Disable access compliance to university infrastructure: built environment students' perceptions

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Received 16 January 2023
Revised 5 April 2023
Accepted 1 May 2023

Abstract

Purpose – Higher education institutions are the citadel of knowledge and are heavily involved in formulating building regulations and building infrastructure designs that must conform to the building regulations. The study aims to identify university infrastructures compliant with disabled access from the perspective of the built environment students in Ghanaian universities.

Design/methodology/approach – Questionnaire surveys were administered to 500 built environment students across ten technical universities in Ghana with a total population of 3066; 341 were expected based on the formula used. However, upon several reminders, 176 responded. Data collected were analysed using Statistical Package for the Social Sciences.

Findings – The findings show that all university facilities are not fully compliant with disabled access. Structures found to be least compliant are the laboratories, canteens, hall of residence, toilet facilities, football fields, places of worship and transport stations. The facilities with high compliance are the administration block, library, hospital building, lecture halls, department offices and ATM areas. The leading causes for this non-compliant are lack of enforcement of the building regulations, low level of disabled students' enrolment, age of the building, lack of knowledge and poor building designs.

Practical implications – Compliance with disabled access makes universities world class and creates safe learning spaces for individuals with disabilities, enforcing the right to education for all individuals, particularly those with disabilities. Lack of compliance with disabled access will hamper the full utilisation of these facilities, thereby affecting quality education delivery to people with disabilities.

Originality/value – The findings are essential to the Ghanaian built environment, the lives of disabled individuals and universities. The results provide knowledge on areas of improvement for complete access to structures and facilities by disabled individuals.

Keywords Accessibility, Disabled, Universities, Facilities, Compliance
Paper type Research paper

1. Introduction

The disruption or restriction of executing regular daily activities due to attributes that might be permanent, momentary or episodic is termed a disability (Kportufe, 2015). Individuals can be

Property Management
Vol. 41 No. 5, 2023
pp. 681-697
Emerald Publishing Limited
0263-7472
DOI 10.1108/PM-01-2023-0004

affected by these attributes from birth or at specific points in their lives due to disease or accident and are considered disabled (Kportufe, 2015). Soltani *et al.* (2012) state that individuals with physical disabilities or impairments are deemed disabled, whereas Kportufe (2015) says that the term disabled persons also includes individuals with long-term mental, intellectual and sensory, not only individuals with physical impairments. The interaction with numerous barriers for persons with disabilities may prevent them from fully and effectively participating in society. According to the United Nations Economic Commission for Africa (2016) statistics, there are over 600 million people worldwide with disabilities, of which 400 million are living in developing countries and 80 million are found in Africa. The United Nations Sustainable Development Goals (United Nations, 2015) and the Convention on the Rights of Persons with Disabilities (United Nations, 2006) promote equal access to education for people with disabilities. Thus several nations, including Ghana, have subscribed to these policy objectives by ratifying them and adopting the ideas in their national education policies.

Despite this, in their everyday tasks, individuals with disabilities face access difficulties. According to Soltani *et al.* (2012), society does not always regard persons with impairments as equals. The authors further state that when compared to regular people in the community, disabled persons are different and have limitations in using the physical environment (Soltani *et al.*, 2012). Ansah and Owusu (2012) state that all human beings with different abilities should be considered during the design and construction phases. These processes should facilitate active utilisation and accommodate a broad range of additional assistance. Therefore, it is critical to properly plan, construct and maintain the physical environment, including public buildings, to render them accessible to satisfy all the users' requirements evenly (Kportufe, 2015).

In 1996, the Ghanaian government formulated the National Disability Policy, which led to the parliament's approval of the Persons with Disability Republic of Ghana Persons With Disability Act (2006) (Act 715). This law aims to ensure equal opportunities and empower and protect disabled people's rights irrespective of gender, race and age. Act 715 provides equal access rights for persons with disability to public places, buildings and services, including library facilities, parking places and facilities at port terminals, among others. For instance, the Persons with Disability Act of 2006 states,

> Except as otherwise required by the condition or the need for improvement of a person with disability, a person shall not subject a person with disability to differential; treatment in respect of residence. (Section 2:3) and
>
> The owner or occupier of a place to which the public has access shall provide appropriate facilities that make the place accessible to and available for use by a person with disability. (Section 6:4).

Despite this law, it has been identified that implementing, supervising and advocating disabled-related activities could be more encouraging (Kportufe, 2015). A study of the related literature indicates that little attention has been given to disabled accessibility issues for higher education building infrastructure. For instance, Soltani *et al.* (2012), Velho *et al.* (2016) and Zamree (2021) in their studies concentrated on disabled access to public transportation terminals, whilst Kportufe (2015) and Ansah and Owusu (2012) dwelled on the accessibility of public buildings by people with disabilities in Ghana. Likewise, Ansah and Bamfo-Agyei (2014) discussed the adequacy of the building facilities available to disabled people at the University of Cape Coast. Again, Zouhaier *et al.* (2013) talked about software installations tailored to the advantage of disabled users. These revelations present a research gap that makes it imperative to investigate the compliance level of disabled access to building facilities, especially that of the institution of higher education since they are critical players in the design and supervision of infrastructure construction.

