Journal of Occupational Safety and Environmental Health
A Publication of the Society for Occupational Safety and Environmental Health

SUPPORTING *ABILITY IN DISABILITY* THROUGH ARCHITECTURE: ASSESSMENT OF ARCHITECTURAL ELEMENTS FOR ENHANCED PARTICIPATION OF MOBILITY IMPARED PERSONS IN RECREATION ACTIVITIES

F.B. Shehu, H. M. Babangida

Department of Architecture, Ahmadu Bello University, Zaria, Kaduna State, Nigeria
Corresponding Author: babanhamza@gmail.com

ABSTRACT
Until recently, designs of buildings and specifically public buildings focussed more on providing what the normal body requires rather than for all categories of users, especially the mobility-impaired persons. Recent architectural design efforts have however, lead to the development of design concepts and principles such as 'universal design, inclusive design and design for all, to address the needs of these categories of building users. The aim of this paper is to identify the level of application of inclusive design principles (IDP) which has now become critical requirements in all designs with specific reference to recreation centres using three case studies in Abuja, Nigeria The research was undertaken using a case study approach in which three existing recreation centres in Abuja were selected. Their selection was based on their functional and operational characteristics in providing a wide range of recreation facilities to both abled bodies and the mobility impaired persons. Prior to the commencement of the case study survey, a checklist of architectural elements and other design considerations with specific reference to accessibility based on the principles of inclusive design was developed and used in assessing the prevalence or otherwise of these features in the three cases studied. The measured accessibility features in the recreation centres include equitable use, simple and intuitive use, low physical efforts and flexibility in use of elements. Others include availability of perceptible information, tolerance for error and 'size and spaces for approach and use'. The results of the assessment analysis indicated that only one of the cases studied scored atleast 50% level in 'perceptible information' as element of inclusive design. This finding implies that there is low application of IDP in recreations centres which ultimately limits participation of the mobility impaired persons. The implication of this finding should prompt designers and professionals in the built environment to apply these principles in the design of recreation centres in Abuja and elsewhere so that the notion of ability in disability could be achieved.

Keywords: Accessibility, Inclusive design, Mobility impaired persons, Recreation centres.

1.0 INTRODUCTION

At the global scale, the concept of inclusive design has been difficult to define (Persson & Ahman 2014). It was nevertheless defined in terms of its operational value according to "British Standard Institute as "the design of mainstream products and/or services that are accessible to, and usable by, as many people as reasonably possible, without the need for special adaptation or specialised design". Similarly, the European Institute for Design and Disability (EIDD) has also defined design for all as "design for human diversity, social inclusion and equality" (Persson & Ahman 2014). These principles are generally believed to provide the physical framework for designing environments that facilitate people's emancipation from buildings that restrict or prevent their ease of mobility and access (Imrie 2012). The term mobility impairment is used to describe various disabling conditions which affect movement and ambulation of the affected persons. While the principles of inclusive design bridge relationship between the disabled and the built environment through the provision of design solutions which bring about physical constraints that substantially limit movement and fine motor controls, such as lifting, walking, and transportation (Bullet 2002). Therefore, the various design solutions in the built environment which focused on only providing solutions to the normal body is thought to neglect varying needs of the mobility impaired persons and thus excluded other building users (Danso, Tudzi & Agyekum 2017). In relation to this, the works of

Afacan (2012) further reiterated that environments which are non-inclusive are created due to the design of buildings and public spaces which often tends to focus on the 'average' person thereby conflicting with the reality of the diversity inherent in actual users.

