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ENHANCING INDOOR COMFORT IN SCHOOL BUILDINGS IN RIVERS STATE

Author: ORIGIE DESTINY,
Co-authored: Arc. PAUL UCHENNA B.
Faculty of Environmental Sciences, Department of Architecture, Rivers State University Port-Harcourt, Rivers State, Nigeria

ABSTRACT

Comfort standards create adequate thermal comfort conditions in buildings. Requirements for comfort are critical, especially to pupils' performance and welfare in school buildings. Learning spaces have been observed to have influenced students' comfort and enhancement of performance in schools. However, many factors are involved in determining how the performances of the students are enhanced by these learning spaces. This study is aimed at investigating students' comfort in learning spaces in relation to the enhancement of performance, it reviews and analyses the indoor comfort requirements based on international standards and previous studies. Thermal comfort is always affected by the energy efficiency of buildings and vice versa. The comparison assessment presents that there is a relation between the poor indoor quality conditions and the low-energy efficiency of buildings. This may occur due to the mismanagement of, ventilation and other factors that determine indoor comfort in school buildings.

INDOOR QUALITY IN SCHOOL BUILDINGS

Indoor comfort in schools deals with the quality of the living environment and the parameters of the building's internal environment, according to results of environmental psychologists' research, people are influenced by aspects of their surroundings.

At present, requirements of comfort are more demanding than in previous periods when, due to the explosion of development of industrial technologies, it appears the possibility to create living

conditions greatly improved. It's found that the energy consumptions significantly depend on the requirements of the occupants concerning comforts, but also the characteristics of the thermo-physical properties of the materials of construction and the performance of the utility systems

Educational spaces are places where studying, reading and writing take place, to make possible these activities is very important that the indoor environment to satisfy the comfort requirements because indoor environmental quality has a significant influence on productivity and learning.

People's indoor comfort depends on lighting and indoor air quality, poor control of these factors in enclosed spaces can cause discomfort to the people who live in them.

Daylight is the primary light source which, aside from being indispensable, has the potential to create cozy and comfortable interior environments. Daylighting is a free natural resource, which allows buildings to develop physical and psychological reactions. Equally important natural light is a renewable resource. Adequate daylighting has been demonstrated to make environments healthier (Zaharim, Azami and Kamaruzzaman, Sopian. Computational Methods in Science & Engineering. WSEAS Press: 2013). Various research projects have already displayed that student performance increases when their classrooms enjoy natural light (Demir, Ayse. "Impact of Daylighting on Student and Teacher Performance." Journal of Educational Instructional Studies in the World 3, no.1 (2013).

More so, in what ways do students react and how do habits develop in these planned spaces? Daylighting will also vary from one school building to another, depending on building orientation, the design professionals must provide extraordinary design leadership through the use of natural daylighting and daylight modeling. The use of research for health and productivity benefits of natural daylight and daylighting modeling must be considered. The dynamic nature of daylight together with the wide range of intensities and distribution demands a sophisticated understanding of its interactions with a building. 'Kuller and Lindsten in 1992 studied children's health and behaviors in classrooms with and without windows for an entire academic year.' They concluded that work in classrooms without windows affected the basic pattern of the hormone cortisol, which

is associated with stress and could therefore have a negative effect on children's health and concentration. Another study in Sweden found that observed behavior and circadian hormone levels of elementary students in classrooms with daylight stayed closer to expected models than those in classrooms with only fluorescent sources. The Swedish researchers concluded that windowless classrooms should be avoided. The built environment plays a large role in the everyday life of humans as we live, work, shop, and play in and around a man-made

structure. Eco-building educational facilities appear to provide an environment that pupils and teachers both value and this finds expression in several external measures.

