



# Perceived Effects of Environmental Factors on Teaching and Learning of Basic Science and Technology in Benue State, Nigeria

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## Abstract

This study was carried out to assess perceived effects of environmental factors on teaching and learning of basic science and technology in Benue State, Nigeria. Descriptive survey research design was adopted in this study to collect and analysed data from the sample of the study. The population of the study was 3,765 Basic Science and Technology teachers selected from 1,824 secondary schools. The sample of the study was 165 drawn from 49 secondary schools through simple random sampling technique using balloting system. The researchers constructed instrument entitled Environmental Factors Assessment Questionnaire (EFAQ), was used for data collection. The instrument was validated by three experts. Split-half method of reliability was used to obtain a reliability coefficient of 0.85. Mean and standard deviation were used to answer the research questions and null hypotheses were tested at 0.05 level of significance using t-test statistical tool to determined significant mean difference among the respondents. The study reveals significant difference between mean responses among respondents on the environmental factors affecting teaching and learning of Basic Science and Technology and techniques to improve environmental quality for the effective teaching and learning of Basic Science and Technology respectively. Conclusion was drawn based on the 95.5% agreement of the respondents on the perceived effects of environmental factors on teaching and learning that; environmental factors negatively affect teaching and learning of Basic Science and Technology and 100% agreement of rural and urban respondents indicated that when these environmental factors are properly checked will improve students' attitude and achievement in science and technology. Recommendation was that teachers and educational stakeholders should ensure good quality school environment for effective teaching and learning.

**Keywords:** Environmental factors, Teaching, Learning, Basic Science and Technology.

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## INTRODUCTION

Basic Science and Technology is the prerequisite subject for students' achievement in pure science subjects like Physics, Chemistry and Biology at senior secondary school level (Nigerian Educational Research and Development Council (NERDC2012). Studying Basic Science and Technology gives students knowledge and training in the scientific and technological methods. This knowledge and training will help students to become scientists and technologist in the fields of science and technology. This means that Basic Science and Technology is the most viable tool for providing students with strong and solid foundation in science and technology to pursue science-technology-related courses in tertiary institutions that are important ingredients for development of the nation. Samuel (2017) posits that for Nigeria to attain desirable development students must be well-grounded in Basic Science and Technology subject at the Basic Educational level. Mohammed and Mukhtar (2016) maintain that for students to acquire meaningful scientific knowledge and skills at the Basic Educational level for sustainable achievement in pure science subjects, schools as matter of fact must be designed to ensure that students are provided with a qualitative and harmonious environment where they can learn and thrive.

Environment consist natural, social and the constructed world which include biotic and abiotic factors. School environmental factors on the other hand may be defined as the totality of all the surrounding and activities that go on in school. This shows that school environmental factors include classrooms, libraries, technical workshops, laboratories, quality teachers, school management, teaching methods, school location, school climate, students' background, lighting, physical structures, temperature, and instructional facilities as well as adequate supervision and monitoring of all the activities that go on in the schools. For teachers to make these environmental factors conducive for the academic growth and development of scientific and technological knowledge and skills of the students they need knowledge of environmental education. The function of environmental education is to help teachers to go beyond been aware of environmental factors affecting teaching and learning but to be action orientated in improving environmental qualities for effective teaching and learning (Kola-Olusanya, 2005).

Environmental education according to Yoloye (1981) as cited in Kola-Olusanya, (2005) has three basic concepts which include: (a) education from environment; (b) education about the environment; and (c) education for the environment. The author maintains that education from the environment is regarded as the application of all human senses to learn from the environment and what affect environmental qualities for effective teaching and learning of science and technology. Education about the environment centres on acquiring the quantitative and qualitative body of knowledge about the environment. Education from the environment is the situation in which education is focused on the need to promote personal responsibility of the teachers on how to improve the quality of school environment for the effective teaching and learning. The functional goal of environmental education is to provide a rich diversity of options, in which teachers and learners can choose the most significant alternatives to improve the environmental quality for effective teaching and learning (Kola-Olusanya, 2005).

