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ENHANCING ACOUSTICS AND LIGHTING IN MEDIA CENTRE

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Abstract

This paper examined the enhancement of acoustics and lighting in a media center. It provided better understanding of the strategies to be adopted in enhancing acoustics and lighting in the broadcasting house. Studying literature reveals that the broadcast studio is a crucial space within the media facility where acoustics is highly needed and the Television broadcast studio needs adequate lighting for images to be captured excellently to enhance viewers satisfaction. The study also looked at the various materials needed to enhance acoustics and their sound absorption capacity and noise reduction coefficient in other to ascertain the materials suitable for some spaces within the facility. It also looked at the type of lights and their characteristics as it may affect the use of spaces. The paper concluded that the spaces within the media center should be intentionally designed to deal with the challenges that might occur in so doing the activity, size and volume of every space inform the materials to be used and the pattern to be adopted.

Keywords*: Acoustics, lighting, media, materials, spaces, studio*

1.0 INTRODUCTION

Media Centre is a structure where audio and video contents as well as written news are broadcast to a wide audience via any audio-visual medium. Recovering parties can be the general public or a large subset of it.

Media plays a vital role in our day to day activities. The media houses considered and integrated are; the Television, Radio and Newspaper Cooperation. The first platform for mass media was the newspaper. The public has long relied on local newspaper writers and journalists to keep them up to date on current events.

The media facilities comprises of the broadcast media and the print media.

Therefore some spaces in the facilities are; studios and control rooms, newsroom, listening room, record library, equipment printing rooms, lithography room, production room, advice and other support facilities such as administrative offices, conference room, reception, café, lounge and theatre.

Nevertheless, these facilities would only be effective if acoustics and lighting are given major attention.

i. Acoustics

According to Grinn (1978), architectural acoustics can be defined as the study of the generation, propagation and transmission of sound in room dwellings and other buildings. Correct application of the principles architectural acoustics can be considerably improve the quality of work in broadcasting studio. Some sounds are desirable and very important to be emphasized, while other sounds are detrimental otherwise known as noise, and they have to be drastically reduced or prevented.

ii. Lighting

The perception of a building space is dependent first by how lit the space is. Primarily, lighting is seen as letting in light into a space to aid vision. Because light does more beyond its primary function of brightening up a building space for the purpose of clarity in vision, extra care must be given in lighting design to archive the desired effort of a space.
Nevertheless, we have two major source of light to space, it could either be, natural lighting or artificial lighting.

2.0 LITERATURE REVIEW

According to Onabajo (2006), broadcasting serves three broad purpose; it informs, educate and entertain the audience. Nevertheless, broadcast statics (Radio or television) perform six main functions. These are; news, education, opinions, propaganda, entertainment and commercial.

i. Television Broadcasting

Is defined as an audio visual medium. It integrates pictures with sound to produce a communication experience shown on the screen. It makes use of sound to explain the visuals presented on the screen. It addresses the emotion and intellect in a remarkable way (Owauamalam, 2007: 238). Television uses the movement of images in a unique way or pattern to express thought and feelings in an exciting and appealing manner. Television broadcasting is a type of broadcasting that includes pictures with sound transmitted through radio frequency to produce a communication experience shown on the screen.

ii. Radio Broadcasting

According to Dan (2018), radio broadcasting is defined as using radio waves to send transmission to large audience, who will listen to the transmission through a radio.

iii. The Newsroom

A newsroom is the central place where journalists – reporters, editors receives and write information from field reporters, wait for assignments and study various newspaper at desks in the newsroom to gather news to be published in a newspaper or an online newspaper or magazine or broadcast on radio, television. The newsroom cannot be effectively utilized without the use of light either natural or artificial lightening.

iv. Studio

The studio is a crucial aspect of a media center, where broadcasting takes place. The studio comes in different sizes based on the number of persons to make use of it. The distinct comes if it's for television or radio broadcasting. Television broadcast studio has various lighting devices and cameras arranged, creatively used to achieve programme productions. Without light, the television broadcast studio will not capture any image in the absent of light. It is light that reveals any image in the absent of light. It is light that reveals an image. Also a good studio must not cast shadow within. That is to say, the objects or image in a studio must not cast shadow in order to have an excellent outcome, this is to the extent to what light is important. It is obvious that both acoustics and lighting are very crucial in the media center and we cannot over emphasize the need for these things.

v. Acoustic Treatment

The studio ceiling and walls are usually treated with acoustic material that prevents sound from bouncing broadly about the studio. This is why television studios are sound "dead". When you clap your hands in an acoustically treated studio, the sound seems to go nowhere; in a more "live" studio, one can hear some of the reverberations which are similar to a slight echo. The studio need heavy, soundproof doors that are large enough to rating than trying to squeeze scenery, furniture, or even vehicles in and out. It is more frustrating than trying to squeeze scenery and properties through undersized studio doors or to have the doors transmit outside sounds.

