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Exit Facilities and Emergency Preparedness in Academic Space: A Case Study

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Abstract

Emergencies are not planned events, and when they happen, they create disruption, and danger to life, property, or the environment. Where many people interface, involved in different activities, the risk of emergency is high. Therefore, it is imperative to plan for emergencies. Develop mitigation plans, train personnel, practice and evaluate the effectiveness of the developed safety measures. For this study, the case study method of qualitative research was adopted. The participants were drawn from the tactical level of leadership among the operators of the respective academic space. Interview guide, complemented with one-on-one interviews were used for data collection. The findings revealed that there was a shortfall in the quantity of the exit facilities in all the academic space evaluated, a lack of disaster management team, no training in safety management or the practice of emergency evacuation drills. Furthermore, the quality and functionality of the exit facilities were influenced by the age of the buildings. The buildings developed before 2015 were found to be deficient in the quality and functionality of the exit facilities compared to the ones developed after 2015. Therefore, this research recommended that a disaster management team should be established, train personnel in safety management and conduct regular emergency evacuation drill. Similarly, the Directorate of Physical Facilities, of the university, should evaluate and make necessary upgrade in the existing exit facilities.

Keywords
Emergency, Evacuation drill, Exit facilities, Safety preparation, Signage

1. Introduction
The safety of people and physical assets in academic spaces should be of major concern to the administrators of academic institutions. Situations that infringe on safety in academic spaces are on the increase. These include fire

incidence, flood, war, civil disturbances, students' unrest, gas leakage, other chemical hazards, and terror attacks, to mention a few. It is imperative, therefore, that adequate preparations are in place to mitigate any emergency within the academic space, for the wellbeing of all stakeholders. Although some emergencies can be predicted, majority is not predictable with any accuracy. Therefore, it is safe to adopt the maxim of the Boys' Scout, 'Be prepared'; against the backdrop that it is cheaper to prevent than manage an emergency. The preparations for safety emergencies should encompass awareness advocacy, continuous education, dynamic dissemination of information on safety, broad based planning, constituting a safety management team, periodic training and conduct of emergency evacuation drills. Several research exercise report that many educational institutions and particular academic spaces do not have a disaster response or emergency management team in place (Juryiah, et al., 2015; Nworu, 2019; Ajadi, 2022; Krug and Huwer, 2023).

The importance of the exit facilities in emergency evacuation management cannot be overemphasised, the success or failure of emergency evacuation hinges on the quality, quantity and functionality of the exit facilities. Exit facilities are emergency escape routes created to enable people exit from an enclosure safely, in case there is an emergency. They are also known as disaster risk reduction (DRR) features. They can be as simple as doorways, stairways and corridors (Shrahily and Albeera, 2025) or as complex as bunkers or tunnels (Nworu, 2019). During any emergency, those affected are under increased tension, stress and are working within limited time, which induces panic responses that may blur their ability to locate the exit facilities (Yenumula, et al., 2015). Therefore, it is important to conduct emergency evacuation drills periodically, to test the efficiency of the exit facilities and emergency preparedness of the end-users of academic facilities.

Furthermore, the functionality of exit facilities is influenced by maintenance practice. The dearth of adequate funding for maintenance activity in higher education (HE) institutions is a global concern. This has constrained maintenance department to reactive maintenance strategies and occasional renovations (Ige and Asaju, 2024; Abd Elghany and Elharakany, 2017). Conversely, concerted efforts are being made in the development of new infrastructure, which soon become dysfunctional without periodic maintenance. To bridge this gap, it is being suggested, in this paper, that administrators of HE institutions should explore the possibility of deducting a 12-15% of the cost of executing new capital project, and transfer same to maintenance allocation to boost the current meagre funds allocated for maintenance purpose, in recurrent budget.

The background for this research is a public university in Jos, Nigeria, established in the mid-1970s, along with others in the different parts of the country. These universities are commonly referred to as the second-generation universities. This university has progressed from using inherited infrastructures, make-shift to developing permanent infrastructure according the 'Standard Guide' (Aminu, 1977) provided by the National University Commission of Nigeria. Due to the increase in students' population, many of the infrastructure developed before the year 2000 have been over stretched beyond their capacity. Secondly, the security challenges in Jos and the environs, in recent years, have become a source of concern to the public and private entities. Therefore, it is imperative to evaluate the state of the exit facilities and emergency preparedness of the operators of the academic facilities that play host to the students and the other stakeholders of the university.

1.1 Objective of the research

The objectives of this research are to evaluate the emergency preparedness, training in safety management and the status of exit facilities in academic space of a higher education institution, in Nigeria.

2. Literature Review

The issue of safety in academic space has continued to attract considerable research activities. This section provides a synthesis of literature focusing on the importance of evacuation exercise and exit facilities, in safety and emergency management.

2.1 Emergency and evacuation exercise from academic spaces

An Emergency can be described as any occurrence with a high probability of escalating to cause immediate danger to life, health, property, or the environment (Ajadi, 2022). Specifically, in academic space, emergencies could be any "incidence that happens to students, teachers, nonteaching staff or visitors to the school, the school building, and the environment, which leads to fear, instability, a threat to lives or death, and destruction of property which brings about an interruption in school activities especially, teaching and learning" (Ajadi, 2022, p. 215). Emergencies could also

be any or a combination of natural disasters such as floods, earth tremors or earthquakes, war, civil disturbances within the proximate communities, students' unrest within the Campus, epidemics or pandemics, improper handling of chemical/biological/radiological materials (Ajadi, 2022).

Disaster or emergency planning and management is not complete without an arrowhead to coordinate the team to execute, progressively monitor and evaluate the effectiveness of the process (Juryiah, et al., 2015). This team is commonly referred to as a 'Disaster Response Team' (DRT). Two critical issues are important in the effective management of emergency evacuation, namely, the means of communicating the emergency to ensure understanding, elicit appropriate response to instruction and how to make sure that everyone, "regardless of physical impairment, moves into a safe place quickly" (Ragsdale and Simpson, 1996, p. 352). Further, the authors suggested that:

- The university should have an overall campus plan for safety, to enable the operators of specific academic facilities to adapt and develop a functional evacuation plan.
- Although it is not possible to develop procedures for every kind of emergency, (fire, bomb threats, power outages, terror attacks, natural disasters, and many more), it is helpful to start from the basics, progressively expanding to cover emerging challenges and include the essentials required for specific academic facility – continuously training safety personnel as you progress.
- Efforts should be made to profile and develop emergency procedures suitable for every user of any academic space, especially those with any level of disability.

2.2 Emergency preparedness for academic spaces

The three academic spaces of interest to this research are lecture halls, libraries and laboratories. The design of a lecture halls should satisfy two basic conditions, first, the hall should be spacious with more than one properly illuminated entrance and exit, and secondly, the arrangement of tables and chairs (Trung, et al., 2022). Citing the Vietnamese standards, the authors suggested that the ratio of the number of seats in a row to the entrance facility should be 12-14 seats in a row for a hall with 2 entrances or 6-8 seats for a hall with only one entrance (Trung, et al., 2022). The National University Commission (NUC), Nigeria, provides a detailed document of 'Standard Guide' for the design and construction of the physical facilities in Nigerian universities. The guide provides clear specification for all academic space, features, fixtures and fittings. Specifically, the guide provides that the width of an exit door for any academic space should be a minimum of 1150mm and increase the width in multiples of 575mm for every 100 persons. In the case of a bungalow and stand-alone academic space, the guide provides a minimum of two exit doors in opposite direction, to allow for easy egress. For multi-story buildings, the guide provides the specifications for exit stairways, suitable corridors and two doors on the same wall emptying into the corridors (Aminu, 1977).

