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ORIGINAL RESEARCH PAPER

Determinants of students perceived manmade environmental hazards and risks in tertiary educational institutions

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ABSTRACT: Environmental hazards caused by living conditions and human behaviour in residential areas are types of manmade hazards which have rarely been studied and documented in literature. Available studies that had considered the conventional residential environment had proved that residents' perception were influenced by human and environmental factors. With focus on educational institutions, this paper assessed the determinants of students' perception of environmental hazards and risks on campus environment. Using probability sampling technique, data were obtained through administration of questionnaire on 367 students of university, polytechnic and college of education in Oyo State. The data collected were analysed using inferential statistics. Findings revealed three broad factors which are socioeconomic background, sanitation behaviour and availability of environmental amenities. It was concluded that environmental amenities influenced students' perception of environmental hazards and risks the most with a regression coefficient (β) of -0.373 compared with sanitation behaviour (β = 0.311) and socioeconomic background (β = 0.123). The appropriate authorities could therefore improve on maintenance of existing environmental amenities and/or provision of new ones in the educational institutions.

KEYWORDS: *Environmental amenities; Environmental hazards; Sanitation behaviour; Socioeconomic characteristics; Students perception; Tertiary educational centres.*

INTRODUCTION

Manmade environmental hazards are mostly technological hazards that result from industrial explosions and fires, nuclear accidents and/or the process of building collapses, among others (Smith, 2001). They are therefore induced by spread and failure of high-risk technologies (Brauch, 2003) and have commonly been reported in literature (Gurevich, 1993; Ezzati *et al.*, 2005; Chilinger and Endres, 2005; Vrijheid, 2000; Aribigbola *et al.*, 2012). Another dimension of manmade hazards which have rarely been studied and documented in literaure is that caused by living conditions and human behaviour in residential areas. These are environmental hazards and risks in residential areas in cities or special environment such as campuses. The hazards and risks in question could manifest based on several factors. One is the lack or inadequacy of environmental amenities which include bathrooms, toilets, water supply and electricity (Ezzati *et al.*, 2005; Afon *et al.*, 2006; Aluko, 2011). Generally, in the built environment, it is expected that, for human residential environment to be qualitative and conducive enough for living, certain environmental amenities must be in place (Ezzati *et al.*, 2005). For instance, in providing housing units for human accommodation, both indoor and outdoor environmental amenities must be present. It is then that such housing units are livable.

Another prominent factor by which environmental hazards and risks in a residential area could manifest is the lack of basic sanitation practices (Asenso-Mensah

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et al., 2009; Daramola, 2015). This has to do with responses to adequacy or inadequacy of environmental amenities. Some inhabitants have environmental amenties but they have poor sanitation behaviour leading to infectious diseases. An instance of this is found in the study of Asenso-Mensah *et al.* (2009). The study assessed the influence of environmental sanitation practices and hygiene on incidence of disease such as diarrhea. It was discovered that the residents are exposed to diseases due to poor sanitation practices despite the availability of environmental amenities. As perception is used in assessing students' opinion about issues of environmental hazards and risks in this study, providing a concise understanding of its concept and application is imperative. Perception is a process whereby individuals form and interpret their sensory impressions in order to give meaning to their environment (Robbins, 1999). It refers to a set of process whereby individuals take cognizance of the elements of the environment and interpret phenomena about them through selection and organization of sensory inputs based on certain conditions (Ejiogu, 2000). According to Mangal (2002), perception is a highly individualized psychological process that helps individual to organise and interpret complex patterns of sensory stimulation that give them the necessary meaning of initiating their behavioural responses.

The use and study of perception is predominant in the field of psychology. Meanwhile environmental psychologists as specialists in the field of psychology have applied the concept of perception in studying various environmental issues (Taylor *et al.*, 1987; Ungar, 1999; Gifford, 2007; Kaymaz, 2012). In addition, application of the concept has for some decades gained increasing interest among environmental scientists such as architects, geographers, urban planners, among others (Lynch, 1960; Downs, 1970; Tuan, 1972; Porteous, 1976; Afon, 2011; Barbara *et al.*, 2014; Ramaswamy and Mosher, 2015). The concept is therefore applied to environmental hazards and risks in this study. In particular, the study attempts to evolve the determinants of students' perception of environmental hazards and risks on campuses of educational tertiary institutions in Oyo State, Nigeria. This study was carried in Ibadan metropolis and Oyo town which are located in the State. The study was conducted during 2016.