Additionally, Demir claims that the effect of daylighting on circadian rhythms can affect productivity as well as health. According to the Green School Initiative (Global Green USA, 2005), daylight provides biological stimulation that regulates body systems and mood, saves costs, and offers the benefits of natural ventilation (Demir, Ayse. "Impact of Daylighting on Student and Teacher Performance." Journal of Educational Instructional Studies in the World 3, no.1 (2013) In these contexts, daylight which is an important component of sustainable design, comes into prominence in preschool design in terms of its impacts on children's attainment. All in all, a proper early childhood facility is a place where pupils can have ample natural light in classrooms (Anita Rui Olds, Child Care Design Guide, (New York, McGraw-Hill, 2001). The benefits of lighting on students' learning are only effective when the lighting in a classroom is planned efficiently (Pulay, Alana S. "Awareness of Day-lighting on Student Learning in an Educational Facility." Master's Thesis, University of Nebraska-Lincoln, 2010.). That means that not only daylight is a requirement for school design but also, it should be provided for appropriately. it can easily be seen that some of the schools are not built with consideration of daylight effects, especially regarding building orientation. While some classes have daylight during the day, others are deprived of natural light all day long. Also, another problem is that even when daylight enters a classroom at some point

during the day, the building is not able to have a design that provides appropriate and sufficient quality daylight in the classrooms. In this case, through this research readers will have a better understanding of how daylight in learning environments for school children should be used

STATEMENT OF THE PROBLEM

A well-planned and suitably adjusted building services technology is required to equally ensure energy efficiency, good indoor comfort including good air quality, and an attractive learning environment in schools. Many different requirements need to be taken into action.

In Rivers state, the shortened overall length of secondary education and increasingly frequent all-day teaching mean that children, adolescents, and teachers these days spend more hours of the week in school buildings. Modern schools need to be able to offer a diverse education and facilitate its use as a learning and living environment. One aspect is architectural design that focuses more on the needs of the children.

However, schools should be able to offer an environment that fosters learning with modern energy technology that provides, for example, demand-based cooling and consistently good air quality. The utmost attention should therefore be paid to the issue of enhancing air movement and ventilation in an active learning environment. Ventilation strategies usually form a key component as part of a broader energy concept. There are three main ways to ventilate schools, natural ventilation for example using windows is the most commonly used system. We have mechanical ventilation which can be implemented as decentralized or centralized systems and hybrid ventilation combines the benefits of natural and mechanical ventilation. Building automation provides good prerequisites for mechanical ventilation.

AIM OF THIS STUDY

The purpose of this study is to explore the impact of day lighting in the classroom in secondary schools in rivers state' cognitive and social skills as related to sunlight in classrooms. Children's cognitive and social behavior were examined with the input of school teachers

DISCUSSION

Spaces are often related to changes in schedule organization and space use. For example, personalized learning, individual pathway planning, team teaching, risk tasks as well as organizing multipurpose, open, and flexible spaces, all often require longer instructional time. Organizational changes take time and education has long and short-term effects on students and their learning (peachter, 2004) therefore we consider school environments to include not only social, cultural, temporal, and physical aspects, but also built and natural environments.

Difficulties have been found out, mostly in learning spaces and built environment while determining the factors that actually contribute to students learning which would then affect performance. Physical wellbeing, affective, cognitive, and behavioral characteristics of individuals are pre-conditioned that can impede or enhance learning. Built environment which is the learning space is one factor of many impacting on student learning outcomes and performance.

It was also found out that School leadership indirectly contributes by providing conditions conducive to learning including resources and teacher professional development (Mulford, 2005). Yet, most of these findings are ignored. Corresponding with the management of new physical learning spaces, teachers and principals should manage multiple curriculum and assessment reforms that are intended to focus on student learning, but that can have contradictory demands on time and space. Poorly designed and ill-maintained schools, often found in areas of lowest educational achievement, can also have a detrimental impact on teachers and in most cases student morale and engagement which would affect their outcome (Filardo, 2008). Mutually, these factors have effects on teachers' work, attitudes, and behaviors, and in turn have flow-on effects on student learning and outcomes. (Knock, 2008) "almost three-quarters of the variation in pupil performance could be attributed to design and environmental factors. All things being equal, the academic performance of a child in the best environment could be expected to be 25% better than an equivalent child in the “poorest” classroom environment.’’

The increasing development of new school buildings in rivers state is likely to envisage the importance of physical learning space because it has implications on how the educational process

takes place. While physical learning spaces still matters, how students learn is a reflection of the relationship between 'person environment' that influences and shapes students' experimental learning. According to Kolb and Kolb (2005), the enhancement of experimental learning in higher education can be achieved through the creation of learning spaces that promote growth-producing experiences for learners.

