

Perception, Level of Awareness And Involvement Of Students From Tertiary Institutions In Environmental Sanitation

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Abstract: Sanitation and personal hygiene are significant to healthy living, growth and development. Environmental sanitation in tertiary institutions is shaped by the availability of sanitary infrastructure and students' knowledge and behavioural practices. This study was designed to assess the students' perception of residential sanitation conditions, awareness of environmental sanitation, and sanitation-related behaviours in four tertiary institutions in Delta State, Nigeria. A community-based descriptive cross-sectional survey was conducted among 320 undergraduate students selected through purposive and simple random sampling techniques. Data was collected using a pretested 28-item questionnaire and analysed with descriptive statistics and independent-samples *t*-test. The analysis shows that the respondents were equally distributed by sex (male = 160, female = 160) and that sanitation infrastructure was generally perceived as inadequate and susceptible to overcrowding. Although toilets and bathrooms were available across the surveyed institutions, 63.8% indicated that a toilet and bathroom served 1-5 rooms, whereas 51.2% rated their condition as fair and 19.1% considered them as poorly maintained. Male residential halls were more congested, with an estimated 26 students per toilet/bathroom facility compared with 20 in female halls. Water supply was available but 36.3% considered the supplied water as non-portable for direct consumption. Sanitation-related practices varied between genders, as most female respondents cleaned their rooms every weekend, flushed toilets often and washed their hands after defecation, compared with the reported percentage for the male counterparts. Sanitation awareness was relatively high as majority consented that they had prior knowledge of environmental sanitation. However, the level of knowledge

differed significantly between genders ($p = 0.019$), as female students demonstrated greater sanitation knowledge than the male students. The study revealed a mismatch between students' awareness and the sanitary conditions of the residential halls, and the study recommends the provision of adequate sanitation and sanitary facilities to cater for the increasing numbers of students, make provision for adequate and decent residential buildings for on-campus students, institute the appropriate mechanism that would discourage squatting among the students and mind-set-based reorientation of the students to improve sanitation behaviour.

Keywords: Environment, Health, Institutions, Sanitation, Students, Delta State.

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1.0 Introduction

Environmental sanitation remains a major public health and environmental challenge globally, particularly because human behaviours, attitudes, and everyday practices strongly influence the quality and safety of the environment in which people live, study, and work (Kurtuluş & Betül, 2015). It is a known fact that human health has been directly threatened by severe environmental issues arising from the activities in and around their immediate surroundings (Raheem *et al.*, 2009). Atasoy (2005) in a research on environmental information and attitudes of primary school pupils, affirmed that life on earth is threatened as a result of environmental problems caused by humans. Other notable researchers like Amadi and Iwuala, (2005), Ekong, (2015), Akpakli *et al.* (2018) and Daramola *et al.* (2018) consistently in their

studies affirmed that environmental problems are among the major global burning issues that has led to the review and reconsideration of the relationship between humanity and nature, the behaviors and attitudes of human towards the environment, responsibilities and duties assumed by human towards nature and the creation of environmental awareness and redefinition of ecological culture.

Globally, poor quality of human environment has been recognized to threaten socio-economic development and human health (Acheampong, 2010). The impacts are severe, particularly on developing nations, thus undermining their development (Bello, 2007). Sanitation is one of the basic services humans owe nature. In fact, it is fundamental to human health and development. Having healthy surroundings set a nation on track for development. Duru *et al.* (2017) define environmental sanitation as a fundamental process that is a key public health intervention which is essential for economic, social and overall wellbeing of communities. It is an intervention process to reduce human's exposure to diseases by providing a clean surrounding for habitation and measures to curtail the outbreak of diseases (Schertenleib, 2005).

Environmental sanitation as a concept refers to fundamental processes aimed at improving the standard of basic environmental conditions affecting the wellbeing of humans. These processes covers the protection of food from biological and chemical contaminants, efficient and safe disposal of human and industrial wastes, clean and safe ambient air, potable and safe water supply as well as adequate housing in clean and safe surroundings. In institutional settings, effective environmental sanitation encompasses adequate and functional toilets, reliable and safe water supply, appropriate waste disposal systems, clean residential surroundings, proper drainage, and hygienic practices among users. The availability of these facilities alone, however, may not guarantee a sanitary environment, since their effective utilization and maintenance depend

substantially on users' knowledge, attitudes, perceptions, and behavioural practices.

Tertiary institutions provide residential and learning environments in which large numbers of young adults live and interact daily. Consequently, inadequate sanitation facilities, overcrowding, poor waste management, irregular water supply, and inappropriate hygiene practices can create conditions that compromise environmental quality and increase the potential for disease transmission. Students, therefore, constitute an important population for assessing the interaction between sanitation infrastructure, environmental awareness, and individual sanitation practices

The consequences of inadequate environmental sanitation have been widely documented across developing countries, where deficiencies in water supply, sanitation infrastructure, waste management, and hygiene practices continue to pose public health challenges. Although improvements in sanitation infrastructure are important, sustainable sanitation also requires adequate awareness, positive attitudes, and appropriate behavioural practices among users (Bello, 2007; Raheem *et al.*, 2009; Kurtuluş and Betül, 2015). This has led international communities over the years to promulgate several declarations on environmental sanitation. There are documented reports that poor sanitation and hygiene increase child morbidity and mortality (WHO, 2015). It accounts for 3.7% of global disease burden and 60% of total diarrheal deaths (Mara *et al.*, 2010). It increases the risk of respiratory diseases, developing hepatitis A, cholera and schistosomiasis (Saleem *et al.*, 2019). In Nigeria, reported rating of sanitation varies widely as high as 80% in some localities and as low as 15% in other areas. Nigeria is among the countries whose documented sanitation coverage rates between 20 and 40% below the targets of the Millennium Development Goals (Banerjee & Morella, 2011).

