Availability and Use of Instructional Materials for Effective Implementation of the Basic Science and Technology Curriculum in Upper Basic Schools in North Central Nigeria

Nascartin Ambdor*

Department of Science and Environmental Education, Faculty of Education, University of Abuja, Abuja, Nigeria

*Corresponding author: Nascartin Ambdor, vitroxsky@gmail.com

Abstract

This study investigates the availability and utilization of instructional materials for the effective implementation of the Basic Science and Technology (BST) curriculum in upper basic schools in North Central Nigeria. The research adopts a descriptive survey design to assess the extent to which instructional resources-such as laboratory equipment, charts, models, and ICT tools-are provided and effectively used by teachers in classroom instruction. Data was collected from a representative sample of teachers and school administrators using questionnaires and observation checklists. Findings revealed that while instructional materials are generally recognized as essential to achieving curriculum objectives, many schools experience inadequate supply and poor maintenance of resources. Teachers often rely on improvised materials due to insufficient funding and lack of government support. Furthermore, the study found a significant relationship between the availability and effective use of instructional materials and students' learning outcomes in Basic Science and Technology. It concludes that improving the provision, accessibility, and proper utilization of instructional resources is critical to enhancing teaching effectiveness and achieving curriculum goals. The study recommends that education authorities should prioritize budgetary allocations, continuous teacher training, and regular supervision to ensure optimal curriculum implementation.

Keywords

Instructional Materials, Basic Science and Technology, Curriculum Implementation, Teaching Resources, Upper Basic Schools, North Central Nigeria, Educational Effectiveness, Teacher Utilization

1. Introduction

The Basic Science and Technology (BST) curriculum is a foundational subject offered in Junior Secondary Schools (JSS 1-3). It is designed to foster scientific literacy, stimulate scientific interest, and prepare students for further education and societal needs via inquiry-based and intense learning methods. The Federal Republic of Nigeria in it is National Policy on Education (2013) said that the BST curriculum is designed to foster an understanding of scientific principles, introduce manipulative and problem-solving abilities, and prepare individuals for career opportunities in science and technology.

The Basic Science and Technology emphasizes four components: Basic Science, Basic Technology, Physical and Health Education, and Information and Communication Technology. These aspects are interconnected as they are instructed to participate in an extensive understanding of scientific principles [1]. The materials used in the actual execution of the curriculum include the relative accessibility and effective application of educational resources such as charts, models, scientific kits, multimedia, and locally adapted materials. The materials facilitate the simplification of complex ideas, augment learner engagement, and improve information retention.[2]

Despite curricular requirements, obstacles persist in implementing Basic Science Technology in upper basic schools due to insufficient instructional materials across various educational institutions of learning. Studies have indicated that urban schools are more prone to have access to instructional materials and functional scientific laboratories compared to their rural counterparts[3] revealed that students exhibited enhanced engagement and improved academic achievement in science-related courses when instructional materials are available and effectively used. This article assessed the availability and utilisation of instructional materials for the implementation of the Basic Science and Technology curriculum in upper basic schools in North Central Nigeria.

2. Statement of the Problem

Instructional tools facilitate student learning, foster creativity, enhance information retention, and integrate the Basic Science and Technology (BST) curriculum. Nevertheless, empirical data indicate that some Nigerian junior secondary schools either lack these resources or use them inadequately. Students in rural schools are unable to acquire scientific thinking and abilities due to the predominance of oral instruction [4]. This has adversely affected the motivation, attitudes, and performance of Basic Science students.

Studies indicate that educational institutions in different regions use instructional resources inequitably. While students in well-resourced schools are more inclined to excel others face challenges in inadequately equipped institutions. [5] Discovered that urban schools had more resources than their rural counterparts, while Nwankwo, Olumese, and Eze observed that rural educators lack laboratory facilities and instructional aids, leading to inadequate curriculum execution. Dahunsi discovered that students with sufficient educational resources exhibited more engagement and retained more material compared to their peers without these tools.[6]

Comprehensive research has not been conducted to investigate the availability and use of instructional resources for implementing the BST curriculum in upper basic schools in North Central Nigeria.