Researchers like Ogundukun and Adeyemo (2010), Atadogu and Lakpini (2013), Adejoh, and Ekele (2014) and Ukeme (2017) observe that the persistent students' poor achievement in science subjects' year in year out is attributed to many external and internal factors ranging from culture/superstitious beliefs to teaching methods including environmental factors. The environmental, social and economic problems in the classroom are becoming increasingly more complex and the ability of teachers and school administrators to handle them is multifaceted and interdisciplinary (Farmer, Knapp, &

Benton, 2007). Many research works have been carried out to address the issue of poor students achievement in science and technology, however most of these works are in the other areas like teaching method, motivation, attitude, little have been done on environmental factors. This prompted the researchers to carry out this study to assess the effects of environmental factors on teaching and learning of Basic Science and Technology in Benue State.

The major challenge faced by the science teachers, stakeholders in education and school administrators today is to provide students with adequate environmental quality for effective teaching and learning. School environmental quality is a harmonious environment with healthy and beautiful attributes to improve teaching and learning for students to acquire scientific and technological knowledge, understanding, skills and attitudes necessary to become life-long learners, (Olawaju, Agusiobo & Vowa, 2006). A harmonious school environment is clean, free from flood and bad odour, well ventilated with adequate supply of light, the air and water are not polluted, the temperature is moderate, and the grass around is properly maintained and has adequate instructional and learning facilities as well as adequate quality personnel (Amoo 2004). A harmonious school environment can play significant roles in teaching and learning of science and technology.

Classroom environments are crucial part of teaching and learning in school; this is because meaningful learning hardly takes place without a classroom. This means that most of the teaching and learning process takes place in the classroom as such meaningful learning will rarely take place without a healthy classroom environment. According to United Nations Educational Scientific and Cultural Organisation (UNESCO, 2000) a healthy class size should not exceed 35 students.

Unfortunately, observation has shown that classroom accommodations in most of Nigerian schools are grossly inadequate due to the large number of students' enrolment in schools. This resulted into overcrowded classrooms because classes originally designed for only 30 or 40 students in most cases and chairs are not enough as such students found sharing chairs, sanding up or sitting on the floor or windows to receive lesson. When students are overcrowded in a class it affects teaching and learning as well as classroom management processes a situation that generally militates against effective teaching and intellectual development of the students in science and technology. In the same vein inadequate supply of classrooms accommodation, libraries and laboratories facilities in most Nigerian secondary schools lead to decline in students' attitudes and academic achievement in science and technology (Adejoh & Ekele, 2014).

Another environmental factor probably might be affecting teaching and learning is school location. School location as environmental factor is the demographic area or place where schools are situated. School location may influence students' attitudes and academic achievement. This is because in a situation whereby the school is situated in a swampy area where classrooms are over flooded with water or noisy area like in the heart of the city or town, near construction sites or near industries/factories where activities disrupting the teaching-learning process is much; students cannot concentrate and do well academically. This prompted the researchers to investigated perception of rural and urban teachers on the perceived effects of environmental factors on teaching and learning of Basic Science and Technology.

School environmental factors are multidimensional and influence students' attitudes and achievement in science and technology. Important as school environmental factor is for the effective teaching and learning of science and technology, it has not been given adequate attention and consideration by educational researchers, government, educational stakeholders and science educators over the years. This necessitated the researchers to carry out this study

to determine effects of environmental factors on teaching and learning of Basic Science and Technology.

### **Statement of the Problem**

Basic Science and Technology if taught in good classroom environment it will serve as a viable tool for providing students with strong and solid foundation in science and technology. Literature have shown that for students to acquire meaningful scientific and technological knowledge and skills at the Basic Educational level for sustainable achievement in pure sciences, schools must be well designed to ensure that students are provided with a harmonious school environment where they can interact and learn scientific and technological concepts. Unfortunately, literature review showed that school environmental factors have not been given adequate attention and consideration by educational researchers, government, stakeholders in education and school administrators over the years. The resultant effect of this is the persistent poor achievement of students in science and technology, since Basic Science and Technology is the predictor for students' achievement in science and technology. This situation prompted the researchers to carry out this study to assess effects of environmental factors on teaching and learning of Basic Science and Technology (BST) in Benue State.

