SER, VOLUME 10, NUMBER 2, JUNE 2008

SCHOOL PLANT LIGHTING, ACOUSTIC, LAYOUT AND STUDENTS' ACADEMIC PERFORMANCE IN KEBBI STATE SECONDARY SCHOOLS.NIGERIA

SANI DANTANI MANGA, Ph.D.

Department of Education
Faculty of Education and Extension Service
Usmanu Danfodiyo University, Sokoto
Dantani.sani@yahoo.com

ABSTRACT

This study ex-rayed the relationship among school plant lighting, acoustics, layout and students' academic performance in Kebbi State secondary schools. Data was generated through the use of examination results format; observation inventory and questionnaire were made up of 500 teachers, 69% of them from school. The data collected was analysed using Pearson Correlation statistics. The results obtained showed that there was a significant positive and high relationship between students' academic performance and the quality of school plant lighting, acoustics and layout respectively. It was recommended among others that school plant construction should pay greater attention to those abetment measures and that layout of school plants should be strictly based on properly drawn master plans as approved in the educational specification of the Kebbi State Ministry of Education.

Introduction

For quite some time now, there has been a global concern on the issue of school effectiveness, particularly with regard to students' academic performance. The general emphasis now is on the provision of a conducive child-friendly leaning environment as one of the basic strategies for the realization of school outcomes. To this end, provision of proper

acoustics of school plant and good layout of buildings, grounds, furniture and infrastructure is considered to be the right step in the right direction. In spite of this however, school plant constitution in Nigeria particularly at the secondary school level, seen to be haphazardly done to the extent that these basic construction factors of lighting, acoustics and layout are neglected.

However, students could experience blurry vision and headaches due to poor lighting. Poor acoustics generate unwanted noise, which could be a source of irritation and distraction. Wrong layout creates a chaotic school environment with traffic bottlenecks.

In the case of Kebbi state, the problem seems to be compounded by poor appreciation of the nature of relationship among school plant lighting, layout, acoustic and students' academic performance. This has partly contributed to the existence of a gap between theory, policy and practice of school plant construction on Kebbi State. The purpose of this study therefore was to examine the relationship among school plant lighting, acoustics, layout and students' academic performance in kebbi state secondary schools. The study attempted to find ways of improving the quality of school plant construction, such that emphasis is laid on providing good lighting, layout and acoustics in school environments.

Review of Related Literature

The review of literature was focused on students' academic performance, school plant lighting, acoustics and layout, both from national and international studies conducted on the variables.

Students' Academic Performance

Students' academic performance in Nigeria schools especially at the secondary school has become an issue of great concern not only to the government but also to the parents and even the teachers themselves. If the academic performance of students were to be used as a yardstick for government's continued assistance to schools as was noted by Fafunwa (1974) in the colonial era, many schools today would no longer exist in Nigerian's educational landscape. This is because student academic performances in Nigerian secondary schools seem to be extremely poor as was reflected in nation wide surveys conducted by Iyamu and Aduwa (2004) who founded that Nigerian students are not proficient in reading, writing, and computation skills; they exhibit very poor knowledge of subjects offered in their curriculum and are lacking in problem solving, practical and vocational skills. Bagudo (2000) submitted that secondary school students especially in Kebbi State do not only perform poorly in

WAEC examinations but that most of those who brandish brilliant NECO results are not able to defend them as is reflected in their poor performance in tertiary institutions and places of work. Sani (2007) notes that apart from other factors and irregularities in the system, the stifling school environment under which students and teachers are forced to operate, contributes significantly to poor academic performance of students.

Lighting of School Buildings

A growing number of studies is confirming the relationship between a schools physical condition, especially its lighting and student's academic performance. For example, Goroff and Brophy (2005) studied the effect of electric lighting and natural spectrum daylight on the academic performance of students in Pennsylvania High Schools.

