

SAFETY CULTURED INDUSTRY THROUGH THE INTEGRATION OF OCCUPATIONAL HEALTH AND SAFETY (OHS) COURSES IN THE BUILT ENVIRONMENT CURRICULUM

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Abstract

Globally, around 5,500 workers die daily from accidents or diseases at work with one-quarter of construction workers more probable than other workers. The rate of accidents leading to fatalities on Nigeria's construction sites is becoming worrisome. Human factor such as workers' non-compliance, low commitment from top management, negligence, human failures have largely been blamed. Safety is not simply common sense, therefore, construction workers and students need to be trained in order to have a sustainable construction industry. The aim of this study is to assess a safety cultured industry through the integration of occupational health and safety (OHS) courses in the Built environment curriculum. An in depth literature review of OHS training materials and using a cross-sectional research design through questionnaire survey and interview sessions with educationists and construction students in the built environment were utilized. A purposive sampling method was adopted for the study. Two sets of questionnaires were developed for the study. Out of the 55 copies of research questionnaire distributed for Educationist, 38 were completed and returned representing a 69% response rate while 100 copies of research questionnaire were distributed to final year construction students with 85 returned representing an 85% response rate. Returned questionnaires were analyzed using SPSS v21.0. The study developed a framework for the integration of Occupational Health and Safety (OHS) courses, the instructional design, and facilities in the Built environment curriculum. The result revealed that construction students had little awareness about Occupational Health and Safety (OHS) courses with the main awareness in use of personal protective equipment (PPE). From the study, educationists revealed that construction students' knowledge in Occupational Health and Safety (OHS) courses will foster a healthy and safe construction environment and also increase employability after graduation. Using a t-test tool, the study revealed that there is no agreement between educationists and construction students on the adequacy of teaching facilities for OHS courses. The study recommended that adequate and effective occupational health and safety (OHS) courses be integrated in the Built environment courses with sufficient facilities and trained personnel to guarantee its success and purpose.

Keywords: Built Environment, Construction, Curriculum, Health and Safety, Sustainable.

1 INTRODUCTION

The micro and macro contributions of the construction industry makes it essential that any challenge confronting it pertains to us all. Challenges such as cost overrun, time overrun, disputes, abandonment, building collapse, accidents etc. have been reported by various researchers. One of the challenges which it has found hard to overcome is its bad safety record. Although, there have been difficulties obtaining accident records on Nigerian construction sites [1, 2]. This is due to contractors' belief that it is bad for business and the lack of safety culture. Also, [3] attributed the low morale towards safety to lack of legislation and regulatory authority on occupational health and safety. Unknown to most contractors, construction safety increases competitiveness and profitability [4, 5].

With the Safety, Health and Welfare Bill of 2012 yet to receive executive assent, the rate of death and injuries cannot be shoved aside as there have been reported cases of building construction collapse on construction workers in the Nigerian dailies [6, 7]. Available figures from [8] revealed that the construction industry averaged a 40.8 percent accident rate per 1000 construction workers in 2013. The same construction industry that has provided succor of employment, livelihood etc. has become death traps for some construction workers. The rapid development of the Nigerian construction industry has resulted in its vast use of machineries and construction of high rise buildings [3, 4, 9].

Thereby, increasing the risk on the average Nigerian construction worker. Globally, [10] reported that many construction workers are killed every year. Statistics from [11] revealed that 1 out of 300 construction workers has the chance of been killed at work.

Another consequence of accidents largely reported is the high economic implications on the individual, employer and society [1, 10]. Many factors have been attributed to causing accidents on construction site, but the human factor has been overly emphasized as a major concern to the industry. In a study by [9] 75 percent of contractors have never heard of the Workers' Act 1974, with only 5 percent familiar with its provision of legal requirements for safety in the Nigeria construction industry. [2, 10] opined that it is possible for the construction industry to improve in its health and safety track record although challenging. Sustainability in the construction industry needs to be tackled with an effective occupational safety and health system. One way this can be achieved is through effective education and training in occupational health and safety (OHS), [12] explained that it should be designed in such a way as to measurably enhance attitudes, skills and knowledge. The individual must attain the level of adequate safety culture which culminates into the organization. According to [13] accidents can only be predicted when construction and project managers are fully prepared and equipped for it. The argument of this study is that preparing construction graduates without adequate knowledge and training on occupational health and safety is creating top management and professionals that are not safety culture committed. Therefore, the study aims to assess a safety cultured industry through the integration of occupational safety and health (OSH) training in the Built environment curriculum. It is against this background that the following objectives would guide the study;

- To examine the level of awareness of construction students to occupational health and safety (OHS).
- To assess the impact of training construction students on occupational health and safety courses.
- To identify the components of the occupational health and safety courses for construction students.