### **Purpose of the Study**

The main purpose of this study was to assess the perceived effects of environmental factors on teaching and learning of Basic Science and Technology in Benue state, Nigeria. Specifically the study focused on the:

- Perceived environmental factors affecting teaching and learning of BST.
- Effectiveness of the perceived techniques that would improve environmental quality for effective teaching and learning of BST.

### **Research Questions**

The following research questions were formulated to guide the study:

- What are the perceived environmental factors affecting teaching and learning of BST?
- What is the effectiveness of perceived techniques to improve environmental quality for effective teaching and learning of BST?

### **Hypotheses**

These hypotheses were formulated and tested at 0.05 level significance.

- There is no significant difference between the mean responses of rural and urban teachers on the perceived environmental factors affecting teaching and learning of Basic Science Technology.
- There is no significant difference between the means responses of rural and urban teachers on the effectiveness of the perceived techniques to improve environmental quality for effective teaching and learning of BST.

## METHODOLOGY

Descriptive survey research design was adopted in this study to collect and analysed data from the sample of the study. The population of the study was 3,765 Basic Science and Technology (BST) teachers selected from 1,824 secondary schools. The sample of the study was 165 drawn from 49 secondary schools through simple random sampling technique using balloting system. The researchers constructed instrument entitled Environmental Factors Assessment Questionnaire (EFAQ), was used for data collection.

The instrument was divided into two parts with 40 items all together. Part one sought information on the perceived environmental factors affecting teaching and learning of Basic Science and Technology which anchored on strongly agree (SA =4 points), agree (A =3 points), Disagree (D=2 points) and strongly disagree (SD =1 point) rating scale for the positively worded items and in the reverse order for the negatively worded items. Part two on the hand sought information on the effectiveness of the perceived techniques for improving environmental quality for effective teaching and learning of BST, anchored on very effective (VE =4 points), effective (E =3 points), slightly effective (SE = 2 points) and not effective (NE =1 point) respectively.

The mean score of 2.50 and above is agreed while the mean score below 2.50 is disagreed. On the other hand mean score of 2.50 and above is consider effective while mean score below 2.50 is consider not effective.

The content and face validity of the instrument was established by three experts, one from the Department of Curriculum and Teaching Benue State University while two were from measurement and evaluation, Department of Educational Foundations and General Studies, Federal University of Agriculture Makurdi. The experts certified that the items of the instrument adequately measured the variable of the study. Split-half method of reliability was used to obtain a reliability coefficient of 0.85. Mean and standard deviation were used to answer the research questions and null hypotheses were tested at 0.05 level of significance. While t-test was used to determine significant difference between mean scores among the respondents.

## RESULTS

### Research Question 1

What are the perceived environmental factors affecting teaching and learning of Basic Science and Technology? The means and standard deviations of the respondents on the perceived environmental factors affecting teaching and learning of BST are presented in the Table 1.

Table 1: Mean and Standard Deviation of the Respondents on the Perceived Environmental Factors Affecting Teaching and Learning of BST

STD=Standard Deviation		N=165						
S/N	Environmental Factors	Rural Teachers		Urban Teacher		Grand		Remark
		Mean	STD	Mean	STD	Mean	STD	
1	Overcrowded classroom of BST	2.73	0.85	3.33	1.05	3.03	0.95	A
2	Overloaded curriculum of BST	3.28	1.04	2.98	0.85	3.13	0.95	A
3	Inadequate instructional facilities	3.14	1.02	3.24	0.98	3.19	1.00	A
4	Poor implementation procedure	3.62	1.07	3.52	1.06	3.57	1.07	A
5	Shortage of qualified BST	3.71	1.08	3.01	0.99	3.36	1.04	A

