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Investigation Of Circulation And Users Comfort In Secondary School Buildings In Kaduna, Nigeria

Izobo-Martins O.O[1, a], and Oluwole O.O[2, b]
Department of Architecture, Covenant University, Ota (Nigeria)
oladunni.izobo-martins@covenantuniversity.edu.ng, folaoluwole3051@gmail.com

Abstract- The circulation system of secondary schools in Kaduna State, Nigeria requires attention as not every potential user finds it comfortable to cope with movement within the school buildings in the study area. The current condition in which the school buildings are in does not encourage inclusiveness within the society. To address this challenge, policies on school building designs should be made to inculcate a circulation system that will be used comfortably by every potential user of educational facilities. This research examined the condition of educational facilities within the study area. Data was collected via questionnaires administered to users of secondary schools within the study area. The data collected were analysed using a descriptive analysis tool called SPSS. The research found out that even though the existing circulation elements within the study area are not constructed according to recommended architectural standards, majority of the users of the educational facilities in which the research was carried out within the study area were comfortable with their movement in the facility. This result is suspected to be given because majority of the respondents have no physical disability. The research also found out that the most preferred vertical circulation element is lift, however they are very costly to install and maintain as a result of the energy required to make them function regularly. Therefore, ramps are recommended to be used as circulation elements in secondary schools in conjunction with a platform lift to bridge the gap that the ramp is expected to occupy in order to achieve a comfortable slope and enable space saved to be used for functional purposes.
Key words*: circulation, comfort, secondary school buildings, users.*

1. INTRODUCTION

According to Rogoff, Callanan, Guitierrez & Erickson (2016), educational institutions may exist in a formal setting where students are made to run academic programs based on regulated curriculum by the government or informal setting where learning is done based on the interest of the student rather than external influence. Asides the norm of having a formal setting of education in an orderly manner as stated above, educational institutions may also exist in form of vocational learning centres where marketable skills can be acquired. That is a place where people who do not have the privilege of going through formal education can also acquire knowledge and skills in order to make them have an independent life according to Agideb (2017). The purpose of architecture is to create spaces that will meet the need of the users, hence school buildings should be properly designed to meet the need of any potential student irrespective

of physical disabilities according to Adewale, Aderonmu, Fulani, Jegede, Adeboye & Izobo-Martins (2015).

Studying educational systems, processes of learning and quality of teaching inside school buildings is a research that has been carried out by numerous researchers. However, one of the related fields of studies, which needs further exploration according to Sailer (2015), is the physical environment in which students learn as the physical environment cannot be separated from the learning environment. It is important for educational researchers not only to focus on the process of learning but to begin to look into how comfortable the learning environment is for students. This will enable them identify innovative strategies that can be implemented in school buildings which will result into a better learning and working environment for every user of educational facilities. The complexity of understanding this relationship is due to the difficulty of evaluating or quantifying the output of the learning process and student's comprehension. Students do not only learn in schools, they also formulate social relations and socialization patterns which cannot be ignored while studying the school building. These factors should not be overlooked as the school years are instrumental to the formative period of the child. It is very easy for what is learnt at a very young age to become part of the child's character forever. Another author, Sailer (2015) opines that it is a good idea to ensure that asides investing into the quality of education that is expected in the learning environment, investment should also be made in the physical environment.

The design of school buildings should be done in order to provide a good and comfortable learning environment that will enable both the fit and physically challenged interact with each other from an early stage of the lives of the students. This will enable the promotion of social interaction within the physically challenged and fit in the society and will result into societal fairness and peaceful coexistence in the long run. A situation where educational facilities cannot cater for people who are physically challenged alongside those that are physically fit is likely to create a society that will be socially divided. This will not be healthy psychologically most especially for those that find themselves in the physically challenged category. Therefore, in order to achieve a learning environment that will enable both the physically fit and physically challenged interact with each other, it will require not only government agencies concerned to make policies that will encourage an inclusive learning environment as collaboration with allied professionals in the building and construction industry will also play an important role in the execution of the policies created by the government. This research will enable educational administrators in collaboration with allied professionals in the building and construction industry develop innovative ways to enable movement within school buildings comfortable for every potential user in the nearest future. (CEUD, 2014)

2. Aim of the study

As a result of facts raised on circulation in secondary school buildings, there is a need for decisions to be taken to improve the building circulation systems in secondary schools in Nigeria. This is to ensure that all the spaces within the school is comfortably accessed by every potential user of the school.

