standard Deviation (SD)	t-value	p-value
Rural school	2.85	0.80	2.01	0.05
Urban school	3.20	0.65		

Source: Authors Computation 2024

The t-test examines if the utilization of physical resources in rural and urban schools significantly differ. A p-value of 0.05 indicates that the utilization of physical resources in rural and urban schools significantly differ.

Hypothesis 3: The adequacy of physical resources and teaching and learning outcomes do not significantly relate.

Table 7: Correlation between Adequacy of Physical Resources and Teaching and Learning Outcomes

Variable	Mean Rating for Adequacy of Physical Resources	Mean Rating for Teaching and Learning Outcomes	Correlation Coefficient (r)	p-value
Adequacy of Physical Resources	3.00	3.50	0.70	0.0002

Source: Authors Computation 2024

The correlation analysis examines the relationship between the adequacy of physical resources and teaching and learning outcomes. A positive correlation coefficient ($r = 0.70$) with a p-value of 0.0002 suggests a significant positive relationship, meaning that better physical resources are associated with improved teaching and learning outcomes.

Discussion

Finding revealed that physical resources are not adequate in Delta state public secondary schools. The inadequacy of physical resources in Delta State's public secondary schools can be attributed to insufficient funding from the government, poor maintenance of existing facilities, increasing student population without corresponding expansion of infrastructure, and possible mismanagement of allocated resources. These factors collectively contribute to a shortfall in essential physical resources needed for effective education delivery. This finding aligns with Odeajo and Odefadehan [11] who found severe inadequacies in physical facilities across Nigerian public schools. Similarly, Asiyai's [12] study in Delta State reported that 78% of public schools lack basic physical infrastructure. However, Akanni et al., [13] found some improvements in physical resource availability in certain regions of Delta State, though still below standards. Anokye et al., [14] partially disagreed, noting that while some resources were inadequate, others met basic requirements. The research on physical facilities and resource adequacy in Delta State educational institutions has shown consistent patterns.

Finding revealed that physical resources are not adequate in urban and rural schools. However, hypothesis tested indicated that adequacy of physical resources in rural and urban schools significantly differ. The disparity in physical resource adequacy between urban and rural schools' likely stems from urban areas receiving more attention and funding due to their higher population density and greater political influence. Rural schools often face challenges of remoteness, lower funding allocation, difficulties in attracting investment, and logistical challenges in resource distribution, leading to significantly different resource levels compared to their urban counterparts. This finding supports Okoi and Omini [15] research which documented significant disparities between urban and rural schools' physical resources. Alokan and Arijesuyo [16] similarly found a significant resource gap between urban and rural schools. However, Wang et al., [17] argued that the disparity is narrowing due to recent rural development initiatives. Wood, [18] presented contrasting evidence suggesting that some rural schools were better equipped than their urban counterparts due to community support.

Finding revealed that available physical resources are effectively utilized in public secondary schools. However, the hypothesis tested indicated that the utilization of physical resources in rural and urban schools significantly differ. The effective utilization of available physical resources despite their inadequacy suggests that teachers and school administrators have developed adaptive strategies to maximize the use of limited resources. However, the significant difference in resource utilization between rural and urban schools might be due to factors such as varying levels of teacher training, different management approaches, disparate maintenance capabilities, and distinct local needs and challenges in these settings. The finding on effective resource utilization despite inadequacy corresponds with Ibi and Igbudu, [19] study showing innovative resource management in schools. Akinfolarin [20] also found similar patterns of adaptive resource utilization. However, Idehen et al., [21] disagreed, reporting significant underutilization of available resources. Okafor and Aruoture [22] found mixed results, with effective utilization in some areas but poor usage in others.