Similarly, the adoption of the principles of Universal Design is gaining high interest globally, advocating for the design of new academic space, rehabilitation or retrofitting to provide inclusive easy access and egress for all users, especially for those with some challenges (Sahoo and Choudhury, 2023; Sholanke, et al., 2019; Hart, 2019; Pilay and Harinarain, 2017). The research effort of Azodo's, et al, (2019), on the assessment of the quantity of exit facilities in the classrooms, in a Nigerian university, showed that the 13 classrooms examined, had seating capacities between 48 and 103, and two doors on the same side of each classroom. Therefore, the evacuation routes, according to the orientation of the doors, would be by the rows. Half of the rows of the class capacity move through door 1 and the other half, moves through door 2, in opposite directions.

Libraries are custodians of "information resources that are in print formats such as textbooks, newspapers, magazines, reports etc, …the electronic and micro formats such as CD-ROM, database, internet/Email, video tapes/cassettes, diskettes, magnetic disk, computers, micro forms (fiche/facsimile) etc…" (Nworu, 2019, p. 318). This facility "houses employees, visiting patrons and a high fuel load due to their diverse collections" (Iske Jr, et al., 2015, p.39). Fire incidents are a common occurrence in library buildings. In developed societies, fire alarms, smoke detectors and automatic fire sprinklers are standard fixtures in library buildings (Iske Jr, et al., 2015). Interestingly, in many developing economies, these fixtures are rare to come by, and where they exist, many of them are not functional, due to the lack of constant water supply. Each library should have a DRT in place. However, the research exercise of Juryiah, et al., (2015, p. 2951), revealed that "55.9% of the academic libraries surveyed in Kuala Lumpur and Selangor do not have a Disaster Response Team in house". This finding is identical to what could be found in many developing economies. In the face of emergencies, many of the academic libraries rely on ad hoc staff to manage the situation. Like library facilities, emergency preparedness should be top priority in laboratory facilities.

A typical academic laboratory handles different degrees of fuel, installations prone to chemical or gas leakage, high pressure reservoirs, hardware failure, unintentional ignition from unsuspected sources and human errors. Thus, fire incidents are a common feature and have the potential to cause serious injury to personnel, major damage to equipment, structure, scientific data and invaluable documents, as well as disrupt educational operations (Omidvari, et al., 2015). Although laboratories are one of the many hazardous facilities in educational institutions, students, generally, do not take safety precautions seriously. The main reason being that safety procedures in the laboratory are generally regarded as boring and monotonous, and safety briefings are therefore considered as annoying, recurring obligations, whose value is primarily not recognized by students until there is disaster (Krug and Huwer, 2023). It is imperative, therefore, to increase the campaign on safety awareness and ensure there are functional exit facilities.

2.3 Exit facilities

The quality and quantity of exit facilities is critical in the effective management of emergencies within any academic space. Functional exit facilities significantly improve evacuation efficiency, reduces congestion in critical areas and improves the safety of occupants (Shrahily and Albeera, 2025). In a multi-story building used for different academic purposes, the authors observed that "corridors, staircases and exits are the spaces in which most delays occur" (Shrahily and Albeera, 2025, p.395), The conclusion of their research supports the hypothesis that "using multiple exits during an evacuation is far superior to relying on a single main entrance" (Shrahily and Albeera, 2025, p.401). To ameliorate the challenge of delay in evacuation, it is important to improve on the quantity and functionality of the exit facilities, properly oriented, to enhance effective and timely dispersal of the crowd.

An emergency exit is an escape route created to enable rapid evacuation of people, from an enclosure, in the event of an accident or disaster. They are disaster risk reduction (DRR) features, designed with the sole objective of offering safe or alternative routes for escape out of structures with little or no harm. These exit systems could be a simple doorways, stairways, bunkers or tunnels, depending on the perceived danger in the proximate communities (Nworu, 2019, p. 318). The buildings in many universities in developing economies are growing in sophistication, like those found in developed economies. Some of these buildings are equally fitted with advanced emergency evacuation exit facilities or routes. However, due to low skills or supporting technology, some of these features are often neglected, underutilized or become obsolete. Due to poor end-users' orientation, many post-construction beneficiaries do not know about the existence of some emergency evacuation features in their facilities or how to operate them (Nworu, 2019).

The most common exit facilities are the doorways and stairways. However, two factors can improve or impair their usefulness during emergency, namely, illumination and signage for the features. The research effort of Azodo, et al, (2019), on the visual safety assessment of classroom, observed that each classroom, in their research, had two doors and six windows. Furthermore, each doorway is $3.2m^2$ and each classroom had six window with a total area of $7,92m^2$. The research affirmed that these classrooms are well illuminated, thus, in case of emergency, students can locate the exit facilities with ease. However, in the event of low visibility from the natural light and electricity disruption, Showers and Chowdhury (2024), suggests that higher educational institutions should adapt Solar energy, as useful energy backup. The second concern is proper signage for guidance during peace and emergency.

2.4 Signage and evacuation management

Under emergency, it is more difficult to find a proper evacuation path, due to the mental stress and time limitation (Yenumula, et al., 2015). In the case of a fire accident, humans often tend to panic and create a chaotic situation.

Figure1. Signage for doorway or corridor

The fire outbreak emits smoke and causes low visibility, which makes evacuation critical under such a situation. Prior knowledge and information on the direction and location of exit facilities for evacuation is essential in tackling fire emergencies (Yenumula, et al., 2015). The signage for exit facilities should be simple, provide clear direction, without ambiguity and using attractive colours. To buttress this point, generic signs gleaned from the internet are used here,

to illustrate the values. Figure 1 can be placed above the doorway or at the entrance to a long corridor. While Figure 2 depicts the ascent and descent from stairway. Figure 3 are exit signs used for people with special needs.

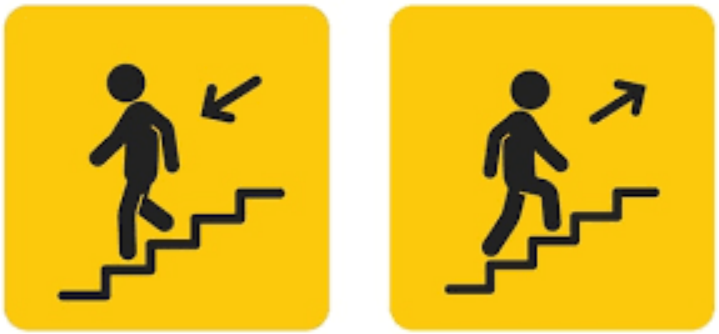


Figure 2. Signage for stairway

Figure 3. Exit for special need

Similarly, Figure 4 are commonly used for fire incidents. Each institution should maintain standard colours for the same signage and exit information, all over the campuses to avoid confusion.