The principal aim of this research is to investigate circulation in secondary school buildings with a view to develop comfortable spaces for every user within the facility.

The scope of the study encompasses one Local Government Area in Kaduna state to reveal the general condition of Secondary Schools in Kaduna State. It is expected that this study will be a guide to achieving comfortable and accessible secondary schools in Nigeria.

1.1 The Study Area

The study area is Chikun Local Government Area of Kaduna state. It is one of the twenty-three Local Government Areas in Kaduna State, Nigeria. The study covered ten out of the twenty-three junior and senior secondary schools in the study area.

The research is limited to studying building circulation and users comfort in the design of secondary schools in the study area. It takes into cognizance several characteristics and attributes that actually make the design of educational facilities comfortable and accessible citing circulation as a major characteristic.

The research would also draw out benefits of having an accessible secondary school building with a convenient building circulation system and the effect it has on the users.

2. LITERATURE REVIEW

2.1 CIRCULATION SPACE IN BUILDING

Circulation within buildings as defined by Yang (2017) is movement through space, it is further described as the path through a floor plan. Circulation spaces in buildings are regarded as paths people use to connect other spaces within a building. Circulation in buildings is a concept that deals with the intentional linking of external and internal spaces in a building. The circulation system in buildings act as the skeletal system that enables a building to be used functionally by its users according to Jiang & Liu (2010). Natapov et al (2015) described an efficient circulation system in buildings as one that connects building users to their destination easily and conveniently. Circulation systems can be used to make a space lively or deserted based on the intent of the designer and purpose of the building according to Wen (2017). Therefore, it is expected that strategies applied in the design of circulation systems in buildings should be based on the purpose of the building and physical abilities of potential users of such buildings. (Neufert & Neufert, 2019)

The building circulation system is a very important aspect in public buildings because it accommodates a lot of people with different physical needs. Public buildings should be designed to meet up with as much accessibility requirements as possible because it is expected that public buildings cannot be avoided by people with different physical needs. (Kocabas, 2013)

Building environments should be designed in manner that promotes easy and convenient accessibility to all spaces by any potential user of the building. The circulation network should promote wayfinding hence enabling people determine their location within a setting easily. Circulation within buildings is expected to involve a plan that will take users of a facility from where they are received into the building to their destination comfortably. Adequate lighting should be considered in the design stage around circulation elements and paths in order to enable users locate them easily as soon as they get into the building. (Lacey, 2004)

2.2 CIRCULATION CHALLENGES IN BUILDINGS

People face circulation challenges when moving are in the external part of a facility, around entrances and exits of a facility, when moving within a building and even when making use of spaces within the facility according to ISO (2011). However, this challenges should be addressed because a lot of public building designs that are done disregard the unique building circulation need of some building types of disabilities, age group and sexes. If universal design strategies are applied to circulation designs, it is believed that every potential users needs in terms of circulation will be catered for. (Yusita, Sherly, & Diana, 2012)

When architects design buildings, they are faced with circulation challenges they have to resolve in order to achieve a functional design in buildings. This problem is divided into direction of movement, type of use of the building, frequency of use and time of use. For direction, people move horizontally or vertically, however architects face more challenges in catering for vertical movement needs in buildings than horizontal movement needs in other to make higher levels in the building easily accessible by every user most especially if it is a public building.

In the aspect of type of use of the building, designers are faced with creating the appropriate circulation system for public buildings. Excessive provision for circulation spaces in private buildings could result into inability of the users to maximize the space and also leads to an increase in cost of the building which might be a waste. Also, it is possible for an architect to under design for circulation in public buildings as he may tend to consider average number of people that make use of the circulation space and may not be comfortable for use during peak periods or special events in public buildings. (Renee, 2011)

Public buildings tend to be very busy at specific times of the day. For instance, it is expected that the main entrance and exits of school buildings will be very busy at opening and closing hours of the day and entry and exit will be regulated during school hours. Therefore, frequency of use varies at the earlier stated points of the school hours and the necessary circulation paths and elements should be designed to accommodate users comfortably at those periods of the day. (Portico.Space, 2015)

Another challenge public buildings such as schools tend to face is in the aspect of maintenance according to Izobo-Martins(2014). It is advisable for mechanical components that can be maintained throughout the building life cycle of the building to be designed and installed in the building. Some buildings in Nigeria have vertical circulation elements such as lifts and elevators that are no longer functional again as a result

of inability of the users to maintain it. Hence, designers should make provision for building circulation circulation elements that can be maintained by the users in order to eliminate wastage.