The goal of society in the modern world is to be more inclusive of all people. Despite the tremendous efforts, society has not yet made the built environment accessible to people with

impairments. Students with disabilities still have difficulty accessing university facilities, despite universities' pride in being centres of top-notch education and inclusivity. The study aims to identify university infrastructures compliance to disable access from the perspective of the built environment students in Ghanaian universities and ascertain the factors attributed to non-compliance to disable access to university infrastructure.

2. Literature review

2.1 Disability and university infrastructure

According to Moriñ a and Morgado (2018), the beginning of the twentieth century, and still today, has been spent advocating for the ability to acquire higher education. In recent decades, this ability to achieve higher education for persons with disabilities has seen efforts made by several nations to ensure that it is practical and meaningful. A universal building design requires incorporating areas designed and developed for everyone (Moriña and Morgado, 2018). Ahmed *et al.* (2014) state that an institution of higher learning is an entire community. It is an educational environment and a place for young adults and seniors to work and live. Suitable accessible alternatives and amenities, both inside and outside the buildings, should be provided in all institutions of higher learning, transportation and road infrastructure for all users. The authors further stated that the architectural surroundings on campuses were not designed for disabled individuals or adapted to accommodate these marginalised persons in society (Ahmed *et al.*, 2014).

Sulaj *et al.* (2021) explained that university education aims to enhance and develop intellectual and scientific capabilities while meeting all students' social requirements. Students with disabilities, as well as general student communities, face several unresolved challenges and requirements. The authors further state that students with special needs face extra hurdles, which include inadequate university infrastructure, economic and social issues, the requirement for transportation and housing, as well as a limitation of recreational activities, job placement and career chances, among others. Prominent hurdles for students with disabilities include unsuitable auditoriums, staircases and lecture rooms, heavy doors, small pathways, elevator doors without a delay function, the lack of ramps and signage, and inefficient laws (Sulaj *et al.*, 2021).

According to Ahmed *et al.* (2014), the university environment should be structured to address varied demands with the most incredible flexibility or be responsive to such versatility to provide equitable access. Furthermore, several areas of shared interest in a university setting should have unrestricted access, including central administration, auditorium, library, lecture and conference rooms, hospital, sports and recreational centres, and student residents. Planners and architects must keep in mind that the university campus is utilised by students with different ability levels and incorporate the universal design method to ensure all students are prioritised in campus designs (Ahmed *et al.*, 2014).

It has been identified that personnel at the university libraries lack adequate knowledge concerning the challenges of persons with disabilities and their rights to access information (Ayoung *et al.*, 2021). However, all teaching, administrative and common areas should be accessible to a wheelchair user. Suitable arrangements should be made for stepped lecture halls or auditoriums. All library facilities, open book stacks and equipment should be accessible. This means there should be an improved investment in infrastructure modifications to enhance disabled persons' access. The recreational facilities should be useable by disabled people to the extent possible (Ansah and Owusu, 2012). Among the universities sampled, only a tiny fraction provided architectural, academic and residential inclusivity and extracurricular alternatives for students with limitations (Maotoana, 2014). Disabled students face several challenges in getting to campuses; for example, public transportation systems have yet to be adapted to accommodate wheelchairs.

Moriñ a and Morgado (2018) discovered in their research that students had difficulty accessing specific common places at several departments since these locations are without lifts. The students also mentioned how tiny the doorways are, making wheelchair access problematic. Students have also commented that lecture rooms have limited or inappropriate furnishings, making it challenging to move around and work effectively. Moriñ a and Morgado (2018) also indicated that insufficient lighting in certain classes was a concern for others. It makes it impossible for them to view the screen or the chalkboard. Most hearing-impaired students reported difficulties in the lecture room due to background noise. Because of the background noise, individuals have difficulty hearing the lecturer's instructions or, in certain circumstances, presenting work necessary for the topic. Obtaining material or the teaching setting might be difficult for university students with visual and hearing impairments (Moriña and Morgado, 2018).

2.2 Building accessibility

Tudzi *et al.* (2017) explained accessibility as the extent to which access is permitted equally by an environment to as many individuals as possible, particularly those with disabilities. Kportufe (2015) also referred to accessibility as the convenience of an entrance, exit and utilisation of a facility and its services by everyone, with the reassurance of personal health, security and well-being during such actions. The policy for People with Disabilities (City of Edmonton (CoE), 2019:2) defines accessibility as follows:

> Accessibility refers to the absence of barriers that prevent individuals and/or groups from fully participating, contributing and benefiting from all social, economic, cultural, spiritual and political aspects of society. The term also refers to rights to access, and to universal design characteristics of products, devices, information, programs, services, infrastructure that enable independent use, or support when required, and access by people with a variety of disabilities.

