ADEQUACY, EFFICIENCY AND ECONOMY: THE MISSING INGREDIENTS IN OUR EDUCATIONAL FACILITIES PLANNING

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Abstract
The objective of this paper is to highlight the importance of such factors as adequacy, efficiency and economy in the planning and designing of a functional school plant. The paper stressed that the culture of effective planning and design of functional educational facilities (school plant) should have been imbibed in the 1950s and 1970s, the two decades immediately after independence when Nigeria took over total control of the educational system. This was also the period in which there was both sharp fall in the expansion of educational facilities as a result of the civil war and massive expansion of educational facilities after the civil war and stimulated by the National Policy on Education 1977 and reviewed 1981, 1998 and 2004. The paper tried to show that school buildings must be adequate in size and number, be efficient and economical if it must serve the educational purpose of teaching and learning. Recommendations on the way forward were made for consideration of government and other stake holders at all levels. One of the recommendations is that, government at Federal, State and local level should insist on proper planning and designing of school plants, irrespective of whatever their initial cost maybe and to ensure adequacy, efficiency and economy in the construction and utilization of education facilities. Professional educators should be involved in the initial planning

Introduction
Meeting the functional needs of both teachers and students, at the lowest cost is a prerequisite in educational delivery everywhere in the world today. Adequacy, efficiency and economy are three fundamental concepts in the planning of educational facilities that guarantees reduction in high cost of school plants and ensures the highest educational returns. The adequacy of a school plant is measured by the degree to which it satisfies the qualitative requirements of the educational programme. Efficiency is related to the functional characteristic incorporated in the design of the facility while economical planning is based on an estimate of the potential educational return (per Nigerian naira) expended on school facilities, although, one cannot measure the absolute educational return per naira expended (Segun, 1980). At any rate, there is greater economy in school plant planning where the expenditure of funds is more likely to produce increased educational returns or greater utilization of space and materials over a longer period of time (Harold, 2007).

The school plants, educational facilities or physical facilities, as they are interchangeably referred to have not received the desired attention by educational planners in Nigeria. Bulama (2001) citing Adesina, pointed out that, no other area of education had been so neglected by educational planners during and after the colonial era like educational facilities. The Federal government of Nigeria during the first republic made attempts to establish the culture of planning and designing school plants very early by commissioning of the international development agency (IDA) to develop standards for school building design between 1965 and 1967 (Godwin, 1988). This study by Godwin came up with a document in form of briefs to guide planners and proprietors of schools in the construction of suitable school buildings. This pioneer effort by Federal Government of Nigeria, in providing a guide to planners and proprietors of schools, may now be considered as wasted effort considering the poor state of educational facilities in our schools. The civil war between 1970 and 1976 further worsened the situation by creating serious setback in the general development efforts of Nigeria which was just beginning to find her feet after so many decades of colonial rule. The schools, especially in the Eastern States, more than any other thing, suffered the most neglect. (Mgbodile, Okeke, Akubue, Ezeocha, Nduanya and Chukwuma, 1986). Other educationists blame the situation on the ambitious policy of the 6 – 3 – 3 – 4 system which they believed lacked

economic vision. According to Nwana (1987) the National policy on education was made at the time that Nigeria's economy was strong but because of gradual decline in the economy schools still do not have adequate physical facilities. Awotunde (1988). Enaohwa and Eferakeya (1989), Okeke (1990), pointed out the failures of the various states to provide adequate school buildings, the empty building and halls were without basic equipment and where such buildings and equipment were provided they were either in adequate or substandard. A careful review of literature therefore reveals that the period between 1970 and 2000 has seen the worst in the state of our educational facilities. This may also point to the fact that no serious effort was made within this period to plan and design educational facilities for Nigerian schools. It is also important that to note that the few facilities provided were in most cases allowed to decay and rotten away. It is also interesting to know that in this century when several nations of the world have made serious appreciable progress in the provision of school facilities, several schools in Nigeria especially primary and secondary schools still sit under the trees in opened air to take lectures. In the tertiary institutions where one would have expected improvement in facilities planning the laboratories, lecture halls and student hostels are jam packed with students because they are designed below capacity and worst of all is the staff offices which were designed to accommodate just a staff but now accommodate not less than four teachers now.

The primary purpose of this paper is therefore to come up with guides that could be followed in planning and to emphasize the importance of adequacy, efficiency and economy as they relate to planning of educational facilities. A secondary purpose is to advance proposals that might be seen as useful in saving money or using as little money as possible to get the best or the highest returns. This review is therefore presented under the following sub – topics, adequacy, efficiency, economy, proposals, summary and recommendations.

