International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Impact Factor (2012): 3.358

Knowledge of Building and Construction Materials among Polytechnic Students

Dr. Ahmed Mohammed Kamaruddeen[1] , Bldr. Halimat Omuya Chatta[2], Bashir Hussain Yahaya[3]

Abstract: ***Knowledge of building and construction materials is fundamental to Architecture, Quantity Surveying and Building Technology practice. This paper therefore examines the knowledge of building and construction Materials among the polytechnic students fromArchitectural Technology (ARCH), Building Technology (BT) and Quantity Surveying (QS) program at Federal Polytechnic Nasarawa, Nigeria. A structured questionnaire was used to obtain data from 174 Higher National Diploma (HND) students about their familiarity with major materials used for the construction of residential houses. The data were analyzed using SPSS (version 16.0) to run descriptive statistics and analyses of variance (ANOVA).The findings revealed that there exists a significant difference among ARCH, BT and QS students with respect to familiarity with construction materials. Students from ARCH scored the highest mean for all materials compared to students from BT and QS. These findings reveal that ARCH students were more familiar with the construction and building materials compared with BT and QS students. This study pioneers and provides a major impetus for future research. Further, it can trigger further research across all the departments of various Schools with respect to a common knowledge or skills students are expected to acquire.***

Keywords: Knowledge, Building & Construction Materials, Polytechnic Students.

1. Introduction

The knowledge of building materials among student in the school of the built environment and design or environmental studies is fundamental to Architecture, Building Technology and Quantity Surveying practices. For an architect, it enables an efficient and appropriate material selection during architectural design. In addition, it enables Quantity Surveyor to be accurate in measurement, estimation and rate calculation. Further, it provides Building technologists with the ability to effectively manage and assemble the materials. This perhaps is one of the reasons why building construction is taught as one of the main course across Architecture, Quantity Surveying and Building Technology department. While all the graduate from the three departments are expected to have the knowledge and be familiar with all the building and construction materials, certain factors such as differences in industrial placement play a significant role in meeting this expectation. Some students are fortunate to secure a place in construction and project based organizations in which construction projects are in progress. While most construction companies operate in the capital cities majority of the students often choose to perform the exercise in places such as local government authorities close to their homes because they cannot afford the cost of transportation and accommodation in cities.

Despite the increasing concern about the brain drain and the quality of graduates produced by Higher Education Institution [1]; and while few studies have examined student learning in higher institutions, vocational training schools and high schools (example, [2-6], less attention has been specifically directed to technical based students in Nigerian Polytechnics. This paper therefore seeks to provide answers to the research question: is there any significant difference in knowledge of construction materials among Architectural, building technology and quantity surveying students in federal polytechnic Nasarawa, Nigeria. Not only is this study urgently needed, it is also critical in the current situation in which the quality of graduates from polytechnics are compared to those from all Universities in Nigeria. More so that employers in the construction industry are keen on employing only those that have a better understanding of construction. A major significance of this research lies in the importance of competence-based approach to teaching and learning professional course, such as Architecture, Quantity Surveying, Building, Law and Medicine etc. The aim of a competence-based approach to teaching and learning is to ensure that knowledge and skill acquired is oriented on practice [7-8]. In narrowing the gap identified in the literature, this paper therefore seeks to achieve the following objectives:

1. To determine the level of familiarity with construction materials among student in Architectural, Building Technology and Quantity Surveying Department at Federal Polytechnic Nasarawa.
2. To determine any significant difference in the familiarity of construction materials among the student in Architectural, Building Technology and Quantity Surveying at Federal Polytechnic Nasarawa.