6	Poor classroom ventilation	2.92	0.88	3.72	1.08	3.32	0.98	A
7	Poor lighting in classrooms	3.21	1.03	3.71	1.08	3.46	1.06	A
8	Marginalization of BST teachers	2.37	0.54	1.87	0.34	2.12	0.44	D
9	Bushy school environment	3.76	1.09	3.36	1.05	3.56	1.07	A
10	Dirty school environment	3.59	1.06	3.52	1.06	3.56	1.06	A
11	Lack of modern instructional materials	4.00	1.10	3.59	1.07	3.80	1.09	A
12	Work overload of BST teachers	3.58	1.07	3.18	1.01	3.38	1.04	A
13	Bad odour emanating from improper waste disposal	3.89	1.09	3.19	1.02	3.54	1.06	A
14	Open defecation and urination around classrooms	4.00	1.10	3.33	1.05	3.67	1.08	A
15	Inadequate classroom accommodation	3.18	1.02	2.98	0.85	3.08	0.94	A
16	Dilapidated school structures	3.36	1.04	3.26	1.03	3.31	1.04	A
17	Lack of toilet facilities in the school	4.00	1.10	2.54	0.76	3.27	0.93	A
18	School location	3.52	1.06	2.52	0.75	3.02	0.91	A
19	Instructional methods	2.53	0.79	3.00	0.89	2.77	0.84	A
20	Teachers-students' motivation	2.65	0.75	2.87	0.98	2.76	0.87	A
21	Culture/superstitious beliefs	3.67	1.06	3.87	1.07	3.77	1.07	A
22	Communal clashes	3.97	1.00	3.67	1.08	3.82	1.04	A
<b>Cluster Mean</b>						<b>3.30</b>	<b>0.98</b>	<b>A</b>

On the basis of Table 1, the study reveals that both rural and urban respondents agreed ninety five-point-five percent (95.5%) that the listed items (1-7 and 9-22 items) as the perceived environmental factors have been affecting effective teaching and learning of Basic Science and Technology in Benue State. The study also reveals that rural and urban respondents disagreed four-point-five percent (4.5%) that the listed item (that is item 8) as the perceived environmental factors does not affect effective teaching and learning of Basic Science and Technology.

The represented mean scores; Decision mean=2.50; 95.5% of perceived environmental factors have been affecting effective teaching and learning of Basic Science and Technology in Benue State with means ranging from 2.63-4.00 rural teachers and 2.52-3.59 urban teachers respectively. Whereas item 8 as a perceived environmental factors with means of rural and urban teachers 2.37 and 1.87 respectively was not accepted as the factor affecting effective teaching and learning of Basic Science and Technology. However the cluster mean of 3.30 with a standard deviation of 0.98 is above the mean cut-off point of 2.50 indicates the agreement of the respondents. This implies that the respondents agreed that the perceived effects of environmental factors on teaching and learning of BST are negatively affecting the teaching and learning of Basic Science and Technology in the study area.

## Hypothesis 1

There is no significant difference between the mean responses of rural and urban teachers on the perceived environmental factors affecting effective teaching and learning of Basic Science Technology. Means responses of rural and urban teachers on the perceived environmental factors affecting effective teaching and learning of BST were analysed and the result of t-test statistic is presented in Table 2.

Table 2: T-test Statistic on the Difference between Rural and Urban Teachers' Mean Responses on the Perceived Environmental Factors Affecting Effective Teaching and Learning of BST

Respondents	N	Mean	STD	df	t-calculated	t-critical	Remark
Rural Teachers	75	59.87	2.01	163	12.78	1.96	Significant
Urban Teachers	90	60.76	2.06				
Total	165						

The finding in Table 2 reveals that the t-calculated value was 12.78 while the t-critical value was 1.96 at p-value of 0.05. Since the t-calculated value (12.78) is greater than the t-critical value (1.96) the null hypothesis is rejected. This shows that there is a statistically significant difference between the means responses of rural and urban teachers on the perceived effect of environmental factors on teaching and learning of Basic Science and Technology.