In their experiment, they divided the student into two groups. One group of students was placed in poorly lit classrooms in which electric lights were switched off and daylight was blunted by drawing windows blinds to create semi-darkened classrooms. The other group was kept in classrooms that had adequate electric lighting as well as natural daylight were subjected to the same curriculum and similar teaching methods in mathematics and languages using teacher made tests. The researchers applied pre-post-tests, quasi- experimental design to establish the differences in performance between the two groups. The study found that students in poorly lit classroom performed 27% below their mates in well lit classrooms.

It should be noted however, that this study was conducted in the United States. The extent of it's applicability to Africa is not clearly determined. The current study shifted the geographical locale from America to Nigeria and used correlation analysis to establish the relationship between lighting and student academic performance in Kebbi State.

School Plant Acoustics

Acoustics has been defined as the engineering that deals with the reduction of noise transmitted through the walls, floors, ceiling and partitions in all types of school buildings or enclosures and from other sources within and around the school environment (Mustapha, 2005:30). Noise in this regard could simply be defined as wanted, unpleasant or disturbing sounds. Sound is a form of energy transmitted as a result of longitudinal vibrations occurring in gas (air) and other materials generating an audible frequency that is measured in decibels (dB). According to Mustapha (2005) the audible frequency range is between 90 dB, which is on the range of 20Hz to 20 KHz. Mechanical impacts, high velocity air or fluid as well as vibrating surfaces and frictions create noise. Thus, in a school setting noise can have its

source from school electric generating plant, movement of furniture, students talking, rotation of fans and other vibrating objects.

Evans and Maxwell (1997) studied the mediating effects of acoustics and chronic noise exposure on reading deficits in California elementary schools. In their experiment, they divided schools into two sections with one section being on the noisy side on which no acoustic measures had been put in place. On the quite side of the school, noise abetment measures were installed in terms of ceilings, carpeted floors, in addition to resilient rubber pads installed on elevated rails, so as to reduce internal and extraneous noise levels. They used California Achievement Tests (CAT) to compare the performance of grade three pupils on both sides of the school and found that pupils on the noisy side of the schools performed 30% below their mates in the quite side of the school.

The current study shifted the geographical focus from California to Nigeria and used a correlation design to examine the extent of relationship between plant acoustics and student academic performance with particular reference to Kebbi State Secondary schools.

School Plant Layout

School plant layout is the orderly arrangement of buildings, grounds, spaces, furniture, and infrastructure so as to ensure maximum utility, service, safety and relevance to school activities. Yusuf (1999) suggested that school buildings and infrastructure generally should be aligned to the micro-climatic elements of sunshine and wind direction so as not expose the school plant to the hazards of violent rainstorms, which could be destructive to the school plant. Aiyepeku (1991) suggested that classrooms and libraries that require a lot of silence should be located away from playgrounds and other noisy areas. Amasuomo (1999) opined that good layout should ensure that furniture in school building is properly arranged for ease of movement.

The impact of layout on student academic performance had been investigated by Yusuf (1999). In his study of climatic hazards on educational planning in Sokoto metropolis, he focused on the effect of school plant layout on protecting the school environment from climatic hazards. Observation inventories were used to identify schools that had either the right or wrong layout as well as to assess the damage suffered by the two categories of schools from violent storms during the 1997/1998 academic session. He found that 70% of schools with layout in which buildings and infrastructure were not properly aligned to climatic elements suffered greater damage and more interruptions of their academic programmes so as to affect repairs. As a consequence, he found that the academic

performance of students from such school was 20% lower than that of those in schools with proper layout. This study differed from Yusuf (1999) in that it used a descriptive correlation design to establish the relationship between school plant layout and student academic performance in Kebbi State secondary schools.

