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Promoting Education on Inclusive Design of the Built Environment at Knust

Anthony K. Danso[1*], Eric P. Tudzi[2] & Kofi Agyekum[1]

[1] Department of Building Technology, College of Art and Built Environment, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

[2] Department of Land Economy, College of Art and Built Environment, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

[*] Anthony K. Danso, E-mail: akdanso2000@yahoo.com

Abstract

Persons with Disabilities (PWDs) represent the most marginalized, neglected and excluded persons in society hence the rise in the activities of various advocacy groups to ensure the inclusion of PWDs in society. One of the most sensitive areas of discrimination against Persons with Disabilities (PWDs) is barriers in the built environment. This study is aimed at promoting and improving inclusive design education and disability equality in Ghana. It therefore assessed the training of the graduates at Kwame Nkrumah University of Science and Technology (KNUST) who later become professionals of the built environment in Ghana. To achieve the objective of the study, the Course Contents of various departments that taught courses relating to the built environment were evaluated through a survey of 259 respondents made up of 23 lecturers, 127 students, 52 design professionals of the built environment and 57 Persons with Disabilities (PWDs). The findings revealed that the curricula of most of the departments that taught built environment courses at KNUST were deficient in the principles of inclusive design. The PWDs on the other hand blamed the government and design professionals for the inaccessible built environment. The study recommends that the present curricula of all relevant departments should be revised to incorporate elements of inclusive design and design professionals who are already practicing in the field should be given refresher courses by their respective professional bodies to make them more responsive to the changing trends of universal design.

Keywords

persons with disabilities, inclusive design, built environment, education, course content, universal design

1. Introduction

Every individual, regardless of his ability or disability, has a fundamental right of movement. This privilege includes the right to access the built environment without any hindrance. The built environment has usually been designed with the concept of what the "normal body" is, thus neglecting the varying needs of Persons with Disabilities (PWDs). For instance in Ghana, vertical movement in public buildings is usually by means of a series of stair cases, light switches and fan regulators are positioned at heights that are usually inaccessible to a wheelchair user, pavements and walkways are often strewn with obstacles and bounded by kerbs, while the ramps in the few public buildings where they are available are constructed at steep slopes making them difficult for PWDs to use. The situation is not different even in the developed countries. For instance in the British general election in May 1997, 75% of polling offices were inaccessible to people in wheelchairs, while few had the technical aids to permit visually impaired people to mark their votes on the polling papers (Imrie, 2001).

Notwithstanding, Article 9 of the United Nations Convention on the Rights of Persons with Disabilities (2006) states inter alia that to enable PWDs to live independently and participate fully in all aspects of life, state parties shall take appropriate measures to ensure PWDs have access on an equal basis with others to the physical environment, to transportation, to information and communication including information and communication technologies and systems, and to other facilities and services open or provided to the public, both in urban and in rural areas. These measures which shall include the identification and elimination of obstacles and barriers to accessibility, shall apply to inter alia buildings, roads, transportation and other indoor and outdoor facilities, including schools, housing, medical facilities and workplaces. In spite of this and other regulations by international and local bodies, PWDs continue to face discrimination in the built environment in their daily lives.

Based on 2010 global population estimates about 15% of the world's population is disabled (WHO, 2011). Of this, 80% are from developing countries of which Ghana is a part (UNDP, 2014). Exclusion of the needs of PWDs is evident at all stages of the design and development of the built environment. It appears that it is either because most designers are ignorant of the needs of PWDs or potential tenants and clients rarely express a demand for accessible buildings and the regulatory controls are not strong enough (Imrie & Hall, 2001). There is therefore the need to factor the various forms of disabilities into the design of the built environment. The design of the built environment should have elements that make it inclusively accessible to all persons. The most effective way of ensuring that the built environment is inclusive will be to ensure that design professionals in the country have adequate knowledge of the needs of PWDs and are skilled to apply the necessary principles needed to produce inclusive designs (Imrie, 2001).

The aim of this research was to examine the current state of inclusive design education at Kwame Nkrumah University of Science and Technology (KNUST), Kumasi—Ghana where majority of professionals of the built environment in Ghana are trained. It sought to:

- Investigate whether the curricula of the relevant departments at KNUST include inclusive design.
- Investigate whether design professionals who are products of these departments incorporate inclusive design in their work.
- Know the perception of PWDs in the city of Kumasi on how accessible their built environment is.