Key objectives of the Inclusive design principles (IDP) therefore include its potentials to provide the most effective way for the mobility impaired persons to attain accessibility in buildings without any difficulty or inconvenience which is achievable through proper architectural design considerations that include a wide range of design strategies to accommodate all kinds of people (Harley et al. 2012; Mace, Hardie & Place 1996; Connell et al. 1997). Further to this, Persson & Ahman (2014) identified benefits that the individual, business community and the society at large stand to gain through the application of principles of inclusive design. The first according to the scholars include economic benefits, which directly translates to individual through increased income for someone who otherwise would not be able to work, if not for an adequate level of accessibility at the workplace. On a business level, companies could have the opportunity to offer products and services to larger markets while at the societal level, social sustainability could be achieved among populace through promotion of quality of life of individuals, especially when job opportunities were opened to the mobility impaired persons.
However, there are standards of disability which forms the basis of the perspective to which the disability is viewed. The medical model considers disability as something to be fixed, treated, or otherwise medicated (Wyman, Gillam, & Bahram 2016). While the social model considers the environment rather than the individual as disabled. This model asserts that the society itself through our attitudes and behaviour, our institutions and laws, our buildings and public spaces creates barriers which can result in segregation and separation. It is from the social model that the concept of inclusive design emerged (Town and Country Planning Association 2009). Therefore, the adoption of IDP also aligns well with the social model of disability. By intending both the physical and digital environments as something that can enable, not disable, all users, the experience is enhanced for everyone regardless of functional ability (Wyman et al. 2016).

Although use of IDP has now been adopted at global level, many public environments fall short of these principles (Basnak, Tauke, & Weidemann 2015). To buttress this assertion, Sholanke et al. (2016) observed that public buildings and environments are not easily accessible to people with disabilities mainly due to a combination of design inadequacies. Similarly, Abubakar, et al., 2016 are also of the opinion that inability to access the built environment is a socially created phenomenon that conceived the design of the environment without giving a consideration that a normal human being can become disabled. It is due to this circumstances that this paper is set to assess the level of application of IDP in recreation centres in Abuja towards promoting accessibility of mobility impaired persons;

I. To provide contextual understanding of the principles of inclusive design
ii. To evaluate the extent to which these principles have been applied in existing recreation centres.
iii. To suggest prescriptive measures that will promote the inclusion of elements of IDP in recreation centres and other public buildings.

2.0 Theoretical Framework: Concept of Inclusive Design

Historically, the term inclusive design which is interchangeably used with either universal design and or design for all (RIBA, 2009: Persson & Ahman, 2014) is according to Duncan (2007) traceable from the mid 1980's in the United States. The term was coined by architect Ronald a wheelchair user who challenged the conventional way of designing products and the built environment for the average user group and laid the foundation for an all-inclusive approach that targets everyone. In countries like Japan and USA, the idea of inclusive design is often referred to as universal design due to the similarity in their general principles. The concept

of inclusive design is to ensure the needs and requirements of all should be taken into consideration and that the finished products are completed to the specification that is collectively suitable, rather than aimed at one section of society (Disability + Architecture = Inclusive Design: Access for All, 2014). Studies show that inclusive design is understood by architects and other built environment professionals in multiple ways (Van der Linden, Dong & Heylighen, 2016; Heylighen, 2014; Wauters, Vermeersch & Heylighen, 2014).

The UK Commission for Architecture and the Built Environment (2006) published five principles for inclusive design in buildings, places and spaces which include concepts which are targeted at providing architectural and other solutions towards meeting the requirements of building users. These include 'People', 'Diversity', 'Choice', 'Flexibility' and 'Convenience'. According to Rachel Toms, Insight & Standards Manager, for U.K Inclusive Design Council, (2006), the first requirement involves design and development which creates spaces and buildings that people can use to form strong, vibrant and sustainable communities which promotes personal well-being, social cohesion and enjoyment. Architecturally, this should involve least use of steps, use of gentle step in place of steps as well as use of low window-sills for a better view among building occupants. Achieving diversity involves the removal of all barriers among the diversity of people which include barriers experienced by people with learning difficulties, mental ill health, visual and hearing impairments. On the other hand, 'choice' offers choices such that a single design solution cannot provide for the needs of all users. Similarly, achieving 'flexibility' provides solution on how the building or space will be used and who will use it in terms of changing uses and demands. Finally, 'convenience' as an element of inclusive design according to the scholar involves making physical environments easy to use for everyone through the use of directional signage, appropriate lighting, visual contrast of elements in enclosure as well as in choice of finishing and materials.