Adequate environmental sanitation practices have not been ensured among the citizens and the prevalence of abusive sanitation behaviors



and impunity with which they are perpetuated calls for great concern. These challenges are particularly relevant in tertiary institutions, where rapid growth in student enrolment may place considerable pressure on existing residential infrastructure. Where the number of students exceeds the capacity of available toilets, bathrooms, water facilities, and waste management systems, overcrowding and inadequate maintenance may undermine the sanitary conditions of student residences. The resultant impacts of these actions are unsanitary and unhealthy environmental conditions that are visible in every region in the country. Most disturbing is the sanitation conditions of most Nigerian tertiary institutions. Reported observations of on-campus residential areas of public tertiary institutions revealed a lot as hostels were littered with pure water polythene, unkempt toilets, heaps of pieces of papers, overcrowding and general awful environmental conditions (Omudu & Akosu, 2013; Odunsi, 2016). Such conditions may increase the risk of exposure to disease-causing pathogens and contribute to the transmission of sanitation-related diseases within institutional environments.

Scholarly research articles that have reported findings on sanitation practices in Nigeria, emanating from learning environments, are very few. Notable studies like Ezra *et al.* (2013), Dunmade *et al.* (2014), Olatunji, (2014), Ejedi, (2015), Daramola & Odunsi, (2016) & Igudia *et al.* (2019) focused and reported different findings on adequacy of sanitation facilities; while findings pertaining issues on provision and deficiencies of sanitation facilities were reported by Owoye and Adedeji, (2003), Amadi and Iwuala, (2005), Olowoporoku, (2014), Daramola, (2015), including Daramola & Odunsi, (2016). From the above highlighted studies, it is evident that sanitation challenges in educational institutions are not limited to the availability of facilities but also involve their adequacy, accessibility, maintenance, utilisation, and the behavioural practices of students. However, the findings across settings

suggest that the presence of sanitation facilities does not necessarily translate into satisfactory sanitation outcomes, highlighting the importance of examining students' perceptions, awareness, and participation in sanitation activities alongside the physical provision of facilities

Despite the studies conducted on sanitation facilities and environmental conditions in educational institutions, relatively limited empirical attention has been given to the combined assessment of students' perceptions of residential sanitation conditions, their level of environmental sanitation awareness, and their actual involvement in sanitation-related activities within tertiary institution residential environments. Furthermore, evidence comparing these dimensions across male and female students and across different types of tertiary institutions in Delta State remains limited. Consequently, it remains unclear whether students' awareness of environmental sanitation is adequately reflected in their everyday sanitation practices and involvement in maintaining their residential environments. From the foregoing, it is evident that there is a paucity of in-depth research on students' knowledge and level of awareness on sanitation matters, socio-economic attributes of students as well as attitude and behavioral practices of students in tertiary institutions on environmental sanitation.

This study aimed to assess students' perception, level of awareness, and involvement in environmental sanitation in selected tertiary institutions in Delta State, Nigeria. Therefore, the objectives of the study were to: (i) examine undergraduate students' perceptions of the environmental sanitation conditions of their halls of residence; (ii) assess the level of environmental sanitation awareness among undergraduate students; and (iii) determine the extent of students' involvement in environmental sanitation activities.

The study is significant because its findings may provide empirical evidence for improving environmental sanitation management in tertiary institution residential facilities. The



findings may assist institutional administrators, student affairs divisions, environmental health officers, and policymakers in identifying deficiencies in sanitation infrastructure and developing interventions that combine adequate facilities with sanitation education and behavioural change strategies.

2.0 Materials and Methods

2.1 Sampling

This study adopted a descriptive cross-sectional survey design. The study population comprised undergraduate students residing in on-campus halls of residence in four selected tertiary institutions in Delta State, Nigeria. The institutions were purposively selected to reflect the three senatorial districts and different ownership categories. Within each institution, students' halls of residence were selected using a simple random sampling technique, with consideration given to male and female residential halls. The targeted population of the study comprised undergraduate students from four tertiary institutions in Delta State as presented in Table 1. The four tertiary institutions were purposively selected to ensure representation of the three senatorial districts of Delta State and different institutional ownership categories. Within each institution, two male and two female halls of residence were selected using simple random sampling, resulting in a total of 16 sampled halls of residence. Students residing in the selected halls constituted the sampling frame, from which respondents were selected using simple random sampling.

The required sample size was determined using Yamane's (1967) formula at a 5% level of precision according to equation 1.

$$n = \frac{N}{1 + Ne^2} \quad (1)$$

where: n = sample size, e^2 = level of precision or sampling error which for the purpose of this research is 0.05, N = population size and 1 = constant number. For the purpose of this study,

0.05, which is 95% level of significance, was our confidence level, where e is the error of margin (0.05).

$$n = \frac{640}{1 + 640(0.05)^2} = 320$$

In the sampled institutions, four halls of residence were randomly selected (two for male and two for female), giving a total of sixteen halls of residence that were sampled. It was revealed that Novena University, Ogume had 410 bed spaces for both male and female students, College of Physical and Health Education, Mosogar had 326 bed spaces, Delta State Maritime Polytechnic, Burutu had 214 bed spaces, while Delta State Polytechnic, Ogwashi-uku had 511 bed spaces. Out of these Fig., 640 students' bed spaces were randomly selected as the targeted sample frame across the four institutions, from which 320 respondents were certified as the sample size. The selection of respondents from the halls of residence was based on simple random. The focus of the study was mainly undergraduate students residing in on-campus hall of residents of the institutions as respondents. Data on the students' hall of residence were collected from the Divisions of Student Affairs of the schools, and a well-designed and pretested research instrument (questionnaire) was used to obtain information from the respondents. Fieldwork was carried out from October to November, 2023.

Field data were collected by the researchers using a questionnaire. A well-structured research questionnaire as an instrument for data collection was designed to collect data on the perception, level of awareness and knowledge of students about environmental sanitation. The questionnaire consisted of 28 items with 2 to 7 options depending on the item. The instrument was tested for validity and reliability. The questionnaire was subjected to content scrutiny by the researchers to 3 experts in environmental management, psychology and statistics for their input and necessary criticism.