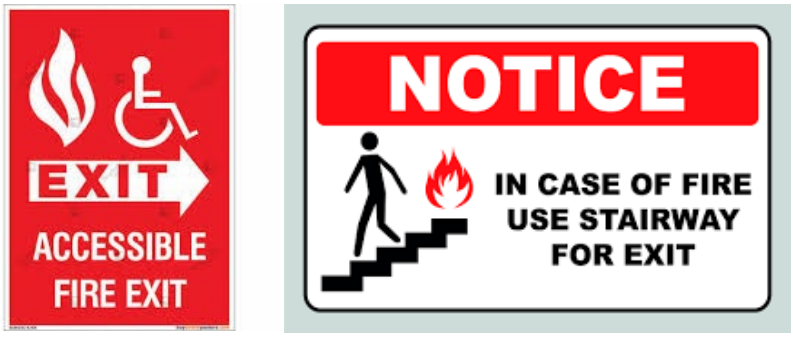


Figure 4. Signage for fire emergency for door and stairway

In buildings with a complex layout, multiple exit signs leading to different directions at an intersection for general circulation may create confusion in people under emergency. Efforts should be made to reduce these confusions by placing 'fire marshals' or safety personnel at such intersections, for proper guidance. However, with the growth in modern technologies, the automated-controlled signage system provides a suitable solution to many signage problems. The system can detect the fire prone areas in the building, identify the best route and activate the corresponding sign blinkers with high intensity. During this action, exit signs that do not lead to the best route become inactive. This efficiently guides people to the right exit facilities during emergencies (Yenumula, et al., 2015).

Drury, et al, (2009), experimented on the effects of cooperation versus competition in a mass emergency evacuation and their success rates by adapting the principles of self-Categorization theory (SCT). The import of this theory is that it challenges the individuals to see other members of the group as being part of themselves, "even where these others are not known or even personally liked" (Drury, et al., 2009, p. 959). This attitude enhances cooperation rather than competition during emergency evacuation. Competition drives the individual to wanting to escape, as quickly as possible, from the risky scene without considering the others in the same scene. This action in turn causes stampedes at the exit facilities, resulting in delays and high risk of hurt to many people, and avoidable casualties. On the other hand, adopting the principles of cooperation in SCT, allows each person to consider the interest and safety of the other persons in the group. This consideration facilitates smooth movements through the exit facilities, with minimal delays and high rate of successful evacuation. The authors described how these principles were used in managing the evacuation of students from an underground laboratory. Each student thought about their fellow student at risk as themselves and offered helping hands. They all moved seamlessly through the exit facilities without competition, and all survived the risk (Drury, et al. 2009). It is imperative, therefore, while planning emergency evacuation training,

drills and actual evacuations, to inculcate the principles of cooperation rather than competition, to improve on the evacuation process and safety of participants (Haghani, et al., 2020).
There are three take aways from the literature reviewed. First, the quality and quantity of exit facilities significantly influence the success of any emergency evacuation exercise. Secondly, each educational institution and academic facility should have a DRT and trained safety personnel. Thirdly, Periodic emergency evacuation drills are essential for effective emergency preparedness. These three factors are in tandem with the objectives of this research. The relevant features, exit facilities, emergency preparedness and training in safety management were evaluated in the three academic spaces used for this research.

3. Research Method

The case study strategy of qualitative research was adopted (Yin 2014). Case study method allows for in-depth information gathering about a particular situation or phenomenon within its context and allows the researcher to relate with the actors directly involved in the subject matter being investigated (Green and Thorogood, 2009). The academic sample for the research was drawn from the lecturers, laboratory and library officials at the tactical levels of leadership, purposively selected. To qualify, each participant must have spent a minimum of five years in the service of the university, in the respective academic space. The respondents were 14 lecturers, 6 laboratory staff and 10 library staff. Several researchers have argued that the sample size is not critical in qualitative research, but the quality of information or ideas generated (Bekele and Ago, 2022; Sarfo, et al., 2021; Malterud, et al., 2015). However, in case study design, researchers have suggested different ranges for sample size, from as low as four to as high as sixty, depending on the aim of the study, sample simplicity, quality of information and the knowledge of the participants on the research subject (Sarfo, et al., 2021; Malterud, et al., 2015). In this research, the participants selected have spent more than seven years in the service of the university, working in the respective academic space, thus, satisfied the minimum condition for participation. They were considered knowledgeable to address the subject of the research and the sample size of 30 participants was considered adequate.

The data was collected using the instrument of open-ended interview guide. Where necessary, after analysis, one-on-one interview was conducted with selected participants, to clarify grey areas in the information volunteered. The principle of content analysis was adopted for analysis. The validity and authenticity of the research information were ascertained through ‘member checks’ where the researchers recycled the analysis back to the key informants for confirmation of report and ‘thick description’ of their response in the context in which the enquiry took place (Ogbeifun, et al., 2016). The results of the analysis are presented in the next section.

4. Results and Analysis

The research information from the respondents to the qualitative interview, complemented with interviews, for the three academic space, were analysied under four classification, namely:

- **a.** The demographic information about the respondents,
- **b.** Emergency types and preparation.
- **c.** The types, quantity and quality of exit facilities, and
- **d.** The recommendations gleaned from the respondents.

4.1 Lecture Halls

Twenty interview questions were delivered to the academic staff, but fourteen were returned from the three groups, represnting the age of the infrastructure. As shown in Table 1, the demographic information about the years of experience of the respondents as lecturers, ranges from 7-36 years. This suggests that the respondents are knowledgeable about the subject of the research and the information obtained is reliable.

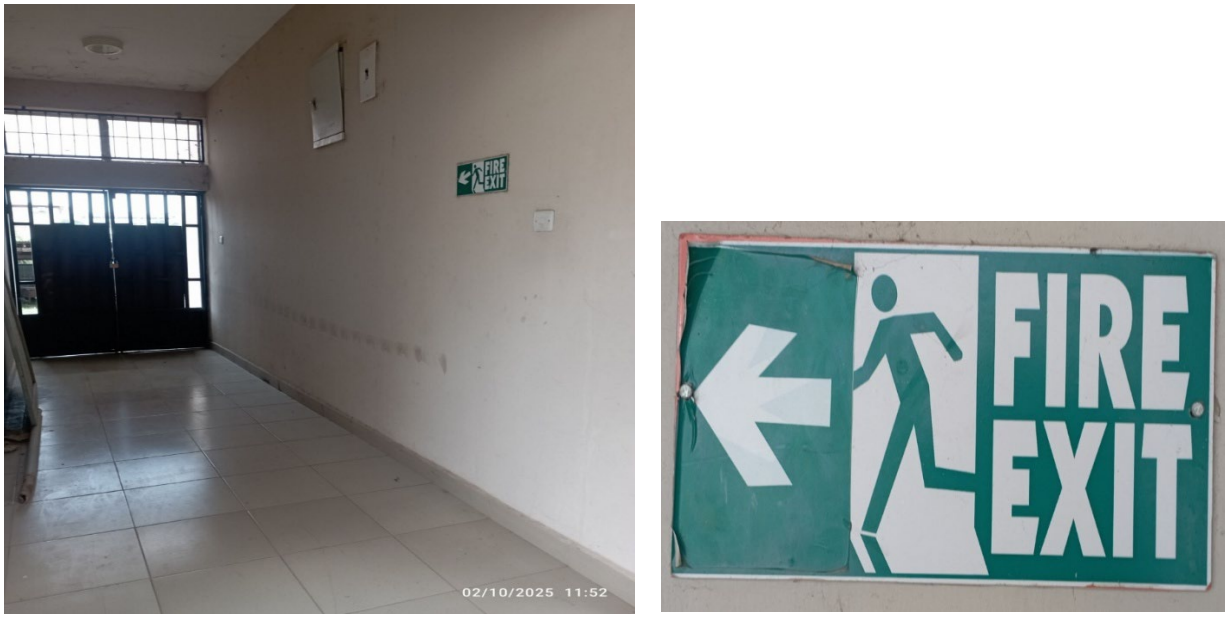
Table 1: Summary of information from respondents for lecture Halls