Methodology

This study adopted a descriptive correlation design conducted ex-post-factor. The population of the study was made up of all the secondary schools in Kebbi State, with senior secondary schools as the target population. All the science schools and 2 technical colleges existing in the state were purposely sampled because of their small number. Stratified random sampling was used to select 20 out of the 35 grammar schools. This gave a total of 26 out of the 41 senior secondary schools representing 63% of the schools to get 587 out of 850 teachers. Observation inventories, WAEC examination format and questionnaire tagged: School Plant Lighting Acoustics, Layout and Student Academic Performance Questionnaire (SPLASAQPQ), was used to collect data. Experts in educational management validated the questionnaire and it has a reliability index of 79 based on test-retest method. On the spot collection of data was used to collect information. Out of 587 questionnaires issued, 500 usable ones were retrieved, giving a return rate of 85%. Pearson correlation analysis was used to test hypotheses formulated.

Data Analysis and Discussion

The dependant variable for this study was student academic performance, while the independent variables were school plant lighting, acoustics, and layout. Student academic performance was first analyzed followed by hypotheses testing.

Table 1: Kebbi state student's academic performance in WAEC from 2002 to 2005.

Year	Number presented	Number of credits	Success Rate	Number failed	Failure Rate
2000	5,037	779	16%	4,258	77%
2001	6,155	1,433	23%	4,722	85%
2002	6,490	1,295	20%	5,195	77%
2003	6,685	1,539	23%	5,146	78
2004	7,672	1,671	22%	6,001	78%
2005	9041	2,348	26%	6,693	74%
Total	41,080	9,065	130	26,820	470
Average	6,847	1,511	22%	4,470	78%

Source: Field work, 2006.

Table 2 indicates that students in Kebbi State secondary schools recorded the poorest performance in the West African school certificate examinations in the year 2000, when the failure rate was as high as 84% and success rate as low as 16%. The highest success rate was recorded in 2005 when 26% of the candidates scored up to four credits and above. For the six years under study, the average success rate was as low as 22%. The poor academic performance of students could be explained from many angles. Prominent among them however was the unfavourable environment under which students were forced to learn.

Hypothesis One

Ho_1: There is no significant relationship between the lighting of school buildings and student academic performance in Kebbi state secondary schools.

Table 2: Relationship between lightning of school buildings and student academic performance.

Variable Entered	N	$\bar{X}$	SD	DF	Calculated r-value	Critical r-value	Decision
Academic	26	1.49	.17	24	.98	.48	Significant
Lighting	26	1.50	.18				

Results in table 2 indicates that the lighting of school buildings was significantly, positively and highly correlated to student academic performance in Kebbi State secondary schools with calculated value of .98 at .05 alpha level. The hypothesis which states that there is no significant relationship between the lighting of school buildings and student academic performance is rejected. This means that the higher the adequacy of lighting in school buildings, the better the academic performance of students could be enhanced. It also implies that where the lighting of school building is grossly inadequate, the academic performance of students could be correspondingly inhibited. Majority of participants to this study (69%) agreed that proper lighting of school buildings could enhance student academic performance.

The high correlation between lighting and student academic performance could be appreciated from the fact that academic activities could be seriously jeopardized especially at night when there is no light, as it will be impossible for students to do their assignment and revise their lecture notes. This finding agrees with Goroff and Brophy (1995) who found that lighting was correlated to students' achievement. They noted that students in poorly lit classrooms could experience eyes strain, blurry vision, and headaches, which results in poor concentration on learning tasks. This in turn contributes to poor academic performance. They

also noted that adequate lighting of school buildings minimizes mental fatigue and hyperactivity in children.

However, the data generated from the observation inventory showed that 60% of school buildings in the 26 sample schools were poorly lit. But, the fact that majority of participants highly appreciated the value of lighting in enhancing students' academic performance was an that the lighting of school buildings in Kebbi State secondary schools has been deliberately neglected and has not been given the serious attention it deserves.

Hypothesis Two

Ho_2: There is no significant relationship between school plant acoustics and students' academic performance in Kebbi State secondary schools.