The Studio can be divided into two sections:

1. The control area which is where the technical members of the production crew stay in order to control programme signals.
2. The performance area is essentially for the creative members of production. The interpretation of programme scripts takes place here. It is sensitive to sound especially during recording and has to be controlled carefully. Some of the facilities used in controlling sounds in the studio are ;
   a. Heavy door with air tight locks. This help prevent any sound coming from without. The door must be sufficiently wide to allow for movement of sets in and out of the performance area.
   b. Double glass window; this is used in keeping the sounds from the control and performance units, confined to their different areas. The glass windows enable visual communication between the production crew in the performance area and those of control area.
   c. The walls of the performance area treated with sound-proof materials to prevent outside sound from coming in.
   d. The ceiling of the performance space is shaped to reflect sound.
   e. The floor is finished with sound absorbing materials.
   f. Noiseless air conditioners are provided for the comfort of the performers, as well as to elongate the life-span of studio equipment.
   g. Suitable lightings which do not him must be provided in performance.

Guidelines for Finishes to Surfaces

a. Walls of the studio shall process high acoustic qualities in order to absorb sounds. In addition any of the surfaces likely to cause a delayed echo or flutter echo should be appropriately treated with a sound absorbing material. As a result, they should not disturb or affect the surrounding spaces. The use of certain walling should be employed in the newsroom willing in order to bring in natural lighting to improve the workability and thermal comfort in the newsroom. The newsroom walling should be desirable for mounting many televisions to monitors many channels.
b. Roofing / Ceiling generally roof are governed by architectural, engineering or economic consideration. The roof should be very strong and resist very high winds. Therefore the roof system will be such that it can span large distances and the use of columns in interior space will be reduced to minimum or entirely eliminated.
   High ceilings are required in the television studios, providing longer reverberation time and to accommodate lighting equipment. Lower ceiling not less than 2.7 floors to finish ceiling should be provided for the radio studios.
   Suspended ceiling is usually provided in the studio, the ceiling is constructed to take acoustical treatment with sound absorbing material partly for control of reverberation and partly to prevent the building echo. At the same time the suspended ceiling accommodates modular lighting fixtures and central air conditioner air inlets and outlets fixtures.

i. **Noise from aircrafts** – If the broadcast house is located where noise from aircraft noise causes a serious disturbance (that is when the noise level created inside the building is more than 50db) special precautions should be engaged to make the ceiling sound proof. Suitable sound proof false ceiling should be provided below the roof under such circumstances.
ii. **Rain Noise –** If problem arises due to perpetual showers some strategy used on the aircraft should be adopted in mitigating the noise from rainfall.

3.0 METHODOLOGY

The primary data were collected by the author via interviews, case studies and physical observations.

3.1 Primary Data collection

Some existing media houses were visited which arranges from television stations, radio houses and newspapers center and data were gathered by interviewing the staff of higher cadre and also going through deliberate observation.

3.2 Secondary Data Collection

The secondary data collection method was used to collect information from the internet sources, literature materials, to have a better knowledge on how to improve during implementation of proposed project.

4.0 Data / Design Presentation and Analysis

The actualization of acoustics and lighting are made possible by designing with respect to available data that could enhance an effective media center.

Table 1: spaces and various treatments needed

Type of space	**Preferred NRC Range**	**Ceiling Treatment**	**Wall Treatment**
Private offices, large offices, small conference rooms, hospitals, labouratory workspaces, libraries, retail shops and stores	0.65 to 0.75	Full	None required
Lobbies, corridors, gymnasium	0.65 to 0.75	Full	Yes
Secondary and college, classrooms, large meeting rooms	0.65 to 0.75	Partial	Yes
Kitchens, cafeterias, laundries, restaurants	> 0.75	Full	Usually none required
Computer equipment	>0.75	Full	Yes
Auditoriums, theatres, radio/TV studios, music practice rooms, audio visual facilities, churches, courtrooms, chapels, mechanical equipment rooms, open – plan schools, language laboratories, factories	(these space in particular require special study to determine the appropriate type, amount and location of sound-absorbing treatment)		
Open offices	>0.80	Full	Yes