Modelling Perception of Environmental Hazards and Risks

Several theories of environmental perception abound in literature but the theory that is most relevant to this study is the Social Cognition Theory (SCT) which was propounded by Albert Bandura in 1986. The theory was earlier in the 1960s conceived as the Social Learning Theory (SLT). The theory is with the view that people have self-organizing, self-reflecting and self-regulating capabilities which makes them to be proactive to the environment other than reactive (Pajares, 2002). By reason of this, peoples' interpretation of their own behaviour informs and alters their personal factors and environment which thereafter informs and alters subsequent behaviour. In doing so, people 'can extract meanings from the environment, construct guides for actions, solve problems cognitively, support forethoughtful courses of actions, gain new knowledge by reflective thought and communicate with others at any distance in time and space' (Pajares, 2002).

The theory further posited that human behaviour is determined by personal and environmental factors in which behaviour is another factor itself. The relationship between these factors is called 'Triad Reciprocality' (Fig. 1). In simple terms, behaviour influences personal factors, personal factors influences environmental factors, and environmental factors later influence subsequent behaviour. This interaction is also mutually reversible.

Considering the personal factors, they comprise cognition, affect and biological events (Pajares, 2002). Among these personal factors, the theory emphasized the importance of cognition in the peoples' ability to perceive reality and perform behaviour. Cognition simply means mental processes by which sensory inputs undergo transformation, reduction, elaboration, storage, recovery and usage (Neisser, 1967). The mental processes include attention, memory, and perception. The attention is a state of awareness which is also a subset of perception (MacCallum, 2015). The environmental factors are elements of social environment. According to Pajares (2002), environmental factors 'influence

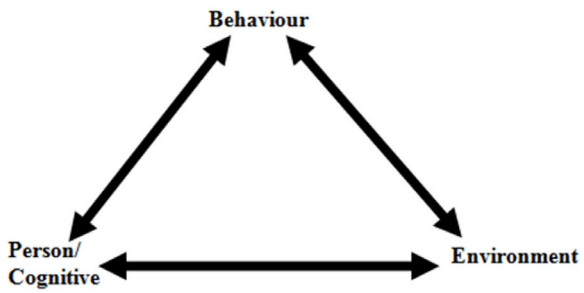

Fig. 1: Social cognitive theory
(Source: Bandura, 1986)

human behaviour through psychological mechanisms of the self-system. Hence, it posited that factors such as economic conditions, socioeconomic status, and educational and familial structures do not affect human behaviour directly. Instead they affect it to the degree of that they influence peoples aspirations, self-efficacy belief, personal standards, emotional states and other self-regulatory influences'.

In applying the SCT, the three factors (personal, behavioural and environmental) were considered as likely determinants of students' perception of environmental hazards and risks. For instance, personal factor such as cognition is imperative. This is because individuals are expected to be first of all aware of their environment and such awareness is in tune with the mental faculty that does the logical reasoning or cognition which later translate to perception by the students. This has been ascertained earlier in literature that awareness precedes perception (Dixon, 1981; Henley, 1984; Bear *et al.*, 2001; Cherry, 2016). This factor is ascribed to the socioeconomic background of students.

The behavioural factors comprise students' sanitation practices which are about their responses to inadequacy of environmental amenities. The environmental factor comprises lack or availability of environmental amenities. The relationships between these factors are also triad reciprocal. This is such that the students' interpretation of their behaviour informs and alters their cognition such as socioeconomic background, sanitation practices or their responses to lack or inadequacy of environmental amenities. All of which in tune informs and alters subsequent behaviour. Based on the theory, the conceptual framework to explain students' perception of environmental hazards and risks was developed (Fig. 2).