A barrier-free environment ensures that individuals with disabilities have the right to partake in all aspects of community life. Individuals with disabilities should have equitable access to public facilities and services in rural and urban locations to participate autonomously in all parts of community life. When designing buildings, accessibility and interior and exterior amenities are vital for everyone, including individuals with disabilities. For this study, the definition of CoE was adopted. According to Soltani *et al.* (2012), a proper pathway has no obstacles or risks. It is not challenging for anyone, including individuals with physical limitations or visual impairment who use wheelchairs or walking aids. Pedestrian paths must be completely obvious, safe, continuous, efficient and aesthetically pleasing. This indicates that design is crucial to buildings and will instantly inhibit several people from using them. Standing for a while is challenging, if not impossible, for disabled people, so having available seats throughout the facilities is essential. According to United Nations (2006, Article 9), governments must *"take appropriate measures to ensure persons with disabilities access, on an equal basis with others, to the physical environment and to other facilities and services open or provided to the public"*. Despite this, Malaysia is still lagging behind other countries regarding public transportation infrastructure knowledge of disability problems (Soltani *et al.*, 2012). Thus, increasing design professionals' awareness of the importance of accessibility planning must be encouraged.

According to Attakora-Amaniampong *et al.* (2022), Ghana's student accommodation providers must offer reasonable services and amenities that guarantee simple accessibility for people, specifically those with impairments, as mandated by Ghana's Persons with Disability Act of 2006 (Act 715). However, the enforcement of the legislation, notably in educational institutions, which includes providing convenient entries to libraries, information centres and lecture theatres, was conducted without an emphasis on off-campus student accommodation. Tudzi *et al.* (2017) stated that despite enacting the Persons with Disabilities Act, the accessibility needs of individuals with disabilities in Ghanaian colleges were not

appropriately incorporated into the physical surroundings. According to Tudzi *et al.* (2017), even though the Act is particularly significant in advancing the rights of people with disabilities, little has been done to execute it. The consequence is that there should be technical knowledge, strict enforcement, and adequate monitoring and assessment in addition to the legislation.

Ansah and Owusu (2012) conducted research in which they questioned the personnel responsible for the authorisation of design concepts for the chosen higher education institutions about whether the facilities created by the designers met the disability criteria. The authorities stated that, even though the legislation has been passed, several of the layouts submitted to them for authorisation do not meet the disability criteria, which they ascribed to a lack of compliance and ignorance of the Act (Ansah and Owusu, 2012). Personnel from the subject area's law enforcement agencies were also questioned to determine if they implemented disability laws in building contemporary structures. Officials acknowledged that disability legislation was not strictly implemented. According to them, the absence of a legislative instrument to support the Act for increased enforcement powers is why they cannot strictly pursue disability legislation. They did, nonetheless, try to persuade architects of public structures to include disabled amenities (Ansah and Owusu, 2012).

Oloruntoyin *et al.* (2021) discovered that experienced contractors in the works department are well-informed about the criteria for structural accommodations for people with disabilities in building design. However, most structures were not planned with wheelchair accessibility in mind. The hostels were designed to house students throughout their time at university, but data suggests that half of the doorways are inaccessible to impaired students. Similar findings were observed in departmental buildings, offices and auditoriums (Oloruntoyin *et al.*, 2021). Among the issues mentioned was the lack of funds to assist academic libraries in meeting the needs of people with disabilities. According to their findings, Ayoung *et al.* (2021) indicated that academic libraries might be unable to obtain all sorts of special equipment for each handicap because of limited resources.

In their study of accessibility on campuses in Nigeria, Oloruntoyin *et al.* (2021) discovered that in one of the situations where a ramp was located, it ended at the ground floor, leaving the top floor unreachable to individuals in wheelchairs. The ramps in new projects were particularly steep and often lacked safety railings. This is because ramps were originally imagined only during some of the structure's design phases. This implies that several campus facilities are not designed or built with individuals with disabilities in mind. It has been observed that more is required from the authorities to create an environment conducive for all citizens, especially for people with mobility-related disabilities (Nykiforuk *et al.*, 2021). This demonstrates the need for more policies on universal designs at the institutional and government levels. Decisions on the design, development and administration of the built environment are thus decided by those with authority. Tudzi *et al.* (2017) concluded that there is a need for a policy stance that would be enforceable on universities to guarantee inclusivity in the acquisition of works, services and products. People with disability cannot be excluded from social life and have the right to enjoy all activities, including using the physical, social, cultural and economic environment, health, education and communication (Zahari *et al.*, 2019). Thus, laws and regulations are promulgated to ensure a comfortable life for people with disabilities. According to their research, Ansah and Owusu (2012) discovered that 3 out of 31 modern constructions have ultimately included or accounted for disability amenities in their development. Twenty-one structures slightly included physically disabled facilities, while seven did not consider or include any physically disabled facilities in their construction and design. The study demonstrated that architectural designers for public structures do not adequately consider individuals with disabilities in their construction and design.

It is evident from the literature discussions that various provisions have been recommended for building to fulfil disability access requirements; many public and

private places and buildings have failed in one way or the other to meet the needs. It is also seen that most of these studies based their findings on the failure of legislative compliance and enforcement, contractors' assertions, resource inadequacy and overlooking the importance of disabled access in the design and construction phase of the facilities. It is therefore eminent that those involved in the design and construction phases currently in an educational environment seeking knowledge to execute these regulations' views are sought, hence the necessity of this study. The findings will increase the awareness level of the future project executors of the failure level of disabled access to facilities despite the numerous regulations, thus helping them become compliant at the design and construction stages of future facilities.