### Research Question two

What is the effectiveness of the perceived techniques to improve environmental quality for effective teaching and learning of Basic Science and Technology? The means and standard deviations of the respondents on the effectiveness of the perceived techniques to improve environmental quality for effective teaching and learning of Basic Science and Technology are presented in the Table 3.

Table 3: Mean and Standard Deviation of the Respondents on the Effectiveness of the Perceived Techniques to Improve Environmental Quality for Effective Teaching and Learning of Basic Science and Technology

STD=Standard Deviation

N=165

S/N	Techniques to Improve Environmental Quality	Rural Teachers		Urban Teachers		Grand		Remark
		Mean	STD	Mean	STD	Mean	STD	
23	Regulation of the number of students sitting in a class	2.69	0.87	3.12	1.05	2.91	0.96	E
24	Irrelevant content of the curriculum of BST should be identified and cut off	3.45	1.06	3.09	0.85	3.27	0.96	E
25	Provision of adequate instructional facilities	3.12	1.05	3.99	0.98	3.56	1.02	E
26	Teachers should use appropriate implementation procedure	3.09	0.85	3.53	1.06	3.31	0.96	E
27	More qualified basic science and technology teachers should employed	3.99	0.98	2.51	0.98	3.27	0.98	E
28	Classroom should be constructed to allow free movement of air for good ventilation	3.53	1.06	3.31	1.08	3.42	1.07	E
29	Classrooms should be constructed to give adequate light	2.54	0.98	3.33	1.03	2.94	1.01	E
30	Regular weeding and cutting of grasses around the school environment	3.31	1.08	3.54	1.05	3.43	1.07	E
31	Constant sanitation in schools' environment	3.33	1.03	3.52	1.05	3.43	1.04	E
32	Provision of modern instructional materials	3.54	1.05	3.65	1.06	3.60	1.06	E
33	Reduction of basic science and technology teachers' work overload	3.52	1.05	3.21	1.07	3.37	1.06	E
34	Practice proper wastes disposal	3.65	1.06	4.00	1.10	3.33	1.09	E
35	Open defecation and urination around classroom should be discourage by school managements	3.21	1.07	3.20	1.06	3.21	1.07	E
36	More classroom should be built in schools to accommodate students enrolment	3.00	1.08	2.98	1.05	2.99	1.07	E
37	Constant rehabilitation of school structures	3.20	1.06	3.56	0.85	3.38	0.96	E
38	Adequate toilet facilities should be provided in the school	2.98	1.05	3.22	1.03	3.10	1.04	E
39	School should be locate far from noisy areas	3.56	0.85	3.67	1.06	3.62	0.96	E

40	Teachers should encouraged to use modern instructional methods	3.22	1.03	3.59	1.07	3.41	1.05	E
<b>Cluster Mean</b>						<b>3.31</b>	<b>0.94</b>	<b>E</b>

The finding in Table 3 shows hundred percent (100%) agreement of both rural and urban respondents on the perceived techniques to improve environmental quality for effective teaching and learning of Basic Science and Technology. The mean scores rang of the rural and urban teachers are 2.54-3.99 and 2.51-4.00 respectively. The represented mean scores; Decision mean=2.50. The Table also indicated cluster mean of 3.31 with a standard deviation of 0.94 which is above the mean cut-off point of 2.50. This implies that the perceived techniques to improve environmental quality for effective teaching and learning of Basic Science and Technology would be effective.

## Hypothesis 2

There is no significant difference between the means responses of rural and urban teachers on the effectiveness of the perceived techniques to improve environmental quality for effective teaching and learning of BST.

Mean responses of rural and urban teachers on the effectiveness of the perceived techniques perceived to improve environmental quality for effective teaching and learning of BST were analysed and the result of t-test statistic is presented in Table 4.