1.1 Inclusive or Universal Design

The Centre for Universal Design (CUD) at North Carolina State University defines Inclusive or Universal Design as the design of products and environments to be usable by all people, to the greatest extent possible without the need for adaptation or specialized design. The CUD has established the following seven principles for the universal design of products and environments: equitable use; flexible in use; simple and intuitive use; perceptible information; tolerance for error; low physical effort; size and space for approach and use (The Centre for Universal Design, 1997).

In the promotion of inclusive design culture, the responsibility for the process of achieving and maintaining inclusive environments does not rest only on design professionals such as architects, engineers and planners but the whole project team and the professionals that surround them such as quantity surveyors, project managers, contractors and site operatives, service engineers, planners and developers (Hanson, 2004). Everyone who makes a decision or acts in a way that creates, alters or influences the nature of the built environment should be conscious of making his designs inclusive. Students therefore need to acquire team working and cross-disciplinary skills to promote an ethos and awareness of inclusive design. Imrie (1996) averred that building and design professionals have little recognition of bodily and/or physiological diversity and so there is a tendency for architects and

designers to design to specific standards and dimensions which revolve around a conception of what the normal body is. Most design professionals seem to conceive of architecture as an abstract, often two dimensional, visual art rather than conceiving of it as something which should be sensitized to the complexity of the human body (Imrie, 1996). In addition most designers also conceive of disabled bodies as mobility or ambulant-impaired, with little perception of the wider range of physical and/or mental impairments which need to be catered for in producing inclusive design. Where designers do produce designs for PWDs it tends to be for wheelchair users only. The challenge is, to explore and question the values held by design professionals; to encourage them to be aware of different needs and expectations. There is now a growing realization that the knowledge and values needed to create and maintain inclusive environments, have in turn to be supported by a more extensive set of people orientated skills than built environment professionals currently utilize. From the above, it is important that the curricula of higher institutions of learning where built environment professionals are trained are tailored to include the principles of inclusive/universal design so as to equip the students early in life with the requisite knowledge and skills which they could utilise later in life.

Reasons why inclusive design should be integrated into the curriculum of the built environment courses are any and varied. For instance a research group set up in September 2001 by the Centre of Education for the Built Environment in the United Kingdom to study inclusive design brought out five arguments to support why inclusive design should be integrated in the curriculum of built environment courses.

- *The moral argument*; it was argued that everybody has the alienable right to participate in community life which includes accessible built environment and so teaching inclusive design in schools will enable students to build their own set of values to support their future practices as built environment professionals.
- *The sustainability argument*; a community becomes sustainable by the establishment of inclusive environments that combine flexible, practical and pliable building forms with long term affordability and access to services.
- *The professional argument*; the import of the moral argument has been captured in the codes of conduct of many built environment professional institutions. These codes of conduct usually demand that their members should cultivate a high sense of responsibility for the way in which their professional actions impact on both clients and users of the built environment.
- *Economic argument*; it was argued that an inclusive environment is an enlarged one which stimulates the growth of access, payment of taxes and trading in goods and services.
- *Legal argument*; the fundamental goal of all legislation is to end all forms of discrimination due to race, sex, religion and disability, etc. The latter seeks to end all forms of discrimination against PWDs which includes the design, construction and management of the built environment and so their professionals should be equipped with the requisite training on inclusive design principles.

1.2 Inclusive Design Education

Education plays a vital role in determining the quality of our built environment. The Tomar Resolution ResAP (2001) promotes the implementation of measures by universities and institutions responsible for higher and further education as well as vocational training to include PWDs in their design curricula and also aims at promoting a consistent policy to improve accessibility. The concept of universal design should be an integral and compulsory part of the mainstream initial training of all occupations working on the built environment at all levels and in all sectors. It recommends that adequate further training should also be made available for both active professionals and student trainees and that the curricula of the latter at under-graduate and post-graduate levels should develop the following skills:

- perceiving the relationship between human beings and their constructural creations and between the latter and their environment.
- understanding the need to accord constructural creations and space in compliance with human needs.
- mastering problem-solving techniques in order to increase the usability of all their constructural creations, taking into account human diversity.

According to Harrison et al. (2015) although inclusive design is a globally accepted way of thinking about the built environment, the quest of making it a fundamental principle in all design situations has just began and the education of future professionals is one of the surest ways to achieve this. This cannot be done in a vacuum without tailoring the curricula of the various training institutions to cater for it. In many higher institutions of the world, many departments have been opening up and embracing the subject. For instance at the University College Cork in Ireland, lecturers of Architectural Education have adopted new teaching methods of teaching inclusive design to include sensitising and raising students' awareness of the barriers and hazards that users face, through observation, simulation and experiential exercise.