Classification	Interview question	Academic facility in focus: Lecture Hall		
		Group 1 (4) Buildings developed in the 1990s	Group 2 (8) Buildings developed between 2000 and 2015.	Group3 (2) Buildings developed after 2015
Demographics	Years in service	8-36yrs	7-22yrs	8 & 16yrs
Emergency types and preparation	Experienced			None
	Anticipated	Fire, civil crisis,	Fire, crisis, robbery, electrical faults	Fire, electrical faults, terror attack
	Training	No	No (yes, but long ago)	Yes
	Signage	No	No	Yes
Type, quantity and quality of exit facility	Type(s)	None	1-3 doors	Doors
	Satisfied with quantity?	No	No	Yes
	Are they functional?	None	Few functional, majority no	Yes
	Operatable during emergency?	No	Average	Yes
	Challenges with exit facilities?	No	Yes/no	None
Recommendations		Create more exit doors		
		Provide security personnel at exit doors		
		Proper signage		
		Train staff on safety preparation and practices		

4.1.1: Emergency types and preparation

The respondents afirmed that they have not witnessed any emergency in the lecture halls in the past, but provided a catalogue of potential risks that may consitute an emergency in future. They include fire incidents, civil disturbance (from within the university or in the proximate communities), electrical faults, robbery or terror attacks.

The respondents identified training in safety and proper signage as challenges in effective emergency planning and management. The respondents from group 3, observed that there has been training in safety and proper signage in their lecture halls and corridors, as shown in Figure 5 (a and b).



(a) **(b)**

Figure 5. Fire exit signs

On the other hand, there was a unanimous 'no' from the respondents in groups 1 & 2 on the issue of signage for emergency exits. On the issue of training for emergency preparedness, the repondents from group 1 said that they have not had any training in safety. While some respondents in group 2 said yes, some others said no. This dual response can be attributed to the age of the respondents in the service of the university. The older staff would have been the ones that said "yes, but long ago", and the younger staff who may not have experience the trainings said "no".

4.1.2: Type, quantity and quality of exit facility

The responses reveal a clear pattern linked to the age of the buildings. We have grouped respondents based on the age of their facility: Group 1 (buildings developed in the 1990s), Group 2 (buildings developed between 2000-2015), and Group 3 (buildings developed after 2015). Generally, door ways are the predominant exit facilities in the lecture halls. All repondents, except those from group 3, are not satisfied with the quantity of exit facilities or their levels of functionality. They also observed that they have challenges operating the few that exists during emergency.
The Ideas generated from their recommendations are presented in Table 1, the synthesis along with the recommendation from the other academic facilities were edited and presented in the section for the discussion of research findings.

4.2 Laboratories

Ten questionnaires were delivered to ten staff members responsible for the operation of academic laboratories, six were returned duly completed. The years of service of the respondents range from 14-42 years. Thus, the information provided are considered credible.

4.2.1: Emergency types and preparation

The demography of the six respondents showed that they have been in the service of the university for the periods between 14 and 42 years. They opined that there has not been any emergency experienced in the laboratories, but postulated that in future, "fire incidence, incidence of faulty electrical systems and civil disturbances" may be potential sources of emergency. They all agreed that they have not witnessed any training session on safety planning or management for laboratory staff. There are adequate and clear signages that enhance the identification of the exit facilities.

4.2.2: Type, quantity and quality of exit facility

All the respondents agreed that each laboratory had two double leaf doors, installed in the opposite walls of the laboratory. During the interview session, they said that "the doors were located in front of the laboratory, parallel to

the demonstration table, to allow for easy egress by column, from the laboratory". They expressed their satisfaction with the quality and not the quantity of the exit (two doors) facilities, because the doors are functional and easy to operate. However, in view of the increase in the number of students using the facilities, the number of exit doors should be increased.

4.3 Libraries

The respondents from the libraries are using library facilities developed across two generations. Group 1 represented the first generation of the libraries developed in the 1980s-1990s. The respondents in group 2 are operators of the new generation library developed after 2015. On the face value, it appeared that the respondent in group 3 did not understand the import of the interview questions. However, after a one-on-one interaction, his response was clarified. All the respondents have served the university between 7 and 33 years and are knowledgeable about the requirements of the research exercise (Table 2).

Table 2: Summary of information from respondents for libraries

Classification	Interview question	Academic facility in focus: Library		
		Group1 (7) [Buildings developed between 1980s and 1990s]	Group 2 (2) [Buildings developed after 2015]	Group 3 (1)
Demographics	Years in service	7-33yrs	8-14yrs	13yrs
Emergency types and preparation	Experienced	Fire		*Influx of PG students. *Writing exams. *Destruction of windows.
	Anticipated	Fire, electrical faults and civil crisis	Fire, civil crisis, flood	
	Training	3-Yes, 4-No	Yes	No (yes, but long ago)
	Signage	No	Yes	No
Type, quantity and quality of exit facility	Type(s)	Doors	Doors	Not answered
	Satisfied with quantity?	No	Yes	Yes, but poorly managed
	Are they functional?	No	Yes	Very functional but poorly managed.
	Operatable during emergency?	No	Yes	No, that is the real problem.
	Challenges with exit facilities?	Yes	No	Designated staff do not have access to the exit facilities.
Recommendations		Create more exit doors		
		Educate staff on location/type of exit facilities		
		Appoint more people to manage the exit facilities		
		Check regularly to be certain the exit faculties are functional		
		Provide security personnel at exit doors		
		Provide proper signage		
		Train staff on safety preparation and practices		

4.3.1: Emergency types and preparation

Two of the libraries in Group 1 have suffered fire incidents in the past, fire incidents are also listed along with other potential sources of emergency, as noted in other academic facilities. Furthermore, because libraries play host to large volume of books, electronic and other materials, flood in any part of the library constitutes emergency. Destructive behaviour of students was also identified as potential emergency. The respondent in group 3, observed that "the disorderly behaviour of some postgraduate students, in one of the scheduled examinations negatively impacted the operations of the library, and resulted in the destruction of equipment and windows". There was a mixed response to the issue of training for safety, few identified that they have witnessed some forms of training (especially in the new

generation libraries) while other cannot remember seeing such exercises. Similarly, the signages are better in the new generation libraries than in the older ones.

4.3.2 Type, quantity and quality of exit facility

Doors are the common type of exit facilities used in the library buildings, coupled with stairways in the multi-story buildings of some of the libraries in the university. The respondents in Group 2 affirmed that they have enough exit facilities, which are functional and easy to operate during an emergency. The major challenges with some of the doors in the older libraries are that many of the exit doors are locked, and fitted with additional bulglary system. They are seldomly opened; constraining all users of the libray to enter and exit from few doors which are also controlled for security reasons. The respondent from the third group added that "the challenges of the non-functional exit doors are because, these doors are not opened periodically, the keys are prone to rust and become difficult to open. Some other doors are complicated with massive bulglary".
Similarly, the recommendation for library facilities are edited and discussed in the section for discussion of research findings.

5. Discussion of Findings

After the data analysis, the findings from the research are discussed under three sub-headings, namely; emergency types and preparation, quantity and quality of exit facilities, and training in safety management and evacuation drill.