1.1 Research Hypothesis

H₀: There is no agreement between educationists and construction students on the adequacy of teaching facilities for OHS courses.

H₁: There is agreement between educationists and construction students on the adequacy of teaching facilities for OHS courses.

2 LITERATURE REVIEW

2.1 Accident on Nigerian Construction Sites

According to [9] accidents are events which are unplanned and unexpected caused by someone's mistakes which could have been prevented. Fig. 1 showed the human failures in health and safety that can result in accidents on construction sites. It is evident that most accidents can be attributed to the two (2) main components of human failures; errors and violations [14].

A cross section of occupational fatalities in the construction sector showed that for developed countries, such as the United States had over 22% [15], across the European Union had 30% [16], United Kingdom had 32% [10]. The accident rate situation highlighted in developing countries is worse [17]. Several factors have been attributed to this phenomenon. [18] observed that priorities are not given to safety consideration on construction projects in developing countries. [9] noted that stakeholders in Nigeria do not attach much seriousness to the issue. Even at that, most accidents and injuries are often times not reported. [13] noted that on many sites, no training programs on safety for the staff and workers exist. A situation where construction employees are required to learn from their own mistake or experience. This makes it hard to obtain reliable data of construction related accidents. Although, [3] reported that in Nigeria there are 2 accidents and 5 injuries per 100 workers. Most fatalities in construction related accidents that become known are those aired via media on collapse of ongoing building construction works and this is on the increase. In summary, [19] estimated that around 5,500 workers die daily from work related accidents or diseases with construction workers three to four times more likely than other workers to die from accidents at work.

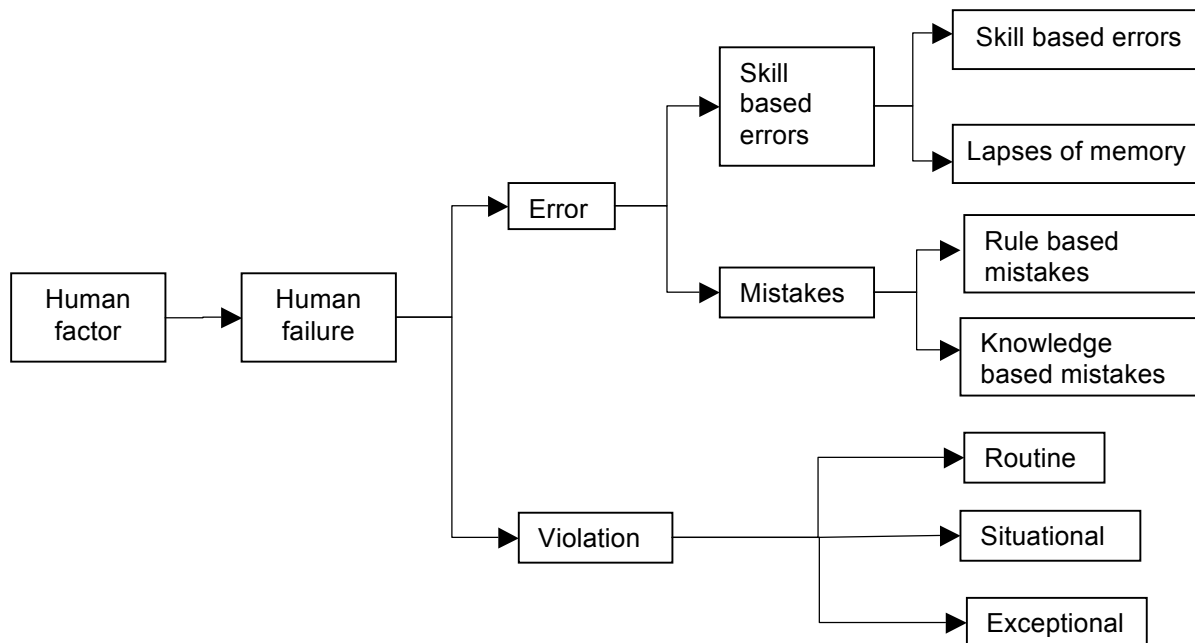


Figure 1: Types of Human failure [14]