At the University of Michigan and University of Portland, Ladner (2017) avers that courses have been designed for freshmen in the Engineering Sciences on accessibility. The University of Washington and the Massachusetts Institute of Technology (MIT) have also introduced capstone courses in engineering courses that deal with accessibility and at the latter, Li (2017) asserts that in the full semester project-based course called Principles and Practice of Assistive Technology (PPAT), the students develop customized, assistive devices with people with disabilities in the Boston area. 35 students enrolled in the class and worked with 11 clients in 2014 and the students normally enrolled in the class because of its project-based design, the survey learning opportunity, or a personal interest or experience with disability.

Khan (2017) intimates that engineering students who enroll at North Dakota State University in a three semester sequence of courses develop customized assistive technologies for veterans with disabilities. In the first semester, the course dwells on the ideology of building accessible designs. The second semester focuses on the project itself, including design stages, creating a plan for the client and ordering parts. In the final semester, the course focuses on further development, prototyping, feasibility, testing with the client and long term plans. Ladner (2017) advocates that beyond including accessibility in mainstream courses, entire courses in accessibility can be introduced in engineering departments of universities and that profile of successful scientists and engineers who have a disability can be introduced during disability lectures to create interest in the subject. He further intimates that students will realize the importance of the subject if disability topics are included multiple times throughout the curriculum and so it is important to weave accessible design knowledge throughout a student's education. He also believes that having a whole course, as well as individual lectures within courses, promotes the idea that these issues are common in engineering and computing.

1.3 Education on the Built Environment at KNUST

A number of departments at KNUST offer courses that deal with the built environment but the Planning (DoP), Civil Engineering (DoCE) and Architecture (DoA) departments are directly involved with the design of the built environment and were therefore used for the studyon inclusive design education at KNUST. The three departments were started in the then Kumasi College of Arts Science and Technology, now the Kwame Nkrumah University of Science and Technology (KNUST) in the late 1950s and have been responsible for the training of most built environment professionals.

The Department of Planning is the only government recognized institution in the country that trains planners (Inkoom, 2009). The department's main mission is therefore to train skilled personnel required to formulate and manage various development policies and programmes at all levels of national development such as the National Vision of Socio-Economic Development which is required by the 1992 Constitution of Ghana, the Economic Management programme, the Growth and Poverty Reduction Strategy (GPRS II) and to promote and implement the improved planning system. Courses taught include Infrastructure Planning, Development Planning Process, Environment and Development, Introduction to the Built Environment and Settlement and Neighbourhood Design.

Presently, apart from KNUST, civil engineering education and training in Ghana is undertaken by the polytechnics and some private universities in the country. It aims at providing a challenging and stimulating educational programme which will create a learning experience for the students in order to offer competent professional services in the development of natural resources and the provision of infrastructure in ways that are beneficial to humankind. At KNUST, the courses offered include Structures, Environmental Quality Engineering, Technical Drawing, Geotechnical Engineering and Highways Engineering.

Architecture education in Ghana started in 1957 with its first students admitted in 1958. The programme was introduced in conjunction with other design programmes to train the built environment professionals to meet the simplest needs of the community. The education and delivery of appropriately skilled graduate architects is vital in the pursuit of the production of good architecture. Courses taught include Climate and Architecture, Technical Drawing, Architectural Science, Building Services and Principles of Design.

Examination of the curricula of these three departments revealed the fact that none of them teaches course that directly or indirectly deals with accessibility. The Departments of Planning, Civil Engineering and Architecture combine lectures, studio work (workshops) and class and community presentations as teaching methods. In addition to these, the three departments usually send their students for vacation training attachments in an attempt to link theory and practice in order to equip graduating students with the skills, attitude and motivation to meet the challenges of development in Ghana. Education on the built environment offered by these three departments at KNUST especially the Planning Department is however hampered by a number of factors as identified by Inkoom (2009). These include high student-lecturer ratio, insufficient classroom and studio space, insufficient availability of teaching and learning aids and insufficient access to literature and journals. The combined effect of these factors is that facilitation of teaching, learning and professional practice is adversely affected. The prevailing situation of high student numbers and general shortage of resources means that the departments are not always able to implement to the full their training programmes. For example, the organization of familiarization trips and field visits to relevant institutions, modelling, and other activities to expose students to the appropriate design practice are hampered. Consequently to cut cost, sites for field exercises have to be restricted to communities at the fringes of the University or from among towns in the Ashanti Region of Ghana where the University is located.