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



Institution	Category by sex	Hall of residence	No. of bed spaces	Targeted bed spaces
Novena University, Ogume	Male	A ¹	128	60
		A ²	106	45
	Female	B ¹	112	45
		B ²	64	30
	Total		410	180
College of Physical and Health Education, Mosogar	Male	C ¹	94	30
		C ²	68	30
	Female	D ¹	104	45
		D ²	60	40
	Total		326	145
Delta State Maritime Polytechnic, Burutu Technology, Burutu	Male	E ¹	88	45
		E ²	76	40
	Female	F ¹	27	27
		F ²	23	23
	Total		214	135
Delta State Polytechnic, Ogwashi- uku	Male	G ¹	198	60
		G ²	123	50
	Female	H ¹	102	40
		H ²	88	30
	Total		511	180

After corrections, some items were modified, some deleted and new ones added. Internal consistency validity was also determined by applying the research instrument to a smaller sample consisting of 50 undergraduate students; thereafter, Pearson r between every item of the scale and the total score of the scale was calculated. The correlation coefficients ranged between 0.56 and 0.64. Pearson r was calculated between the total of its factor and every item. The correlation coefficients ranged between 0.62 and 0.76. The validity of the scale was confirmed as satisfactory as all correlation coefficients were significant. The instrument was further subjected to Cronbach's alpha reliability measure. Students' perception towards sanitary infrastructure was 0.68, students' sanitation behaviours were 0.72 and students level of knowledge and awareness about environmental sanitation was 0.79. These reliability coefficients were confirmed satisfactory. The questionnaires were administered thereafter by the researchers to

students residing in the selected halls of residence, answered and retrieved back immediately. The collected data were tabulated in an SPSS version 21 spreadsheet. Descriptive statistics were used to analyse the data. The socio-demographic data of the respondents were analysed with the aid of contingency tables and charts. Student t-test was used to test the hypothesis in order to determine whether there was a significant difference between male and female students in terms of the mentioned variables.

2.2 Ethical Considerations

Ethical approval for the study was obtained from the appropriate institutional research ethics committee before commencement of data collection. Permission was also obtained from the relevant authorities of the participating tertiary institutions. The purpose and procedures of the study were explained to the respondents, and participation was voluntary. Informed consent was obtained from all participants before administration of the questionnaire. Respondents were assured



that the information provided would be treated confidentially and used solely for research purposes, and no personally identifying information was collected.

3.0 Results and Discussion

3.1 Socio-Demographic Characteristics of Respondents

A total of 320 undergraduate students drawn from four certificate-awarding tertiary institutions in Delta State participated in the study. The socio-demographic characteristics of the respondents are presented in Table 2 and illustrated in Figs. 1-4. The characteristics considered included age, gender, marital status, religion, and academic level.

The mean age of the respondents was 24 ± 1.77 years, with ages ranging from 17 to above 31 years. As presented in Table 2 and Fig. 1, the largest proportion of respondents, 189 (59.1%), were aged 25-28 years. This was followed by 86 (26.9%) respondents aged 21-24 years and 21 (6.6%) aged 17-20 years. Respondents aged 29-31 years accounted for 16 (5.0%), while 8 (2.5%) were above 31 years of age. The predominance of respondents within the 25-28-year age category indicates that the study population consisted largely of young adults within the typical age range of undergraduate students.

The distribution of respondents by gender showed an equal representation of males and females. Each gender comprised 160 respondents, representing 50.0% of the total sample. This balanced distribution is advantageous for gender-based comparisons because it provides equal group sizes and reduces the potential influence of unequal sample representation on comparative analyses. The gender distribution is presented in Table 2, while the comparative pattern is further illustrated in Fig. 1. FWith respect to marital status, the majority of respondents, 284 (88.8%), were single, while 33 (10.3%) were married and 3 (0.9%) were divorced (Table 2; Fig. 2). The predominance of single respondents is consistent with the demographic characteristics generally expected among undergraduate students, most

of whom are within the younger adult age groups. The relatively small proportions of married and divorced respondents indicate that these categories constituted a minor segment of the study population.

The religious distribution of the respondents is presented in Table 2 and Fig. 3. Christianity constituted the predominant religion, accounting for 247 (77.2%) respondents, followed by Islam with 49 (15.3%). Sixteen respondents (5.0%) reported practising traditional religion, while 8 (2.5%) identified with other religious affiliations. The distribution therefore indicates that although Christianity was predominant among the respondents, the sample included students from different religious backgrounds.

The academic-level distribution of the respondents is also presented in Table 2 and Fig. 4. Respondents in Level Two constituted the largest proportion of the sample, with 112 (35.0%) students, followed by Level Three with 73 (22.8%) and Level Four with 61 (19.1%). Level One students accounted for 45 (14.1%) respondents, while 25 (7.8%) were in Level Five and 4 (1.3%) were on extension. The relatively higher representation of Level Two students indicates that respondents at this academic level constituted the largest group in the sample, whereas students on extension constituted the smallest group.

Overall, the socio-demographic characteristics indicate that the study population was predominantly composed of young, single undergraduate students, with an equal representation of male and female respondents. The sample also included respondents across different academic levels and religious affiliations, providing a reasonably diverse population for examining sanitary conditions, sanitation behaviour, and knowledge and awareness of environmental sanitation among undergraduate students.

3.2 Perception of Sanitary Conditions of Students' Residential Halls

Table 3 and Fig. 5 present respondents' perceptions of sanitary conditions and basic environmental health facilities in male and



female residential halls. The assessment covered room occupancy, water supply and quality, toilet and bathroom facilities, waste storage, drainage, drain maintenance, pests, and pest-control measures.