3. Methodology

3.1 Research approach

Research is the methodical and data-supported pursuit of a response to questions, the solutions to a problem or a better understanding of an occurrence (Kabir, 2016). This study aims to identify university infrastructures' compliance to disable access from the perspective of the built environment students in Ghanaian technical universities. The objective can be expressed in terms of quantity, therefore, making a quantitative approach appropriate for the study. According to Creswell (2014), a quantitative research approach must be used to examine numerical data through statistical procedures.

3.2 Target population and sample size

According to Shukla (2020), a population is a sizable group of people who share the distinctive characteristic under investigation, from which a researcher selects a sample and for whom study results may be generalised. The target population for the study encompasses built environment students in the ten technical universities in Ghana. The researchers, therefore, contacted the Heads of Departments at each university via telephone to find out the total number of students enrolled. The researcher populated the information to arrive at a student population of 3066 (see Table 1).

After identifying the population size of the built environment students at the ten universities, the researchers used the sample size formula from Welman *et al.* (2005) to calculate the required sample. The study used a confidence level of 95%, often used in social science, a standard deviation of 50% and a margin of error of plus/minus 5%. The required sample size based on the total population was calculated as follows:

Table 1.
The population of built environment students in ten technical universities in Ghana

Universities	Student population
Cape Coast Technical University	180
Accra Technical University	300
Takoradi Technical University	500
Kumasi Technical University	500
Sunyani Technical University	200
Tamale Technical University	500
Wa Technical University	131
BOLGA Technical University	171
Koforidua Technical University	270
Ho Technical University	314
Total	*3066*

Source(s): Table compiled by the authors

$$Sample\ size = \frac{\frac{z^2\,x\,p(1-p)}{e^2}}{1+\left(\frac{z^2\,x\,p(1-p)}{e^2\,x\,N}\right.}$$

where

N = total population (3066)

z = z-score or confidence level of 95% (1.96)

e = margin or error of ± 5% (0.05)

p = standard deviation of 50% (0.5)

Thus,

$$Sample\ size = \frac{\frac{1.96^2\,x\,0.5(1-0.5)}{0.05^2}}{1+\left(\frac{1.96^2\,x\,0.5(1-0.5)}{0.05^2\,x\,3066}\right.} = \frac{384}{1.125} = 341$$

The calculated minimum sample was 341 students.

3.3 Sampling method

Shukla (2020) defines sampling as choosing a population's components to include in a study. Random sampling is how each sample is chosen randomly, and each population element has an equal chance of getting chosen (O'Leary, 2021). All the built environment students from the selected universities have an equal chance of being selected for the research; hence, random sampling is an appropriate method. All population members must be known, accessible and equally likely to consent to be included in the sample for random sampling to be valid (O'Leary, 2021). The researcher randomly distributed 500 questionnaires to built environment students across the ten technical universities in Ghana, aiming to get the required sample size of 341. Thus, 50 questionnaires were distributed in each university. The researchers engaged built environment students in each university who distributed the research questionnaires to the students. Thus, any person who is a built environment student willing to fill out the questionnaire was selected and given a questionnaire. The students who received the questionnaires were given three weeks to complete and submit them back. However, 176 questionnaires were received, despite several reminders and follow-ups. This gives a response rate of 52. The researchers used technical universities because they train students who will be specialists in designing and overseeing the construction of facilities; thus, they would be incorporating disabled access regulations in the designs.

3.4 Data collection method

When using questionnaire surveys, the responders comprise diverse and dispersed populations. As a result, the questions are created with the knowledge that respondents will be required to fill up the responses themselves (Parveen and Showkat, 2017). Data was collected through questionnaire surveys administered through personal delivery. The researchers recruited one person from each of the sampled universities. The questionnaire was emailed to the research assistant, who printed the questionnaire for the built environment students during lecture times. The respondents took the questionnaire to various residences, filled it in and delivered it to the research assistant. The respondents were given three weeks to fill in the questionnaire. The survey was done within a month. The survey questions were developed using the literature review and identifying common

building infrastructure at these universities. The questionnaire was divided into three sections; Section 1: Respondent's demographics, Section 2: Facilities compliance with disabled access in the ten technical universities and Section 3: The causes of non-compliance in the university facilities.

3.5 Data analysis

The Statistical Package for the Social Sciences (SPSS) was used to examine the data. Aljandali (2016) indicated that SPSS software covers all aspects of the analytical procedure, including planning, data collecting, processing, reporting and application. It provides a comprehensive collection of data analysis and statistical algorithms that work on many personal computers (Aljandali, 2016). The data was analysed categorically and numerically. Frequencies and percentages represented the participants' demographics. The percentage indicates the proportion of participants in the different categories. The mean values, standard deviation, compliance percentage and ranking were computed to demonstrate the universities' compliance with disabled access. The causes of non-compliance were depicted with mean values, standard deviation and rankings. The mean values were arranged in descending order to indicate the highest average of causes of non-compliance in university facilities. Factor analyses were also done for each set of questions to ascertain their veracity. The demographics of the respondents are shown in Table 2.