Adequacy and Suitability of School Spaces

The concept of adequacy is primarily concerned with the number, size, shape and quality of educational spaces available (Adesina 1980, Ogunsaju 1982, Castaidi 1994). Castaldi further stated that adequacy alone does not ensure a well planned school facility. Suitability of instructional space with respect to function and operation of a school is a correlated consideration. In more specific terms, spaces for learning should be adequate and suitable from the stand point of environmental controllability, shape, atmosphere, location, ease of maintenance, long range economy and the likes.

Adequacy of Number

Education specifications should state the number of students and the various types of spaces that will be both necessary and sufficient for the desired educational program. In addition to instructional spaces, a certain number of supporting spaces must be included, such as storage areas, preparation rooms, locker spaces, toilets lounges, and the like. The number depends primarily upon the types and size of the school plant, and upon the scope of the educational programme to be housed in it. In a nut–shell, sufficient number of both instructional and supplementary spaces should be provided. The term "sufficient" suggest that the number of spaces should not be in excess.

Adequacy of Size

The size of an instructional space directly influences its proper functioning particularly if the number of square meters falls below the minimum needed for the function. The space required for each activity should be determined by actual measurement, under experimental condition, if necessary.

Adequacy of Environmental Controls

In every learning space, there is need for adequate control of heating, cooling, humidity, lighting and acoustic. Adequate control of these factors is vital to effective learning and for the health of the learners. Thermal, acoustical and visual controls are directly related to the needs of the human body. Instructional space should therefore be designed with ample thermal capacity, including controls for both heating and cooling. In addition, they must have adequate illumination and optimum acoustical standards. Castaldi (1994) emphasized that, the environment of school buildings should be designed so that it is psychologically stimulating to the students and users. Colour

proportion, shape, lighting penetration texture of interior spaces, furniture and finishing, all contribute to the atmosphere within an instructional space.

Suitability of Shape

The shape of an instructional space should be suitable for the function for which the space is designed (Frederickson, 1973). Frederickson further contended that, rectangular and almost square classrooms are quite suitable for classes of about 30 students that will be engaged in non-laboratory-type of instruction. Shape may be critical in some particular instructional spaces. For example a combination of lecture room – laboratory, where peripheral laboratory tables are desired should be long and narrow to make the most efficient use of the floor space.

Adequacy of Space Relationships

A school building should be designed so that it functions as a single organism Segun (1982) and Castaldi (1989). These educators further opined that parts of school building should be located in proper relationship to each other in order that the activities in the building can be conducted efficiently, conveniently, healthfully and safely.

Location of Functionally Related Spaces

From the stand point of economy, efficiency and ease of communication between faculty and staff, it is highly desirable that spaces housing similar or closely related instructional activities be clustered together (Woodruff, 1976). For example, all science spaces, such as those for biology, chemistry, physics and general science, could be located in a single cluster in a high school building. In a college or university, for example, chemistry, physics, and Biology buildings could be clustered, perhaps, around a science library.

Location of in Compactable and Unrelated Spaces

According to Wolff (1976) and Castaldi (1994) incompatible spaces should be well separated. They pointed out that for acoustical reason, for example, it is necessary to separate spaces planned for noisy activities from those whose activities are quiet, e.g. workshop areas should not be near the library. Furthermore, for psychological reasons, it is desirable to separate the entrance of the guidance office from that of the principal's office. For reasons of economy, air-conditioned spaces would be separated from the power plant or boiler room and for natural lighting, it might be necessary to separate adjoining wings with substantial distance, if natural lighting is to be the primary source of illumination. The time necessary for students to travel from one space to another should be taken into account too, because, if the distance between classroom buildings become too great, it may be necessary to increase the time allowed between periods and perhaps lengthen the school day.

Location in Relation to Safety

In placing each activity within the building or on the school site, safety and health of the students and staff should be considered (Wolff,1976). For example, the location of storage space in workshop areas presents a serious safety hazard. Spaces requiring service drives should be laid out with great care to ensure safety of students and school personnel. Unloading zones should be properly situated in relation to both sidewalks and main drive-ways. Students should not be required to cross drive ways in travelling from the bus unloading area to the building or in walking from the play areas to the gymnasium. On a college campus, it is desirable simply to eliminate all vehicles from the central core of each group of buildings.

Efficiency of a School Building

Efficiency of school building refers to architectural design of the building that is likely to improve the instructional effectiveness or operational characteristics of the building (Barnadt 1969 and Adesina 1980). In a broader sense, efficiency is related to greater functional return for the money expended. In designing a school building many proposals have to be considered from which the best is picked. It is paramount that the functional aspects of the proposed school building be stated and described clearly in the educational specifications. This is so because functions of a building should determine the shape, size or space that should be provided for each activity. In planning for functional

efficiency, school planners must also take into account the type of teaching materials and instructional equipment to be used. Functional efficiency demands that both the building and its equipment be conceived as a single, unified educational goal.