Regarding room occupancy, 55.0% of male respondents reported 6-10 occupants per room, whereas 49.4% of female respondents reported 1-5 occupants and 48.1% reported 6-10 occupants. Overall, 51.6% reported 6-10 occupants per room, while 7.2% reported 10 or more. The relatively high occupancy, particularly in male halls, suggests overcrowding and possible pressure on available sanitary facilities.

This observation was also supported by the researchers' field assessment, which indicated that male halls were more congested than female halls. Water availability was comparatively better in female halls. Among female respondents, 43.1% reported that water was often available and 53.1% indicated that it was available most of the time, compared with 26.3% and 58.1%, respectively, among male respondents. Tap water (48.4%) and borehole water (34.1%) were the major sources, while 17.5% relied on well water. Although 63.7% considered the supplied water potable, 36.3% regarded it as non-potable, indicating a potential water-quality concern.

Table 2: Socio-demographic characteristics of respondents (n=320)

Socio-demographic variables		Frequency	Percentage
Age	17-20	21	6.6
	21-24	86	26.9
	25-28	189	59.1
	29-31	16	5.0
	Above 31	8	2.5
	Total	320	100
Gender	Male	160	50
	Female	160	50
	Total	320	100
Marital Status	Single	284	88.8
	Married	33	10.3
	Divorced	3	0.9
	Total	320	100
Religion	Christianity	247	77.2
	Islam	49	15.3
	Traditional religion	16	5.0
	Others	8	2.5
	Total	320	100
Academic level of respondents	Level one	45	14.1
	Level two	112	34.7
	Level three	73	22.8
	Level Four	61	19.4
	Level Five	25	7.8
	Extension	4	1.3
	Total	320	100



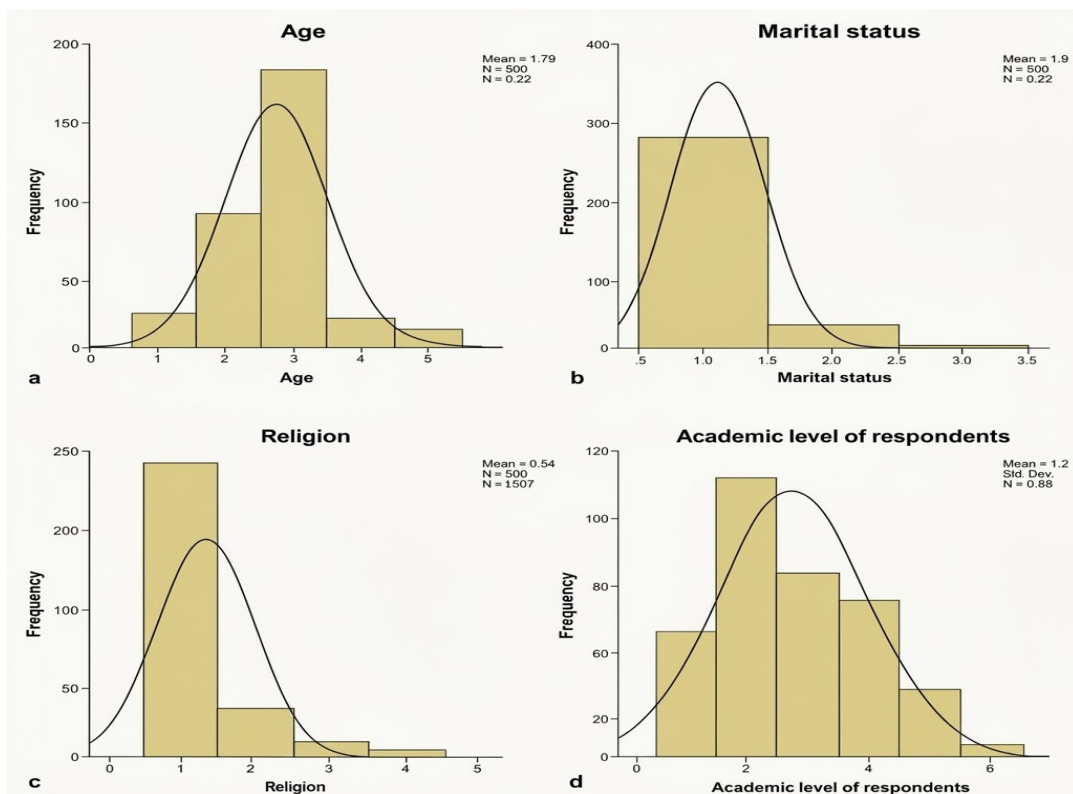


Fig. 1 (a): Age distribution of respondents, Fig. 2 (b): Marital status distribution of respondents Fig. 3 (c): Religion distribution of respondents and Fig. 4 (d): Academic level of respondents

Daily water use was highest among respondents consuming 31-40 L (48.8%), followed by 21-30 L (35.3%). Only 4.1% reported using more than 40 L daily. Thus, most respondents used less than the 50 L per capita daily benchmark recommended for basic domestic and personal hygiene needs (UNESCO, 2006).

Toilets and bathrooms were reportedly available in all halls; however, their adequacy was questionable. Overall, 63.8% of respondents indicated that one toilet/bathroom served 1-5 rooms, 30.6% reported 6-7 rooms, and 5.6% reported more than seven rooms. The corresponding Figs. for male halls were 61.2%, 27.4%, and 9.4%, compared with 66.3%, 31.8%, and 1.9% for female halls. The estimated per capita use further indicated that approximately 26 students shared these facilities in male halls compared with 20 in female halls, suggesting greater pressure on facilities in male residences. Although 29.7% rated the facilities as good, 51.2% considered

them fair and 19.1% poor. Female respondents generally reported better facility conditions than males. Similar concerns regarding overcrowding and deteriorating hostel sanitation facilities have been reported by Somja (2013) and Daramola *et al.* (2018). Nylon bags were the most commonly reported room waste-storage facility (55.9%), followed by plastic baskets (33.8%) and buckets (10.3%). Their use may reflect affordability and accessibility. At the institutional level, 50.7% rated waste-storage facilities as fair, 40.9% as good, and 8.4% as bad. Piped drains were the most common drainage type (42.8%), followed by covered (31.9%) and open drains (25.3%). Drain conditions were rated good by 42.2%, fair by 38.8%, bad by 15.6%, and very bad by 3.4%. Most respondents (78.8%) reported weekly drain cleaning, while 15.6% reported daily and 5.6% monthly cleaning. The predominance of weekly rather than more frequent cleaning may contribute to poor environmental



hygiene, particularly where drains are heavily used.