Table 2 indicates the demographics of the respondents. The result suggests that at 12.5%, Takoradi Technical University has the highest number of respondents, followed closely by Cape Coast Technical University, Tamale Technical University and Bolgatanga Technical

	Frequency	Percentages (%)
Name of the university		
Cape Coast Technical University	20	11
Ho Technical University	15	9
Kumasi Technical University	15	9
Takoradi Technical University	22	13
Sunyani Technical University	15	9
Tamale Technical University	20	11
Koforidua Technical University	15	9
Bolgatanga Technical University	20	11
Wa Technical University	17	10
Accra Technical University	17	10
Total	*176*	*100.0*
Gender		
Male	159	90
Female	17	10
Total	*176*	*100.0*
Year of study		
First year	58	33
Second year	40	23
Third year	58	33
Fourth year	11	6
Masters	4	2
Others	5	3
Total	*176*	*100.0*

Source(s): Table compiled by the authors

Table 2. Participants' demographics

University at 11.4%. Wa Technical University and Accra Technical University's respondent rate was 9.7%. Ho Technical University, Kumasi Technical University, Sunyani Technical University and Koforidua Technical University indicated the least respondent rate at 8.5%. The results showed a significant gender difference, with 90% male and 10% female respondents. The results also indicated that most respondents were first- and third-year students at 33%. The respondent rate of fourth-year students was 6%, other students at 3% and master's students at 2%, the lowest.

4. Findings

4.1 Compliance with disabled access facilities

Participants were asked to identify the compliance level of disabled access to a list of various building facilities on their campuses using a 5-point Likert scale. Where 1 = non-existent, 2 = poorly provided, 3 = partially provided, 4 = adequately provided and 5 = fully provided. The responses were then coded in an Excel spreadsheet and transported to SPSS for analysis, as indicated in Table 3.

Table 4 indicates the findings of the facilities from the ten universities concerning disabled access compliance. The results showed that most facilities are 50% and above disabled access compliant. The mean values are arranged in descending order. The administration facilities have the highest mean value of 3.41, indicating the average administration facilities value and being the most compliant facilities on the university campuses. The library closely follows it with a mean value of 3.35, and the hospital building with m = 3.03 being the three facilities with disabled access compliance within the mean value range of 3. Lecture halls (m = 2.98), Department offices (m = 2.89), ATM areas (m = 2.85), Exam centres (m = 2.79), Campus FM station (m = 2.72), Staff bungalows (m = 2.7), Ceremony ground (m = 2.67), Parking areas (m = 2.66), Auditoriums (m = 2.63), SRC/GRASAG office (m = 2.62), Laboratory (m = 2.61), Cafeteria/Canteens (m = 2.56), Hall of residence (m = 2.5), Toilet facilities (m = 2.41), Football field (m = 2.39) and Places of worship (m = 2.27) are all facilities

Facilities	Mean	Std. Dev.	Compliance level (%)	Ranking
Administration	3.41	1.54	68.30	1
Library	3.35	1.53	67.00	2
Hospital building	3.03	1.48	60.60	3
Lecture halls	2.98	1.44	59.50	4
Department offices	2.89	1.52	57.80	5
ATM areas	2.85	1.65	57.00	6
Exam centres	2.79	1.35	55.80	7
Campus FM station	2.72	1.57	54.30	8
Staff bungalows	2.7	1.38	54.10	9
Ceremony ground	2.67	1.38	53.40	10
Parking areas	2.66	1.5	53.30	11
Auditoriums	2.63	3.47	52.60	12
SRC/GRASAG office	2.62	1.47	52.40	13
Laboratory	2.61	1.4	52.30	14
Cafeteria/Canteens	2.56	1.32	51.10	15
Hall of residence	2.5	1.43	50.00	16
Toilet facilities	2.41	1.3	48.30	17
Football field	2.39	1.35	47.70	18
Places of worship	2.27	1.3	45.50	19
Transport station	2.02	1.33	40.30	20

Source(s): Table compiled by the authors

Table 3. Compliance with disabled access to facilities in the ten technical universities

within the mean value range of 2.98–2.02 and Transport station being the least compliant facility with a mean value of 2.02.

As indicated in Table 4, the KMO measure of sampling adequacy achieved a value of 0.938, exceeding the recommended minimum value of 0.7. Bartlett's test of sphericity was also statistically significant (<0.05), thus supporting the factorability of the data.

Table 5 revealed the correlation of variables based on their factor loadings after rotation in Principal Component Analysis. Variables with the highest factor loading in one component belong to that component; the highest factor loading must be of a significant value of 0.4 and above (see Table 5). Component 1 was labelled academic facility, component 2 commercial area and component 3 students' centre. The names given to these factors were derived from closely examining the variables within each factor.