5.1 Emergency types and preparation

An emergency as described by Ajadi, (2022), encompasses natural, incidental and man-made sources, such as flood, earth tremor or earthquake, fire from multiple sources, epidemic or pandemic, and man-made scenarios like civil disturbances, war and improper handling of chemical/biological/radiological materials. Each or any combination of these scenarios have the potential of causing danger to life, health, property, or the environment, within the academic space, the institution or the proximate communities (Ajadi, 2022). The data collected from the three academic spaces identified potential sources of emergency as fire incidence, civil disturbance, incidence of faulty electrical systems, robbery, terror attacks and flood.

The sources of fire incidences and surrounding elements significantly influence its impact. Knowing that fire incidences can emanate from many sources, require that the planning for fire emergency should be broad based. The research efforts of Sholanke, et al., (2020) on the fire emergency safety preparedness in the buildings (academic and administrative) in Covenant University, in Nigeria, revealed that the fire emergency safety preparedness was low, because there was no comprehensive plan for firefighting and features in the building. Similarly, fire evacuation drills were a rare exercise. Although there was evidence of some fire extinguishers, majority of the users of the buildings cannot operate the devices. In similar research, focusing on the awareness of safety measures and the location of safety devices in the buildings used by a group of 153 students, 102 (66.67%) of the students surveyed fanned ignorance about the safety measures and 83 (54.25%) did not know the location of the safety devices in the buildings (Sholanke, et al. 2024). This underscores the need for periodic education, training and the practice of evacuation drills.

Ngwoke et al., (2024), conducted a broad-based evaluation of fire disaster preparedness in three selected universities in Osun State Nigeria (A Federal, State and Private university respectively). In the research, 15 participants were purposively selected: Five each, from the three universities. The findings revealed that fire disaster preparedness was low in the selected universities. This is like the conclusion of the research survey of the emergency preparedness in library buildings in two regions in Malaysia and by extension, the low level of emergency preparedness in many educational institutions in developing countries (Juryiah, et al., 2015).

Civil disturbance (of any degree) can be planned or spontaneous. As observed by a respondent from the library, postgraduate students that were meant to write examination were the architects of the disturbance in their examination venue. Civil unrest originating from external or internal sources, eventually disrupt the operations of educational institutions (Tabe and Emekako, 2025). The most common unrest internal to the institution are the ones originating from the staff or students' body. These unrests may be mild but sometimes they can be violent and destructive. The principles of managing these groups of conflicts include the dynamic information flow to all stakeholders, to guide their movement to and within the institution, increasing security presence around critical facilities, targets and vulnerable persons, then progressively engaging the aggrieved group in persuasive communication to resolve the impasse (Aradau and Van Munster, 2012; Strong et al., 2021). In extreme cases, some forms of force could be

employed to mitigate escalation and damages. On the other hand, the incidence of terror attacks requires long term preparations, intelligent gathering and networking with specialist agencies. The pre-planning stages require training in the use of codded language, evacuation drills and the use of kinetic approaches (Aradau and Van Munster, 2012), This challenges the institution to improve on the quantity, quality and functionality of exit facilities (Shrahily and Albeera, 2025).

Flood is any high flow, overflow, or inundation by water, from a river or other bodies of water, which causes or threatens damage. Other sources of flood could be from dam failure or overflow, broken service pipes (water, drainage and sewage pipes), and the rise in the ground water table, especially in buildings with basement (Terungwa and Iyortyer, 2013; Dastpak, et al., 2023). Depending on the size of the body of water, the contributing catchment areas and the geographical terrain, the hazards from a flood can be felt within a small or large circumference or route (Terungwa and Iyortyer, 2013). For example, the periodic discharge of excess water from a major dam in the Republic of Cameroon, discharges into several rivers in some parts of the North-Eastern section of Nigeria. These rivers flow towards the Southern parts of the country, causing flood challenges in Taraba, Plateau, Nasarawa, Benue, Kogi, Edo, Anambra, Delta, Rivers and Bayelsa States, before the water finally discharges into the Atlantic Occean (Abubakar, et al., 2020). Thus, any educational institution within or along any flood plain suffers from the effects of flood in the proximate communities alike. However, in localised scenarios within each educational institution, the design, construction and maintenance of surface and underground drainage systems, roof drainages, effective use of facades, cautious use of and periodic maintenance of service pipes, windows and other openings in external walls can help to reduce the negative effects of flood (Odufuwa, et al., 2012; Samad and Sheikh, 2024).

5.2 Quantity and quality of exit facilities

During a fire incidence, many people suddenly rush to the nearest exits, causing congestion in the exit area, making it difficult for effective evacuation, increasing the risks of injuries and fatalities. Two critical factors influence the rate of effective evacuation, namely, the crowd's movement behaviour and the conditions of the exit facilities (Chiu, et al., 2021). The conditions of exit facilities worth noting, include the quantity, width, arrangement, the angles of turns in exit routes and exit signage (Jeon, et al., 2019; Khamis, et al., 2020; Kodur, et al., 2020). In addition, the panic induced by a fire can potentially have a detrimental impact on the efficiency of evacuating through exits (Wei, et al., 2023). The research efforts of Huan-Huan, et al., (2015) on the influence of the exits' configuration on evacuation processes, suggest that the crowd evacuation duration decreases with an increase in the quantity of exit facilities and width. Conversely, the duration decreases with the increase in exit thickness and turning angles. Similarly, when the total exit width is small, the capacity of the exit becomes the main factor affecting the total evacuation time. On the other hand, if the total exit width is large, the pedestrian's travel distance to the exit becomes the main factor influencing the evacuation time (Huan-Huan, et al., 2015). Furthermore, as the distance between two adjacent evacuation doors increases, the evacuation efficiency of the crowd decreases (Sticco, et al., 2017; Ma, et al., 2021.

The provision of different components of academic services (administration, faculty or college) within the same cluster has resulted in developing massive edifices. Thus, wayfinding within these buildings is a challenge to members using the different component parts of the same complex and their visitors during normal operations and a nightmare during an emergency. Several research efforts advocate for the dynamic use of effective signage (static and electronic), as panacea for wayfinding during peace and emergency, in a large building complex (Maina and Audu, 2016; Jeon, et al., 2019; Kodur, et al., 2020; Sholanke, et al. 2024). Maina and Umar, (2015), provided three prong recommendations as panacea to the challenges of both wayfinding and effective evacuation from large building complex (Maina and Umar, 2015, p. 1227), thus:

> Architects and other design professionals need to pay closer attention to the design and location of physical features as wayfinding systems for multi-level buildings in future, provide properly designed signage and graphics placed at areas of high visual integration, as well as employ security personnel with training in emergency management.

5.3 Training in safety management and evacuation drill

The recommendations from the three facilities in the academic spaces used for this research, on how to improve the safety of end-user include the need to educate the end-users on the location, type and the operation of the exit facilities within their property. Secondly, the need for periodic training of staff on safety preparations and practices. These recommendations are discussed as end-users' orientation and maintenance, training in safety management and the practice of evacuation drills.

End-users' orientation are part of the concluding activities during the construction phase of any building project. In the exercise, the end-users are shown the features, fixtures (machines), documentations and manuals as well as on-the-job training in operation process and simple maintenance of the features (Fahri, et al., 2015). In terms of exit facilities and safety features in completed buildings, the end-users are shown the location of the exit facilities (doors), operation, periodic maintenance approach and operations during emergency. Similarly, the end-users are educated on the safety features in their facility. However, the exit facilities in the older buildings, before 2015, have varied degrees of functionality. This buttresses the observations of Fahri, et al., (2015), that during the operation phase of any building, continuous training of end-users is necessary, coupled with periodic maintenance. These action steps guarantee the usability, availability and reliability of the exit facilities and safety features.