Mosquitoes were the most frequently reported pests (58.4%), followed by houseflies (29.1%). Mosquito nets constituted the major pest-control measure (55.0%), followed by insecticides (30.3%), rat poison/traps (7.8%), and protective clothing (6.3%). Male respondents reported greater use of insecticides, whereas female respondents more frequently used mosquito nets. Overall, the findings indicate that although basic sanitary facilities were present, overcrowding, inadequate water availability, limited water consumption, overstretched toilets and bathrooms, and suboptimal drainage maintenance remained important environmental health concerns.

3.3 Perceived Sanitation Behaviour of Respondents

Table 4 presents respondents' reported sanitation practices. Most respondents (64.4%) reported cleaning their rooms every weekend, with a substantially higher proportion among females (76.9%) than males (51.9%). Only 8.8% reported monthly cleaning. This gender difference suggests greater attention to immediate environmental cleanliness among female students and is consistent with

observations reported by Daramola and Olowoporoku (2016).

Bathroom use was also more frequent among female respondents: 67.5% reported very frequent use compared with 39.4% of males. For toilet use, however, 78.8% of male respondents reported using the toilet whenever pressed, compared with 35.6% of females. Toilet flushing was generally satisfactory, with 61.6% reporting very frequent flushing and 34.7% reporting frequent flushing. Female respondents recorded a higher proportion of very frequent flushing (71.3%) than males (51.8%).

Hand hygiene after defecation was less consistent. Although 36.6% reported washing their hands very often and 40.0% often, 17.5% did so only occasionally, while 3.7% seldom and 2.2% never washed their hands. Female respondents generally demonstrated better handwashing practices. Nevertheless, water alone was the most commonly reported handwashing material (53.4%), compared with soap and water (43.8%), indicating a need to strengthen hygiene education and access to soap. Similar gender-related differences in hygiene practices have been reported by Ezra *et al.* (2013), Omudu and Akosu (2013), and Daramola (2015).

Table 3: Perception of respondents on sanitary condition of hall of residents



Attributes of hall of residents	Male residential hall		Female residential hall		Total	
	Frequency	%	Frequency	%	Frequency	%
Number of occupants in respondents' rooms						
1-5	53	33.1	79	49.4	132	41.2
6-10	88	55.0	77	48.1	165	51.6
10 & above	19	11.9	4	2.5	23	7.2
Total	160	100	160	100	320	100
Availability of water						
Often	42	26.3	69	43.1	111	34.7
Most time	93	58.1	85	53.1	178	55.6
Occasionally	25	15.6	6	3.8	31	9.7
Total	160	100	160	100	320	100
Source of water supply						
Tap water	72	45.0	83	51.9	155	48.4
Borehole	53	33.1	56	35.0	109	34.1
Well water	35	21.8	21	13.1	56	17.5
Water Vendor	-	-	-	-	-	-
Total	160	100	160	100	320	100
Quality of water supplied						
Portable	106	66.3	98	61.3	204	63.7
Not potable	54	33.7	62	38.7	116	36.3
Total	160	100	160	100	320	100
Average quantity of water used daily (litres)						
>20	22	13.8	16	10.0	38	11.8
21-30	51	31.8	62	38.8	113	35.3
31 & 40	76	47.5	80	50.0	156	48.8
Above 40	11	6.9	2	1.2	13	4.1
Total	160	100	160	100	320	100
Availability of toilets and bathrooms						
Yes	160	100	160	100	320	100
No	-	-	-	-	-	-
Total	160	100	160	100	320	100
Number of rooms to toilet and bathrooms						
1-5	98	61.2	106	66.3	204	63.8
6-7	47	27.4	51	31.8	98	30.6
above 7	15	9.4	3	1.9	18	5.6
Total	160	100	160	100	320	100
Condition of toilet and bathrooms						
Good	38	23.8	57	35.6	95	29.7
Fair	79	49.4	85	53.1	164	51.2
Poor	43	26.8	18	11.3	61	19.1
Total	160	100	160	100	320	100
Type of waste storage facility in rooms						
Plastic basket	48	30.0	60	37.5	108	33.8
Nylon bags	101	63.1	78	48.8	179	55.9
Buckets	11	6.9	22	13.7	33	10.3
Total	160	100	160	100	320	100



Condition of waste storage facility in the institution						
Good	62	38.8	69	43.1	131	40.9
Fair	87	54.4	75	46.9	162	50.7
Bad	11	6.8	16	10.0	27	8.4
Total	160	100	160	100	320	100
Type of drains						
Piped drain	64	40.0	73	45.6	137	42.8
Covered drain	54	33.7	48	30.0	102	31.9
Open drain	42	26.3	39	24.4	81	25.3
Total	160	100	160	100	320	100
Condition of drains						
Good	58	36.3	77	48.1	135	42.2
Fair	61	38.1	63	39.4	124	38.8
Bad	33	20.6	17	10.6	50	15.6
Very bad	8	5.0	3	1.9	11	3.4
Total	160	100	160	100	320	100
Cleaning of drains						
Daily	22	13.8	28	17.5	50	15.6
Weekly	135	84.3	117	73.1	252	78.8
Monthly	3	1.9	15	9.4	18	5.6
Total	160	100	160	100	320	100
Common pests in residential halls						
Mosquitoes	96	60.0	91	56.9	187	58.4
Cockroach	11	6.9	9	5.6	20	6.3
Rat	5	3.1	4	2.5	9	2.8
Housefly	42	26.3	51	31.9	93	29.1
Ant	6	3.7	5	3.1	11	3.4
Total	160	100	160	100	320	100
Method used to prevent pest						
Insecticide	74	46.3	23	14.4	97	30.3
Mosquitoes net	69	43.1	107	66.9	176	55.0
Protective clothing	4	2.5	16	10.0	20	6.3
Rat poison/trap	11	6.8	14	8.7	25	7.8
Other	2	1.3	-	-	2	0.6
Total	160	100	160	100	320	100