2.3 NEED FOR INCLUSIVENESS IN EDUCATIONAL FACILITIES

Human right organizations discourage discrimination against the physically challenged in the society. They are also making efforts towards prohibiting any form of discrimination or exclusion from desired educational opportunities for anyone who may be physically impaired. According to UNESCO (1960) education is not only for the people who can access it easily but should be one that seeks to break the barrier that potential learners encounter hence increasing the productivity of every member of the society.

Also in Nigeria, educational governing bodies are now making policies that support inclusive education and this started when the Universal Basic Education was founded. The latest revised policy document on education in Nigeria calls for accessibility needs of children with varying physical abilities to be met for the purpose of education. (Ajuwon, 2012)

3. METHODOLOGY

The quantitative method of research approach was adopted. Questionnaires were distributed to staff which are users of randomly selected secondary schools in Chikun Local Government Area of Kaduna State, Nigeria. Quantitative data were also collected using questionnaires and these data were analysed using descriptive statistics method via the SPSS statistical package.
The population of the study is comprised of teaching and non-teaching staff of the secondary schools in the study area. Out of twenty-four secondary schools in Chikun Local Government Area of Kaduna State, ten schools were selected for the study which represents approximately forty percent of the schools present in the study area. Fifteen questionnaires were distributed in each of the ten secondary schools within the study area. Out of one hundred and fifty questionnaires distributed, the data from one hundred and twenty-four respondents was recovered. Data analysis was carried out using SPSS statistical analysis software. Data analysis was done using descriptive statistics using simple percentages to indicate result gotten from the study. (Bassi, 2011)

4. RESULTS AND DISCUSSION

4.1 Characteristics of the Respondents

A total of fifteen staff in each of the ten schools representing an average of 40% of the regular staff strength in twenty-four secondary schools in Chikun local government area were involved in the questionnaire survey.

Table 4.1: Bio-Data

Sex of Respondent	Frequency	Percent
Male	53	42.7
Female	71	57.2
Total	124	100

Table 4.1 Bio Table Showing Data of Respondents

Source: fieldwork, 2020.

Table 4.1 displays the statistics of the number of respondents to the questionnaire that was distributed within the study area. From the table, the population consists of staff across secondary schools in the study area. One hundred and twenty-four people responded to the questionnaire. 42.7% of the respondents are male while 57.2% of the respondents are female. This makes the research collate data from both genders in fair distribution.

4.2 Employment Status in the Selected Secondary Schools

Staff working in secondary schools are divided into two major categories namely, teaching staff and non-teaching staff. Table 4.2 below shows the distribution of respondents according to employment status.

Table 4.2: Employment Status of Respondent

Status of Respondent	Frequency	Percent
Teaching Staff	99	79.8
Non-Teaching Staff	21	16.9
Others	4	3.2
Total	124	100

Table 4.2 Table Showing Employment Status of Respondents

Source: fieldwork, 2020.

From the table above, 79.8% of respondents are teaching staff, 16.9% of respondents are non-teaching staff while 3.2% belongs to others category. Students who had special physical challenges where given the questionnaire to fill and they represent the others category. This means that the distribution of the questionnaire went across every category of people within the study area. However, more students were not given the questionnaire to fill because questionnaires cannot be distributed to minors.

Table 4.3: Years of Service as a Staff

From the survey majority of staff in the schools worked there within a decade. Therefore, they would have a good knowledge of the physical environment of the educational facility.

Status of Respondent	Frequency	Percent
0-5	59	47.6
6-10	56	45.2
11-15	5	4.0
16-20	4	3.2
Total	124	100

Table 4.3 Table Showing Years of Service as a Staff

Source: fieldwork, 2020.

47.6% of the respondents have served in their educational facility between 0 and 5 years which represents the majority, 45.2% have worked between 6 and 10 years, 4% have worked between 11 and 15 years and 3.2% of respondents have worked between 16 and 20 years according to table 4.3. Majority of the respondents have worked in their respective educational facilities for enough time to understand how the building circulation system within the educational facility affects their comfort.

Table 4.4: Physical Ability Status

QUESTION	NO	YES
Do you have any physical disability?	91.8	8.2

Table 4.4 Table Showing Physical Ability Status of Respondents

Source: fieldwork, 2020.