2. Methodology

This study has been designed as a survey research where quantitative data was obtained by means of independent questionnaires administered to lecturers and students of the DoP, DoCE and DoA of KNUST, design professionals at the Building and Roads Research Institute (BRRI) Kumasi, Architectural and Engineering Services Limited, Kumasi, and the Development Office of KNUST.

PWDs at some rehabilitation schools in Kumasi were also included in the survey. The sample size for lecturers and students was obtained using the Kish (1965) formula while haphazard sampling was used for design professionals and the PWDs.

Closed ended questions were used where respondents were given the option to choose from fixed options. The questions were expressed in a simple and clear manner so that respondents could understand and respond appropriately. Two sets of questionnaires were designed for the lecturers and students and they contained 18 and 19 multiple choice questions respectively. The questions were prepared in three categories: general personal information about the respondent, the respondent's assessment of the current curricula of his/her department with reference to the principles of inclusive design and thirdly, the respondent's knowledge of the Ghana Building Code and Persons with Disability Act. The questionnaires for the design professionals comprised of 12 multiple choice questions who were required to assess their own designs in relation to the principles of inclusive design and the Ghana Building Code. The questionnaires for the PWDs comprised of 10 multiple choice questions to determine the type of challenges, barriers and discrimination they face. The data gathered was organized and analysed using Microsoft Excel and SPSS after which conclusions were drawn. Data gathered during the survey are presented and analysed in the light of the standard principles of inclusive design discussed earlier. An item was rated as satisfactory (3) if it met the minimum requirements of inclusive design while items that were better thansat is factory were designated as Good (4) and Very Good (5) but those below satisfactory were rated as Fair (2) and Poor (1).

Questionnaires were used because they have the advantage of protecting the privacy of the respondent and grant the respondent the leverage to provide needed information. It also reduces the element of bias because it cuts off interviewer involvement. There is the further reduction of bias because all respondents respond to the same set of questions. Comparatively, it is less expensive and less time consuming than other methods. Finally, the tabulation of close-ended responses is relatively easier for studies like this. However, it is also conceded that the use of questionnaires has challenges which tend to serve as limitations on research findings. These include the difficulty in capturing emotions of respondents. Furthermore, since perceptions and levels of understanding differ from person to person, respondents may read different meanings into specific questions or terms. At times too, the responses to certain questions may call for further probing which the questionnaire approach does not provide for (Creswell, 2012; Marshall, 2005; Ackroyd & Hughes, 1981). Cognizant of some of these challenges, the selection of respondents was carefully done. There was much effort to also use unambiguous questions and response options. It is therefore assumed that the respondents well understood the questions and responded intelligently. The findings are accordingly reliable but limited to the study area and the period of the study.

3. Results

3.1 Assessment of the Current Curricula by Lecturers

The Department of Planning had a total of 18 lecturers while the Civil Engineering and Architecture departments had a total of 16 lecturers each. The number of lecturers who responded to the questionnaires at the Planning, Civil Engineering and Architecture departments were nine, six and eight respectively. In the survey, the lecturers were requested to assess and grade the current curricula at their departments against the standard principles of inclusive design postulated by the CUD. The outcome of their assessment is presented in Table 1. The mean of the responses indicated that 83.4%, 89.5% and 90.7% respectively of the Planning, Civil Engineering and Architecture lecturers assessed the content

of the current curricula used by their Departments in the provision of inclusive design as neither good nor very good. None of the 23 lecturers from the three departments assessed the contents of the current curricula of the various Departments in relation to inclusive design as very good. What was more worrisome was the fact that most of the lecturers in the three Departments were not very conversant with Act 715; the legislation that seeks to make built environment accessible to PWDs. From these responses, it is evident that the present curricula taught by the lecturers of the three Departments do not sufficiently equip their students to become built environment professionals who are equipped with the rudiments of inclusive design. The aspirations of the PWDs to have an accessible environment may therefore remain unrealised.