To develop a strong desire and positive attachment to enhance indoor comfort, mental skills in a student are essential. The development of such skills is facilitated through appropriate instruction, and authentic assessment in a well-designed and enabling environment that purpose to provide a facility that creates an environment where students can develop their mental, physical, and social skills in rivers state This project will explore the enhancement of the performance and efficiency of such a facility by applying the principles of natural ventilation, natural lighting, and passive energy system to optimize ambiance and indoor comfort. Passive ventilation systems in buildings make use of natural forces like the buoyancy of hot air and wind to encourage airflow through the interior of the building. The result is that moist stale air is being extracted and replaced with fresh clean air. Natural ventilation system makes use of outdoor air coming into the rooms through operable windows, doors, and other openings, sometimes pollution and odor follow the flow. Learning environments as in school buildings need good ventilation to dilute this indoor air pollution otherwise the classrooms will be stuffy and smelly and the air may be unhealthy undiluted with cleaning, pest control, and toxins from furniture, body odor from staff and students, produced in school activities.

DAYLIGHT IN CLASSROOMS

Lightning of classrooms should be at a level that is sufficient for student activities such as writing and reading on the study tables and blackboards, or boards on the wall. A school with insufficient light can reduce a student's ability to learn due to the effect the lightning has on physiology. Poor spectral light can create eye strain, leading to decreased information processing and learning ability and causing higher stress levels Providing the appropriate level of illumination, with uniform

distribution of light with ungeared effect are essential for a comfortable classroom indoor environment.

FACTORS AFFECTING INDOOR COMFORT IN SCHOOLS IN RIVERS STATE

Basically, the factor that affects indoor comfort in Rivers State is numerous. This is because they are both environmental and personal.

They include:-

1. Radiant temperature

2. Air temperature

3. Air velocity

4. Relative humidity

5. Regular variation of circulation (Monsoons/ Seasonal variation).

PERSONAL FACTOR

6. Clothing

7. Work rate/ metabolic rate or a level of activity. Other factors that may have some effect on thermal comfort are age, sex, body shape, state of health, ethnic grouping, diet, sleep, the colour of clothing, acclimatization, availability of fresh air, transients, the colour of a spacious enclosure, and noise. An indication of the relative importance of these other factors is the fact that when all the six major factors are within an acceptable and optimal range, about 70% of the population will be comfortable.

1.RADIANT TEMPERATURE:- Thermal radiation is one major factor that affects thermal comfort. It is the heat that radiates from a warm object. Radiation is present when there are heat sources in an environment. It thus affects how one losses or gain heat to the environment. The skin absorbs almost as much radiant energy as a matt black object, although may be reduced by wearing reflective clothing. Examples of radiant heat sources include; the sun, fire reflective fire

furnaces, steam rollers ovens, walls in kilns, cookers, dryer, hot surfaces and machinery, molten metal which is readily obvious in the Nigerian environment. This brings about heat stress if not properly controlled.

2.AIR TEMPERATURE: - This is another factor that affects thermal comfort in rivers state. It is characterized by fluctuations. However high temperature increases thermal stress thus influencing the behavior of putting on light clothing, as evident in students' behavior in rivers state. Air temperature is the major factor that controls physiological temperature. Therefore an urgent need to arise to curb this effect of air temperature so as to be tolerated by man/students in both high and low temperature in rivers state Nigeria: which is thermal comfort. For instance in Akure, Lagos, Abuja, Port Harcourt, Kaduna there is high temperature while in Jos and some highlands and riverine areas there prevails low temperature.

3.AIR VELOCITY: - air velocity is an important factor to be considered in enhancing indoor comfort because people are sensitive to it. However, still or stagnant air in indoor environments that are artificially heated may cause students/teachers to feel stuffy. It may also lead to a build-up of odour. Nevertheless, moving air in warm or humid conditions can increase heat loss through convection without any change in air temperature. Also, small air movement in a cool or cold environment may be perceived as draught, if the air temperature is less than skin temperature, it will significantly increase convective heat loss. Moreover, physical activity also increases air movement, so air velocity may be corrected to account for a person's level of physical activity.