91.8% of respondents are living without physical disabilities, while 8.2% of respondents affirmed that they had disabilities, amongst which one is crippled, three indicated that they were limping and the remaining 5 did not specify the type of disability they had. This indicates that not every respondent is physically fit and they face restrictions in areas in which accessibility for them was not factored into the design. This means that there are people with physical disabilities that will want to attend conventional educational institutions and they should not be deprived of their will to do so because the physical environment was not designed to be accessible for them.

Apart from people who are physically challenged from birth, accidents and diseases may happen at one point on the order and this may result into discomfort in movement of building users. Should this occur, they will no longer to participate actively in learning spaces that they may not be able to access comfortable and this might result into a setback in the learning process of the student. We do not pray to have such happenings, but we are living in a world where accidents happen and we should begin to make our public buildings able to accommodate the physically challenged. This will promote an inclusive environment.

Table 4.5: Vertical Movement Within the Educational Facility

This section addresses vertical circulation of the educational facilities within the study area. Data was collated on vertical circulation elements that were present within the educational facilities and the relationship of the vertical circulation elements with users' comfort.

QUESTION	NO	YES
Are stairs present in your educational facility?	6.5	91.1
Are ramps present in your educational facility?	95.2	2.4
Are escalators present in your educational facility?	96.0	1.6
Are lifts present in your educational facility?	96.0	0.8
Are elevators present in your educational facility?	96.0	1.6

Table 4.5 Table Showing Vertical Circulation Elements Present in Educational Facilities

Source: fieldwork, 2020.

Table 4.6: Vertical Circulation and Users Comfort

QUESTION	NO	YES
Do you make use of stairs comfortably?	28.2	71.0

Table 4.6 Table Showing Vertical Circulation Elements in Relation to Users Comfort

Source: fieldwork, 2020.

According to table 4.5, only stairs are present in the educational facilities within the study area. 91.1% of respondents have stairs within their educational facilities while 2.4% do not have stairs in their schools. 95.2% of respondents do not have ramps in their educational facilities, 96.0% do not have escalators, 96.0% do not have lifts and 96.0% do not have elevators**.**

According to majority of respondents only stairs are present in all the educational facilities within the study area. 71% of the respondents within the study area find movement with stairs comfortable, while 28.2% of respondents do not find usage of stairs comfortable. Recall that in table 4.4, only 8.2% of the respondents had a physical challenge. This means that some people who do not have any physical challenge are not comfortable with vertical movement with stairs. In case studies carried out, it was discovered that some school buildings had narrow stair width and had a steep slope. This would have contributed to discomfort in the usage of stairs as vertical circulation elements and the solution to this is that adequate space should be allotted to stair halls in order to achieve a comfortable slope in the design of stairs.

If stairs are the only vertical circulation elements in the educational facilities within the study area, it means that people with physical challenges will find it difficult in accessing spaces at a higher level. The design of ramps would have been a better alternative but it is often avoided by designers because ramp

consumes a lot of space that would have been used for other functional activities in an attempt to achieve a comfortable slope.

Therefore, in other to make circulation comfortable for every potential user within the educational facility and also save space that will have been used for a comfortable ramp design innovative design measures can be introduced.

Ramps are not present in the educational facilities according to 95.2% of the respondent in table 4.5. These are simple circulation elements that were neglected even on ground floors. Ramps are one of the vertical circulation elements that solve the challenge of moving people with different physical disabilities over the years. The advantage of ramps is that it does not require energy to operate but the disadvantage is that in order to achieve a comfortable slope during the design it tends to occupy a lot of space that would have been useful as a functional space

Escalators, Lifts and Elevators

These vertical circulation elements according to a vast majority of the respondents are not present in the educational facilities in the study area. After an interview with the school administrator in one of the case study locations on why, it is because of the high cost of installation and maintenance which involves energy. They stated that parents of some students are still struggling to pay the school fees of their wards and there is no how the presence of these circulation elements will not cause a hike in the school fees of students in the study area if considered.

Horizontal Circulation Elements in Educational Facilities

This section addresses horizontal circulation of the educational facilities within the study area. Data was collated on horizontal circulation elements that were present within the educational facilities and the relationship of the horizontal circulation elements with users' comfort.

Table 4.7: Horizontal Circulation and Users Comfort

QUESTION	NO	YES
Do you make use of entrances comfortably?	5.6	93.5
Do you make use of exits comfortably?	6.5	92.7
Do you make use of lobbies comfortably?		
Do you make use of internal doors comfortably?	40.3	55.6
	8.9	89.5

Table 4.7 Table Showing Horizontal Circulation Elements in Relation to Users Comfort

Source: fieldwork, 2020.