The construction industry is continuously evolving and the risks becoming ever challenging. [13] noted that accidents occur as a result of the unique nature of the industry. And therefore, the unique nature must be used to address the unbecoming image of the industry as the resultant effect of accidents are tremendous. Effects such as damage to plant equipment and the loss of productive work time [13], work disruptions, loss of trained manpower and reduce the work rate [9, 20], loss of corporate image [1]. Several studies have linked cost of accident and construction works. [21] observed that the cost of accidents accounts for 8.5% of the total tender price in the Chinese construction industry. While [22] stated that the total cost of accidents ranges between 7.9% and 15% of the total costs of non-residential new construction. But the cost of life lost on construction sites through construction related accidents cannot be quantified. These issues have enforced the need for a constructive safety culture in the Nigerian construction industry.

2.2 Occupational Health and Safety Curriculum Development

Occupational health and safety has been defined by the [24] as: “The prevention and maintenance of the highest degree of physical, mental and social well-being, the prevention of ill-health among workers caused by their working conditions, The protection of workers from factors adverse to their health in their employment, and the placing and maintaining workers in occupational environments adapted to their individual and psychological conditions.” According to [25] the lack of awareness of contractors on Occupational Health and Safety (OHS) management systems in construction contributes to the accident at construction site. Amongst factors to improve occupational safety and health, [12] identified educating educators and students on occupational safety and health through effective education and training.

MODULE 1	•Introduction to OSHA
MODULE 2	•Identifying and Controlling Hazards
MODULE 3	•Injury and Illness Prevention
MODULE 4	•Accident Prevention/Accident Investigation
MODULE 5	•Hazardous Material Handling, Storage, Use and Disposal
MODULE 6	•Hazard and Risk Assessment

MODULE 7	•Health and Safety Plan
MODULE 8	•Personal Protective Equipment (PPE)
MODULE 9	•Fire Protection and Prevention
MODULE 10	•Emergency and Incidence Response
MODULE 11	•Welfare Provision on Construction Sites
MODULE 12	•Management Commitment and Employee Involvement
MODULE 13	•Site Induction
MODULE 14	•Conducting Safety Meetings
MODULE 15	•Introduction to Workers' Compensation and Return to Work
MODULE 16	•Stress Management
MODULE 17	•Legal Rights and Responsibilities

Figure 2. Suggested Occupational Health and Safety (OHS) curriculum (Adapted from [26, 27])

According to [12] improving occupational safety and health (OSH) in the construction industry is a slow but achievable process. Safety should be considered paramount, hence, the need to integrate occupational health and safety courses into the built environment curriculum. Fig. 2 showed a suggested list of occupational health and safety curriculum that can be integrated into the built environment curriculum. The curriculum covers course outlines from the International Labour Organization (ILO), Health and Safety Executive and Occupational Safety and Health Administration (OSHA). In engaging construction students in occupational health and safety course it is essential that certain resources are provided. There is need for adequate space and facilities which encourages small group exercises or hands-on training using equipment as part of classroom and activity-based learning. The space must be set up in a way that encourages interaction between the trainer and the students and facilitates easy discussion and brainstorming sessions among students as shown in Fig. 3. Equipment and Technology should also be used in communicating OHS training across to the students such as Smart boards, OHS videos, web based materials etc. in order to enhance learning. In the classroom and activity based learning, [28] suggested that the course should be administered using course design as specified in Fig. 4. The idea of this type of OHS program is that safety should begin early not only in adulthood. And therefore, construction students can thereby bring about the need transformation that is needed in terms of safety on construction sites.