Table 4: T-test Statistic on Means Difference between Rural and Urban Teachers on the Effectiveness of the Perceived Techniques to Improve Environmental Quality for Effective Teaching and Learning of BST

Respondents	N	Mean	STD	df	t-calculated	t-critical	Remark
Rural Teachers	75	59.87	2.01	163	12.78	1.96	Significant
Urban Teachers	90	60.76	2.06				
Total	165						

The result from Table 4 shows that t-calculated value was 11.68 while t-critical value was 1.96 at p-value set value of 0.05. Hence t-critical value is less than t-calculated value the null hypothesis which states that there is no significant difference between the means responses of rural and urban teachers on the effectiveness of the perceived techniques to improve environmental quality for effective teaching and learning of BST is rejected. This shows that there is a significant difference between the mean responses of rural and urban teachers on effectiveness of the perceived techniques to improve environmental quality for effective teaching and learning of Basic Science and Technology.

## The Following are Summary of Major Findings

- There is a statistical significant difference between the mean responses of rural and urban teachers on the perceived environmental factors affecting teaching and learning of Basic Science
- There is a statistical significant difference between the means responses of rural and urban teachers on the effectiveness of the perceived techniques to improve environmental quality for effective teaching and learning of BST.

## DISCUSSION

The results of the analysis of data on research questions and null hypotheses are hereby discussed according to objectives. The findings in Table 1 reveals a remarkable 95.5% agreement of both rural and urban teachers that the listed perceived environmental factors were affecting teaching and learning of Basic Science and Technology with the mean ranging from 2.54-3.99. The result in Table 2 showed a statistical significant different between the mean responses of the respondents on the effects of the perceived environmental factors on teaching and learning of Basic Science and Technology.

The findings of this study agreed with that of Atadoga, and Lakpini (2013) Mohammed and Mukhtar (2016) Samuel (2017) who pointed out in their various studies that factors affecting teaching and learning of science and technology are multifaceted. They observed in their studies that for Nigeria students to acquire meaningful scientific and technological knowledge and skills at the Basic Educational level for sustainable achievement in pure science subjects, schools should be designed to ensure students are provided with a harmonious environment for the effective teaching and learning of science and technology. This result was also in line with that of Adejoh and Ekele (2014) who observed that culture and superstitious beliefs have negative effect on teaching and learning of science and technology. The finding in this study was in variant with that of Ukeme (2017) who pointed out that demographic area of schools does not influenced teaching and learning of science and technology.

The result from Table 3 reveals that respondents agreed 100% with all the items listed as perceived techniques to improve environmental quality for effective teaching and learning of Basic Science and Technology with the mean scores ranging from 2.51-4.00. The finding of this study was in-line with that Temitayo, Nayaya and Ajibola (2013) who found out that appropriate lightning and good classroom ventilation improve test scores of students, reduces off task behaviour and plays a significant role in students' achievement in science and technology. The study also agrees with Agu, and Samuel (2018) reported that quality school environment makes students feel happy and enhances their intellectual development. The authors pointed out that quality school environment includes good instructional strategies and conducive classrooms learning environment that have a potential of improving students' attitudes, interest and achievement in science and technology.

## CONCLUSION

Based on the findings of this study which showed 95.5% of both rural and urban teachers' agreement on the listed perceived environmental factors affecting teaching and learning of Basic Science and Technology and their 100% agreement on the perceived techniques to improve effective teaching and learning, the researchers concluded that:

- Environmental factors are negatively affecting teaching and learning of Basic Science and Technology in Benue State.
- If these environmental factors are properly checked teaching and learning of BST in Benue State will improve.
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## Recommendations

Based on the results of this study the recommendations was that; Seminars, conferences and workshops should be organized by government and relevant professional bodies such as Nigerian Educational Research and Development Council and Science Teachers' Association

of Nigeria to educate and sensitize science teachers on the proper way of ensuring good quality school environment for effective teaching and learning.

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