4.RELATIVE HUMIDITY: - Humidity can be explained as the resultant effect when if water is heated and it evaporates to the surrounding environment, the resulting water in the air is the humidity. Thus, relative humidity is the ratio between the actual amount of water vapour in the air and the maximum amount of water vapor that the air can hold at that air temperature. Hence, relative humidity between 40% to 70% does not have a major impact on thermal comfort. In some offices, humidity is usually kept between 40% to 70% because of computers. However, in school buildings, which are not conditioned or where the climatic outdoor conditions may influence the indoor thermal environment, relative humidity may be higher than 70% on warm or hot humid

days. Humidity in the indoor environment can vary greatly, and may be dependent on whether there are drying processes (paper mills, laundry) where steam is given off; as evident in oil companies located in Port Harcourt. A high humidity environment has a lot of vapour in the air, which prevents the evaporation of sweat from the skin. In hot environments, humidity is important because less sweat evaporates when humidity is high (80% +). The evaporation of sweat is the main method of heat loss in humans. Accordingly, when vapour- impermeable personal protective equipment (PPE) is worn, the humidity inside the garments increases as the wearer sweats because the sweat can not evaporates.

5.REGULAR VARIATION AIR CIRCULATION: This is another environmental factor. It is as a result of the northeast trade winds which prevails to about 3000m and bring dry and stable air masses which often carry dust particles from the desert region over which it originates, these winds are locally called "harmattan". This air carried are warm and humid, thus affecting the thermal conditions of the Nigeria climate, bringing about rapid heat gain during the day and heat loss at night and early mornings. This is experienced over the country.

BENEFITS OF DAYLIGHTING

According to the Green School Initiative (Global Green, USA, 2005), daylight contributes to biological impulses, which balance body systems and mood, provides energy conservations, and helps the benefits of the natural environment (Taylor, 2009). An internal clock, which is synchronized to the sunlight, controls all species' behavior in the world, including humans. Thus, light is an initial aspect of internal clocks. According to Johnson, higher productivity is provided in a space by better views, natural light, temperature control, and the mental advance of higher volume places. Gelfand (2010) claimed that natural lighting in classrooms can connect students to nature and also directly promote the mood of children and teachers.

Research has demonstrated that windows provide benefits to people by daylighting and enable people to access views of the outside and also provide a place where teachers feel happy and able to control their surroundings. Although it may not be said directly, the role of daylighting on the health of people is recognized for a long time. A school, which is designed by green school

principals, provides benefits to student's physical and emotional health. Natural light in classrooms provides a healthy place for teaching and enhances Vitamin D generation and circadian regulation. The amount of daylight is significant for the vision of students and it restricts the negative impacts of electrical lighting. According to Baker and Steemers, electric light can trigger strain, fatigue, and circadian dysfunction in people. In addition, sunlight is an initial source for gaining Vitamin D, which is very important for people's internal system. Using natural light or daylight for illumination is one of the hallmarks of high performance in buildings. In addition to the benefits of supplying substantial light for free, natural light provides great physical and psychological benefits to the school building occupants.

RECOMMENDATION

there are some challenges for Rivers State scholars to address the situation of poor indoor comfort in schools by improving technologically; providing materials for buildings that could cope with their climatic conditions irrespective of the limits the environment poses to them. Efforts for the government to support training in this regard; achieving thermal comfort, is a welcome idea to attaining thermal comfort, in Nigeria. more also, the climatic condition has become the norm of the building with respect to human comfortability as we can not solely rely on artificial means due to the present situation of things. The greater understanding derives from the factors of climatic conditions that should be put in place to forestall the problem of discomfort. The planting of trees as a natural means of improving ventilation, school buildings in rivers state should take the design of a courtyard for reasonable ventilation, external walls of schools must have enough openings for cross ventilation of the building's interior, school building shells need to be properly shaded from the unconditional space outside in order to avoid overheating of the conditional space.

CONCLUSION

Based on the discussions of the study, improved indoor environmental quality has a tremendous impact on building technology, teachers' performance, comfort, workspace utilization, and overall

productivity. The extent to which office workspaces satisfy the desired comfort of lecturers in carrying out assigned duties is reflected by indoor environmental quality. The study shows the intensity of classrooms and office workspace utilization by students and teachers on core academic functions is a reflection of their performance.

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