3. Purpose of the Study

The purpose of this study was to determine the availability and use of instructional materials for the implementation of the Basic Science and Technology curriculum in upper basic Schools in North-Central, Nigeria. Specifically, the objectives of the study were to;

i. Find out the common instructional materials available for implementation of Basic Science and Technology curriculum in Upper Basic Schools based on location;
ii. Ascertain the difference in the level of utilization of instructional materials for implementation of Basic Science and Technology curriculum in Upper Basic Schools based on location.

Research Questions

1.What are the common instructional materials available for implementation of Basic Science and Technology curriculum by teachers in Upper Basic Schools based location?
2.What is the difference in the level of utilization of instructional materials for implementation of Basic Science and Technology curriculum in Upper Basic Schools based location?

Ho_1: There is no significant difference in the mean responses of Basic Science and Technology teachers regarding the common instructional materials available for the implementation of Basic Science and Technology in Upper Basic Schools in North central Nigeria based on location.[7]

4. Methodology

This study employed descriptive survey research design. Descriptive survey according to Nwogu (2015), refers to a design in which a group of people or items are studied by collecting and analyzing data from few people or items considered to be representative of the entire population. The population of this study was 4, 026 Basic Science and Technology teachers in public Upper Basic Schools in North Central Nigeria. A Sample size of three hundred and eighty-six (386) respondents formed the sample of this study. Multi stage sampling procedure was adopted in selection of the sample size.[8] The instrument used for data collection was a questionnaire designed by researcher titled: Availability and use of instructional materials for implementation of basic science and technology curriculum. The instrument was divided into two (2) sections, A and B. Section A sought information on personal data of Basic Science and Technology teachers such as location and educational qualification, while section B consists of check list comprising 37 items on availability and use of Instructional materials for Implementing Basic Science and Technology curriculum. The check list was arranging Available(A), Not Available (NA) for availability, while for utilization it was Highly Utilized (HU), Moderately Utilized (MU), Rarely Utilized (RU), Not Utilized (NU).[9] The instrument was validated by three experts to check face and content validity, one expert was from Department of Science and Environmental Education, University of Abuja, one from Department of Science and Technology Education, Federal University of Technology Minna and experienced Basic Science and Technology teacher from Federal Capital Territory Universal Basic Education Board. The experts' corrections and suggestions were used in the final production of the instrument. To determine the reliability of the instrument, a pilot test was carried out using thirty (30) Basic Science Teachers in the schools that had similar characteristics with the sample of this study. The reliability of the instrument was determined using internal consistency method and Cronbach Alpha statistics which yielded reliability index of 0.89. this shows that the instrument was reliable.[10]

The data for this study were collected by administering the questionnaire by the researcher, and research assistants to the respondents to fill and return on the spot to avoid loss of the questionnaire. The data collected were analyzed using both descriptive and inferential statistics. Frequency count and percentage were used to analyse bio- data of respondents, mean and standard deviation was used to answer the research questions while for the inferential statistics, the null hypotheses were tested using independent Mann-Whitney U test statistics at 0.05 significant level. [11]

5. Results

The data collected from the study were analyzed and presented in the tables as follows:

Research Question One: What are the common instructional materials available for implementation of Basic Science and Technology curriculum by Basic Science and Technology teachers in Upper Basic Schools based location?

Table 1. Mean and standard deviation on common instructional materials available for implementation of basic science and technology curriculum based on location N=386.