Furthermore, the respondents from the three clusters of academic spaces investigated, recommended that its personnel should be trained in the act of identifying, preventing, mitigating and managing safety and emergency concerns. Junwei, et al., (2019) identified key talent areas that should be harnessed and developed when training personnel for safety and emergency management. These talent areas include the seeing eyes and listening ears, operational safety and emergency management personnel, supervisors of safety and emergency management, personnel responsible for the implementation of safety and emergency management, and talents in decision-making for safety, security and emergency management (Junwei, et al., 2019, pp. 85-86). This talent hunt and development enhance the capacity of the personnel to have a comprehensive grasp of the macroscopic situation, predictive ability in the development trend and the psychological quality of being at risk and not being confused. The trained personnel can familiarize with the generation, development, influence and resolution of events, to make corresponding countermeasures at different stages of development. They demonstrate a high sense of responsibility and dedication to resolve the challenges in the best interest of the people (Junwei, et al., 2019). The implications of these suggestions are that safety and security should be prepared for, executed by trained and not ad hoc personnel.

Generally, the training in safety and emergency management should start from simple measures, such as the dissemination of safety instructions, display of safety information, signage for evacuation route and safe gathering places, as shown in Figure 6. The building under reference in the notice is a multi-level and multiple component building housing lecture halls, classrooms, laboratories and staff offices. Training sessions should include conducting evacuation drills and simulations of different scenarios of emergency (Ogbeifun, et al., 2016; Carvalhais, et al., 2024). The practice of emergency evacuation drills is the simplest test of emergency preparedness of the end-user of academic facilities. The conduct of each drill and its evaluation provide information on the emergency response by the occupants and visitors; the adequacy of the exit facilities and the emergency mitigation feature as well as the egress time compared to the required standard. Ogbeifun, et al., (2016) observed that "conducting evacuation drills in Higher Education institution is complex due to the composition of its constituency, multiple activities, time constraints and the human dynamics: some view evacuation drills as a wasteful exercise" (Ogbeifun, et al., 2016, p. 1). The low level of interest in emergency evacuation drills, notwithstanding, the authors recommended the use of awareness campaigns to educate the end-users on the importance of safety. Noting that it is easier to prepare for emergency during peace time, rather than during the emergency itself. The progressive interactions, along with communicating safety tips through multiple communication systems, could help to develop more intimate relationships, winning their support and cooperation.

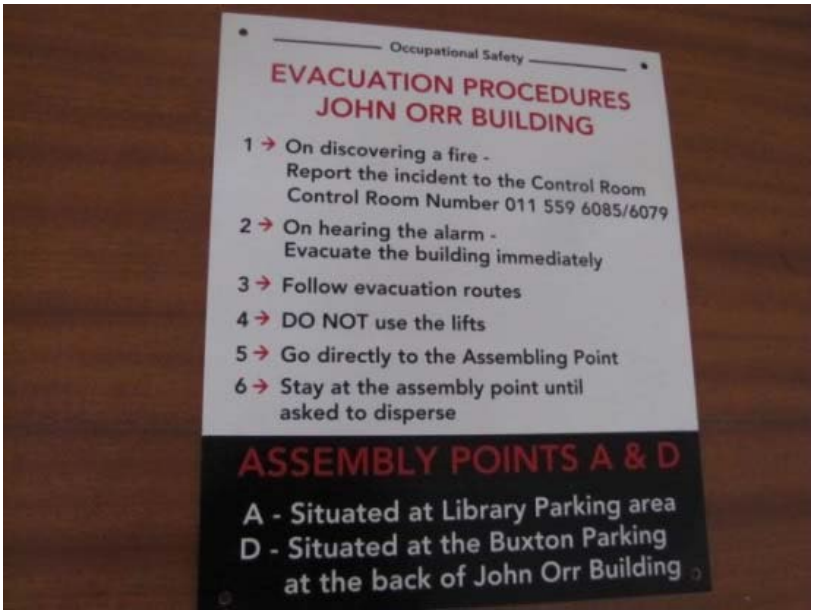


Figure 6. Information on evacuation procedure. (Courtesy: Ogbeifun, et al., 2016).

When preparing for emergency evacuation drills resulting from fire incidence, it is important to simulate the scenario close enough to a typical fire incidence (Ko *et al.*, 2007). The fire scenario, in an academic facility (lecture hall), should be arranged with the active participation of the head of department, the specific lecturer whose teaching period will be used, students' representative, the department responsible for the operation and maintenance, the fire service representative (internal or external), the security division and any other stakeholders. Identify how smoke can be introduced into the lecture hall, from external sources. The students' representatives, prepared for the assignment, should raise the alarm of fire incidence, other students in the team quickly run to open the exit facilities and the lecturer, trying to calm the situation directs the evacuation process, before the external members of the disaster risk reduction (DRR) team comes into the scene to help. When the students are the designated safe space, the lecturer or a member of the DRR should address the students (Chixiang, et al., 2012; Croce, et al., 2008; Ko, et al., 2007).
The above scenario is feasible in the case of a stand-alone lecture facility. On the other hand, when the academic space is integrated with other facilities for different use, the evacuation drill will assume a different dimension. In this regard, the in-built fire alarm systems should be triggered. The evacuation route could be guided by the combination of human agents, emergency lighting, illuminated exits signs and pre-recorded evacuation directives hoisted on a 'public address' (PA) system (Ogbeifun, et al., 2016, p. 4). If the occupants of the built facility are to respond appropriately to the fire alarm, it presupposes that they should be introduced to the sounds and signals, by way of orientation, lectures, and localised demonstrations (Ogbeifun, et al., 2016).

6. Conclusion and Recommendations

The objectives of this research were to evaluate the emergency preparedness in the operation of lecture halls, laboratories and libraries of a higher education institution, in Nigeria, in terms of training in safety management and the quality of exit facilities. The case study method of qualitative research was adopted; data was collected using interview guide and selected interviews of key informants. The findings revealed that the quality and functionality of the exit facilities were influenced by the age of the buildings. The exit facilities in the buildings developed before 2015 were generally deficient in terms of functionality compared to the buildings developed after 2015. However, there was a significant shortfall in the quantity of the exit facilities in all the academic space evaluated, compared to the current students' capacity. Furthermore, the research revealed that there were no formal disaster management teams in the facilities evaluated, no training in safety management or the practice of evacuation drills.
Therefore, this research recommended areas for further studies and actions to include:

- A comprehensive survey of all the built facilities of the university, documented according to faculties and units. The Directorate of physical facilities should use the information for the routine, medium and long-term renovation and upgrade plans.

- Transfer 12-15% of the funds for capital development to maintenance allocation, to boost the fund allocated for maintenance purposes.
- Before the handing over of newly constructed facilities, the project manager and the directorate of physical facilities should ensure proper end-users' orientation, test run of fixtures and fittings and periodic maintenance of exit facilities and safety fixtures.
- Disaster management teams should be established in all academic facilities, to coordinate emergency preparation, training and practice of evacuation drills.
- The training in emergency preparation should include simulation-based evacuation drill and integration of smart signage, by adapting suitable technology.