Efficiency in Maintenance and Operation of a Building

School plants should be planned and designed to keep the cost of maintenance and operation at a minimum. Operational costs are directly related to the cost of services, fuels, expendable supplies, utilities, and the like. According to UNESCO (1975), maintenance cost refers primarily to the expenditure required to maintain buildings and its equipment in its original state of utility. When considering operational efficiency, school buildings should be designed so that the materials chosen and equipment are selected on the basis of maximum human efficiency. For example, easily and quickly cleared surfaces should be chosen over those that involve a lower initial procurement cost but are more costly to maintain. Features that save the time of the employees who operate or occupy the structure are important. For example, the placement of doors and the location of service spaces with respect to entrances, driveways, unloading zones in relation to each other, should be carefully studied to minimize unnecessary loss of time or motion. Fuels and utilities should be conserved as much as possible. Heat losses and gains must be taken into account, not only to provide sufficient heating or cooling capacity but also to achieve economies in the operation of the system. Additional insulation or low conductivity windowpanes means greater initial cost, but the savings in operation cost over the life of the building will generally more than compensate for them. The design of the building should reduce waste of electrical power, gas and water as much as possible. For example, the use of low voltage light controls would permit the custodian to control all the lights in a building from a single panel. Water conservation is also desirable, but not at the expenses of function (UNESCO, 1975).

Efficiency of maintenance is concerned with durability and cost of upkeep. Materials that are relatively maintenance free should be preferred over less costly materials requiring greater care. The life expectancy of the equipment and materials is a basic consideration in the selection of such items. Those that have the lowest depreciation cost per year should be given first consideration, unless such choices adversely affect the educational function.

Efficiency in Storage and Handling of Materials

All materials should be stored as close as possible to the place where they are used. Storage rooms, therefore, should be strategically placed in a building with reference to delivery, distribution, and utilization. Sound business practice demands that storage spaces be controlled. Consequently storage room should be designed and situated so that control is facilitated. It is also necessary to plan storage spaces to prevent spoilage or damage to materials stored in them.

Efficiency in the Design of Circulation Patterns within a School

The architectural design of students' circulation space has a pronounce influence on the educational function of a school building. UNESCO (1975) stated as a rule that circulation patterns must allow students traffic to flow rapidly from one part of the building to the other. However, extreme care must be exercised to ensure that the space provided for circulation is not only necessary but sufficient. Excessive circulation space is wasteful from the standpoint of both initial investment and operation. Circulation space should be completely adequate, but in planning the size of lobbies, corridors, and other circulation spaces in a school building, it should be remembered that efficiency in circulation space yield two advantages, savings in initial capital outlay and reduction in operational costs.

Economy

Economy, in the planning and designing of a school building refers to the actual savings in capital outlay that can be achieved through good architectural design, Harold (2007), suggested that a building should be economical but not cheap. The time invested in discussion, research, and study to affect economies is not always commensurate with the savings realized. So there is need for plans and specifications to be reviewed in terms of function and efficiency. This is so that all these benefits can be achieved at minimum bearable cost. More economic facilities are possible through

creative building design, long range planning, use of new concepts and the like. It should be noted that there are two economies namely, true and false economies. School planners should always insist on true economy. A true economy must meet the following true test:

(i) The reduced cost in capital outlay does not adversely affect the curriculum or educational efficiency of the school.
(ii) The reduced initial cost does not result in increased maintenance and operational cost.

The first test deals with intangible educational outcomes that are difficult to evaluate. Nevertheless, school planners should be fully convinced that economy does not hinder or restrict the desired educational program. The second test on maintenance and operational cost on the other hand, is quite objective and relatively simple to apply. For example, Pierce (1990), after carrying out a research on lighting system reported that, fluorescent system (of school lighting) will probably cost slightly more initially, but the annual clearing, recapping and operation cost will more than offset this slight difference in less than a year's time. This is apart from the complete illumination effect of fluorescent lighting. However, incandescent lighting, although it is economical in terms of initial capital has high maintenance cost. Replacement will equal that of florescent lighting yet it does not have the illuminating effect of florescent lighting.

Economy Related to the Design of a School Building

The design of a building strongly influences its cost. The design also affects its cost of operation. According to Castaldi (1994), there is rambled (scattered) building design and there is a compact design. Whichever is chosen, it should be born in mind that the primary purpose of a school building is to educate students. No design should be adopted unless it satisfies the requirement of the desired educational program.The principle of compact design suggest that greater economy of financial capital outlay and operational cost with respect to heating and cooling is obtained when the perimeter of a building is left as short as possible. For this reason, long classroom should be avoided. Long, narrow wings are less desirable than the structures, in which wings are combined to form a more compact building. For example, arranging classrooms so that the narrow end faces the corridor tends to promote compactness and economy.