2.1 Concept of Recreation

The term recreation according to Fairchild (1970) refers to 'any activity pursued during leisure, either individually or collectively, that is free and full of pleasure, having its own immediate appeal, not impelled by a delayed reward beyond itself, or by any immediate necessity'. Additionally, recreation has been operationalised as a type of experience, as a specific form of activity, as an attitude, as an integral part of life, or as a field of work" (Ntan 2014). Other definitions which are relevant to the objective of this paper include one offered by The Countryside Recreation Research Advisory Group (1970) which defines it as 'any pursuit engaged upon during leisure time, other than pursuits to which people are normally 'highly committed' (the latter includes; such things as optional shopping, overtime, secondary work, house repairs, car maintenance, further education, homework, child care, religion and politics). Recreation is a concept that cannot easily be defined because it consists of a variety of activities undertaken in a wide range of locations. Therefore, any activity that is done due to an individual's choice during free time in order to enjoy, relax, get satisfaction, improve in wellbeing and fitness is referred to as recreation. Based upon the definitions above therefore, it behoves to operationalise recreation centres as places where diverse groups of individuals get to participate in various activities. The recreation complex is however, a building complex which provides spaces for different kinds of activities such leisure, physical fitness and relaxation.

2.2 Architectural Elements in Recreation Centres that affect Inclusive Design

As presented in the preceding section, an inclusive environment is expected to be responsive to people's needs, be flexible in use, offer choices when a single design solution cannot meet all users' needs and be convenient so they can be used by the mobility impaired without undue effort or special separation (Fletcher, 2006). Achieving these principles in public and private buildings however, hinged upon the provision of key architectural elements in the design. Literature reviewed indicated several of these elements that directly affected accessibility in buildings (Table 1) and which directly relate to the principles of inclusivity (Abubakar et al.2016; Basnak et al. 2015).

Table 1 The Five Principles of Inclusive Design and their Architectural Interpretations

INCLUSIVE DESIGN	
Principle 1: People	**-**
Principle 2: Diversity	**Equitable Use**
Principle 3: Choice	**Simple and intuitive design, low Physical efforts**
Principle 4: Flexibility	**Flexibility in use**
Principle5: Convenience	**Perceptible Information, Tolerance for Error, Size and Space for Approach and Use**

Source: (Adapted from Wong, 2014)

In the context of recreation centre designs and the affected elements whose application were measured directly affected 'diversity' choice' flexibility and convenience' in the design. These include measuring the application of the principles at the point of 'entrances', 'doors, 'entrance lobbies', 'receptions' 'stairs', lifts/escalators', 'passage ways,' and 'sanitary facilities'. These architectural elements were measured in terms of providing equitable use (diversity), simplicity and intuitive designs (choices), flexibility in use (flexibility) and availability of 'perceptible information, tolerance for error, size and space for approach and use (convenience).