2. Literature Review

The relevance of knowledge about building and construction materials among construction professionals is much. While this knowledge enables the professional such as architects, quantity surveyors and builders to perform their job efficiently such the application of sustainability concept to construction, especially now that the quest for sustainability concept has increased among the stakeholders across construction industries [9]. For example, adequate knowledge of construction of building material enables the designer or architect to select between traditional and contemporary building material or both. The choice can be influenced by certain factors such as client requirement, energy requirement, ecological needs and customer requirement. Traditional building materials are used for construction because they have better relations with the environment than the contemporary building materials [10]. Where traditional building materials available cannot provide the required strength or building properties, contemporary building materials are chosen because they

provide better properties than traditional building materials in some aspects. Such properties include like durability and mechanical properties

It has been acknowledged that one of the means to achieving sustainable building is selecting right and appropriate materials that will influence the performance of the building to achieve the desired sustainability goals [11]. Additionally, Knowledge of building materials is crucial to material selection required for addressing green gas emission. This is so because selecting the right building materials can significantly enhance the life cycle energy of a building as well as the operational heating and cooling energy requirements of buildings [12]. In responding to both direct and indirect impacts of construction on the environment, practitioners in the construction industry have begun to pay attention to controlling and correcting the environmental damage due to their activities [13]. An important strategy is the sustainable selection of materials to be used in building projects. This endeavor has been identified as the easiest means for designers to incorporating sustainable principles in building projects [14].

3. Methodology

Most studies use questionnaire and interview as instruments for collecting data. Questionnaires are preferred when respondents are widely scattered [15]. Conversely, interviews are used when respondents are easily accessible geographically [16]. While all the respondents are easily accessible within Architectural, Quantity Surveying and Building departments, this study, however used questionnaire because the respondents are students. Moreover, interviewing the students by their lecturers might make them feel uncomfortable. The students were therefore availed the freedom and ample time to respond to all the items in the questionnaire.

3.1 Samples

The respondents for this study are first and second year higher national diploma students from Architecture, Building Technology and Quantity Surveying Departments, Federal Polytechnic Nasarawa, Nigeria. These two groups of students were chosen because they are expected to have performed both four months and one year industrial placement project based organizations. Following Krejcie and Morgan's [17], a total of 174 sample size is adequate for this study. A total of 174 questionnaires was physically distributed to the student in the three departments using a non-proportionate stratified random sampling [18]. The respondents were informed about the importance of the study and encouraged to complete and return the questionnaire. All the questionnaires were completed and returned, yielding a responds 100% responds rate.

3.2 Measurement

Due to the nature of research, a self-developed questionnaire derived from the literature was used to assess students' familiarity of construction materials. The categories of materials examined are Walling materials (blocks) and were grouped into two according to process (manual or machined mold) and sizes of blocks (225mm and 150mm). Timber was examined based on the types of wood (Black Afara, Obeche, Mansonia and Iroko). Concrete materials and Terrazzo materials (aggregate) were examined according to size of aggregate (19mm and cheapens used for terrazzo). Reinforcement bars were examined based on diameter (16mm, 12mm). Plumbing materials were examined based on types. Electrical Materials (cables, switches and incoming service equipment) were examined based on diameter and types respectively. Tiling materials were examined based on size and type (size and type). Paint materials were examined based on types only. Following Sekaran (2006) [18] on a Likert scale, respondents were asked to tick from 1 to 5, were 1 = Cannot identify both materials, 2 = Can identify one material, 3 = Can identifies both materials, 4 = Can Differentiate both materials, 5 = Can identify and differentiate both materials.

3.3 Reliability Test and Data Analysis

Prior to using SPSS version 16.0, for running the descriptive analyses and analyses of Variance (ANOVA) were performed to achieve the research objectives, reliability test was performed. Pre-test was carried out on 6 lectures (2 lecturers each from Arch, QS and BT department) in order to obtain their feedback. Their comments and suggestions were incorporated into the final questionnaire. A pilot test was also performed on 3 students, each of the three departments. Cronbach's coefficient alpha was used to determine the reliability of the various items used in the study. This was to ensure that the scales adopted in this study were not ambiguous and that all items within a factor were measuring the same underlying dimensions. Higher coefficient alpha is an indication of greater consistency among the items and the confidence that the measurements are reliable. This study followed the minimum reliability acceptance level [19], where 0.7 is considered acceptable. The Cronbach's coefficient alpha value of the instrument used in this study is 0.895.