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Reference

Abd Elghany, M. Mona and Elharakany, A. Reem, Questioning facilities management in higher education in Egyptian context for better decision-making process of funding allocation, International Journal of Business and Management; Vol. 12, No. 7; pp. 129-137, 2017. https://doi.org/10.5539/ijbm.v12n7p129

Abubakar, B., Umar, H., Barde, M. M. and Adamu, S. Socio-economic Impact of Flooding on the Riverine Communities of River Benue in Adamawa State, Nigeria, *FUTY Journal of the Environment*, vol. 14, no. 2, pp. 116-124, 2020.

Ajadi, O Timothy, Emergency Management in Educational Institutions, In (Eds) Martins Fabunmi, George K. T. Oduro, John Enow Tabotndip and Ophelia Affreh. *Leadership in Education*. First Edition, 2022. pp. 213-227 ISBN: 978-978-59025-7-0. Published by the Education Dialogue Association (EDUDIA) and the Institute for Educational Planning and Administration (IEPA), Category 2 Affiliate of UNESCO, based at the University of Cape Coast, Ghana.

Aminu, J. "Design and Construction", In *Standards Guide for Universities*, National University Commission, Lagos, Nigeria. 1977

Aradau, C and Van Munster, R. The time or space of preparedness: Anticipating the "next terrorist attack, *Space and Culture,* vol. XX, no. X, pp. 1-12, 2012. https://doi.org/10.1177/1206331211430015

Azodo, A P, Onwubalili, C and Mezue, C T, Illuminance quality and visual safety assessment of classroom environment in a Nigerian University, *2nd International Engineering Conference*, pp.94-104, 2019. Available online at: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.researchgate.net/profile/Adinife-Azodo/publication/338375969_ILLUMINANCE_QUALITY_AND_VISUAL_SAFETY_ASSESSMENT_OF_CLASSROOM_ENVIRONMENT_IN_A_NIGERIAN_UNIVERSITY/links/5e0fd00592851c8364b01107/ILLUMINANCE-QUALITY-AND-VISUAL-SAFETY-ASSESSMENT-OF-CLASSROOM-ENVIRONMENT-IN-A-NIGERIAN-UNIVERSITY.pdf . Accessed July 23, 2025.

Bekele, W. B. and Ago, F. Y. Sample Size for Interview in Qualitative Research in Social Sciences: A Guide to Novice Researchers. *Research in Educational Policy and Management*, vol. 4, no. 1, pp. 42-50, 2022. https://doi.org/10.46303/repam.2022.3

Carvalhais, C, Dias, R, Costa, C and Silva, V. Manuela, General knowledge and attitudes about safety and emergency evacuation: The case of a higher education institution, *Safety*, vol. 10, no. 1, 2024. Available online at: **https://doi.org/10.3390/safety10010003** Accessed (html) on August 7, 2025.

Chiu, Y.-P.; Shiau, Y.-C.; Lai, Y.-H. Study on related simulations between exit characteristics and evacuation performance. *Microsyst. Technol*., vol. 27, pp. 1091–1098, 2021.

Chixiang M, Baotie S, Shimei S and Hui L., Analysis of performance-based fire safety evacuation in a college library, *Procedia Engineering,* Elsevier, vol. 43, pp, 399-406, 2012.

Croce P.A., Grosshandler W.L., Bukowski R.W. and Gritzo L.A, A position paper on performance-based design for fire code applications, *Fire Safety Journal*, Elsevier, vol. 43, pp, 234-236, 2008.

Dastpak, P., Sousa, R.L. and Dias, D. Soil Erosion Due to Defective Pipes: A Hidden Hazard Beneath Our Feet. *Sustainability*, vol. 15, article 8931, pp. 1-23, 2023. https://doi.org/10.3390/su15118931

Drury, J, Cocking, C, Reicher, S, Burton, A, Schofield, D, Hardwick, A, Graham, D and Langston, P. Cooperation versus competition in a mass emergency evacuation: A new laboratory simulation and a new theoretical model, *Behaviour Research Methods,* vol. 41, no. 3, pp. 957-970, 2009. https://doi.org/10.3758/BRM.41.3.957

Fahri, J., Biesenthal, C., Pollack, J. and Sankaran, S. Understanding megaproject success beyond the project close-out stage*, Construction Economics and Building,* vol. 15, no. 3, pp. 48-58, 2015. http://dx.doi.org/10.5130/AJCEB.v15i3.4611

Green, J. and Thorogood, N., *Qualitative methods for health research* 2nd Ed., SAGE Publication, London, 2009.

Huan-Huan, T.; Li-Yun, D.; Yu, X. Influence of the exits' configuration on evacuation process in a room without obstacle. *Phys. A Stat. Mech. Its Appl.*, vol. 420, pp. 164–178, 2015.

Haghani, M, Sarvi, M and Shahhoseini, Z. Evacuation behaviour of crowds under high and low levels of urgency: Experiments of reaction time, exit choice and exit-choice adaptation, *Safety Science*, vol. 126, article 104679, pp. 1-20, 2020. https://doi.org/10.1016/j.ssci.2020.104679

Hart, M. The Importance of Universal Design on College Campuses, *Philologia* vol. 11, no. 1, pp. 7-12, 2019. https://doi.org/10.21061/ph.176

Ige, O. V and Asaju, O. A, "Facility maintenance culture in Nigerian universities: A case study of a public university", In (Eds) Akinbogun, P. Solomon, Aigbavboa, O Clinton and Akinbogun, T. Oluwaseun, *Facility Management Practices Empirical Cases in Developing Countries*, Spinger Nature, Switzerland AG, pp. 1-17, 2024. ISBN 978-3-031-65320-9. ISBN 978-3-031-65321-6 (eBook). https://doi.org/10.1007/978-3-031-65321-6

Iske Jr, S. D. Allen and Lengfellner, G. Linda, Fire, water and books: Disaster preparedness for academic libraries, *Professional Safety*, October 2015, pp. 39-46, 2015.

Jeon, G.Y, Na,W.J, Hong,W.H and Lee, J.K. Influence of design and installation of emergency exit signs on evacuation speed. *Journal of Asian Archit. Build. Eng*., vol. 18, pp. 104–111, 2019.

Junwei, S, Zhangliang, C, Gang, L, Yu, D and Runlu, C, The training of college security and emergency management talents under the overall national security concept in the new era, *Advances in Social Science, Education and Humanities Research*, vol. 345, pp. 83-87, 2019.

Juryiah, S, Khalid, M and Dol, N. Disaster preparedness for academic libraries in Malaysia: An exploratory study, *International Journal of Social, Behavioural, Educational, Economic and Management Engineering*, Vol:9, No:10, pp. 2946-2952, 2015.

Khamis, N.; Selamat, H.; Ismail, F.S.; Lutfy, O.F.; Haniff, M.F.; Nordin, I.N.A.M. Optimized exit door locations for a safer emergency evacuation using crowd evacuation model and artificial bee colony optimization. *Chaos Solitons Fractals*, vol. 131, article 109505, 2020.

Ko S, Spearpoint M and Teo A., Trial evacuation in an industrial premises and evacuation model comparison, *Fire Safety Journal*, Elsevier, vol. 42, pp, 91-105, 2007.

Kodur, V.K.R.; Venkatachari, S.; Naser, M.Z. Egress Parameters Influencing Emergency Evacuation in High-Rise Buildings. *Fire Technol*., vol. 56, pp. 2035–2057, 2020.