According to CEBE Special Interest Group's research, the above mentioned lapses often occur in institutions partly because most of the lecturers have been trained to accept inclusive design as an appendage but not a vital part of the design of the built environment. For this reason, the knowledge of many of these lecturers is restricted to the teaching of technical codes. Although Lifchez (1987) avers that technical specifications alone in themselves cannot create inclusive environment the survey revealed that teaching of building codes and technical specifications in the three Departments was not even satisfactory (Table 1). Secondly it must be appreciated that the teaching of inclusive design cannot be achieved simply by the traditional teaching methods like "adding a lecture, assigning a reading, or teaching a code" to the students but should rather involve pedagogical strategies and attitudinal changes which rely on a mixture of alternative and traditional pedagogical practices (Welch & Jones, 2001). Thirdly inclusive design is an evolving, fluid and complex speciality and so Continuing Professional Development (CPD) for both lecturers and professionals is essential to sustaining good inclusive design practice. In the light of the above, the faculties of the three Departments should come to terms with the complexity of inclusive design, change some of their teaching methods and course contents and involve themselves in CPD among others to improve the teaching of inclusive design in their Departments.

Table 1. Assessment of Current Curricula by Lecturers of the Three Departments at KNUST

DESIGN PRINCIPLES	PLANNING (%) (N=9)					CIVIL ENGINEERING (%) (N=6)					ARCHITECTURE (%) (N=8)				
	5	4	3	2	1	5	4	3	2	1	5	4	3	2	1
Developing the skills of students in bringing out designs that are useful and marketable to people with diverse abilities	0.0	33.3	66.7	0.0	0.0	0.0	0.0	77.8	22.2	0.0	0.0	0.0	75.0	25.0	0.0
Developing the skills of students in bringing out designs that accommodates a wide range of individual preferences and abilities	0.0	11.1	33.3	55.6	0.0	0.0	0.0	66.7	33.3	0.0	0.0	0.0	75.0	25.0	0.0
Developing the skills of students in bringing out designs that are easy to understand, regardless of the user's experience	0.0	33.3	66.7	0.0	0.0	0.0	33.3	66.7	0.0	0.0	0.0	12.5	87.5	0.0	0.0
Developing the skills of students in bringing out designs that communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities	0.0	0.0	33.3	66.7	0.0	0.0	0.0	66.7	33.3	0.0	0.0	12.5	87.5	0.0	0.0

Developing the skills of students in bringing out designs that minimizes hazards and the adverse consequences of accidental or unintended actions regardless of ambient conditions	0.0	22.2	55.6	22.2	0.0	0.0	33.3	66.7	0.0	0.0	0.0	0.0	100.0	0.0	0.0
Developing the skills of students in bringing out designs that can be used efficiently and comfortably and with minimum tiredness	0.0	22.2	66.7	11.1	0.0	0.0	16.7	50.0	33.3	0.0	0.0	25.0	75.0	0.0	0.0
Developing the skills of students in bringing out designs that have appropriate sizes and space for approach, reach, manipulation, and use regardless of the user's body size, posture, or mobility	0.0	11.1	22.2	66.7	0.0	0.0	0.0	83.3	16.7	0.0	0.0	25.0	75.0	0.0	0.0
Educating students to the building codes and regulations that address disability discrimination	0.0	0.0	0.0	55.6	44.4	0.0	0.0	0.0	33.3	66.7	0.0	0.0	0.0	100.0	0.0
MEAN OF RESPONSE	**0.0**	**16.7**	**43.1**	**34.7**	**5.6**	**0.0**	**10.4**	**59.7**	**21.5**	**8.3**	**0.0**	**9.4**	**71.9**	**18.8**	**0.0**

3.2 Assessment of the Current Curricula by Students

Tables 2 and 4 show the responses of third and final year students of the various Departments on their assessment of how inclusive their current curricula are. The survey targeted the third and final year students due to their longevity in their departments as students. 65, 29 and 38 students respectively from the DoP, DoCE and DoA were surveyed. Generally, like their lecturers, the students in the three departments rated their present curricula as being non-responsive to the requirements of inclusive design. For example, only 13 (20%) of the Planning students had knowledge of the Disability Act 715 (Table 4). This implies that four out of five of the students are ignorant of the legislation that seeks to address discrimination against PWDs in the built environment. Furthermore, 36.8% of the Planning students as compared to 16.7% of the lecturers assessed their curricula as providing good or very good education on inclusive design. Responses received from the students of the DoCE (Table 2) indicated that whereas 57.1% of the respondents believed that their curricula provided satisfactory knowledge of the principles of inclusive design, only 4% of them had knowledge of the Disability Act 715. Similarly, 95% of students from the DoA admitted their ignorance of the Disability Act (Table 4). On the contrary, majority of the DoA students (91.4%) intimated that they were receiving satisfactory or better training in inclusive design.