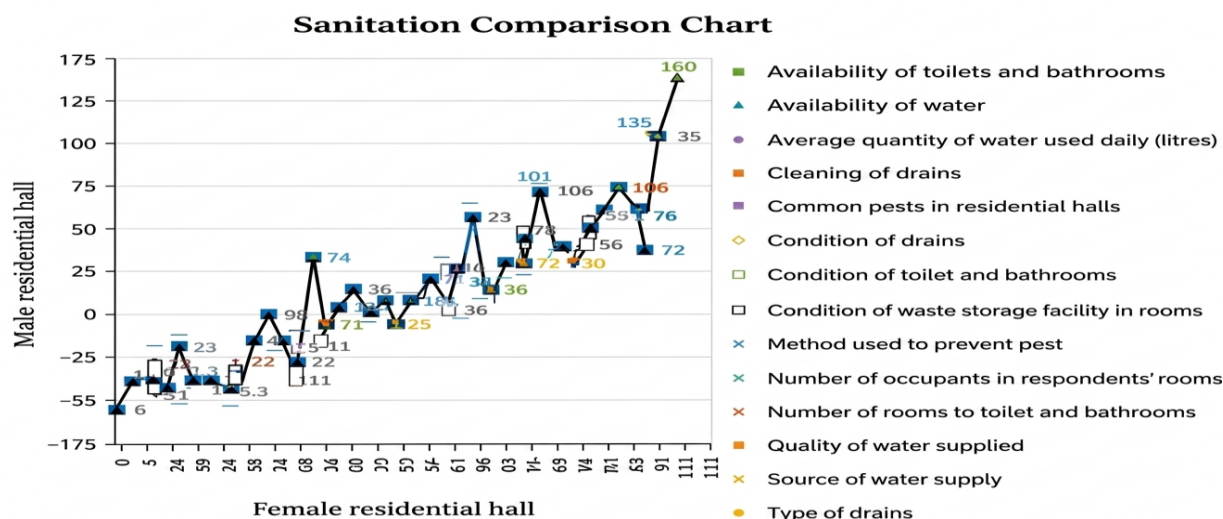


Fig. 5: Comparison between groups: Male residential halls by Female residential halls

When toilets were unavailable or in poor condition, 43.7% of respondents reported using nearby bushes and 33.4% using nylon bags. Other alternatives included open spaces in the dark (11.7%), areas behind hostel buildings (6.3%), and potties (4.3%). Male respondents more frequently reported using bushes and areas behind hostel buildings, whereas females more frequently used nylon bags and potties. These practices indicate important sanitation and public-health risks associated with inadequate or poorly maintained toilet facilities.

3.4 Knowledge and Awareness of Environmental Sanitation

Table 5 and Fig, 6 summarize respondents' knowledge and awareness of environmental sanitation. All respondents (100%) reported awareness of environmental sanitation programmes in Nigeria. Television was the leading information source (33.4%), followed by radio (14.3%), internet (11.3%), posters/signboards (8.8%), class lectures (7.5%), and health personnel (7.2%). Female respondents reported greater exposure to television, internet resources, posters/signboards, and seminars/workshops, suggesting potentially greater access to sanitation-related information.

Regarding the objectives of environmental sanitation, 52.8% identified health promotion, 34.1% disease prevention, and 11.9% personal hygiene/cleanliness. Waste disposal (31.5%), sweeping/cleaning of surroundings (24.4%), potable water provision (20.6%), sewage disposal (10.6%), handwashing (6.6%), and food safety (6.3%) were identified as components of environmental sanitation. These responses indicate generally satisfactory awareness of the major elements of environmental sanitation.

Open dumping was the most frequently identified waste-disposal method (44.7%), followed by sanitary landfill (38.8%), recycling (7.8%), incineration (5.0%), and composting (3.7%). However, identifying open dumping as a known disposal method should not be interpreted as endorsement of its environmental suitability. Respondents also identified infection (32.8%), pollution (27.8%), blocked drains (22.3%), and pest-breeding sites (10.0%) as major consequences of poor sanitation. Overall, the findings suggest substantial awareness of environmental sanitation and its health consequences, consistent with Duru *et al.* (2017), Adeyemo *et al.* (2013), Yadavannavar *et al.* (2010), and Nwakile *et al.* (2017).