2.3 The Mobility-Impaired Persons: Conceptual Definition

In order to encourage people to fully participate in all aspects of recreation and leisure, the design of the building must be physically as well as socially accessible. Historically, accessibility to public spaces has limited the opportunity for people with disabilities to engage in social and recreational activities (Rimmer et al. 2004). The design of the built environment should have elements that make it inclusively accessible to all persons. Thus, the need to factor the various forms of disabilities into the design of the built environment (Danso et al. 2017). According to a document prepared by Physical & Mobility Impairments: Information & News (PMIIN) in 2016, mobility impairment can be defined as a category of disability that includes people with varying types of physical disabilities. The disabilities which this definition covers includes those that affect the upper or lower limb loss or disability, manual dexterity and disability in co-ordination with different organs of the body. The ACCESS Project an advocacy project group sponsored by the Colorado University under the department of Occupational Therapy however defines mobility impairment as the inability of a person to use one or more of his/her extremities, or a lack of strength to walk, grasp, or lift objects. According to this group, the impairment may be caused by a number of factors, such as disease, an accident, or a congenital disorder and may be the result from neuro-muscular and orthopaedic impairments. Overall, however, the world health organisation classified impairments under the umbrella term 'Disability'. It defines it in general as 'a problem in body function or structure' (WHO). It further explained it as a complex phenomenon, reflecting the interaction between features of a person's body and features of the society in which he or she lives. In this paper, the mobility-impaired shall be considered as persons that use a wheelchair, crutches, or a walker to aid his or her mobility with specific reference to accessing physical environments.

1.0 Methodology

A case study method was adopted to carry out the research using checklists in order to examine the current status of some selected recreation centres in Abuja namely; Package B Complex, Evelyn recreation centre and Mediterranean recreation centres. Case study as research method according to Yin (2003) can be regarded as “an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident”. Essentially this research approach in architecture allows investigators to retain the holistic and meaningful characteristics of real-life events while analysing a specific phenomenon approach (Souza 2017). A checklist (Table 2) of architectural elements was developed during physical survey which serves as reference to check the level of application of IDP on the accessibility features in these recreation facilities.

Table 2: Checklist sample

	Elements	Aspects	Yes	No	Absent
1	**Access to bldgs:**				
	Ramped access	-Slip resistant floor surface -Min. of 1800mm wide -Presence of level landing at top and bottom of ramp -Gradient of the ramp(< 1:20 steep) -Ramp and its landing free of doors -Presence of hand rails on either sides of the ramp			
	Stepped access	-Rise of each step should be between 150mm and 170mm. -Rise and going of each step should be uniform throughout the flight. -Width of the flight should not be less than 1.2m.			
	External doors	-Accessible door Knobs -Use of Automatic doors -Adequate door width (>1000) -15mm maximum threshold			
2	**Access within buildings:**				
	Entrance lobbies	-Circulation width not < 1800mm -Levelled and slip resistant floor surface			
	Reception/waiting areas	-Accessible/unobstructed reception desk/counter to all users within the range of 950mm-1100mm (for standing users) &700mm (for seated users). -Clear manoeuvring space for wheel chair users. -Provision of seats of different heights.			
3	**Vertical/horizontal circulation:**				
	Stairs	-100mm-170mm rise for each stairs -Min. unobstructed width of 1200mm -Slip resistant treads			
	Corridors/passageways	-Unobstructed Corridors. -Provision of Min corridor width of 1800mm -Provision of splayed or radius corners			
4	**Sanitary facilities:**				
	Accessible toilets	-Doors, other than those for accessible toilets, must not open out into corridors. -A minimum overall room dimension of 1500mm x 2200mm -Provision of left handed and right handed toilet -Provision of riser seat attachments -provision for left or right handed transfer should be made. -provide wall mounted drop down support rails and wall mounted, slip resistant tip up seats (not spring loaded). -WCs must be in accordance with the conditions for wheelchair accessible WCs -WC and wash-hand basin 500mm x 450mm deep and rim height between 720 - 740mm			
	Accessible shower/ Changing facilities	-Provision of Individual self-contained shower facilities -A shelf that can be reached from the seat or wheelchair should be provided for toiletries. -An emergency assistance pull cord should be easily identifiable and can be reached from the seat or the floor -Facilities for limb storage should be included for the benefit of amputees. -The floor should be level and slip resistant when dry or wet. -There should be a manoeuvring space of at least 1500mm deep in front of lockers which should be provided at an accessible height. -Wall mounted drop down support rail in the shower area			