Source: M. David Egan (1988)

Table 2 : percentage of sound absorbed and reflected based on opening and materials

	Percentage reflected	**Percentage absorbed and transmitted**	**Sound absorption co-efficient (x)**
Open window 1ft x 1ft	0	100	1.0
1 ½ thick glass fibre	20	80	0.80
4" thick brick	98	2	0.02
1ft of perfect absorption is equivalent to 1 sabin			

Source: M. D Egan (1988)

Table 3: Selected materials for sound reflecting and absorbing used on walls, floors and ceilings.

Floors, Walls and Ceilings (Sound Reflecting Materials)	**NRC (Noise Reduction Number)**
Marble glazed tile	0.00
Steel	0.10
Wood 1-in paneling with air space behind	0.10
Walls (sound absorbing)	**NRC**
Heavyweight drapery, 18 02/yd^2, draped to half area	0.60
Shredded-wood fiber board, 2 in thick on concrete (mtg. A)	0.60
Carpet, heavy, on 5/8 in perforated mineral fiberboard with airspace behind	0.70
Floors (sound reflecting materials)	**NRC**
Concrete or terrazzo, marble, glazed tile	0.00
Linoleum, rubber, or asphalt tile on concrete	0.05
Wood	0.10
Wood parquet on concrete	0.05
Floors (Sound absorbing materials)	**NRC**
Carpet, heavy on concrete	0.30
Carpet, heavy on foam rubber	0.55
Ceiling (sound reflecting materials)	**NRC**

Concrete	0.00
Gypsum board	0.05
Plaster on lath	0.05
Plywood, 3/8 in thick	0.15
Ceiling (Sound absorbing materials)	**NRC**
Acoustical board ¾ in thick, in suspension system	0.95
Shredded-wood fibre board, 2 in thick on lay-in grid	0.65
Sprayed cellulose fibres, 1 in thick on concrete	0.75
Glass-fibre roof fabric, 1 in thick on concrete	0.08
Polyurethane foam, 1 in thick, open cell, reticulated	0.30
Parallel glass-fibre board panels, 1 in thick by 18 in deep, spaced 6 ½ in apart, suspended 12 in below ceiling	0.85

Source: M. D. Egan (1988)

NRC (Noise Reduction Coefficient) is a simple-number rating of the sound absorption coefficient of a material. It is an average that only includes the coefficients in the 250Hz to 2000Hz frequency range and therefore should be used with caution.

Therefore one should be careful when selecting a product based on its NRC alone because the NRC does not include the α's at 125Hz and 4000Hz, it should not be used to evaluate materials for rooms, where music ore speech perception is important.

5.0 INTERPRETATION AND DISCUSSION OF FINDINGS / DESIGN DISCUSSION

5.1 Design Synthesis

Design synthesis is usually directed towards the total integration of the relevant factors with the design requirements of the project amid at solving the acoustical and lighting problems in the design.

5.2 Design Philosophy

Architecturally the design is ultimately about the configuration, connections, shape and orientations of physical forms. The architecture integrates various activities and symbolizes broadcasting while satisfying the effective design strategies needed (acoustics and lighting).

To adhere and enhance acoustics and lighting, proper effort will be made to provide facilities for the different activities to be controlled. The major architectural problem lies in putting the various facts into the real design of the project, including the placement of materials on walls, floors and ceilings and also the proper position of lighting points and determining the required level of illumination needed.

The area of space determines the level of illumination. For the new room, the day lighting is required to lit the space which could be enhanced by proper positioning of the new room and other work space to take advantage of the day lighting. The positioning of the studio should be zoned such that there is no interruption. Provision of sound looks such that the sounds without do not get within the studio space.

5.3 Lighting

The perception of the space with a media center is dependent by how lit the space is. Lighting is seen as letting in light into a space to aid vision. Light performs beyond brighten up a space.

For the purpose of clarity in vision, extra care must be given in lighting design to achieve the desired effect of space. Lighting is used for decorative as well as functional purposes, through the distinction between these two uses is tending to reduce with emphasis on aesthetics. The level of luminosity and its pattern are important in setting the mood of the interior and of directing attention to appropriate features.

(Ham, 1998), if the range of luminosity is small, the scene lacks attraction or focus and appears dull, if in addition the level appears gloomy. A brightly lit interior with uniform lighting provide interest and compel attention.