Finding revealed that adequacy and use of resources have an impact on teaching and learning outcomes in schools. the hypothesis tested indicated significant positive relationship, meaning that better physical resources are associated with improved teaching and learning outcomes. The positive relationship between physical resources and learning outcomes can be explained by several factors: adequate facilities enable practical demonstrations and hands-on learning experiences, proper infrastructure creates a conducive learning environment, well-equipped classrooms support diverse teaching methods, and sufficient resources reduce the time and effort spent improvising, allowing teachers and students to focus more on actual learning activities. This direct correlation emphasizes how physical resources serve as essential tools for effective teaching and learning processes. This finding strongly aligns with Tunde [23] who established a significant correlation between physical resources and academic performance. Likewise, Ngezack et al., [24] found that schools with better physical resources showed moderate higher academic achievement. Nkedishu, et al., [25] found a significant relationship between physical facilities and academic staff productivity, supporting our findings about resource impact on teaching outcomes. Scherrer et al., [26] found that students achievement score was related to school facilities. However, Umeh, and Hamzah [27] argued that teacher quality had more impact than physical resources on learning outcomes. Additionally, Nkedishu [28] established that physical school surroundings significantly affect teachers' job satisfaction in public secondary schools, aligning with the findings on how resource adequacy impacts teaching effectiveness.

Conclusion

Based on these findings, it can be concluded that while public secondary schools in Delta State face significant challenges with the adequacy of physical resources across both urban and rural locations, school staff have

demonstrated resilience in effectively utilizing the available resources. However, the marked disparities between urban and rural schools in both resource adequacy and utilization patterns suggest an inequitable educational balance that requires urgent attention. The strong positive correlation between physical resources and learning outcomes highlights the critical importance of addressing these resource inadequacies and disparities, as they directly impact educational quality and student achievement. Therefore, there is a pressing need for policymakers and educational stakeholders to implement comprehensive strategies that will bridge the resource gap between urban and rural schools, enhance overall resource adequacy, and support effective resource utilization to improve teaching and learning outcomes across all public secondary schools in Delta State.

Control of Methodological Rigor and bias

The deliberate mitigation of bias that is used during the process of conducting the study enhances the conclusions made in this study. Through the multistage sampling method we were able to have a representative sample of 588 teachers that represents the different educational system of Delta State, in both urban and rural settings without overrepresenting more convenient locations. The two different tools used in triangulation of data the validated AURTLOQ questionnaire and the WAEC-based checklist enabled us to triangulate and minimized the impact of single-source bias. Our instruments had high reliability (0.81) and expert validation, which guaranteed reliable and consistent measurements of all respondents. In addition, we have used a mixed method of analysis consisting of descriptive statistics and strong inferential tests such as the Kolmogorov-Smirnov test that does not assume any normality, which makes our statistical inferences more acceptable. This anonymity of respondents reduced the influence of social desirability which encouraged the truthful evaluation of the adequacy and use of resources. Presentation of data in the form of charts and histograms also created extra layers of verification, enabling patterns to be naturally formed instead of being formed as a result of prediction.

Recommendations

Here are four main recommendations:

1. The government should start a fund to improve physical resources in public secondary schools in Delta State, focusing on the schools that need help the most. Regular checks should be done to ensure the funds are being used properly for building and maintenance.
2. Education officials need to create a fair plan for distributing resources that addresses the gap between urban and rural schools. This plan should provide extra support for rural schools and set basic standards that all schools must meet.
3. The Ministry of Education should implement training for school leaders and teachers on managing and using resources well. This could include workshops, sharing success stories, and creating guidelines that fit both urban and rural environments.
4. There should be collaboration among the government, businesses, and local communities to improve and maintain resources in public schools. This means partnering with private companies, involving the community in resource management, and ensuring a solid plan for keeping everything in good shape for learning.

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Conflict of Interest Declaration

The authors declare that they have no competing interests that could inappropriately influence the research presented in this manuscript. Specifically:

1. No financial relationships with organizations that might have an interest in the submitted work.
2. No other relationships or activities that could appear to have influenced the submitted work.
3. No personal, professional, or financial relationships that could potentially bias this research.
4. All authors have contributed significantly to the conception, design, analysis, and writing of this manuscript.

5. The research was conducted independently without external influence from any organization that could benefit from the study outcomes.

All authors have read and approved the final manuscript and confirm that this declaration accurately reflects their circumstances.

Ethical Approval

The Ethical Committee of the Department of Educational Management and Foundations, Faculty of Education, Delta State University, Abraka, Nigeria, approved this study on July 22nd, 2024, with Ref. No. DEL/FOE/EMF/0130.

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