Table 2. Assessment of Current Curricula by Students of the Three Departments at KNUST

DESIGN PRINCIPLES	PLANNING (%) (N=65)					CIVIL ENGINEERING (%) (N=49)					ARCHITECTURE (%) (N=38)				
	5	4	3	2	1	5	4	3	2	1	5	4	3	2	1
Developing the skills of students in bringing out designs that are useful and marketable to people with	5.0	47.5	37.5	10.0	0.0	2.0	14.3	46.9	30.6	6.1	18.4	39.5	26.3	15.8	0.0

diverse abilities															
Developing the skills of students in bringing out designs that accommodates a wide range of individual preferences and abilities	7.5	35.0	52.5	5.0	0.0	2.0	16.3	52.9	18.4	4.1	13.2	26.3	52.6	7.9	0.0
Developing the skills of students in bringing out designs that are easy to understand, regardless of the user's experience	0.0	27.5	60.0	12.5	0.0	2.0	12.2	65.3	18.4	2.0	7.9	34.2	57.9	0.0	0.0
Developing the skills of students in bringing out designs that communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities	2.5	27.5	65.0	5.0	0.0	2.0	10.2	65.3	18.4	4.1	2.6	31.6	60.5	5.3	0.0
Developing the skills of students in bringing out designs that minimizes hazards and the adverse consequences of accidental or unintended actions regardless of ambient conditions	7.5	55.0	35.0	2.5	0.0	6.1	30.6	53.1	6.1	4.1	21.1	47.4	28.9	2.6	0.0
Developing the skills of students in bringing out designs that can be used efficiently and comfortably and with minimum tiredness	2.5	35.0	60.0	2.5	0.0	6.1	10.2	67.3	14.3	2.0	15.8	31.6	50.0	2.6	0.0
Developing the skills of students in bringing out designs that have appropriate sizes and space for approach, reach, manipulation, and use regardless of the user's body size, posture, or mobility	2.5	20.0	70.0	7.5	0.0	6.1	12.2	59.2	18.4	4.1	18.4	50.0	23.7	7.9	0.0
Educating students to the building codes and regulations that address disability discrimination	0.0	20.0	50.0	17.5	12.5	0.0	21.1	40.8	18.4	10.2	0.0	21.1	52.6	18.4	7.9
MEAN OF RESPONSES	**3.4**	**33.4**	**53.8**	**7.8**	**1.6**	**3.3**	**15.9**	**57.1**	**17.9**	**4.6**	**12.1**	**35.2**	**44.1**	**7.6**	**1.0**

From the above it is evident that a lot of overhauling will have to take place in all the three departments if the objectives and principles of universal design as laid out by CUD are to be realised. According to some researchers (CEBE, 2002; CUD, 1997; Avoke, 2001), these changes must include bringing students into direct contact with the different user groups during their training. This will enable the students to observe and listen to the representatives of the different user groups, represent and act as user's advocates and even work directly with the users to foster the sense of empathy, personal understanding and knowledge. Also students of built environment professions should be advised to involve consultation, collaboration and participation as vital ingredients of communication and

representation in their inclusive design education. This approach is different from the traditional form of representation which addresses the formal and organisational qualities of space.

Furthermore since built environment courses tend to employ a range of teaching situations such as seminars, lectures, design studios and workshops, inclusive design principles must not only be incorporated from early stage as an important part of the curriculum but must be taught together with skills such as team working, meeting and listening to user-needs, accessible representation skills and environmental auditing. Courses must also adopt an interdisciplinary and multi-professional approach where the students are taught to appreciate the fact that inclusive design is a chain where various professionals play their vital roles to make the environment accessible. Students should therefore acquire strong team working skills and understand their role in the team.

3.3 Assessment of Designs Produced by Professionals

A total number of 52 built environment design professionals made up of 13 Planners, 17 Civil Engineers and 22 Architects from Kumasi responded to the questionnaires. They were made to assess whether their designs as professionals satisfied the requirements of inclusive design. Their responses, presented in Table 3 showed that only 21.4% and 26.8% respectively of professional Planners and Civil Engineers as compared with 53.0% of Architects disclosed that the level of inclusiveness in their designs was above satisfactory while 44.5%, 29.4% and 18.2% of professional Planners, Civil Engineers and Architects respectively rated the inclusiveness of their designs as below satisfactory. As mentioned earlier, inclusive/universal design is a complex, fluid and ever-changing discipline that cannot be easily mastered. Inclusive design education therefore requires a philosophy of continuous learning from all its students, teachers and especially its professionals who need the cultivation of good research and self-directed study skills and more importantly, present CPD (Continuous Professional Development) as a prerequisite for professional practice. This is very pertinent in the light of the fact that Act 715 which serves as the regulatory framework for accessibility of the built environment in Ghana was passed as recently as 2006 when most professionals had completed their studies and left the classroom. Therefore it is only CPD by their various professional bodies that can assist them to catch up with current trends in inclusive design.