Table 4: Students' perceived sanitation behaviour



Behaviour	Male residential hall		Female residential hall		Total	
	Frequency	%	Frequency	%	Frequency	%
Cleaning of students' room						
Every weekend	83	51.9	123	76.9	206	64.4
2 nd week of the month	51	31.9	35	21.8	86	26.8
Monthly	26	16.2	2	1.3	28	8.8
Not at all	-	-	-	-	-	-
Total	160	100	160	100	320	100
Use of bathroom						
Very often	63	39.4	108	67.5	171	53.4
Often	76	47.5	46	28.8	122	38.1
Occasionally	13	8.1	6	3.7	19	5.9
Not at all	8	5.0	-	-	8	2.5
Total	160	100	160	100	320	100
Frequency in the usage of toilet						
Frequently	19	11.8	59	36.8	78	24.4
When pressed	126	78.8	57	35.6	183	57.2
Not often	15	9.4	42	26.3	57	17.8
Not at all	-	-	2	1.3	2	0.6
Total	160	100	160	100	320	100
Flushing of toilet after use						
Very often	83	51.8	114	71.3	197	61.6
Often	69	43.1	42	26.3	111	34.7
Occasionally	6	3.8	3	1.8	9	2.8
Seldom	2	1.3	1	0.6	3	0.9
Not at all	-	-	-	-	-	-
Total	160	100	160	100	320	100
Washing of hands after defecation						
Very often	41	25.6	76	47.5	117	36.6
Often	65	40.6	63	39.4	128	40.0
Occasionally	38	23.8	18	11.3	56	17.5
Seldom	9	5.6	3	1.8	12	3.7
Not at all	7	4.4	-	-	7	2.2
Total	160	100	160	100	320	100
Hand washing materials						
Soap & water	57	35.6	83	51.9	140	43.8
Water only	94	58.8	77	48.1	171	53.4
None of the above	9	5.6	-	-	9	2.8
Total	160	100	160	100	320	100
Alternative when toilet is in bad condition						
Nearby bush	103	64.3	37	23.1	140	43.7
In a nylon	24	15.0	83	51.9	107	33.4
Toilet floor	2	1.3	-	-	2	0.6
Behind hostel building	16	10.0	4	2.5	20	6.3
Use of potty	-	-	14	8.8	14	4.3
Open space in the dark	15	9.4	22	13.7	37	11.7
Total	160	100	160	100	320	100



3.5 Gender Difference in Knowledge and Awareness of Environmental Sanitation

Table 6 presents the independent-samples t -test assessing gender differences in selected knowledge and awareness indicators. The results showed a statistically significant difference for Question 3 ($t = 2.351$, $p =$

0.019), whereas Questions 2, 4, 5, and 6 were not statistically significant ($p > 0.05$). Specifically, Question 3 produced a mean difference of 0.194 (95% CI: 0.032–0.356), indicating a significant gender-related difference in this knowledge indicator.

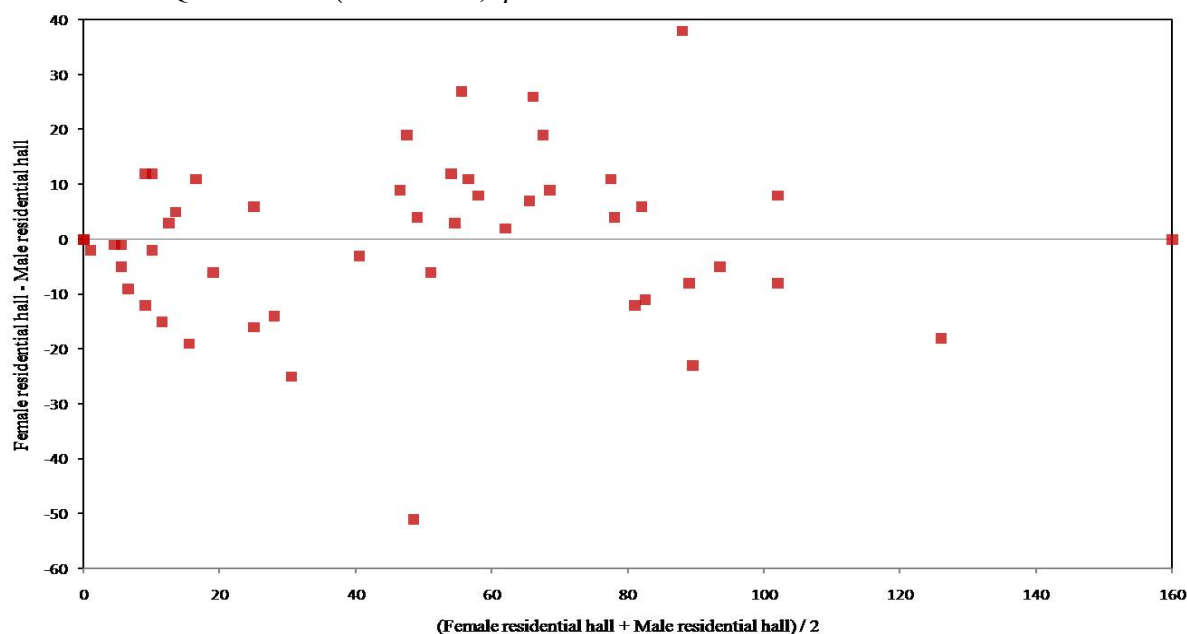


Fig. 6: Gender comparison on knowledge and awareness of environmental sanitation

Therefore, H_{01} is rejected only with respect to Question 3, while it is retained for Questions 2, 4, 5, and 6. The evidence does not support the original blanket conclusion that there was a significant difference across all six indicators. Rather, the results indicate that gender differences in environmental-sanitation knowledge were indicator-specific. This finding provides partial support for studies reporting greater environmental-health awareness among females (Zelezny *et al.*, 2000), although it contrasts with Ekong (2015), who reported greater participation in sanitation activities among males.

In accordance with the study objective, level of knowledge and awareness about environmental sanitation between male and female students was assessed based on six distinct indicators as outlined in the research instrument. The result displayed in Table 6 present the analysed indicators that were used

to ascertain whether or not, if there was significant difference on the percentage ratio of male from female students on knowledge about environmental sanitation. Critical examination of the analysed data revealed significant difference on the percentage ratio of female respondents that were more knowledgeable about environmental sanitation programme than male respondents, hence rejecting the null hypothesis. This implies that significant difference exist between male and female students on the level of knowledge and awareness about environmental sanitation. The finding therefore upheld earlier reported finding by Zelezny and colleagues in which female gender showed more favorable sound knowledge background about environmental sanitation than male (Zelezny *et al.*, 2000).

The finding further affirmed the finding as earlier captured in Table 4, where it was revealed that female students may be more



knowledgeable about environmental sanitation programme than male students. Furthermore, this finding evicts the finding by Ekong (2015) who reported a significant association between gender and participation in environmental sanitation activities ($p < 0.05$), with male

respondents showing more odds of participation than females. It is therefore inferred in this study that female students were more knowledgeable about environmental sanitation programmes than the male counterparts.