Table 3: Relationship between school plant acoustics and student academic performance

Variable Entered	N	$\bar{X}$	SD	DF	Calculated r-value	Critical r-value	Decision
Academic	26	1.49	.17	24	.98	.42	Significant
Lighting	26	1.49	.18				

Result in table 3 indicates that the acoustic of school plant was significantly, positively and highly correlated with students' academic performance in Kebbi State secondary schools with a calculated r-value of .98 being greater than the critical r-value of .42 at .05 level of significance. The null hypothesis, which states that there is no significant relationship between school plant acoustics and student academic performance in Kebbi State secondary schools, is rejected. This suggests that the better the acoustics of the school plant, the better the academic performance could be enhanced, and that poorer the acoustics of school environment, the poorer the enhancement of students' academic performance could be. Majority of the participants (68%) agreed that proper acoustics of school plant could enhance students' academic performance.

The high level of positive correlation between school plant acoustics and students' academic performance could be explained in the context of the fact that proper acoustics provide a quite school environment that minimizes noise stress and distraction from learning tasks. This finding agrees with Evans and Maxwell (1997) who found that students felt tensed up in noisy classrooms and that students learn better when noise level was reduced to 40 decibels. They found that the ability of students to clearly hear and understand what was being spoken

was impaired by unwanted noise, which led to deficits in mental concentration, making more errors no difficult tasks and giving up on tasks before the allotted time expires. Noise within school buildings was found to decrease teaching time forcing teachers to continuously pause and monotonously repeat themselves. However, the observation inventory on school plant acoustics revealed that 70% of schools studied had poor acoustics. This means that although most of the school buildings had ceilings as part of noise abetment measure, no attempts were made to regularly lubricate electric fans to stifle to nose emanating from their rotation when they are switched on. Most schools (70%) were not fenced as a barrier against noise from highways or nosy neighborhoods. This poor quality of acoustics was probably as a result of negligence as majority of participants (68%) were aware of the value of acoustics on students' academic performance.

Hypothesis Three

Ho_3: There is no significant relationship between school plant layout and students' academic performance in Kebbi State secondary schools.

Table 4: Relationship between schools plant layout and students' academic performance.

Variable Entered	N	$\bar{X}$	SD	DF	Calculated r-value	Critical r-value	Decision
Academic	26	1.49	.17	24	.99	.42	Significant
Lighting	26	1.50	.17				

Results in table 4 indicates that school plant layout was significantly, positively and highly correlated with student academic performance with calculated r-values of .99 being greater than the critical r-value of .42 at 0.5 level, using 24 degrees of freedom. The hypothesis, which states that there is no significant relationship between school plant layout and students' academic performance in Kebbi State secondary schools, is therefore rejected. This means that the better the layout of the school plant the better the academic performance of students could be enhanced. The majority of the participants of this study (65%) agreed that the layout of the school plant could enhance students' academic performance.

The high level of correlation between school plant layout and student academic performance could be explained from the fact that good layout provides a quite, beautiful and orderly environment that better academic performance among students. This finding agrees with Stewart (1999) who found that good layouts help to isolate noisy areas of the school such as

playgrounds from areas that require quietness. In addition good layout of buildings, furniture and infrastructure makes for efficient movement of men and materials as well as effective movement of men and materials as well as effective execution of academic activities. Poor layout of furniture in classrooms and lecture halls in particular, obstruct free movement, which creates difficulties for teachers when supervising students during lessons. This gives room for students to be distracted from classroom activities, which in turn could affect students' academic performance.

The observation inventory on school plant indicated that only 40% of selected schools had good layout. This means that the separation of quite academic activities areas from noisy non-academic activity areas; alignment of school buildings to climatic elements; economy of space in locating structures and general orderliness of arrangement of facilities was poorly done, and was therefore not in line with the master plan approved by the Kebbi State Ministry of Education.

The poor quality of school plant in spite of the good appreciation of the value of good layout on enhancing students' academic performance was an indication of deliberate neglect or incompetence on the part of school plant constructors.