4.1.1 Component 1: academic facility. This component has eight sub-factors. The variables that had high loading are library (0.827), administration (0.811), lecture halls (0.803), staff bungalows (0.755), examination centres (0.729), department offices (0.714), cafeteria/canteens (0.593) and toilet facilities (0.544). The findings agree with the study of Drafor and Jones (2008) and concluded that most toilet facilities are not disability friendly, making it difficult for

Table 4.
KMO and Bartlett's test on compliance with disabled access to facilities

Kaiser–Meyer–Olkin measure of sampling adequacy		0.938
Bartlett's test of sphericity	Approx. Chi-Square	1942.907
	df	190
	Sig	0.000

Source(s): Table compiled by the authors

Table 5.
Rotated component matrix on compliance with disabled access to facilities

	Component		
	Academic facility (1)	Commercial area (2)	Students' centre (3)
Library	0.827		
Administration	0.811		
Lecture halls	0.803		
Staff bungalows	0.755		
Exam centres	0.729		
Department offices	0.714		
Cafeteria/Canteens	0.593		
Toilet facilities	0.544		
ATM areas		0.767	
Transport station		0.757	
Ceremony ground		0.729	
Parking areas		0.640	
SRC/GRASAG office		0.597	
Laboratory		0.560	
Campus FM station		0.536	
Auditorium			0.764
Places of worship			0.627
Hall of residence			0.571
Hospital building			0.567
Football field			0.540

Note(s): Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalisation

Source(s): Table compiled by the authors

physically challenged people to access them. Similarly, accessing examination centres is difficult due to non-compliance with the provision of ramps.

4.1.2 Component 2: commercial area. Seven variables load onto component 2. ATM areas (0.767), transport station (0.757), ceremony ground (0.729), parking areas (0.640), SRC/GRASAG office (0.597), laboratory (0.560) and campus FM station (0.536). The findings corroborated that of Tudzi *et al.* (2017), who argued that the provision of ramps leading to the ATM facilities was non-existence making the areas not compliant with disabled access. Moriñ a and Morgado (2018) further endorsed the results obtained in this research. They argued that those with vision impairments criticised the lack of signs and auditory indications along routes in public transportation facilities.

4.1.3 Component 3: students' centre. Five variables load onto component 3. Auditorium (0.764), places of worship (0.627), hall of residence (0.571), hospital building (0.567) and football field (0.540). The outcome is justified by a similar study by Attakora-Amaniampong *et al.* (2021) that most students' accommodations did not have a lift to buildings with more than four floors, making it difficult for them to have access to other floors in the residences.

4.2 Causes of non-compliance

The respondents were also asked to identify the causes of the non-compliance from a list of factors using a 5-point Likert scale which read as follows: 1 = strongly disagree, 2 = disagree, 3 = unsure, 4 = agreed and 5 = strongly agreed. The responses were then analysed and ranked in order of importance, as indicated in Table 6.

Table 6 indicates the causes of non-compliance to disabled access on university campuses. The lack of enforcement of building regulations is ranked number 1 with a mean value of 3.24, indicating the highest average non-compliance response. It is followed closely by the low level of disabled student enrolment with a 3.23 mean value. The data showed the age of the building (m = 3.11), lack of knowledge (m = 3.1), poor building designs (m = 3.09) and lack of space (3.07) as causes of non-compliance with mean values above 3. The data also indicated causes of non-compliance as the lack of funding (m = 2.86), lack of awareness by building designers (m = 2.84), no requirements for disabled access (m = 2.81), difficulty in constructing disabled access (m = 2.8) and poor spatial planning (m = 2.75).

As indicated in Table 7, the KMO measure of sampling adequacy achieved a value of 0.692, exceeding the recommended minimum value of 0.7. Bartlett's test of sphericity was also statistically significant (<0.05), thus supporting the factorability of the data.

Table 8 revealed the correlation of variables based on their factor loadings after rotation in Principal Component Analysis. Variables with the highest factor loading in one component

Causes of non-compliance	Mean	Std. Dev.	Ranking
Lack of enforcement of the building regulations	3.24	1.23	1
Low level of disabled students enrolment	3.23	1.26	2
Age of the building	3.11	1.13	3
Lack of knowledge	3.1	1.39	4
Poor building designs	3.09	1.24	5
Lack of space	3.07	1.35	6
Lack of funding	2.86	1.24	7
Lack of awareness by building designers	2.84	1.31	8
No requirements for disabled access	2.81	1.35	9
Difficult to construct disabled access	2.8	1.31	10
Poor spatial planning	2.75	1.3	11

Source(s): Table compiled by the authors

Table 6. Causes of non-compliance for disabled access

belong to that component; the highest factor loading must be of a significant value of 0.4 and above (see Table 8). Component 1 was labelled design skill, component 2 buildability and component 3 knowledge skill. The names given to these factors were derived from closely examining the variables within each factor.

4.2.1 Component 1: design skill. This component has five sub-factors. The variables that had high loading are the age of the building (0.697), lack of enforcement of the building regulations (0.665), low level of disabled students enrolment (0.647), poor building designs (0.553) and lack of funding (0.536). The findings agree with the study of Oloruntoyin *et al.* (2021), who reiterated that inaccessible entrances are a symptom that building designers were unaware of the needs of people with disabilities, which results in poorly planned structures.