In table 4.7, majority of the respondents are comfortable with the horizontal circulation elements within the study area. 93.5% of the respondents make use of the entrances comfortably, 92.7% of respondents make use of exits comfortably, 55.6% of respondents make use of lobbies comfortably and 89.5% of respondents make use of internal doors comfortably. Therefore, majority of respondents are comfortable with the existing state of entrances, exits, lobbies and internal doors within their educational facilities. However, there is a call for attention to lobbies in educational facilities because compared to other horizontal circulation elements in buildings, 40.3% of respondents do not find moving in lobbies comfortable. From observation, most educational facilities within the study area had lobbies designed with a width of 1,500mm. Hence it is recommended that lobbies in educational facilities should be at least 2,000mm wide in order to ensure comfortable movement of buildings and ensure that two wheel chairs can pass beside each other comfortably.

Table: 4.8 Movement within the Educational Facility

QUESTION	H.C	C	N	UC	H.UC
How comfortable is your movement within the facility?	17.7	34.7	42.7	3.2	0.8
How comfortable are you with the vertical movement within the facility?	11.3	37.1	41.9	8.9	0.8
How comfortable is the indoor circulation within the facility?					
How comfortable are you with the horizontal movement within the facility?	12.9	34.7	47.6	4.0	0.8
How comfortable is the outdoor circulation within the facility?	14.5	35.5	46.0	3.2	0.8
	17.7	36.3	37.9	5.6	0.8

Table 4.12 Table Showing Comfortability with Movement of Respondents

Source: fieldwork, 2020.

From the table 4.8, the highest category of respondents is neutral to how movement within the existing educational facilities within the study area affects their comfort. The next majority of respondent category indicate that they are comfortable with moving within the existing circulation system within educational facilities within the study area. This result is expected because 91.8%% of respondents are living without any form of physical disability. However, the aim of this research is to make every space within the school building easily accessible by every potential user of the facility, therefore it is possible to increase the percentage of respondents that are comfortable.

11.3% of respondents are highly comfortable with their vertical movement around the facility, 37.1% are comfortable, 41.9% have neutral views which is the mode, 8.9% are uncomfortable and 0.8 are highly

uncomfortable. Therefore, from the respondents it is seen that majority are not really sure about their comfortability with the vertical movement in their schools.

12.9% of respondents are highly comfortable with their movement around the facility, 34.7% are comfortable, 47.6% have neutral views which is the mode, 4.0% are uncomfortable and 0.8 are highly uncomfortable. Therefore, from the respondents it is seen that majority are neutral on moving around their facilities comfortably.

14.5% of respondents are highly comfortable with their horizontal movement around the facility, 35.5% are comfortable, 46.0% have neutral views which is the mode, 3.2% are uncomfortable and 0.8 are highly uncomfortable. Therefore, from the respondents it is seen that majority are neutral on moving around their facilities comfortably.

17.7% of respondents are highly comfortable with their movement around the facility, 36.3% are comfortable, 37.9% have neutral views which is the mode, 5.6% are uncomfortable and 0.8 are highly uncomfortable. Therefore, from the respondents it is seen that majority are neutral on moving around their facilities comfortably.

4.8 Accessibility by the Physically Challenged

QUESTION	NO	YES
Can all categories of people (physically challenged people inclusive) access every space comfortably within the facility?	56.5	43.5
Would you like an inclusive educational facility, where people can learn and work irrespective of physical abilities and disabilities?	20.2	78.2
Are the physically challenged restricted within the facility?	47.6	50.8

Table 4.8 Table Showing Accessibility Possibility by the Physically Challenged

Source: fieldwork, 2020.

56.5% of respondents claim that spaces in the facility cannot be accessed comfortably by every potential user of the educational facilities within the study area while 43.5% of respondents claim that the spaces can be accessed comfortably by every potential user. This means that some people's movement will be restricted in educational facilities within the study area as a result of cases of physical disability recorded in table 4.8.

78.2% of respondents do not mind having people with different physical abilities in their educational facilities while 20.2% do not want people with different physical abilities in their educational institution. This indicates that there are people who live with a mindset of discrimination against people that are

physically challenged and this is the segregated society that lack of inclusion within the society is creating. Therefore, when public buildings are made accessible to all, people will learn to accommodate people living with disabilities.

Table 4.9: Mobility Aid Used by Respondents

QUESTION	NONE	WALKING STICK	WHEEL CHAIR	CRUTCHES
Mobility Aid	86.3	4.8	2.4	1.6

Table 4.9 Table Showing Mobility Aid Used by Respondents

Source: fieldwork, 2020.