Table 3. Assessment of Designs Produced by Various Professionals

DESIGN PRINCIPLES	PLANNERS (%) (N=13)					CIVIL ENGINEERS (%) (N=17)					ARCHITECTS (%) (N=22)				
	5	4	3	2	1	5	4	3	2	1	5	4	3	2	1
Producing designs that are useful and marketable to people with diverse abilities	0.0	23.1	30.8	46.2	0.0	0.0	29.4	70.6	0.0	0.0	9.0	45.5	45.5	0.0	0.0
Producing designs that accommodates a wide range of individual preferences and abilities	0.0	15.4	38.5	46.2	0.0	0.0	41.2	35.3	23.5	0.0	13.6	45.5	31.8	9.1	0.0
Producing designs that are easy to understand, regardless of the user's experience	0.0	23.1	23.1	53.8	0.0	0.0	23.5	58.8	17.6	0.0	13.6	40.9	45.45	0.0	0.0

Producing designs that communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities	0.0	30.8	46.2	23.1	0.0	0.0	11.8	70.6	17.6	0.0	13.6	27.3	31.8	27.3	0.0
Producing designs that minimizes hazards and the adverse consequences of accidental or unintended actions regardless of ambient conditions	0.0	7.6	76.9	15.4	0.0	0.0	29.4	58.8	11.8	0.0	13.6	31.8	40.9	13.6	0.0
Producing designs that can be used efficiently and comfortably and with minimum tiredness	15.4	69.2	15.4	0.0	0.0	11.7	76.5	11.8	0.0	0.0	63.6	22.7	13.6	0.0	0.0
Producing designs that have appropriate sizes and space for approach, reach, manipulation, and use regardless of the user's body size, posture, or mobility	0.0	7.7	46.2	53.8	0.0	0.0	17.6	52.9	29.4	0.0	4.5	36.4	36.4	22.7	9.1
Producing designs that conform to building codes and regulations that address disability discrimination	0.0	0.0	23.1	76.9	0.0	0.0	0.0	29.4	58.8	11.8	13.6	27.3	27.3	22.7	22.7
Producing designs that conform to the Disability Act 715	0.0	0.0	15.4	61.5	23.1	0.0	0.0	5.9	88.2	5.9	9.1	45.5	9.1	18.2	18.2
MEAN OF RESPONSES	**1.7**	**19.7**	**35.1**	**41.9**	**2.6**	**1.3**	**25.5**	**43.8**	**27.4**	**2.0**	**17.1**	**35.9**	**31.3**	**12.6**	**5.6**

Table 4. Knowledge and Use of Act 715

DEPARTMENT	CATEGORY	YES (%)	NO (%)
PLANNING	LECTURERS	44.4	55.6
	STUDENTS	20.0	80.0
	PROFESSIONALS	15.4	84.6
CIVIL ENGINEERING	LECTURERS	50.0	50.0
	STUDENTS	4.0	96.0
	PROFESSIONALS	5.9	94.1
ARCHITECTURE	LECTURERS	12.5	87.5
	STUDENTS	5.0	95.0
	PROFESSIONALS	36.4	63.6

On the whole, the DoA was rated higher than the other two Departments by their lecturers, students and the professionals. This was not surprising because on relative terms, the DoA's curriculum had more slant towards inclusive design principles which in turn produced students and professionals who are relatively more informed of inclusive design than their counterparts in built environment. This affirms the assertion that whatever goes into the teaching and learning stage of a curricula will ultimately affect the professional conduct of the individual.

3.4 Responses from PWDs

A total of 57 PWDs from Kumasi where KNUST is situated responded to the questionnaires and of these, 32 were females. Majority of the respondents were between the ages of 15 and 25. They were required to answer questions concerning the barriers and challenges they face when accessing the built environment and the agencies which, in their opinion are responsible for the problems they encounter. All the 57 respondents admitted that they encountered challenges accessing the built environment. Imrie (1996) attributed this to the fact that design professionals have little recognition of bodily and/or physiological diversity increasing the tendency for architects and designers to design to specific standards and dimensions which revolve around a conception of what the normal body is. The survey revealed that roads and pavements (25%) are the most inaccessible of the various elements in the built environment. It was followed by vertical circulation (23%) and building entrances (19%) in that order. The results of the survey also indicated that 70% of the PWDs face these challenges in the built environment on daily basis. It is therefore imperative that design professionals that work in the built environment are equipped with inclusive design principles to make them responsive to the changing needs of PWDs.