Krug, M and Huwer, J. Safety in the Laboratory—An Exit Game Lab Rally in Chemistry Education. *Computers*, vol. 12, no. 67, pp. 1-13, 2023. https://doi.org/10.3390/computers12030067

Ma, G.; Wang, Y.; Jiang, S. Optimization of Building Exit Layout: Combining Exit Decisions of Evacuees. *Adv. Civ. Eng*., Article 6622661, 2021.

Maina, J. J. and Umar, B. O. Wayfinding in multi-level buildings: a study of the senate building, Ahmadu Bello University *In:* Laryea, S. and Leiringer, R. (Eds) *Procs 6th West Africa Built Environment Research (WABER) Conference,* 10-12 August 2015, Accra, Ghana, pp. 1227-1241. Accessed July 25, 2025.

Maina, J. J. and Audu, M. T. Wayfinding in Educational buildings: A Case Study of the Faculty of Environmental Design, Ahmadu Bello University, *Environ Journal of Environmental Studies*, vol. 4, no. 1, pp. 1-15, 2016.

Malterud, K, Siersma, D. Volkert and Guassora, D. Ann. Sample size in qualitative interview studies: Guided by information power, Qualitative Health Research, pp. 1–8, 2015. **https://doi.org/10.1177/1049732315617444**

Ngwoke, V. Nwora, Fayomi, O. Fidelis and Wahab, B Akeem, Evaluation of fire disaster preparedness in selected universities in Osun State Nigeria: A qualitative study, *NIU Journal of Humanities*, vol. 9, no. 3, pp. 33-42, 2024.

Nworu, N. Carl, Library emergency exit systems: A proactive planning and design against attacks, Ebonyi Journal of Library and Information Science, vol. 6, no. 2, pp. 317-329, 2019.

Odufuwa, B.O, Adedeji, O.H, Oladesu, J.O and Bongwa, A. Flood of Fury in Nigeria Cities. *Journal of Sustainable Development,* vol. 5, no. 7, pp. 1-11, 2012.

Ogbeifun E, Mbohwa C, Pretorius J H C, Evacuation drill: A test of emergency preparedness, *Proceedings of the International Conference on Infrastructure Development in Africa*, Johannesburg, South Africa, July 10-12, 2016 pp. 1-12. Accessed July 28, 2025.

Omidvari, M, Mansouri, N and Nouri, J. A pattern of fire risk assessment and emergency management in educational center laboratories, *Safety Science*, vol. 73, pp. 34–42, 2015. http://dx.doi.org/10.1016/j.ssci.2014.11.003

Pillay, S. Jhavan and Harinarain, N. Innovative solutions for lecture venues: The students' perspective, *Proceedings of The Eleventh Built Environment Conference*, 6 - 8 August 2017, Durban, South Africa, pp. 60-71

Ragsdale, W. Kate and Simpson, J, Being on the safe side, *Association of College & Research Libraries*, Vol. 57, no. 6, pp. 351-356, 1996.

Sahoo, K. Sushil and Choudhury, B. Bibhuti, Wheelchair accessibility: Bridging the gap to equality and inclusion, *Decision Making Advances,* vol. 1, no.1, pp. 63-85, 2023. https://doi.org/10.31181/dma1120239

Samad, N. and Sheikh, I. Catastrophic sways of floods on the education sector in Pakistan. *Academy of Education and Social Sciences Review*, vol. 4, no. 1, pp. 21–31, 2024. https://doi.org/10.48112/aessr.v4i1.591

Sarfo, O. Jacob, Debrah, P. Timothy, Gbordzoe, I. Newton, Afful, T William and Obeng, P. Qualitative research designs, sample size and saturation: Is enough always enough? Journal of Advocacy, Research and Education. 2021. 8(3), pp. 60-65. https://doi.org/10.13187/jare.2021.3.60

Sholanke, B Anthony, Ekhaese, N Eghosa and Ekundayo, A. Peace, Users' knowledge of fire safety measures in educational environment: A case study of a college building in Nigeria, *International Journal of Safety and Security Engineering,* vol. 14, no. 1, pp. 135-143, 2024. https://doi.org/10.18280/ijsse.140113

Sholanke, B. Anthony, Oche, G Ajonye and Paul, O. Fire emergency safety preparedness in the college of leadership development studies building in Covenant University, Ota, Nigeria, *Civil Engineering and Architecture*, vol. 8, no. 6, pp. 1463-1480, 2020. https://doi.org/10.13189/cea.2020.080628

Sholanke, A. B., Adeboye, A. B and Alagbe, O. A. Design solutions creating barriers to achieving universal design compliance of academic building in universities in Nigeria, *International Journal of Civil Engineering and Technology (IJCIET)*, vol. 10, no. 1, pp. 671-690, 2019. http://www.iaeme.com/IJCIET/index.asp

Showers, O.S.; Chowdhury, S. Enhancing energy supply reliability for university lecture halls using Photovoltaic-Battery microgrids: A South African case study. *Energies*, vol.17, article no. 3109, pp. 1-26, 2024. https://doi.org/10.3390/en17133109

Shrahily, Y Rald and Albeera, A. Haithem, Comparative analysis of engineering building evacuation efficiency: a two-phase study on multi-exit versus single-exit strategies at Al-Baha university, *J. Umm Al-Qura Univ. Eng. Archit*. vol. 16, pp. 395–413, 2025. https://doi.org/10.1007/s43995-025-00115-2

Sticco, I.M.; Frank, G.A.; Cerrotta, S.; Dorso, C.O. Room evacuation through two contiguous exits. *Phys. A Stat. Mech. Its Appl*., vol. 474, pp. 172–185, 2017.

Strong, A.C., Stockman, T., Heale, T., Meyer, S. and Meyerson, E. Persuasive communication practices of engineers in cross-boundary decision-making", *Engineering Studies,* vol. 14 No. 3, pp. 216-238, 2021. https://doi.org/10.1080/19378629.2022.2144738

Tabe, T Hennades and Emekako, R**.** Navigating educational challenges amidst civil unrest: An in-depth exploration of the impact on access in the north and south-west region of Cameroon, *Perspectives in Education*, vol. 43, no. 2, pp.: 37-53, 2025. https://doi.org/10.38140/pie.v43i2.7768

Terungwa, C. Upa and Torkwase, C. Iyortyer, Current issues in flood disaster: Challenges and implications for science and technology to enhance environmental education**,** *Academic Journal of Interdisciplinary Studies,* vol 2 no 6, pp. 61-65, 2013. **https://doi.org/10.5901/ajis.2013.v2n6p61**

Trung N D, Trang P T H, Huy D T N, Diep N T. Designing and constructing Universities with lecture hall and relevant regulations, *Journal of Art and Architecture Studies,* vol. 11, no. 1, pp. 08-13, 2022. https://dx.doi.org/10.54203/jaas.2022.2

Wei, X., Lou, Z., Song, H., Qin, H and Yao, H. Exploring the impacts of exit structures on evacuation efficiency. *Fire*, vol. 6, no. 462, 2023. https://doi.org/10.3390/fire6120462

Yenumula, K, Kolmer, C, Pan, J and Su, X, BIM-Controlled Signage System for Building Evacuation, *International Conference on Sustainable Design, Engineering and Construction, Procedia Engineering*, vol. 118, pp. 284 – 289, 2015. https://doi.org/10.1016/j.proeng.2015.08.428

Yin, R. K., *Case study research - design and methods,* 5th ed. Singapore: SAGE. ISBN 978-1-4129-6099-1, 2014.