According to the result displayed in table 4.14 above, 86.3% of respondents require no mobility aid to move around the facility, 4.8% of the respondents require walking stick to move around in the educational facility, 2.4% of the respondent require a wheel chair to move around within the educational facility, 1.6% of respondents require crutches to move around in the educational facilities within the study area. This means that public buildings should not be designed and constructed with the assumption that only the physically fit will want to come there. For those that are physically fit, accidents do occur which might make movement challenging around a public facility lacking accessibility provision for the physically challenged. This means that such people will not be able to go on with their normal activities in a public building till they recover, in a situation where they cannot recover, they might have to call it quit.

Table 4.10: Assistance for the Physically Challenged

QUESTION	ASK FOR ASSISTANCE	COMPLAIN TO THE PERSON IN CHARGE	LEAVE THE FACILITY	NONE
How do people move when accessibility provision do not meet their needs?	51.6	20.2	12.1	12.9

Table 4.10 Table Showing how the Physically Challenged are Assisted in the Building

Source: fieldwork, 2020.

Where accessibility provision does not meet the needs of users of educational facilities within the study area, 51.6% of the respondents claim people would ask for assistance, 20.2% claim that the concerned people would complain to the person in charge, 12.1% claim that they would leave the facility and 12.9% chose none of the options provided. This means that it is important for a space to be designed in public buildings for building circulation support. However, in order to cut cost, the receptionist or security personnel should be allocated spaces at the entrance of public buildings in order to provide required assistance to building users that may not know their way around public buildings.

5. SUMMARY OF FINDINGS

The study revealed that even though the existing circulation elements within the study area are not properly constructed according to recommended architectural standards, majority of the users of the educational facilities in which the research was carried out within the study area were comfortable with their movement around the facility. For the purpose of this study horizontal and vertical circulation elements were investigated. Majority of the users were comfortable with the existing circulation system within the facility, this is because majority of the respondents have no physical disability, however majority of respondents stated that the functional spaces cannot be accessed comfortably by every potential user which is the aim of this research.

The only vertical circulation element present within the study area is stairs, ramps that would have enabled every potential user access ground floor levels were not considered in the design which creates inconvenience, they were not also considered when accessing higher levels. Also in classrooms the arrangement is not friendly to every potential user, it is arranged in the conventional setting which expects every user of the facility to be without physical disability. However, inclusiveness should be considered when designing any educational facility as it is expected to be a facility accessible to the public.

The most preferred vertical circulation element is lift; lifts are easily used by all categories of people with different physical abilities. However, lifts are very costly to install and maintain as a result of the high energy it requires. Therefore, ramps are the next best element to recommend, however this element in other to achieve a recommended slope consumes a lot of functional space, hence innovative ways should be applied to cover achieve the recommended slope.

6. CONCLUSION

From the results obtained in this study, the following conclusions are made. Majority of the users of the existing circulation system in the study area find it comfortable because majority of the respondents do not have any form of physical disabilities. Vertical circulation elements such as elevators, lifts and escalators are not used because of high cost of installation and maintenance and ramps were neglected where they could have been applied easily because of the space it consumes in relation to stairs and other vertical circulation elements. For a ramp to connect two floor levels together, it requires a long distance in other to achieve its recommended slope which may tend to consume a lot of functional space. Therefore, the design of circulation system should be done with consideration of any potential user that will use it and circulation multipliers should be applied during design. Ramps are the best circulation elements to be applied in the design and should be done in an innovative way in order to integrate it into the functional space of the educational facility.

To integrate the design of ramps into the vertical circulation system of educational facilities to save space that would have been used for other functional activities and at the same time use vertical circulation elements that that require less energy. Ramps could be used in conjunction with platform lifts. Some

platform lifts are not as costly as lifts and elevators and it will be easy for school administrators to integrate this system into their educational facilities. In situations where these platform lifts cannot go above a certain height, then ramps could be used to enable complete the educational system with a minimum distance required to be covered, hence a comfortable slope will be achieved.

Horizontal movement in educational facilities is a category of movement that can have an impact on the comfort of users. It is important that entrances and exits are wide enough to enable users enter and exit the school building comfortably during a peak period of traffic and in case of any emergency. Lobbies in educational facilities should have a minimum width of 2,000mm in order to be able to allow two wheel chairs pass by each other comfortably.

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