S/N	Instructional Resources	Urban N=231			Rural N=55		
		F	%	DEC	F	%	DEC
1	Basic science laboratory	145	62.7	A	86	55.4	A
2	Battery	30	12.9	NA	16	10.3	NA
3	Cartoon	17	7.36	NA	12	7.74	NA
4	Chalkboard/Whiteboard	231	100	A	155	100	A
5	Charts	221	95.6	A	140	90.3	A
6	Computer	171	74.03	A	96	61.9	A
7	Connecting wires	205	88.7	A	92	59.4	A
8	Dissecting board	229	99.3	A	113	72.9	A
9	Evaporating dish	163	70.6	A	46	29.7	NA
10	Evaporating flask	43	18.6	NA	7	4.51	NA
11	Films	53	22.9	A	5	3.2	NA
12	Filter papers	48	20.7	NA	13	8.3	NA
13	Flannel Board	51	22.1	A	6	3.8	NA
14	Gear	49	21.2	NA	9	5.8	NA
15	Indicators	123	53.2	A	31.	20.7	NA
16	Laboratory Apparatus such beaker	122	52.8	A	31	20.1	NA
17	Magnifier	44	19.0	NA	10.	6.4	NA
18	Meter rule	98	42.4	NA	14	1.03	NA
19	Microscope	68	29.4	NA	16	10.3	NA
20	Mock-up	76	32.9	NA	14	9.03	NA
21	Models	127	54.9	A	14	9.03	NA
22	Pictures	108	46.7	NA	24	15.4	NA
23	Posters	135	58.4	A	40	25.8	NA
24	**Projector**	178	77.0	A	11	7.1	NA
25	Pulleys	127	54.9	A	11	7.1	NA
26	Real Objects	136	58.8	A	88	56.7	A
27	Retort stand and clamp	35	15.2	NA	12	7.7	NA
28	Safety goggles	78	33.7	NA	16	10.3	NA
29	Screw drivers	203	87.8	A	136	87.7	A
30	Soil samples	202	87.4	A	106	68.3	A
31	Spatula	200	86.5	A	139	89.6	A
32	Specimen ofcrude oil	198	85.7	A	128	82.5	A
33	Spring balance	195	84.4	A	112	78.7	A
34	Stop watches	90	38.9	NA	18	11.6	NA
35	Stoves	94	38.9	NA	18	11.6	NA
36	Textbooks	172	74.5	A	98	63.2	A
37	Thermometers	172	74.5	A	98	63.2	A
38	Wire gauge	140	60.6	A	17	10.9	NA

Key: F= Frequency, %= Percentage, N = Number of Respondents, A= available and NA = not available

The analysis on table 2 indicated that out of 38 instructional materials listed urban schools had a greater number of instructional materials, with 31 of the materials have percentage scores above the benchmark of 50% marked as available. In contrast, rural schools had only 22 instructional materials marked available, indicating a significant difference in resource access based on location while 14 items were found to be available in both schools. Therefore, the common instructional materials available for implementing Basic Science and Technology curriculum in upper basic schools in urban and rural locations were basic science laboratory, chalkboard or whiteboard, charts, computer, connecting wires, dissecting board, real objects, screwdrivers, soil samples, spatula, specimen of crude oil, spring balance, textbooks, and thermometers.

Research Question Two: What is the difference in the level of utilization of instructional materials for implementation of Basic Science and Technology curriculum in Upper Basic Schools based location?

Table 2. Mean and standard deviation on level of utilization of instructional materials for implementation of basic science and technology curriculum based on location N=386.

S/N	Instructional Resources	Urban N= 231			Rural N= 155		
		Mean	STD	Dec	Mean	STD	Dec
1	Basic science laboratory	2.05	0.22	RU	1.93	0.24	RU
2	Battery	2.04	0.22	RU	1.32	0.47	RU
3	Cartoon	1.85	0.35	RU	1.47	0.51	RU
4	Chalkboard/Whiteboard	3.94	0.39	AU	3.63	0.49	AU
5	Charts	3.03	0.26	MU	3.01	0.11	MU
6	Computer	2.04	0.21	RU	2.32	0.51	RU
7	Connecting wires	2.16	0.37	RU	2.06	0.24	RU
8	Dissecting board	2.09	0.29	RU	2.10	0.57	RU
9	Evaporating dish	2.07	0.26	RU	2.50	0.50	MU
10	Evaporating flask	2.07	0.27	RU	2.50	0.50	MU
11	Films	1.09	0.42	RU	1.72	0.88	RU
12	Filter papers	2.04	0.21	RU	2.28	0.45	RU
13	Flannel Board	2.94	0.24	MU	2.78	0.41	MU
14	Gears	2.04	0.21	RU	2.21	0.41	RU
15	Indicators	2.02	0.11	RU	2.30	0.46	RU
16	Laboratory Apparatus such beaker	2.04	0.21	RU	2.00	0.12	RU
17	Magnifier	1.99	0.06	RU	2.71	0.95	MU
18	Meter rule	2.95	0.21	MU	3.04	0.75	MU
19	Microscope	1.14	0.64	RU	1.71	0.53	RU
20	Mock-up	1.04	0.21	RU	1.82	0.75	RU
21	Models	2.38	0.68	RU	2.21	0.11	RU
22	Pictures	2.96	0.18	MU	2.43	0.49	RU
23	Posters	2.94	0.25	MU	2.43	0.49	RU
24	**Projector**	1.97	0.32	RU	1.81	0.58	RU
25	Pulleys	2.04	0.30	RU	1.44	0.60	RU
26	Real Objects	2.98	0.18	MU	2.59	0.49	MU
27	Retort stand and clamp	2.89	0.44	MU	2.47	0.50	RU
28	Safety google	2.88	0.46	RU	3.01	0.01	MU
29	Screw driver	1.99	0.09	MU	2.56	0.49	MU
30	Soil sample	2.99	0.13	RU	3.00	0.11	MU
31	Spatula	2.04	0.22	MU	2.01	0.13	RU
32	Specimen of crude oil	2.96	0.26	RU	3.12	0.12	MU
33	Spring balance	1.99	0.06	MU	2.10	0.31	RU
34	Stop watch	2.04	0.22	RU	2.56	0.49	MU
35	Stove	3.93	0.28	RU	3.32	0.79	MU
36	Textbooks	2.12	0.40	MU	2.22	0.44	RU
37	Thermometer	1.77	0.41	RU	1.56	0.49	RU
38	Wire gauge	2.05	0.22	RU	1.93	0.24	RU
	Sectional Mean	**2.30**	**0.27**	**RU**	**2.31**	**0.43**	**RU**