Three recreation centres served as the case studies in this paper which include the Package B complex of the National Stadium, Evelyn and Mediterranean Recreation centres all located in Abuja. Although there are several other recreation centres in the research area, a purposive sampling was adopted in selecting these three based on their functional and operational characteristics in providing a wide range of recreation activities to its users. While the variables used for the assessment of the case studies application were derived based on the universal design principles, the collected data were thus, analysed using descriptive statistics to determine the extent of application in other words the number of appearance of identified elements which facilitate inclusiveness in the architectural design of the recreation centres. To achieve this, scale of between 1(very low), 2 (low), 3 (moderate), 4 (high) and 5 (very high) was used to indicate the level of the applications of the elements in the design of recreation centres.

No	VARIABLES	
1	DIVERSITY	
	-Equitable Use	Does not segregate nor stigmatize any group of users Provisions for privacy, security, and safety for all users Appealing design to all users
2	CHOICE;	
	—Simple and Intuitive	Eliminates unnecessary complexity Consistency with user's expectations and intuition. Accommodates wide range of literacy and language skills Arrange information consistently with its importance
	—Low Physical Effort	Allow user to maintain a neutral body position. Use reasonable operating forces. Minimize repetitive actions Minimize sustained physical effort
3	FLEXIBILITY;	
	—Flexibility in use	Provides choice in methods of use Accommodate right- or left-handed access and use. Facilitate the user's accuracy and precision. Provide adaptability to the user's pace.
4	CONVENIENCE;	
	—Perceptible Info.	Use diffe rent modes (pictorial, verbal, tactile) for redundant presentation of essential information. Provide adequate contrast between essential information and its surroundings Maximize "legibility" of essential information. Make it easy to give instructions or directions. Provide compatibility with a variety of techniques or devices used by people with sensory limitations.
	—Tolerance for Error	Arrange elements to minimize hazards and errors: Provide warnings of hazards and errors Provide fail-safe features. Provide a clear line of sight to important elements for any seated or standing user.
	—Size and Space for Approach and Use	Make reach to all components comfortable for any seated or standing user. Accommodate variations in hand and grip size. Provide adequate space for the use of assistive devices or personal assistance.

1.0 Results and Discussions

The level of applications of the architectural elements which here in served as the variables for the Package B Complex located in the National Stadium Complex are as indicated in Table 2. As shown in the Table 2, the average compliance to Choice and diversity was 3.71 and 3.57 respectively, a score which tends towards high with the least average of 2.87 for 'convenience' indicating score between low and moderate application, while others such as 'flexibility in use under 'flexibility' perceptible information and 'tolerance' both under 'convenience' made a score of 3.0 respectively indicating a moderate

application of IDP in the design of the recreation centre. Among the individual elements measured however, (entrances, doors, entrance lobbies, reception, stairs, passage ways and sanitary wares), equitable use and low physical efforts have a high level of reflection. However, there is moderate level of reflection of flexibility in use, perceptible information, simple and intuitive use, size and space for approach and use as well as tolerance for error on the building components in the design of the complex.

Table 2.0: Level of Application of IDP in the Architectural Design elements of Package B Complex, at the National Stadium, Abuja obtained from Observation Checklist

No	VARIABLES	Entrance	Doors	Entrance lobbies	Reception	Stairs	Lifts/escalator	Passageways	Sanitary facilities	Mean REMARKS
1	DIVERSITY									*Mean*
	—Equitable Use	4	4	4	3	2	-	4	4	3.57 High
2	CHOICE;									
	—Simple and Intuitive	4	3	3	3	2	-	3	4	3.14 Moderate
	—Low Physical Effort	4	4	4	4	2	-	4	4	3.71 High
3	FLEXIBILITY;									
	—Flexibility in use	4	3	3	3	2	-	3	4	3.14 Moderate
4	CONVENIENCE;									
	—Perceptible Info.	4	4	2	3	-	-	4	4	3.0 Moderate
	—Tolerance for Error	4	4	3	3	2	-	3	4	3.0 Moderate
	—Size and Space for Approach and Use	4	3	3	3	1	-	3	3	2.87 Moderate

Similarly, the results obtained from Evelyn Recreation Centre, Abuja indicated various levels of application of IDP in its design. As shown in Table 3, only availability of 'perceptible information' scored a mean of 2.71 indicating moderate application. All other IDPs had mean scores of between 2.1 and 2.42 indicating low application in its design. Hence, the accessibility features at Evelyn recreation centre is relatively low for all the IDPs except perceptible information which has a moderate level of application.