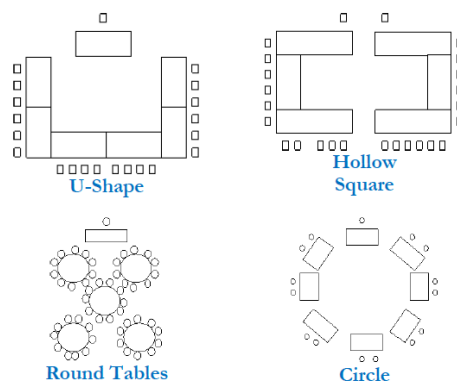


Figure 3. Room Setups that Encourage Participation and Improve Learning [28]

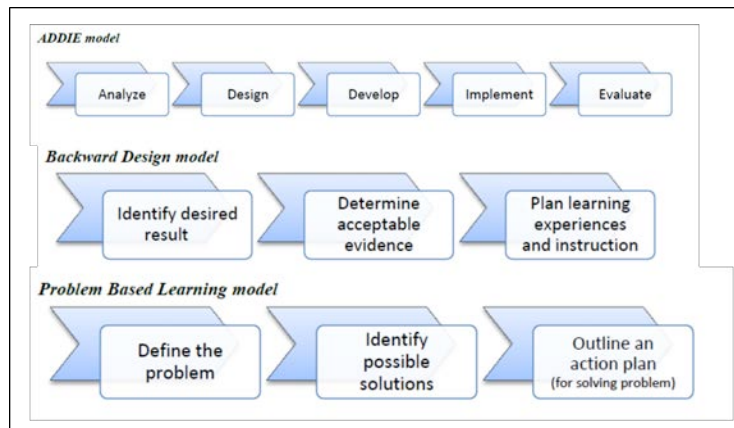


Figure 4. Instructional designs for OHS courses [28]

2.3 The Built Environment

According to [29] the built environment is the heart of any economy. The crucial role of this industry makes it important that the education given to its future professional is not taken with levity. [30] emphasized that institutions of higher learning are critical. [31] stated that the primary purpose of built environment education is the preparation of people for a vocation in the built environment. [32] stated that these institutions around the world have recognized that they have a unique responsibility towards the goal of achieving sustainability. Therefore, there must be a conscious effort to link construction students with the construction industry. [33] suggested that a proactive action must be taken to overcome the safety issue in construction sector which this study posits. In a situation when the need for health and safety is paramount as this study has shown, the issues of safety should not be left to be garnered during the experiential years of the occupation alone. [31] suggested that if the built environment education cannot contribute increased efficiency in the way the industry is run, then it has failed in its purpose. [32] opined that fostering a healthy, just and environmentally sustainable society will require a large shift in thinking, values and action - a change in mindset. The impact in studying and researching in the built environment should be oriented towards the problems confronting society, and this largely depends on the awareness, knowledge, skills and values construction students acquired during their requisite period of study in the university [31, 32].

3 METHODOLOGY

The study been an exploratory study was conducted using a cross-sectional research design, where samples were drawn from the population of study. This study was carried out through questionnaire survey and interview sessions with educationists in the built environment. The study area were two (2) tertiary institutions; Public institution and Private Institution located in Lagos and Ogun State. The targeted population comprised of construction students and educationists in the Built environment in the selected institutions. A purposive sampling method was adopted for the study. The purposive sampling technique was used because the study is specific to a group of people and the construction characteristics relevant to the study such as academics and final year students in the Department of Architecture, Building, Quantity Surveying and Civil Engineering. Two sets of questionnaires were developed for the study. Out of the 55 copies of research questionnaire distributed for Educationist, 38 were completed and returned representing a 69% response rate while 100 copies of research questionnaire were distributed to final year construction students with 85 returned representing an 85% response rate.

4 RESULTS

The result and discussion as obtained from the distributed questionnaires are presented under the following headings;

4.1 Background Information

The background information of the respondents (academics and final year undergraduate students) revealed that among educationists, the professions highlighted include Architects had the highest

participation in the study with 14 (36.8%), which was followed by 12 (31.6%) Builders, 8 (21.1%) Civil Engineers and 4 (10.5%) Quantity Surveyors. A survey of the highest academic qualification attained by the academics revealed that they fall into two main categories of 25 (65.8%) of the academics having MSc/MBA/MPM degree and 13 (34.2%) have PhD degrees. The working experience of the educationists in the field of academics showed that 17 (44.7%) had 6-10 years working experience, while 13 (34.2%) of the academics had 11 – 15 years working experience, 6 (15.8%) had 0 – 5 years working experience and 2 (5.3%) had over 15 years working experience.

A cross section through the background information of the final years construction students engaged in the study showed that Building/Building Technology students had the highest participation in the study with 30 (35.3%), while 23 (27.1%) were students of Architecture, 18 (21.2%) were Quantity Surveying students and 14 (16.4%) were Civil engineering students. The gender distributed showed that 67 (78.8%) were male and 18 (21.2%) were female students.