The framework illustrated students' socioeconomic background, environment and behaviour as the three factors that affect students' perception of environmental hazards and risks. The socioeconomic background constitutes age, income, gender, educational level and childhood environment. Students' environment is considered in terms of availability of environmental amenities such as water supply, electricity, drains, among others. Students' behaviour is considered in regards to environmental sanitation behaviour. Specific variables generated for these factors were used in measuring students' perceived environmental hazards and risks in the study area through environmental hazards and risks process: hazard identification, risks assessment and risk control.

MATERIALS AND METHODS

The study was conducted on the campuses of University of Ibadan, Ibadan (UI); The Polytechnic, Ibadan (PolyIbadan); and Federal College of Education, Oyo (FCE) which are located in Oyo State. The study focused on students residing in on-campus hostels of these institutions as its respondents. Based on this focus, data on the students' hostels were obtained from the Divisions of Student Affairs of these institutions. UI has nine undergraduate student hostels which are referred to as Halls of Residence on its campus, PolyIbadan has four hostels and FCE has two hostels.

The hostels were later stratified based on gender as presented in Table 1. In UI, two halls were randomly selected out of six male halls while two were selected out of three female halls. In the Polytechnic, Ibadan, one hall was selected from the two female halls, while the only male hall was selected and the two available halls in FCE were selected. Overall, eight halls were selected

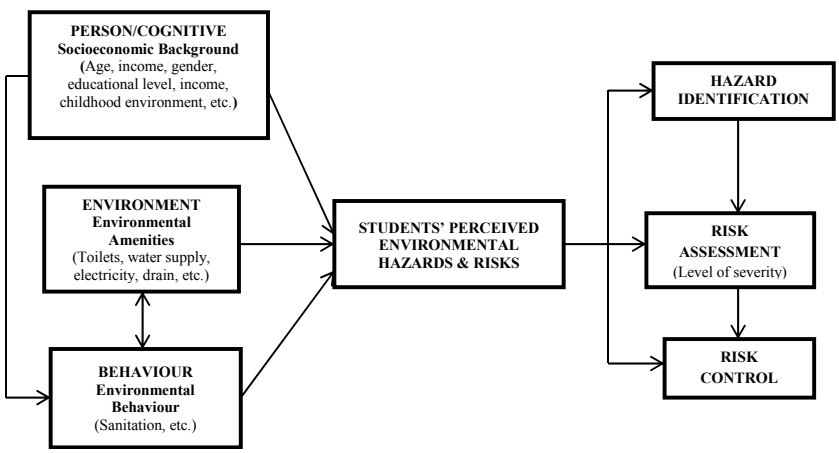

Fig. 2: Students' environmental hazard and risks perception framework

Table 1: Sample size based on the categories and capacities of selected halls of residence

Institution	Category by gender	Hall of residence	No of rooms	Sample size (20%)
University of Ibadan	Male	Nnamdi Azikiwe	253	51
		Mellamby	187	38
	Female	Queen Elizabeth II	235	48
		Queen Idia	298	60
	Total		973	197
Polytechnic, Ibadan	Male	Unity	192	39
	Female	Olori	309	62
	Total		501	101
Federal College of Education (Special), Oyo	Male		36	36
	Female		33	33
	Total		69	69

from the three institutions. The number of rooms in the selected halls was determined. It was found out that there are 973, 501 and 69 rooms in UI, PolyIbadan and FCE respectively. Every 5th room in the selected halls in UI and PolyIbadan were sampled while all the rooms in FCE were selected. This led to selection of 197 rooms in UI, 101 rooms in PolyIbadan and 69 rooms in FCE; thereby making it a total of 367 rooms that were sampled for the purpose of this study.

Questionnaire was thereafter administered on one student was in each of the rooms. Thus, a total of 367 students were sampled for the study. Information that were collected from the students included socioeconomic background, level of awareness of environmental hazards, severity of environmental risks, and responses to environmental amenities in hostels and academic areas. Information on socioeconomic characteristics and responses to environmental amenities were obtained as categorical and continuous data where necessary. Information on level of awareness of environmental hazards and severity of environmental risks were measured on a five point Likert scale (1= not at all aware / severe, 2 = slightly aware/ severe, 3 = somewhat aware / severe, 4 = moderately aware/ severe and 5 = extremely aware/ severe). Data collected were analysed using inferential statistics such as correlation, factor and regression analyses.