The bright features should be most significance to the users: the darker ones those of less importance or those from which attention may need to be distracted. Lighting serves for aesthetic effects as well as for safety.

The function of a space will determine the amount of light required. Different building types and different area of buildings require varying degree light, some demand day lighting while others demand artificial lighting meaning that there are two ways to illuminate a space. The sun is the natural source while electricity is the major source of artificial lighting.

5.3.1 Natural Lighting

Natural lighting, also known as day light due to the fact that the sun is the source though it is not the primary source of light in a media center especially in the television broadcast studio, all natural light are banned from being used. Nevertheless for the news room, windows are created to let in natural light (day light).

Day light, skillfully employed provides the architect with one of his most effective modes of aesthetic architectural expression (Lawson 1981).

The colours and conditions of the floor and wall surface affects the level of illumination in a room. Though, besides doors and windows, natural lighting can be introduced into the building through the roof by roof – lights.

5.3.2 Artificial Lighting

Artificial light is a critical design issue just as day light. Artificial lighting is the most widely used, this is because artificial lighting is completely under the control of the architect as it allows for control in areas of illumination in a building space. Artificial lighting could be used as interior and exterior lighting.

a. **Exterior Lighting:** Exterior lighting are used to achieve the following:
   Create the awareness and promote the interest in the media centers
   i. Reduces the probability of decedents
   ii. Facilitates security in the building by illuminating car parks, access roads thereby checking the user of the facility.

Exterior lighting can be applied in the following ways:

i. Upwards illumination to emphasize vertical features in so doing, giving them form and shape
ii. Concealed illumination under arches, in window recesses
iii. Flood lighting of external facades
iv. Down lighting below canopies

b. **Interior Lighting**

The level of luminosity and its pattern are significant in setting the mood of the interior and directing attention to appropriate features. Variations in luminance are used to provide interest and compel attention. It advised that the bright features be those of most significance to the users, the darker ones to be those of less importance or those from which attention may need to be distracted. In studio, for lighting to be effective, the following conditions have to be met.

In studio, for lighting to be effective some conditions have to be met:

i. The spatial illumination must be at a sufficient level to avoid strong contrast and possible negative effects, whilst allowing concentration over long periods.
ii. A balance should be maintained between the relative brightness of surface in view and colour harmonization.
iii. Combination of special lighting is needed to enhance multiple use of the studio.

The most commonly used light sources are incandescent, fluorescence and high-density discharge.

Incandescent

Incandescent lamps are available in a wide range of variety of sizes, shapes, and colour. Some standard shaped bulbs are available with a partial coating of silver for the purpose of concentrating the light in one direction only. More efficient for this purpose tough, are the special inside-silver reflector lamps, available in spot (concentrated-beam) and flood type (wide-beam) types. Projector lamps are similar but are of special construction that permits them to be used outdoors, exposed to the weather, they are available in spot and flood types (Ham 1998).

The selections of artificial light source are controlled by the desired:

i. Colour quality
ii. Total output of light source
iii. The light expectancy of the source
iv. Amount of heat produced
v. Overall cost (Lawson 1981)

Fluorescent: The fluorescent lamp is an electric discharge source in which light is produced predominantly by fluorescent powders activated by ultra violet energy generated by a mercury arc. When proper voltage is applied, an 'arc' is produced by current flowing between the electrodes through the mercury vapour. This discharge generates light fluorescent lamp are available in number of colours and in no less than 14 'whites' ranging from a very cool blue – white to warm pinkish-white.

High-Intensity Discharge (Mercury): Discharge lamps include the groups of lamps commonly as mercury. Metal halide, and high-pressure sodium lamps. The look like incandescent lamps in that they provide a point source light, but they are more closely related to fluorescent lamps since they are electric discharge lamps.

5.4 Acoustics

Acoustics treatment are highly required in the studio in order to address all issues associated with sound and the effect of noise that would affect the production with the space. Besides keeping the rain out, the next most important thing a studio must do is to provide a place where speech can be clearly understood. This means a good studio will have a good intelligibility rating.

The media center should be located if possible in areas not prone to noise.