4.2.2 Component 2: buildability. Three variables load onto component 2. Difficult to construct disabled access (0.819), lack of awareness by building designers (0.771) and no requirements for disabled access (0.700). The findings corroborated that of Tudzi *et al.* (2017), who argued that the provision of ramps leading to the ATM facilities was non-existence making the areas not compliant with disabled access. Owusu-Ansah *et al.* (2018) further endorsed the results obtained in this research. It is agreed that building designers' lack of information regarding the importance of creating accessible buildings can be blamed.

4.2.3 Component 3: knowledge skill. Two variables load onto component 3. Lack of knowledge (0.825) and Lack of space (0.657). The outcome agrees with Ayoung *et al.* (2021) that most residential facilities do not have adequate space to accommodate the construction of ramps and other disability-friendly access facilities for easy access of physically challenged persons.

Table 7.
KMO and Bartlett's test on non-compliance for disabled access

Kaiser–Meyer–Olkin measure of sampling adequacy		0.692
Bartlett's test of sphericity	Approx. Chi-Square	497.252
	df	55
	Sig	0.000

Source(s): Table compiled by the authors

Table 8.
Rotated component matrix on non-compliance for disabled access

	Component		
	Design skill 1	Buildability 2	Knowledge3
Age of the building	0.697		
Lack of enforcement of the building regulations	0.665		
Low level of disabled students enrolment	0.647		
Poor building designs	0.553		
Lack of funding	0.536		
Difficult to construct disabled access		0.819	
Lack of awareness by building designers		0.771	
No requirements for disabled access		0.700	
Lack of knowledge			0.825
Lack of space			0.657

Note(s): Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalisation

Source(s): Table compiled by the authors

5. Discussion

5.1 Disabled access compliance to school infrastructure

The study's findings indicate that the administration building (68.30%), library (67%) and hospital building (60.60%) are more than 60% disability compliant. Compliant facilities include adequate signage for easy manoeuvring of the building. The signage in these buildings is clear and speaks to every person. Pillay and Gumbo (2019) indicated that inadequate signage causes way-finding issues within structures. The buildings have adequate ramps, lifts and parking to accommodate individuals with disabilities. The compliant infrastructure consists of suitable toilet facilities and circulation. Although the administration, library and hospital buildings have met a little more than the minimum requirements for disabled access, much remains to be accomplished.

The universities buildings found to be 50–59% disability compliant are Lecture halls (59.50%), Department offices (57.80%), ATM areas (57%), Examination centres (55.80%), Campus FM station (54.30%), Staff bungalows (54.10%), Ceremony ground (53.40%), Parking areas (53.30%), Auditoriums (52.60%), SRC/GRASAG office (52.40%), Laboratory (52.30%), Cafeteria/Canteens (51.10%) and Hall of residence (50%). The facilities allow freedom of movement and flexibility. Disability-compliant lecture halls have high-quality audio and enhancement equipment to benefit students with hearing impairments. The seating arrangements in specific lecture halls restrict the participation and movement of individuals with physical impairments (Pillay and Gumbo, 2019). It has also been indicated that several university buildings allow for easy access inside the buildings but are restricted to certain areas such as offices, toilet facilities and other common areas, therefore not fully compliant with disability access. Tudzi *et al.* (2017) indicated that although most buildings had enough signage for information and navigation, they needed braille-marked. Although parking, ATMs, cafeterias and ceremonial grounds allow for adequate movement, proper pathways with adequate markings were lacking, making the areas not completely compliant with disabled access (Tudzi *et al.*, 2017). The hall of residence indicated lower compliance with disability access. Attakora-Amaniampong *et al.* (2021) indicated that although several university residences consist of automated doors, corridors that are wheelchair friendly, short distances to emergency exits and spacious toilet facilities, students showed dissatisfaction with being confined to one floor and not having access to other floors in residence.

The findings show that toilet facilities, football fields, places of worship and transport stations are minor disability-compliant facilities, below 50%. Students indicated dissatisfaction with toilet facilities in several buildings, such as narrow spaces inaccessible for wheelchair users, no adequate railing inside toilet spaces, and lack of braille signage for blind individuals to differentiate gender (Drafor and Jones, 2008). Facilities such as football fields and places of worship consist of vertically raked and slanting seating, making it difficult for individuals with physical impairments to access top seats (Pillay and Gumbo, 2019). Transport stations on campuses were the least disability-compliant facilities. Visually impaired individuals criticised public transport facilities for lacking signage and audible signals along routes (Morina and Morgado, 2018). A study has identified the absence of clear signage for disabled parking in several universities' transportation facilities, making it difficult for them to access these areas easily (Tudzi *et al.*, 2017).

Implications: The university's non-compliance to disabled access to facilities disregards the 2006 Persons with Disability law. This means those who must teach the disability laws due to their expertise in building and infrastructure development are not complying with them. For instance, the Persons with Disability Act 715, section 8 prescribes a jail term not exceeding three months for any person who contravenes by making public facilities and buildings inaccessible to the disabled. Despite this penalty prescribed by the law, the infringement is evident in most of the facilities located at the sampled universities. This

indicates that students may complete their education without being fully aware of the implications of not incorporating disabled access to the public and private infrastructure they will design and construct. There is an urgent need for the university authorities to re-evaluate all their facilities to ensure the renovations are done to comply with the disability laws fully and educate the students on the importance of making infrastructure accessible to disabled individuals.