RESULTS AND DISCUSSION

This section comprises the results and interpretation of data collected on factors influencing students' perception of environmental hazards and risks in the study area. As conceptualized in this study, students' perception of environmental hazards and risks was found to be influenced by three factors which are students' socioeconomic background, environmental behaviour and environmental amenities. Guided by the conceptual framework for this study, the stepwise regression analysis (hierarchical or sequential) is used to examine the causal relationship between the students' perception of environmental hazards and risks (dependent variable) and independents variables (students' socioeconomic background, environmental behaviour and environmental amenities). Students' perception of environmental hazards and risks, as the dependent variable is conceived to be a linear transformation of awareness of environmental hazards and risks and the severity of environmental risks. This was determined by making the students to indicate, via a 5-point Likert scale, their awareness of environmental hazards, awareness of environmental risks, and severity of environmental risks in the study area. Possible responses ranged from not at all aware/severe (coded as 1) to extremely aware/severe (coded as 5). The individual scores for each Likert item were summed to create a sum-score for their respective items under each of awareness of environmental hazards and risks, and severity of environmental risks database. The sum-scores were then added up to create the respective composite sums. A mean index was later computed to arrive at students' environmental hazards and risks perception index (SEHRPI) which was the resulting criterion variable.

The independent variables, according to the conceptual framework, are socioeconomic background, environmental behaviour and environmental amenities. In measuring them, some observed variables were used. The variables included in socioeconomic background were age, income, gender, educational level, income and childhood environment. The variables included under environmental amenities were availability of facilities such as toilet, bathroom, drains, etc. The variables included in environmental behaviour were students' sanitation practices or responses to environmental amenities. The binary categorical variables among

these were coded '0' and '1' while those with more than two categories were dummied with consideration for reference category.

Factor Analysis was later used in reducing the observable variables into their latent variables. This was done in accordance with the laws of convergent and divergent realities. Convergent reality ensured that all the variables that were supposed to unite under the same factors united while divergent reality ensured that those that were expected to separate under different factors separated. In order to resolve the issue of collinearity between the predictors, a Principal Component Analysis (PCA) was employed. The Kaiser-Meyer-Olkin (KMO) test with KMO index > 0.5 was used to determine if the dataset was suitable for factor analysis. The KMO index of 0.782 was obtained verifying the suitability of the dataset. A Varimax rotation matrix was also conducted to ensure that the variables rearranged themselves in such a way that one of the components loaded highly on one of the original variables and loaded lowly on others. Rotation converged in 5 iterations and a three-component solution yielded clearly interpretable results. Variables with component loadings not lower than 0.50 were considered, while those with loadings of less than 0.50 excluded (Table 2).

Component 1, with eigen value of 5.674 accounted for the highest proportion (16.21%) of variance of the dataset. This component loaded highly on variables such as availability of toilet in hostels (0.502), availability of bathroom in hostels (0.750), availability of electricity in hostels (0.745) among others. Hence, it was named availability of environmental amenities. Component 2 which had an eigen value of 4.977, accounted for a high proportion (14.22%) of variance in the dataset. It loaded highly on variables such as unkempt toilets in hostels (0.815), unkempt bathrooms in hostels (0.678), unkempt toilets in academic areas (0.788), unkempt waste storage facilities in hostels (0.511), unkempt waste storage facilities in academic areas (0.692), among others. It was therefore named environmental sanitation behaviour.