The analysis on table 4 indicated that urban Basic Science and Technology teachers had a mean score of 2.30 with standard deviation of 0.27 while rural Basic Science and Technology teachers had a sectional mean score of 2.31 with standard deviation of 0.43 based on the acceptance limit of 2.50 mid-point on a 4-point rating scale. The result indicates that urban and rural Basic Science and Technology teachers did not differ in their level of utilization of instructional materials for implementation of Basic Science and Technology curriculum in North Central Nigeria.

Ho_1: There is no significant difference in the mean responses of Basic Science and Technology teachers regarding the common instructional materials available for the implementation of Basic Science and Technology in Upper Basic Schools in North central Nigeria based on location.

Table 3. Summary of mann whitney U test analysis results analysis on availability of instructional material based on location.

Location	N	Mean Rank	Sum of Rank	Z	P	Remark
Urban	155	181.64	28154.2	-1.714	0.086	Not significant
Rural	231	201.46	46537.26			

The result from the analysis on table 4, revealed that the mean rank scores were 181.64 and 201.46 for urban and rural Basic Science teachers respectively. Furthermore, the sum of mean ranks scores were 2154.2 and 46537.26 for urban and rural Basic Science teachers respectively. Also the significant p-value of 0.086 was greater than 0.05 level of significance. As a result, the first hypothesis was accepted. This show that there is no significant difference in the response of urban and rural Basic Science and Technology teachers on available instructional materials for the implementation of BST in Upper Basic Schools.

Ho_2: There is no significant difference between the mean response of Basic Science and Technology teachers regarding the level utilization of instructional materials for the implementation n Upper Basic Schools in North central Nigeria based on location.

Table 4. Summary of mann whitney U test analysis on utilization of instructional materials based on location.

Location	N	Mean Rank	Sum of Rank	Z	P	Remark
Urban	231	188.10	43451.1	0.235	1.187	Not Significant
Rural	155	201.55	31240.25			

The result from the analysis on table 4, revealed that the mean rank scores were 188.10 and 201.55 for urban and rural Basic Science teachers respectively. Furthermore, the sum of mean ranks score were 43451.1 and 31240.25 for urban and rural Basic Science teachers respectively. Also the significant p-value of 1.187 was greater than 0.05 level of significance. As a result, the second hypothesis was accepted. This show that there is no significant difference in the response of urban and rural Basic Science and Technology teachers on utilization of instructional materials for the implementation of Basic Science and Technology in Upper Basic Schools based on location.

Discussion of Findings

The research found out that most of the instructional materials required for successful implementation of the Basic Science and Technology (BST) curriculum in Upper Basic Schools are not available. The research finding further showed that the instructional materials like chalk boards, charts, science kits and simple laboratory equipment are usually found in both urban and rural schools, and there was no major report between the teacher reactions according to the location. The result of this finding is consistent with the report, who found that simple instructional aids, such as charts and chalkboards, are very are widely available due to government standardization efforts in public schools and also corroborate that actual objects, mere science apparatus, and invented materials are normally ventured in the course of school formation to aid science teaching. On the same note, that such materials as charts and models are among the basic supplies in the process of the science curriculum learning.