4. Results

Table 1 presents the result of analyses from 174 respondents selected as the respondents for this study from three different departments: Architecture (27.0%), BT (29.1%) and Quantity Surveyor (33.9%). Most of them were at HND I level (54.6%) compared to the HND II level (45.4%). Almost all of the respondents have less than three years of experience (92.0%). 71.3 % of the respondents were satisfied with their industrial training.

Table 1: Background of the Respondents

	Frequency	Percentage
Department		
ARCT	47	27.0
BT	68	39.1
QS	59	33.9
Level		
HND1	95	54.6
HND11	79	45.4
Mode		
Full Time	174	100.0
Experience (years)		

<3	160	92.0
3-5	8	4.6
6-9	2	1.1
>9	4	2.3
Satisfaction with Industrial Training		
Yes	119	71.3
No	48	28.7

Table 2 presents the descriptive analysis for the students' familiarity with the construction material examined. Most of the respondents (60.7%) could not identify both Black Afara wood & Obache wood (mean=1.81). 40.2 percent were also could not identify both Flexible connector & Non Flexible connector (mean=2.76) and 41.6 percent failed to identify both Nipple & Union Connector (mean=2.55).

It was also found that most of the respondents (82.8%) were able to identified both 225mm block & 150mm block (mean=4.63), Machine mold blocks & Manual mold blocks (mean=4.33), 12mm Iron Rod & 16mm Iron Rod (mean=4.30) and Distribution Board & Change Over Switch (mean=4.23) as shown in Table 2 and Figure 1. Over 70 percent of the respondents were able to identify and differentiate these materials.

Table 2: Familiarity with Construction Materials

	Percentage					Mean
	1	**2**	**3**	**4**	**5**	
1. Machine mould blocks & Manual Mould blocks	2.3	5.2	21.3	-	71.3	4.33
2. 225mm block & 150mm block	0.6	1.7	14.9	-	82.8	4.63
3. Black afara wood & Obache wood	60.7	22.0	5.2	-	12.1	1.81
4. Mansonia wood & Iroko wood	42.0	28.7	9.8	-	19.5	2.26
5. 50 X 50mm wood & 50 X 75mm wood	14.9	3.4	14.9	-	66.7	4.00
6. 13mm galvanized iron pipe & 19mm galvanized iron pipe	26.2	9.9	13.4	-	50.6	3.39
7. Flexible connector & Non Flexible connector	40.2	10.3	16.1	-	33.3	2.76
8. Upvc pipe & PVC pipes	10.3	34.5	14.4	0.6	40.2	3.26
9. Glazed tiles & unglazed tiles	19.1	20.2	9.8	-	50.9	3.43
10. Plaster of Paris (p.o.p) & Acoustic Ceiling	14.5	27.7	9.8	-	48.0	3.39
11. 19mm aggregate & Terrazzo cheapens	15.7	22.1	12.2	-	50.0	3.47
12. Text coat paint & Gloss paint	10.4	10.4	15.0	-	64.2	3.97
13. 1.5mm Cable & 2.5mm Cable	21.5	6.4	12.2	-	59.9	3.70
14. Single Core Cable & Double Core Cable	39.3	4.6	8.1	-	48.0	3.13
15. Distribution Board & Change Over Switch	7.5	9.2	9.8	-	73.4	4.23
16. 0.55mm Aluminium Sheet & 0.75mm Aluminium Sheet	28.9	8.1	16.8	-	46.2	3.27
17. 20mm Aggregates & 40mm Aggregates	25.7	9.9	10.5	-	53.8	3.46
18. 12mm Iron Rod & 16mm Iron Rod	8.1	4.0	12.7	-	75.1	4.30
19. Marble Floor & Terrazzo Floor	6.4	15.0	13.3	-	65.3	4.03
20. Nipple & Union Connector	41.6	20.8	8.1	-	29.5	2.55
21. 2Gang Switch & 3 Gang Switch	13.3	6.9	14.5	-	65.3	3.97
22. Concrete 1:2:4Mix & Concrete 1:3:6 Mix	12.1	5.8	16.8	-	65.3	4.01