Table 5: Knowledge and awareness of environmental sanitation among sampled respondents



Variable	Male residential hall		Female residential hall		Total	
	Frequency	%	Frequency	%	Frequency	%
Have you heard about environmental sanitation in Nigeria						
Yes	160	100	160	100	320	100
No	-	-	-	-	-	-
Total	160	100	160	100	320	100
Source of information						
Television	49	30.6	58	36.4	107	33.4
Radio	27	16.8	19	11.8	46	14.3
Student orientation programme	10	6.3	6	3.7	16	5.0
Health personnel	8	5.0	15	9.4	23	7.2
Class lecture	15	9.4	9	5.6	24	7.5
Seminar/workshop	6	3.8	8	5.0	14	4.4
Newspaper	8	5.0	-	-	8	2.5
Friends/relatives	7	4.4	8	5.0	15	4.7
Poster/sign boards	11	6.8	17	10.6	28	8.8
Internet	16	10.0	20	12.5	36	11.3
Sanitation agencies	3	1.9	-	-	3	0.9
Total	160	100	160	100	320	100
What is the objective of environmental sanitation						
Promoting health	78	48.7	91	56.9	169	52.8
Preventing diseases	53	33.1	56	35.0	109	34.1
Personal hygiene/ cleanliness	26	16.3	12	7.5	38	11.9
Avoid contact with people	3	1.9	1	0.6	4	1.2
Total	160	100	160	100	320	100
What constitute environmental sanitation						
Waste disposal	57	35.6	44	27.5	101	31.5
Hand washing	8	5.0	13	8.1	21	6.6
Safe guarding food	11	6.9	9	5.6	20	6.3
Sewage disposal	14	8.7	20	12.5	34	10.6
Provision of potable water	34	21.3	32	20.0	66	20.6
Sweeping/cleaning of our surroundings	36	22.5	42	26.3	78	24.4
Total	160	100	160	100	320	100
Types of waste disposal known						
Open dumping	70	43.7	73	45.6	143	44.7
Sanitary landfill	63	39.4	61	38.1	124	38.8
Incineration	6	3.8	10	6.3	16	5.0
Recycling	12	7.5	13	8.1	25	7.8
Composting	9	5.6	3	1.9	12	3.7
Total	160	100	160	100	320	100
Effects of poor sanitation practices						
Causes infection	49	30.6	56	35.0	105	32.8
Unhealthy living condition	12	7.5	7	4.4	19	5.9
Block drainages	38	23.8	33	20.6	71	22.3
Provides breeding sites	15	9.3	17	10.6	32	10.0



Serve as source of pollution	42	26.3	47	29.4	89	27.8
Causes injuries	3	1.9	-	-	3	0.9
Serve as hideout for criminals	1	0.6	-	-	1	0.3
Total	160	100	160	100	320	100



Table 6: Significant difference between male and female respondents on knowledge and awareness ratio on environmental sanitation

Gender			Levene's Test for Equality of Variances				t-test for Equality of Means				
			F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
										Lower	Upper
Question 2	Equal variances assumed		0.542	0.462	-0.066	318	0.948	-0.025	0.380	-0.773	0.723
	Equal variances not assumed				-0.066	317.566	0.948	-0.025	0.380	-0.773	0.723
Question 3	Equal variances assumed		6.996	0.009	2.351	318	0.019	0.194	0.082	0.032	0.356
	Equal variances not assumed				2.351	306.911	0.019	0.194	0.082	0.032	0.356
Question 4	Equal variances assumed		1.424	0.234	-1.124	318	0.262	-0.256	0.228	-0.705	0.192
	Equal variances not assumed				-1.124	317.704	0.262	-0.256	0.228	-0.705	0.192
Question 5	Equal variances assumed		0.398	0.529	0.787	318	0.432	0.094	0.119	-0.141	0.328
	Equal variances not assumed				0.787	312.735	0.432	0.094	0.119	-0.141	0.328
Question 6	Equal variances assumed		0.376	0.540	0.338	318	0.736	0.063	0.185	-0.301	0.426
	Equal variances not assumed				0.338	317.999	0.736	0.063	0.185	-0.301	0.426



4.0 Conclusion

This study assessed students' perception of residential sanitation conditions, awareness of environmental sanitation, and sanitation-related behaviours in four different tertiary institutions in Delta State, Nigeria. This was necessary because the reoccurring abusive sanitation behaviours of undergraduate students and the level of impunity with which they are perpetuated have created serious concern. Based on the findings, the study established that the surveyed institutions had limited residential halls for both genders. Male halls were more congested and the sanitary facilities poorly maintained than female halls. The numbers of students residing in the halls were higher than the officially allocated numbers per room, thus revealing that the rooms were congested and overstretched. The respondents generally had an acceptable level of knowledge about environmental sanitation, but this knowledge was not evident in their sanitation-related behaviours and maintenance culture. Female students also had better sanitation-related practices and relatively higher knowledge of environmental sanitation than their male counterparts. This suggests that the knowledge of students do influence sanitation behaviours; but knowledge alone cannot compensate for inadequate toilets facilities, bathrooms, water supply and residential space. The results showed that female students consumed more litres of water than male students but within UNESCO benchmark for preparing meals and personal hygiene. Private institution had better sanitary facilities than the public institutions studied and female halls had better and functioning sanitary facilities than those of males. The study therefore recommends that the tertiary institutions should incorporate environmental education programs that cover every aspects of the environment into students' curriculum in order to improve their knowledge and understanding of the environment. Also, adequate sanitation and sanitary infrastructure to cater for the increasing number of students should be made available in on-campus hostels. Since it is a general belief that

overcrowded houses are characterized by poor sanitary conditions, the management of the various institutions should prioritize the construction of decent residential buildings for on-campus students.

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