Summary of Findings

The result of data analysis in this study revealed that in Kebbi State secondary schools:

1. There was a significant positive and high correlation between the lighting of school buildings and students' academic performance.
2. There was a significant positive and high correlation between the acoustics of school environment and student academic performance.
3. There was a significant, positive and high correlation between school plant layout and student academic performance.

Conclusion

The quality of school plant construction in Kebbi State Secondary schools was poor as was particularly manifested in inadequate lighting, poor acoustics and wrong layout. This has negatively contributed to the poor level of student academic performance. The substandard quality of school plant construction, which was deficient in lighting, acoustics, and layout was not as a resulted of a gap in knowledge or appreciation of the correlation between these three crucial construction factors and student academic performance but was essentially due to deliberate neglect of educational specification during school plant construction.

Recommendations

1. Adequate lighting should be provided in school buildings by ensuring hat windows are large enough to occupy at least 20% of wall space, and are properly aligned to the direction of sunlight and wind. There should be at least four functional electric bulbs or fluorescent tubes in each classroom and other academic buildings.
2. Acoustics of school plant should be given serous attention. All school buildings should have proper ceilings o help in noise absorption. Fans should be well lubricated to reduce noise generated by their rotation. There should be adequate shielding of noise generated from electric generators at the source. Acoustic barriers like tall walls should be used as fence to block noise generated from traffic and other sources from school neighborhoods.
3. The layout of the school plant should be properly planned to ensure that there is proper separation of unrelated activity areas; alignment of buildings to climatic elements; economy of space; orderliness in road network, orderly arrangement of furniture, and neat placement of infrastructure.
4. Strict penalties should be imposed on those who deliberately fail to comply with educational specifications during the construction of school plant.

References

Aiyepeku, T. R. (1996): .Inspection of schools and colleges. Ibadan; Heinemann Educational Books.

Amasuomo, J. O. M. (1999): Designing seating arrangements in lecture theater, and classrooms for effective teacher-student interaction. *The Nigerian Teacher Today.* 7 (1): 166-173.

Bagudo, A.A. (2004): Critical problems requiring urgent attention: Education in Kebbi State. Paper presented at working retreat for senior civil servants in Kebbi State, at Argungu Fishing Hostel, Kebbi State, December 21.

Evans, G. W. & Maxwell, L. (1997): Chronic noise exposure and reading deficits: The mediating effects on language acquisition. Environment and Behaviour 29(5)638-650 (online): Retrieved January 14, 2005, from http://www.desiguishme.com/research/maxwell/noisechildren.htm.

Fafumwa, A. B. (1974): *History of education in Nigeria*. London: George Allen and Irwin publishers.

Goroff, T. L. & J. E. Brophy (2005): *Electric lighting and daylight in schools*. Council for education facilities planning international (CEFPI) issue track papers (on line). Retrieved January 4, from http://wwwcesoir.cra/facilitiesplanning/htm

Iyamu, E. O. & S. E. Aduwa, (2004): *School effectives survey in Nigeria* (on line). Retrieved. January 14, 2005 from: http://www.cesoir.cra/facilityplanning/htm

Mustapha, A. (2005): Assessment and control of noise sources in Nigeria Defense Academy. *The Valiant*, **35** (1): 30 - 38.

Sani, D. M. (2007): *Relationship among school construction, utilization, maintenance and school effectiveness in Kebbi State secondary school, Nigeria*. Unpublished Doctoral Thesis, University of Ilorin.

Stewart, C. S. (1999): Facilities, site planning and layout. In Bittel, L.R. & Ramsey, J.E. (Eds). *Encyclopedia of professional management.* Danbury, Connecticut. McGraw-Hill Inc, **1**: 299 - 303.

Yusuf, A. K. (1999): The hazards of some climatic elements on educational planning in Sokoto metropolis. *Farfaru Journal of Multi-Disciplinary Studies (FJMDS)*, **5** (1): 92 – 100.