It was also found that instructional materials are not very much utilized in the implementation of the BST curriculum and that there is significant difference in the response of the teachers according to location where the urban teachers indicating that they used instructional materials more frequently. This supports the results of who have indicated that in urban schools, there are higher chances of having sufficient instructional resources as compared to rural schools. Similarly, affirmed that urban teachers have the advantage of enjoying better infrastructure that enables the utilization of teaching resources and more innovative approaches.

6. Conclusion

Based on the findings of the study, it was concluded that instructional materials required for effective implementation of Basic Science and Technology in upper basic schools in North Central Nigeria are available while others are not. The findings further stated the available instructional materials are not always utilized for the teaching and learning of Basic Science and Technology in upper Basic Schools in North Central, Nigeria

7. Recommendations

1.School administrators should ensure equal access to teaching resources and ongoing professional development to meet the needs of both urban and rural teachers in delivering the curriculum

2.The school administrators should supervise and assess Basic Science and Technology Teachers teaching in all schools in order to ensure adequate resources were utilize for effective Basic Science and Technology curriculum implementation.

References

[1] Esther Njiro. Community of Inquiry and Its Application for Distance Education. (2015). Journal of Educational and Social Research, 5(1), 123. https://doi.org/10.5901/jesr.2015.v5n1p123

[2] Sevda Budak, Jenelle Reeves. How Teachers Enhance Reading by Blending in Grammar https://doi.org/10.7176/JEP/10-15-04

[3] Barau, B., Abdulhameed, A., Ezra, A., Muhammad, M., Kyari, E., & Bawa, U. (2018). Heavy metal contamination of some vegetables from pesticides and the potential health risk in Bauchi, northern Nigeria. AFRREV STECH: An International Journal of Science and Technology, 7(1), 1–11. https://doi.org/10.4314/stech.v7i1.1

[4] Addaratul Hasanah, Rizabuana Ismail, Nurman Achmad, Sismudjito ., and Ria Manurung. 2020. "Interaction Patterns Among International Class Students and Regular Class Students in Yayasan Pendidikan Shafiyyatul Amaliyyah Medan, Indonesia". Journal of Education, Society and Behavioural Science 32 (4):1–7. https://doi.org/10.9734/jesbs/2019/v32i430189.

[5] Reima Al-Jarf. 2021. "Enhancing EFL Freshman Students' Reading Skills With Inspirational Quotes". Asian Research Journal of Arts & Social Sciences 13 (4):1–11. https://doi.org/10.9734/arjass/2021/v13i430219.

[6] Anderman, E. M. (2002). School effects on psychological outcomes during adolescence. Journal of Educational Psychology, 94(4), 795–809. https://doi.org/10.1037/0022-0663.94.4.795

[7] Smith, M.E. · Coffin, A.B. · Miller, D.L. ...Anatomical and functional recovery of the goldfish (Carassius auratus) ear following noise exposure J. Exp. Biol. 2006; 209:4193-4202

[8] U-Sayee, C. R. and Adomako, E. B. (2021). Supervision practices and challenges of high school principals in the Greater Monrovia area of Liberia: Implications for quality education. Heliyon, 7(4), article e06895. https://doi.org/10.1016/j.heliyon.2021.e06895

[9] Tiamwatt, J. M. . "Intensive School-Based Instructional Supervision (ISBIS) Influences Academic Teaching Performance". International Journal of Membrane Science and Technology, vol. 10, no. 2, June 2023, pp. 149-54, doi:10.15379/ijmst.v10i2.1177.

[10] James Sebastian, Elaine Allensworth, Wolfgang Wiedermann, Craig Hochbein & Matthew Cunningham (2018): Principal Leadership and School Performance: An Examination of Instructional Leadership and Organizational Management, Leadership and Policy in Schools, DOI: 10.1080/15700763.2018.1513151

[11] Stephent, O., (2018). The Effects of instructional supervision of master teacher to organizational performance of teachers: A reflection. Press Reader. https://tinyurl.com/577vabsz