5.2 Contributory factors to disabled access non-compliance to school infrastructure

The findings indicate that the lack of enforcement of the building regulations is the most contributing factor to non-compliance with university infrastructure. Attakora-Amaniampong *et al.* (2022) demonstrated in their study that enforcing building regulations in educational institutions was often conducted without emphasis on accessibility for disabled students. Although building regulations for disabled access exist, the lack of strict enforcement, monitoring and assessment leads to institutions being non-compliant with the rules. The low level of disabled student enrolment also contributes to non-compliance for disabled access. When educational institutions record low numbers of enrolled disabled students, they see no incentive for making structures accessible, as most enrolled students can utilise the facilities (Kportufe, 2015). Even though disabled students have a right to access higher education, they are aware of institutions that are more accessible to their needs and will likely not enrol on universities that do not comply with disability access. To ensure that universities do not infringe on the right of disabled individuals to higher education, a barrier-free environment should be promoted in their facilities and activities.

The results identified the age of university buildings as a cause for non-compliance with disabled access. Several universities have been in operation for many years, and structures built several decades back did not consider the needs of disabled individuals. This is evident in buildings that only utilise stairs and have no lifts, no provision for ramps, small pathways, lack of signage, etc. (Sulaj *et al.*, 2021). The lack of knowledge is also indicated to cause non-compliance within the university facilities. When individuals are not well informed about disabled access and ways to ensure accessibility to structures, they cannot incorporate disabled access to structures. Oloruntoyin *et al.* (2021) indicated that construction individuals are ill-informed about disabled access in building designs. The lower awareness level among building designers is attributed to ignorance of universal access.

The findings also indicate that poor building designs cause non-compliance with disabled access. The ignorance of building designers towards disabled access leads to poorly designed buildings. It is indicated by inaccessible doorways, offices and auditoriums (Oloruntoyin *et al.*, 2021). The lack of space was indicated in the findings to be a factor in the non-compliance of universities to disabled access. Because several universities have been operating for decades, they lack the necessary space to incorporate new building structures accessible to disabled individuals. The findings indicated that inadequate funding contributes to disabled access non-compliance in university facilities. To cater for disabled individuals, specialised equipment has to be acquired; however, several universities have indicated a limit in their funds, resulting in being unable to cater for the needs of disabled individuals.

Implications: The findings indicated that certain universities have no requirements for disabled access, which causes them to be non-compliant with disabled access. The needs of disabled individuals are ignored when there are no policies and requirements to enforce disabled access. However, this is not so in Ghana since the Persons with Disability Act 715 has existed since 2006. It must, however, be emphasised that most of these university facilities were constructed before the promulgation of the current law. Since the law cannot take retroactive effects, it may be appropriate to change the existing buildings to accommodate the law. Despite these observations, other facilities constructed after 2006

needed to be more compliant. Gavu *et al.* (2015) indicated in their research that for universities to create barrier-free environments, they need to formulate policies and requirements for disabled access. These findings also indicate the difficulty of constructing disabled access as one of the causes of non-compliance. To easily build disabled access, developers and architects must forego costly aesthetics and lavish finishes to focus on constructing spaces for specialised amenities to meet disabled persons' needs. Spatial planning was also a contributory factor to non-compliance in university facilities. Poor spatial planning in university structures manifests in spaces and layouts that exclude access to disabled students. Spatial planning ensures that environments are safe, non-hazardous and accessible to all individuals. All facilities and amenities should be planned in a harmonious and accessible manner to include all individuals, especially those with disabilities.

6. Conclusion

The Ghanaian built environment students indicated that most university infrastructures were above 50% compliant with disability access. Although 50% and above compliance is a good indication by universities of disabled accessibility, it shows that the universities are not entirely compliant with disabled access. Complete compliance will ensure that all students can fulfil their right to education. The students indicated the factors attributed to the non-compliance of universities' infrastructure, with lack of enforcement of the building regulations as the highest ranking factor. When universities fail to enforce and implement building regulations for disabled access, they become non-compliant. The study also indicated that when disabled students do not enrol at universities, infrastructure remains non-compliant as they have few disabled students to cater for. The low level of disabled student enrolment should not make universities comfortable in their non-compliance as they infringe on the rights of disabled students to access education. The study achieved its goals of identifying university infrastructure compliant with disabled access and indicated that at 63%, administration facilities are the most compliant with disabled access. The study also identified the age of the buildings, poor building designs, lack of knowledge and lack of funding as some of the factors attributed to the non-compliance of universities. The study indicated that although several university infrastructures are somewhat compliant with disabled access, there is still room for improvement to ensure complete compliance of all infrastructure in Ghanaian universities. The study recommends re-evaluating all infrastructure and making them fully compliant with disabled access. Old university facilities should be renovated to create disabled accessways and signs to make them easily accessible to disabled individuals. Students should be taught to adhere to the disabled access laws in infrastructure development. Future studies may look into ways of making university infrastructure disabled compliance.

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