The PWDs were also given the opportunity to assign blame for the inaccessible built environment. Of the options provided, almost half (47%) of the respondents attributed the problems associated with inaccessible built environments to design professionals. This view was corroborated by Imrie (1996), who asserted that most design professionals (which would include architects, engineers and planners) seem to conceive of architecture as an abstract, often two dimensional, visual arts rather than conceiving of it as something which should be sensitized to the complexity of the human body. Hanson (2004) went further by saying that the responsibility of an accessible environment does not rest solely with the designers of the built environment, but with the entire project team. This therefore makes other professionals such as quantity surveyors, project managers, contractors and site operatives, service engineers and developers also culpable. The second agency blamed for the inaccessible built environment was the central government (41%). The United Nations Convention on the Rights of Persons with Disabilities (2006) obliges party states which include Ghana to take appropriate measures to ensure that PWDs have access, on an equal basis with others to the physical environment. Most of the respondents stressed that even though the government has enacted laws to ensure an inclusive environment, it should go further to guarantee that those laws/regulations are fully enforced.

4. Conclusion

Inclusive or universal design is now a globally accepted philosophy that seeks to suggest that without it being included at the design stage, people will increasingly find themselves with an environment, products, systems and services that are inaccessible to the majority of intended users. Without awareness of these issues and the corresponding education in methods and techniques of inclusive design, future designers such as architects, engineers and planners will unknowingly incorporate impediments in their current and future designs. The current curricula of departments that teach built

environment courses at KNUST however do not provide adequate education on inclusive design. This has led to the situation where most students studying courses of the built environment at KNUST are ignorant of issues pertaining to inclusive design. Both lecturers and students at these Departments admit the deficiency and most of the graduates of the three Departments who end up working as professionals in the built environment are also not able to fully inculcate the concept of inclusive design in their professional practices. Traditional curriculum design methodologies require that the boundaries of a subject, the areas contained within the boundaries and the linkages between them are established. When dealing with the curricula on design courses such as Architecture, Engineering and Planning, there is always a need to establish a balance between academic offerings and industry needs. There is therefore the need not only to broaden the curricula of these departments at KNUST to include inclusive design but also change the way these courses are taught to make the products of the University to become relevant to industry and keep pace with the rapidly changing world.

5. Recommendations

a) The present philosophy, curricula and teaching methods of all Departments involved in built environment design education at KNUST should be revised to incorporate more elements of inclusive design.

b) On similar lines as the Tomar Resolution ResAP (2001), it is further proposed that the University authorities, the National Accreditation Board, the National Council for Tertiary Education and the Ministry of Education should come up with policies that will enhance inclusive design education in KNUST in general and the three departments in particular.

c) The education and training of design professionals should take an interdisciplinary and multidisciplinary approach; covering all disciplines relevant to the built environment. Linkages to other courses should offset the problem of isolating the subject in the curriculum.

d) Since the whole project team is responsible for achieving and maintaining inclusive designs (Hanson, 2004) all Departments that train students to ultimately become members of such project teams should make the teaching of inclusive designs a major component of their curricula. To further inoculate the team work ethic into the students, it is proposed that there should be joint lectures where students from the various departments would study aspects of inclusive design together and also undertake group exercises or mini project works in inclusive design. This will serve as a good preparatory ground for their future work in inclusive design and with time ultimately impact the industry.

e) Lecturers and professionals should continually be trained to be abreast with the principles of inclusive design to enable the former transfer the skills to their students and the latter incorporate them in their professional designs. Professional bodies should employ the CPD and refresher courses to retrain their members who are already in the field to make them more responsive to the changing trends of inclusive design.

f) It is recommended that further research using other methods other than questionnaires should be undertaken. This will complement the current study since issues which could not be captured through the use of questionnaires would appropriately be unearthed. This will ultimately lead to a holistic appreciation of the problem and in consequence a more holistic solution proffered. Together, the two will serve as a stronger basis for policy direction and better impact on the various allied departments, professions and the construction industry as a whole.

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