Every acoustical situation can be described in terms of a source of sound, a path for transmission of sound, and a receiver of the sound. Sometimes the source strength can be increased or reduced, the path can be made less or more effective, and the receiver made more attentive by removing distractions, or he can be more tolerant to the disturbance. For example, a noisy air-conditioning unit (source) bothers the occupant of an office (receiver), the problem must be analysed in terms of reducing the noise at the source (selection of the quietest available equipment, proper mounting etc), what can be done about reducing the transmission (path) by the way of structure and dusts (resilient separation, absorbent lining, etc), and what can be done to get the receiver to tolerate a bit of the noise. Attack on any

single aspect of the problem may result in over design or an unsatisfactory solution (Ham 1998).

5.4.1 Strategies to Achieving the Acoustic Requirements

i. The shape of the studio / room done such a way that there will be no standing wave
ii. Raise the sound source to achieve a free flow of direction sound waves
iii. Raise the floor for better sound effect
iv. The second source should be surrounded with sound reflective or abortion surfaces when necessary like plywood, plastics, fiber glass, gypsum board etc.
v. Surfaces which can set strong reflection must be avoided like the opposite and parallel plain.
vi. Surfaces that are concave curved should be avoided.

5.4.2 Basic Principles for dimensioning of rooms to ensure good acoustics

Geometrical and statistical room acoustics rising waves theory all lead to result and conclusions which can be used in the construction of a room from these, the acoustical behavior of the room.

1. The volume of the room
2. The form of the room
3. The reverberation time of the room

i. The Volume of the room

When the volume of a room increases, the surface are increased, so the total absorption also increase: as we are dealing primarily with a defined and specific sound power P. The energy density W which exists also falls as the absorption A increases. The following relationship then applies = W4P/CA

ii. The Form of the Room

Nowadays, solution can be found to the question of favourable or unfavourable room proportion from the stand point of wave acoustics, at best for simple room forms that are rectangular. The proportions of the sides of the parallel piped can be selected in such a way that the elegant toner of the room are distributed as evenly as possible, hence, it follows that integral ratios are to be avoided.

iii. Reverberation Time of the room

Reverberation is the upwelling and dying and of chaotic sound. It is also considered as sound coming and going in all direction at one time, unlike reflections which are organized sound waves with a direction and strength that could be measured.

When reverberation are much, it blur words together. When reverberation can be too loud or last longer. When the room is designed reverberation has reasonable loudness and last proper amount of time.

Reverberation is stored in the volume of the hall and absorbed on the surface of the studio. The duration requires for sound to diminish out of a studio depends on the ratio of volume to the surface area and the acoustical friction provided by the walls, floor and ceiling of the studio once the architectural surfaces and furnishings have contributed their percentage of acoustical friction the reverberation time is usually still long. At this point acoustic materials have to be introduced to make up the difference (Noxon)

For every room there is an optimum reverberation time. This is also dependent on the volume of the room the form and the use.

iv. Diffusion

Sound energy are spread evenly in a given environment. For a space to have perfect diffusion of sound, the reverberation twice as the same at any listening position.

Some principles that applies in the planning of room firms includes;

i. Sound path must be unobstructed and direct as possible
ii. To achieve sufficient diffusion, parallel surfaces must be avoided; also, large flat surfaces must be broken up in such a way that they reflect as diffusely as possible.

v. Sound Absorber

Every material and item used in construction has an absorption coefficient, people, brick, windows etc. absorb sound in addition to every material having absorption coefficient, and the amount of absorption varies with the frequency of sound. Carpets, drapes and curtains absorb most high frequencies while wood and thin plasters on furring strips absorb lower frequencies.

There are four major types of absorbent materials and they differ in levels of which they absorb sound.

1. Membrane absorbents which are best at low frequencies
2. Resonant absorbents can be turned to a very narrow band of any frequency
3. Perforated panel absorbents are combination of resonant and porous absorbents, best in medium frequencies.

CONCLUSION AND RECOMMENDATIONS

The findings from the study revealed the necessity of acoustics and lighting in enhancing an effective media center.

As Offices require adequate lighting to carryout office work. The broadcast studio for the television requires adequate lighting because it has to deal with both picture and sound. Therefore shadow is not permitted to be created in the TV studio which creates the need for adequate lighting. Artificial lighting is to be used in the television studio.

It is recommended that while enhancing acoustics and lighting, the size of the room, the volume of the room, considered in order to enhance effectiveness.

Same applies to the application of lighting in a space. The space will determine if natural lighting or artificial lighting is to be brought into the room. The amount of light needed too also affects the type of light to be provided as light varies in intensity and the amount of light required also influences the number of lighting point if artificial light is to be provided.

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