Component 3 had an Eigen value of 2.246, accounted for the lowest proportion (6.41%) of variance in the dataset. It loaded highly on variables such as gender (-0.500), age (0.787), academic level (0.649), monthly allowance (0.524), parents' income (0.502) and type of environment lived before 12 years of age (0.500). It was then named socioeconomic background. The three components were used for further analysis using multiple

Table 2: Rotated component matrix

Initial variable	Component		
	1	2	3
Gender			-.500
Age			.787
Academic level			.649
Monthly allowance			.524
Parents' income			.502
Type of environment lived before 12 years			.500
Availability of toilet in hostels	.502		
Availability of bathroom in hostels	.750		
Availability of electricity in hostels	.745		
Availability of drains in hostels	.782		
Availability of kitchenette in hostels	.665		
Availability of waste storage facility in hostels	.743		
Availability of waste collection services in hostels	.768		
Location of toilet in hostels	.501		
Type of bathroom in hostels	.500		
Location of bathroom in hostels	.589		
Location of kitchen in hostels	.603		
Type of drains in hostels	.514		
Unkempt toilets in in hostels		.782	
Unavailable toilets in hostels		.815	
Unkempt bathrooms in hostels		.611	
Unavailable bathrooms in hostels		.678	
Unavailable waste storage facilities in hostels		.511	
Unkempt toilets in academic areas		.788	
Unavailable toilets in academic areas		.758	
Unavailable waste storage facilities in academic areas		.692	

Extraction method: Principal Component Analysis Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations
b. Keys: 1 = Availability of Environmental Amenities; 2 = Environmental Sanitation Behaviour; 3 = Socioeconomic Background

regression analysis in sequential order of three models. The regression model summary of these components in relation students' perception of environmental hazards and risks is presented in Table 3.

As contained in Table 3, availability of environmental amenities was the entry level variable in regression model 1. Evident in this regard, the effect of environmental amenities on student's perception of environmental hazards and risks was determined. Availability of environmental amenities had a coefficient of multiple determination ($R^2 = 0.139$) which made it a good predictor of student's perception of environmental hazards and risks. This implies that 13.9% of student's perception of environmental hazards and risks was predicted by environmental amenities available to them in their various institutions. Regression model 2 showed the effect of environmental sanitation behaviour when it was added to environmental amenities in predicting their effects on student's perception of environmental hazards and risks. Both environmental amenities and environmental sanitation behaviour were known to have a coefficient of multiple determination ($R^2 = 0.230$). This implies that 23.0% of student's perception of environmental hazards and risks was predicted by both environmental amenities available to them and their environmental sanitation behaviour in their various institutions. Moreover, the coefficient of determination for environmental sanitation behaviour was determined as change in the coefficient of multiple determination ($\Delta R^2 = 0.091$). This was done to ascertain the actual percentage contribution of environmental sanitation behaviour to the model. Hence, 9.1% of student's perception of environmental hazards and risks was predicted by students' environmental sanitation behaviour in the various institutions.

In regression model 3, socioeconomic background was added to environmental amenities and environmental sanitation behaviour in predicting their effects on student's perception of environmental hazards and risks. The three components were known to have a coefficient of multiple determination ($R^2 = 0.253$). This implies that 25.30% of student's perception of environmental hazards and risks was predicted by environmental amenities available to students, students' environmental sanitation behaviour and students' socioeconomic background. In furtherance, the coefficient of determination for socioeconomic characteristics was determined as change in the coefficient of multiple determination ($\Delta R^2 = 0.023$). This was done to ascertain the actual percentage contribution of socioeconomic background to the model. Hence, 2.3% of student's perception of environmental hazards and risks was predicted by students' socioeconomic background in the various institutions. Based on this regression analysis, the regression equations were as follows:

For the unstandardized coefficients (B) as:

$$y = B_0 + B_1x_1 + B_2x_2 + B_3x_3 + \ldots + B_nX_n + \varepsilon \quad (1)$$

$$y = 206.619 - 38.487x_1 + 32.088x_2 + 13.198x_3 + \varepsilon \quad (2)$$

For the standardized coefficients (β), the regression equation is:

$$y = \beta_1x_1 + \beta_2x_2 + \beta_3x_3 + \ldots + \beta_nx_n \quad (3)$$

$$y = -0.373x_1 + 0.311x_2 + 0.128x_3 \quad (4)$$

Where:

B_0 = Constant

y = Students' Perception of Environmental Hazards and Risks

x_1 = Environmental Amenities

x_2 = Environmental Behaviour

x_3 = Socioeconomic Background

ε = Error term

Table 3: Regression coefficient summary

Model		Unstandardized coefficients		Standardized coefficients
		B	S.E.	Beta (β)
1	(Constant)	206.619	4.998	
	Availability of environmental amenities	-38.487	5.005	-.373
2	(Constant)	206.619	4.715	
	Availability of environmental amenities	-38.487	4.721	-.373
	Environmental sanitation behaviour	32.088	4.721	.311
3	(Constant)	206.619	4.671	
	Availability of environmental amenities	-38.487	4.677	-.373
	Environmental sanitation behaviour	32.088	4.677	.311
	Socioeconomic background	13.198	4.677	.128

a. Dependent variable: Student's perception of environmental hazards and risks

b. Note: R =0.373, R=0.139, [F (1,365) = 59.127, p = 0.000] for model 1;
R=0.486, R2=0.23, ΔR2= 0.091, [F (2,364) = 56.317, p = 0.000] for model 2;
R=0.503; R2=0.253, ΔR2= 0.023. [F (3,363) = 40.917, p = 0.000] for model 3.

Eq. 2 and Eq. 4 are the models built for predicting students' perception of environmental hazards and risks from availability of environmental amenities, students' environmental sanitation behaviour and students' socioeconomic background. The Eq. 2 was built based on the unstandardized regression coefficients of the predictors while existing on different units of measurement. To better explain the predictor with the highest regression coefficient, Eq. 4 was computed using the standardized coefficients with the error term eliminated. Thus, the predictors could be compared directly.

From Eq. 4, environmental amenities (β_1 = -0.373) was the highest predictor of students' perception of environmental hazards and risks in their various institutions. The negative regression coefficient did not connote inverse relationship between students' perception of environmental hazards and risks and environmental amenities. It was as a result of 'Suppression Effect' existing between the independent variables that a negative regression coefficient emerged. The effect was such that environmental amenities were not directly related to the students (i.e. provided by the school management) whereas sanitation behaviour and socioeconomic background were directly related to the students. If more of environmental amenities were provided but the student had poor sanitation behaviour and socioeconomic background, their perception of risks would definitely reduce. Hence, a unit increase in environmental amenities that was supposed to enhance better perception of environmental hazards and risks could induce poor perception because of suppression effect.

The next component was environmental behaviour (β_2 = 0.311) which implies that as sanitation behaviour of students changed positively through increasing awareness and enlightenment programmes, the perception of students would increase as regards environmental hazards and risks in the institutions. Lastly, was the students' socioeconomic background (β_3 = 0.123). It indicates that socioeconomic characteristics and childhood background of students both had positive influence on their perception. A unit increase in socioeconomic background factor will then lead to an increase in perception of environmental hazards and risks in the institutions.

CONCLUSION

This study assessed factors influencing students' perception of environmental hazards and risks in UI, PolyIbadan and FCE, which are public tertiary institutions in Oyo State. Based on the findings from the study, it is concluded that availability of environmental amenities is the major factor affecting students' perception of environmental hazards and risks in the institutions. In essence, the available amenities in the institutions could not serve the existing needs of students and as in the course of time not well maintained. This is also ascertained by the findings of Ezra, Bilimi and Aliba (2013) and Olatunji (2014) that revealed the inadequacy of basic environmental amenities as well as the poor condition of available ones in tertiary education institutions in Nigeria. It is therefore pertinent for the school management to improve on provision, maintenance and overall management of environmental amenities both in the hostels and academic areas.

The next determinant of students' perception of environmental hazards and risks is the environmental behaviour of students which changed positively with increased awareness, while the least determinant is students' socioeconomic background which had little influence on their perception of environmental hazards and risks in the institutions. To remedy the situation, strict regulations should be enforced the respective school authorities to curb the unsanitary responses of students in relation to use and disuse of environmental amenities. This is because if adequate and functional environmental amenities were available in tertiary educational institutions as well as strict regulations to monitor students' use and disuse of those amenities, there would be reduction in students' unsanitary behavior that could evolve environmental hazards and risks. This could also evolve environment-friendly behavior of students in public tertiary educational institutions.

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CONFLICT OF NTEREST

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

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