Long range planning of school facilities is another consideration in achieving economy. Economy in long range planning is promoted by acquiring school site in advance of needs. It is not always necessary to purchase the site early. New schools should be located properly in relation to the area of future population growth of the school (Harold 2007). Economy may be improved through the development of a long range financial plan design to keep the credit rating of school as high as possible.

Suggestions for Improving Economy in School Plant Planning

The following suggestions by Castadli (1994) are aimed at saving- money or using as little money as possible to get the best or the highest returns.

1. Economy is improved when instructional spaces are designed to serve several functions in such cases; the room utilization factor is likely to increases and, under certain condition, fewer spaces may be needed.
2. Construction materials should be selected on the basis of ease of maintenance and durability. As mentioned earlier, substituting materials that reduce the cost of initial capital outlay do not necessarily achieve economy.
3. Prefabrication of the whole or some parts of a building is economical in maintenance and durability. Prefabrication can be made possible on the basis of savings, through mass production of major sections of a school building .the initial capital outlay is generally lower ; the building can be tailor-made to satisfy the needs of the school; they can be erected quickly and they can be disassembled and moved from one location to another.

Conclusion

The primary purpose of school plant is to create conducive learning environment for teaching and learning. Therefore the facilities should be planned and designed so that they are adequate in number and quality and be efficient and economical in operation, in the 1960s and 1970s when

children were going to school mostly in the rural areas the school environment were far more attractive than the homes they were coming from . But because of inadequate planning and neglect, the home environments of school children are now far more attractive than those in the schools. This is true not only at the primary and secondary school levels but even at the tertiary level.

The school environment must be attractive and friendly for all groups of learners especially at the primary and secondary school level. A lot of effort should be put in planning and design so that the stress of learning under the shade, sitting on empty bare floors without furniture and the very poor environmental control which makes learning unbearable can be avoided. Rather than being repellent the school environment should be inviting.

Recommendations

In considering adequacy, efficiency and economy in planning and designing school plant the following recommendations are made for the consideration of governments school authorities, architects and school proprietors.

1. Government at Federal, state and local levels, should insist on proper planning and designing of school plants whatever their initial cost to ensure adequacy, efficiency and economy in the construction and utilization of educational facilities.
2. Appropriate maintenance culture should be adopted by school authorities in operating the plants what ever their initial cost
3. Educational specifications should be prepared for every educational facility. This should be carried out by seasoned educators and educational administrators who have experience of the activities that will be carried out in each of the facilities, the educational specifications will describe the activities to be carried out in each facility, the equipment and instructional materials that will be used in the facilities, the number and age group of students that will be served. Theses specifications will be a document which the architect will use to design each of the facilities.
4. The federal and state ministries of education need to create separate division or units in the planning division. Ministries charged with the responsibility of planning and inspection of educational facilities in all public and private schools should be given a specific and clear mandate of what to do in terms of inspection and maintenance. This will allow for specific attention to be focused on educational facilities.

References

Adesina S. (1980). *Some aspects of school management.* Ibadan, Board Publication Limited.

Bulama, K. H. (2001). *An evaluation of educational facilities in state technical colleges in north Eastern Nigeria.* An Unpublished PhD thesis, Department of Vocational Teacher Education, University of Nigeria Nsukka.

Barnadt, J. & Soehr, K. M. (1969). Plan for flexibility and growth. *American Vocational Journal, 2 (3).*

Castaldi, B. (1989). *Educational facilities (planning, modernization & management) fourth edition.*

Castaldi, B. (1994). *Educational facilities, planning, modernization and management.* Boston: allyn and Bacon.

Frederickson, N. H. (1973). The principal and school plant planning. *The Bullutin of the Western Association, Olume 1(3), 13 – 16.*

Harold, B. G. (2007). *The secondary school building of tomorrow, edited by Alvan C. Eurich in high school.* New York: Pitonan publishing company.

Ogunsanju, S. (1982). A prognostic view of Nigeria's secondary school building design in the 90s and after. *A Journal of Calabar Educator.*

Segun, A. (1980). *Some aspect of school management.* Ibadan: Board Publication Limited.

Segun, O. (1982). A prognostic view of Nigeria's secondary school building design in the 90s and after. *Calabar Educator.*

UNESCO (1975). *Planning building and facilities dor higher education.* Paris: UNESCO Press, pp 42.

Woodruff, A. P. (1976). *Can you go cluster in your shop*. Washington D. C: School shop.

Wolff, C. S. (1976). *Osha and the school shop.* Washington D. C: School shop.