Table 3. Level of Application of IDP in the Architectural Design of Evelyn Recreation Centre, Abuja obtained from Observation Checklist

	VARIABLES	Entrance	Doors	Entrance lobbies	Reception	Stairs	Lifts/escalator	Passageways	Sanitary facilities	REMARKS
1	DIVERSITY									*Mean*
	—Equitable Use	2	2	3	3	2	-	2	1	2.1 Low
2	CHOICE;									
	—Simple and Intuitive	2	3	3	3	2	-	3	1	2.42 Low
	—Low Physical Effort	3	2	3	2	3	-	2	2	2.42 Low
3	FLEXIBILITY;									
	—Flexibility in use	2	2	2	3	2	-	3	2	2.28 Low
4	CONVENIENCE;									
	—Perceptible Info.	4	3	2	3	2	-	2	3	2.71 Moderate
	—Tolerance for Error	2	2	3	3	2	-	3	2	2.42 Low
	—Size and Space for Use Approach and	2	3	3	3	1	-	2	2	2.28 Low

The results of the last case study as obtained are shown in Table 4. Except availability of 'perceptible information' which had a mean score of 2.71 indicating a moderate application of IDP in the design of the recreation centre, the result indicated that the other three IDPs with mean range scores of between 2.14 to 2.42 were applied in the design at low level. Therefore it can be seen that accessibility features at Mediterranean recreation centre is relatively low for all the principles except perceptible information which has a moderate level of application.

Table 4. Level of Application of IDP on the Architectural Design elements of Mediterranean Recreation Centre, Abuja

	VARIABLES	Entrance	Doors	Entrance lobbies	Reception	Stairs	Lifts/escalator	Passageways	Sanitary facilities	REMARKS
1	DIVERSITY									*Mean*
	—Equitable Use	2	2	3	3	2	-	2	1	2.14 Low
2	CHOICE;									
	—Simple and Intuitive	2	3	3	3	2	-	3	1	2.42 Low
	—Low Physical Effort	3	2	3	2	3	-	2	2	2.42 Low
3	FLEXIBILITY;									
	—Flexibility in use	2	2	2	3	2	-	3	2	2.28 Low
4	CONVENIENCE;									
	—Perceptible Info.	4	3	2	3	2	-	2	3	2.71 Moderate
	—Tolerance for Error	2	2	3	3	2	-	3	2	2.42 Low
	—Size and Space for Approach and Use	2	3	3	1	2	-	2	3	2.28 Low

4.1 Summary of Applied IDPs compared

Analysis carried out on the case studies based on the application of the principles of inclusive design has revealed that there is a certain degree of distinction on level of application between all case studies. Thus, results revealed that the Package B complex has the highest application of IDP in its design with 64%, followed by Evelyn recreation centre and Mediterranean recreation centre with a 32% each and emerald recreation centre has the lowest application of IDP with 25%. Therefore, as shown in Table 5, all case studies have a low level of application of IDP in their design except package B complex which is slightly above average.