4.2 Level of awareness in occupational health and safety (OHS)

Investigation was carried out to examine the level of awareness of construction students in occupational health and safety (OHS). The occupational health and safety parameters used were generated from the suggested modules for the occupational health and safety (OHS) curriculum. The result as shown in Table 1 revealed that Personal Protective Equipment (PPE) had an overall mean score (OMS) of 2.92 and ranked 1st, Identifying and Controlling Hazards had OMS of 2.60 and ranked 2nd, Health and Safety Plan had OMS of 2.59 and ranked 3rd.

Table 1. Level of awareness in occupational health and safety (OHS).

Occupational health and safety (OHS)	Architecture	Building/Building Technology	Quantity Surveying	Civil Engineering	Overall Mean Score	Overall Rank
	Mean Score					
Introduction to OSHA	1.78	1.99	1.68	1.66	1.94	16 th
Identifying and Controlling Hazards	2.40	3.65	1.98	3.11	2.60	2 nd
Injury and Illness Prevention	2.12	3.56	2.45	2.81	2.53	5 th
Accident Prevention / Accident Investigation	2.41	3.55	2.03	2.89	2.53	5 th
Hazard Materials Handling, Storage, Use and Disposal	1.85	2.24	1.50	2.10	1.99	15 th
Hazard and Risk Assessment	2.12	2.62	2.06	2.64	2.38	11 th
Health and Safety Plan	2.28	3.60	2.16	3.28	2.59	3 rd
Personal Protective Equipment (PPE)	2.65	3.84	2.55	3.51	2.92	1 st
Fire Protection and Prevention	2.28	3.28	2.11	2.90	2.48	8 th
Emergency and Incidence Response	1.92	3.32	1.92	3.05	2.50	7 th
Welfare Provision on construction sites	2.21	3.59	1.98	2.89	2.54	4 th
Management commitment and Employee Involvement	2.01	2.61	1.72	2.61	2.37	12 th
Site Induction	1.99	3.10	2.20	2.75	2.42	9 th
Conducting Safety meetings	2.18	3.07	2.52	2.44	2.41	10 th
Introduction to Workers' Compensation and Return to Work	1.59	2.29	1.71	2.38	2.20	14 th
Stress Management	1.87	2.53	1.43	2.57	2.35	13 th
Legal Rights and Responsibilities	1.35	1.85	1.02	1.82	1.41	17 th

4.3 Impact of training construction students on occupational health and safety courses

This section assesses the impact of training construction students on occupational health and safety courses. Academics' response on the identified impact of OHS trainings on construction students is shown in Table 2. The table revealed that fostering a healthy and safe construction environment had a mean score (MS) of 4.30 and ranked 1st, Improve employability ranked 2nd with a MS of 4.22, Increased competencies in Health and Safety and Ability to teach others on Health and Safety both ranked 3rd with MS of 3.97.

Table 2. Impact of training construction students on OHS courses.

Impact	Mean Score	Ranking Index
Foster a healthy and safe construction environment	4.30	1 st
Improve employability	4.22	2 nd
Increased competencies in Health and Safety	3.97	3 rd
Ability to teach others on Health and Safety	3.97	3 rd
Increased ability to investigate and report accidents	3.63	5 th
Ability to identify hazards at worksite	3.61	6 th
Sustainability of the construction industry	3.54	7 th
Ensures that the individual is not injured at work	3.53	8 th
Develops a health and Safety culture	3.48	9 th
Higher productivity on job	3.44	10 th
Engenders quick response to emergencies	3.20	11 th
Increased ability to mitigate risks	3.18	12 th
Increase in safety practices on Construction sites	3.12	13 th
Increase the knowledge of construction occupation	3.01	14 th
Improve supervision on construction sites	2.99	15 th
Increased Innovation and creativity	2.98	16 th
Boost self-sufficiency and self-reliance	2.95	17 th
Increased understanding on legal rights about Health and Safety	2.91	18 th
Reduced financial costs of accidents and injuries	2.86	19 th
Reduce the frequency of accidents on construction sites	2.86	19 th