Table 5.0 Summary of IDP Application Assessment Findings from case study

VARIABLES	PACKAGE B COMPLEX	EVELYN RECREATION CENTRE	MEDTRRNEAN RECREATION CENTRE
Equitable use	High (100%)	Low (25%)	Low (25%)
Simple and intuitive use	Moderate (50%)	Moderate (50%)	Low (25%)
Low physical efforts	High (100%)	Low (25%)	Low (25%)
Flexibility in use	Moderate (50%)	Low (25%)	Low (25%)
Perceptible information	Moderate (50%)	Moderate (50%)	Moderate (50%)
Tolerance for error	Moderate (50%)	Low (25%)	Low (25%)
Size and space for approach and use	Moderate (50%)	Low (25%)	Low (25%)
Average (Mean Score)	64%	32%	29%

1.0 Conclusion

This study was undertaken to assess the level of application of inclusive design principles IDP in buildings with specific reference to how these buildings provide access especially for the mobility impaired persons; to buildings, within buildings, vertical/horizontal circulation as well as in places and spaces where sanitary facilities were provided. The overall results of the analysis indicates low-level application of accessibility features in the study area as only one out of the three cases had more than 50% (above average) level of application on accessibility features in Nigeria and elsewhere. The findings of the research also goes in line with the studies of (Abubakar et al. 2016; Basnak et al. 2015; Danso et al. 2017; Sholanke, et al., 2016) who discovered that the designed physical environment and especially public buildings were generally inaccessible to the physically challenged. This negates the focal point of inclusive design, which is to produce buildings and physical environments that are accessible and usable by as many people as reasonably possible without segregation and exclusion. Based upon the outcome of the paper therefore, it is recommended that recreation centre managements should begin to make efforts to ensure that there is no form of difficulty or inconvenience in access and use of facilities and buildings in their recreation centres. In creating a sustainable recreation environment, it is vital to ensure that facilities, buildings and the environment make provision for equity among its users.

References

Afacan, Y 2012, Achieving inclusion in public spaces: a shopping mall case study. In P. Langdon, J. Clarkson, P. Robinson, J. Lazar, & A. Heylighen (Eds.), Designing inclusive systems (pp. 85–92). London, UK: Springer.

Abubakar, A., Adam, M., & Ghafar, N. A 2016, Response of universal design to the mobility experience of disabled people in tetiary institutions of north-west Nigeria. *Journal of Universal Design in the Built environment*.

Access Project 2010, Department of Occupational Therapy, Colorado State University http://accessproject.colostate.edu/disability/modules/MI/tut_MI.php

Alvarenga, F. B., & Dedini, F. G. 2005. The principles of inclusive design. *COBEM 2005 18th International Congress of Mechanical Engineering.*

Basnak, M., Tauke, B., & Weidemann, S 2015, Universal design in architectural education: who is doing it? how is it being done? In A. Aksamija, J. Haymaker, & A. Aminmansour (Eds.), *Future of architectural research. Proceedings of the Architectural Research Centers Consortium ARCC 2015 Conference* (pp. 670-678). Perkinsb Will.

Bullet, D 2002, Usability Glossary: Mobility impairment. http://www.usabilityfirst.com/glossary/main.cgi?function=display_term&term_ http://www.usabilityfirst.com/glossary/main.cgi?function=display_term&term_id=1037. [accessed 2017 October 2]

Connell, B.R., Jones, M., Mace, R., Mueller, J., Mullick, A., Ostroff, E., et al. 1997, The principles of universal design. North Carolina State University, the Center for Universal Design. http://www.ncsu.edu/project/design-projects/udi/center-for-universal-design/the-principles-of-universal-design/

Countryside Recreation Research Advisory Group 1970, Countryside Recreation Glossary, Cheltenham, UK, Countryside Commission, p. 7.

Danso, A. K., Tudzi, E. P., & Agyekum, K 2017, Promoting education on inclusive design of the built environment at Knust. *Modern Management Science & Engineering*, vol. 5, no. 2, pp. 2052-2576, viewed 30 July 2017, from www.scholink.org/ojs/index.php/mmse.

Disability + Architecture = Inclusive Design: Access for All. 2014. Retrieved july 5,

2017, from Building specifier: https://www.building specifier.com

Document M: Access to and Use of Buildings 2010 incorporating 2013 amendments. UK

Duncan, R. 2007. *Universal Design-Clarification and Development.* North Carolina: North Carolina State University.

EIDD: The EIDD Stockholm Declaration 2004. Adopted on 9 May 2004, at the Annual General Meeting of the European Institute for Design and Disability in Stockholm. Design for All Europe 2004

Fairchild, H. (ed.) 1970, Dictionary of Sociology. Westport, CN, Greenwood Press, p. 251 (orig. pub. 1944).

Fletcher, H 2006. *The principles of inclusive design: they include you.* London: CABE.

Persson, H., Ahman, H 2014, Universal Access Inf Soc DOI 10.1007/s10209-014-0358-z

Harley, D., Vetere, F., Fitzpatrick, G., Kurniawan, S 2012, Intergenerational context as an emphasis for design. Univ. Access Inf. Soc. vol 11, no 1, pp. 1–5, viewed 4 April 2019, Doi;10.1007//s10209-011-0228-x

Heylighen, A 2014, About the nature of design in universal design. *Disability and rehabilitation,* vol 16, no. 36, pp. 1360-1368.

Imrie, R 2001, Barriered and bounded places and the spatialities of disability. *Urban Studies*, 231-237.

Imrie, R 2012, Universalism, Universal Design and equitable access to the built environment. *Disability and Rehabilitation,* vol 34, no. 10, pp. 873–882. http://dx.doi.org/10.3109/09638288.2011.624250

Mace, R.L., Hardie, G.J., Place, J.P 1996, Accessible environments: toward universal design. North Carolina State University: The Center for Universal Design. http://www.ncsu.edu/ncsu/design/ cud/pubs/p/pud.htm (1996).

Ntan, E. A 2014, *Calabar municipal recreation centre expression of indigenous context in recreational facility design,* thesis, Zaria, Ahmadu Bello University, viewed 20 September 2017, Kubanni database.

RIBA 2009, *Inclusive Design: Creating a user's World.* London.

Rimmer, J. H., Riley, B., Wang, E., Rauworth, A., & Jurkowski, J 2004, Physical activity participation among persons with disabilities:Barruers and facilitators. *American Journal of Preventive Medicine*, 419-425.

Sholanke, A. B., Adeboye, A. B., Oluwatayo, A. A., & Alagbe, O. A 2016, Evaluation of universal design compliance at the main entrance of selected public buildings in Covenant University, Ota, Ogun State, Nigeria. *3rd International Conference on African Development Issues* (p. 188). Ogun: Covenant University Press.

Souza, R. C. F 2017, Case Studies as method for architectural research. Working Paper · January 2015 DOI: 10.13140/RG.2.2.15768.19207.Publication at:https://www.researchgate.net/publication/314147521

Town and Country Planning Association 2009. *Applying inclusive design principles to eco-town development.* London: RAP Spiderweb Ltd.

Van Der Linden, V., Dong, H., & Heylighen, A. 2016. From accessibility to experience: Opportunities for inclusive design in architectural practice. *Nordic Journal of Architectural Research.*

Wauters, H., Vermeersch, P.W., Heylighen, A 2014. *Reality check: notions of accessibility in today's architectural design practice*, in: Lim, Y. K., Niedderer, K., Redstreom, J., Stolterman, E., Valtonen, A. (Eds.), DRS 2014: Design's Big Debates. Umeå, Design Research Society & Umeå Institute of Design, pp. 1482- 1491.

WHO, n.d Health Topic: Disabilities. Downloaded 2019. https://www.who.int/topics/disabilities/en/

Wong, H. L. 2014. *Architecture without barriers: Designing inclusive environments accessible to all.* Ryerson University: Unpublished Masters thesis.

Wyman, B., Gillam, S., & Bahram, S 2016. Inclusive design: from approac to execution. *Museums and the Web.* Los Angeles, USA: USD Design.