4.4 Research Hypothesis

The study attempted to evaluate the adequacy of teaching facilities for OHS courses between the two groups under study (educationists and construction students). Using t-test at $p \leq 0.05$ the hypothesis that there is no agreement between educationists and construction students on the adequacy of teaching facilities for OHS courses was tested. Teaching facilities such as space, equipment and facilities, OHS tutors, OHS curriculum etc. were grouped together to form the basis of the comparison. Table 3 showed the agreement between educationists and construction students on the adequacy of teaching facilities for OHS courses. The rule for the acceptance or rejection of the hypothesis is that when $p > 0.05$, the hypothesis is accepted, but when $p \leq 0.05$, the hypothesis is rejected. The result showed that the p-value (0.16) was greater than the critical p value (0.05); therefore, accept the hypothesis. The implication is that educationists and construction students differ on the adequacy of teaching facilities for OHS courses.

Table 3. Adequacy of teaching facilities for OHS courses.

Variable	N	Mean	t-value	Df	p-value	Decision
Teaching facilities	123	56.736	2.228	120	0.16	Accept H_0

5 DISCUSSION OF RESULT

The study developed a framework of equipment and facilities from room setup, instructional designs, teaching aids, tutors including an OHS curriculum needed to implement OHS courses in the built environment curriculum. The study revealed that there is little awareness of construction students to occupational health and safety (OHS). With the level of awareness mainly in Personal Protective Equipment (PPE) by construction students. The exposure to PPE may be due to the compulsory industrial training (IT) programmes or Student Work Experience Programme (SWEP) engaged in their 2nd and 4th year in their various institutions. The findings imply that construction students are largely unaware of the core issues of health and safety. [14] stated that lack of awareness in health and safety by supervisors is one of the leading cause of accidents on work site. Presently, for construction graduates to be abreast of HSE matters, they have to engage in different adult training of continuous professional development (CPD) on OSH trainings. [9] noted that there is a general lack of awareness on the importance and legal requirements for safety in the construction industry in Nigeria. [34] stated that this level of awareness can be raised by effective safety trainings. Educationists identified that training construction students on occupational health and safety courses will foster a healthy and safe construction environment and improve employability of the construction students. As the study has emphasized, the rate of accident on construction sites is becoming worrisome, therefore, alternative avenues to reduce this trend must be explored. [35, 36] emphasized the importance of safety training, stating that safety training improves the safety performance in the construction industry. Effective training of construction students can be one of the best ways in improving site safety performance, as [37] reported that there is a relationship between the safety climate on site and personal characteristics of the employees. Education level and safety knowledge possessed by the individual are critical of these personal characteristics. Also, in this global and dynamic environment, the new set of graduates need to be equipped with new set of skills to make them adaptable to the numerous challenges facing the industry. [31] stated that the built environment education should be aimed at solving the challenges confronting the society. The study revealed that there is no agreement between educationists and construction students on the adequacy of teaching facilities for OHS courses. This difference can be attributed to the little knowledge possessed by construction students in OHS topics and therefore implies that the teaching facilities on OHS courses are inadequate. The built environment curriculum needs to be overhauled to entertain issues that can be relevant for a sustainable construction industry.

6 CONCLUSION AND RECOMMENDATION

The Nigerian construction industry has come a long way. To achieve a sustainable industry, general issues regarding the alarming rate of accident and injuries must be carefully tackled. The study assessed a safety cultured industry through the integration of occupational health and safety (OHS) courses in the Built environment curriculum. The study posited that since culture can be learned, therefore, safety culture can be learned but quite early while still in the tertiary institution. The study identified teaching equipment and facilities such as the instructional design, the room setup to engender discussion, gadgets, teaching aids and an OHS curriculum inform of a module outline for construction students. It was observed that there is little awareness on OHS amongst construction students with their main awareness being Personal Protective Equipment (PPE). Academics observed that training construction students on OHS courses while still in their undergraduate programmes would foster a health and safe construction environment and improve employability of the construction students. The study also revealed that there is need for provision of teaching facilities for OHS courses. The study recommended that adequate and effective occupational health and safety (OHS) courses be integrated in the Built environment courses with sufficient facilities and trained personnel to guarantee its success and purpose. The subject of safety should be a national project through the National University Curriculum (NUC), whereby funding and curriculum adjustment would be carried out. Similarly, it is essential that academics in the built environment are exposed to OHS trainings in order to be able to effectively transfer adequate knowledge of OHS to construction students. This can be achieved through seminars and workshops organized between the tertiary institutions and OSHA training bodies in order to increase the level of awareness.

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