Figure 1 presents the mean scores for familiarity of all the building materials examined in this research. The building materials with the highest mean score (4.63) is 225mm and 150mm indicating that most students from all the three departments can differentiate the blocks, based on their sizes. Machine molded block has a mean score of 4.33, indicating the students can differentiate between automated moulded and manual moulded blocks. Reinforcement bar has a mean score of 4.3 indicating that students can differentiate reinforcement bar base on their sizes. From electrical materials, distribution board has a mean score of 4.23. Based on this result, it can be inferred that most building materials having a higher mean score are most commonly used for new or maintenance projects.

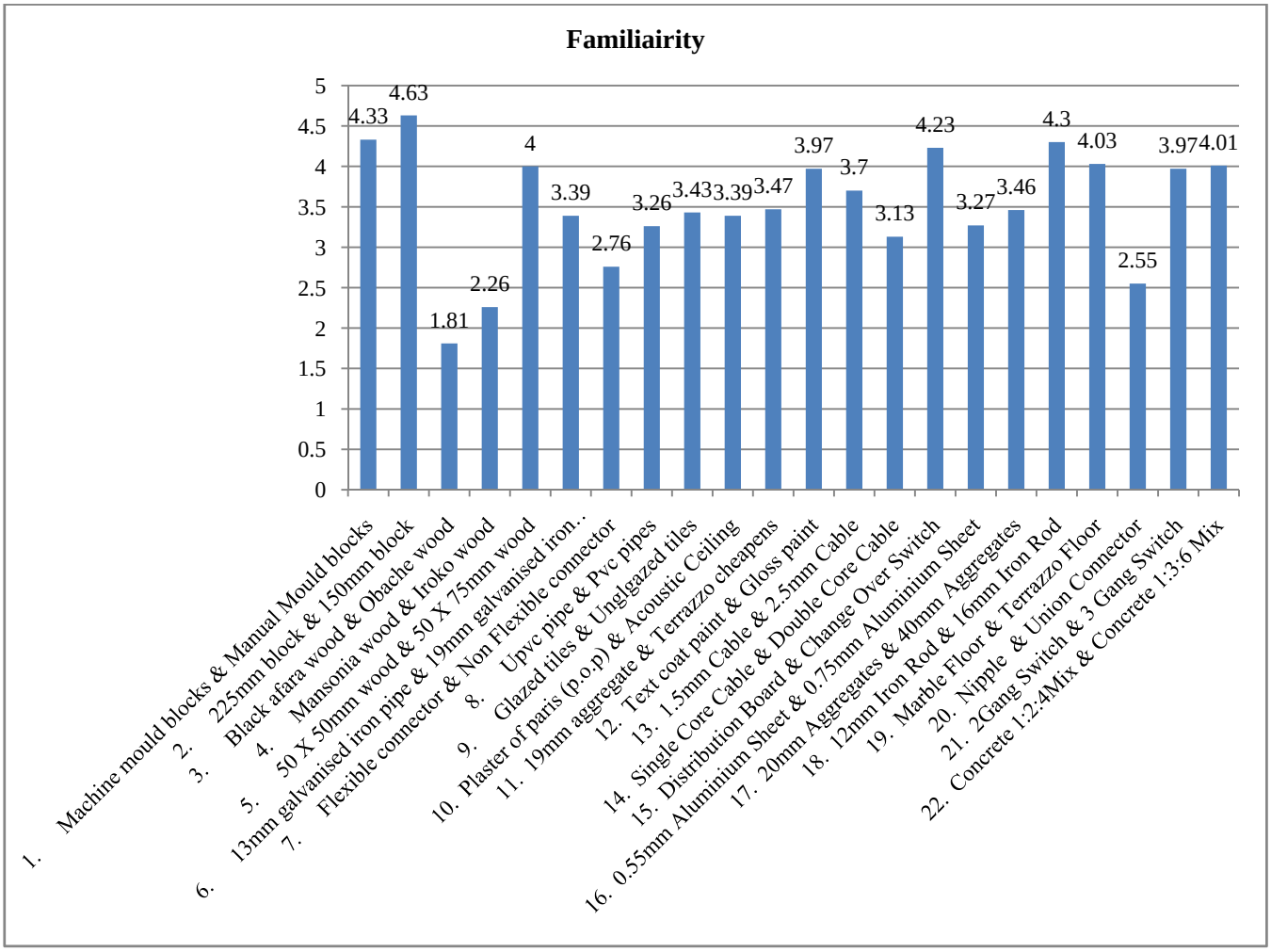

Figure 1: Mean Score for the knowledge of the Construction Materials

Table 3 summarizes the one-way ANOVA results to differentiate students' knowledge of the construction materials among departments. Significant differences were found in the familiarity of the construction materials at p<0.01 for Black afara wood & Obache wood (F=11.499, p<0.01); Flexible connector & Non Flexible connector (F=7.501, p<0.01); Upvc pipe & PVC pipes (F=8.304, p<0.01); Glazed tiles & unglazed tiles (F=4.816, p<0.01) and Plaster of Paris (P.O.P) & Acoustic Ceiling (F=12.807, p<0.01). There were also s significant difference at the same level (p<0.01) among department on 19mm aggregate & Terrazzo cheapens (F=7.354, p<0.01); 0.55mm Aluminium Sheet & 0.75mm Aluminium Sheet (F=11.044, p<0.01); 20mm Aggregates & 40mm Aggregates (F=4.843, p<0.01); 12mm Iron Rod & 16mm Iron Rod (F=4.378, p<0.01); and Concrete 1:2:4Mix & Concrete 1:3:6 Mix (F=4.839, p<0.01). The following materials were significant at p<0.05 as follows: Mansonia wood & Iroko wood F=3.183, p<0.05); Text coat paint & Gloss paint (F=3.557, p<0.05) and Marble Floor & Terrazzo Floor (F=5.447, p<0.01). They were significant differences for other Materials.

Table 3: Knowledge of Construction Materials among Arch, BT and QS students

		Percentage			F	Sig.
		ARCH	*BT*	*QS*		
1.	Machine mould blocks & Manual Mould blocks	4.47	4.40	4.14	1.391	.252
2.	225mm block & 150mm block	4.79	4.63	4.49	1.627	.200
3.	Black afara wood & Obache wood	2.54	1.65	1.42	*11.499***	.000
4.	Mansonia wood & Iroko wood	2.72	2.13	2.05	*3.183**	.044
5.	50 X 50mm wood & 50 X 75mm wood	4.19	4.09	3.75	1.317	.271
6.	13mm galvanized iron pipe & 19mm galvanized iron pipe	3.62	3.45	3.14	1.075	.344
7.	Flexible connector & Non Flexible connector	2.45	3.37	2.31	*7.501***	.001
8.	Upvc pipe & PVC pipes	4.00	3.01	2.95	*8.304***	.000
9.	Glazed tiles & unglazed tiles	3.96	3.00	3.52	*4.816***	.009
10.	Plaster of Paris (p.o.p) & Acoustic Ceiling	4.34	2.94	3.16	*12.807***	.000
11.	19mm aggregate & Terrazzo cheapens	4.19	3.31	3.05	*7.354***	.001
12.	Text coat paint & Gloss paint	4.45	3.84	3.74	*3.557**	.031
13.	1.5mm Cable & 2.5mm Cable	3.96	3.49	3.74	1.074	.344

14.	Single Core Cable & Double Core Cable	3.55	2.81	3.16	2.214	.112
15.	Distribution Board & Change Over Switch	4.30	4.12	4.29	.352	.704
16.	0.55mm Aluminium Sheet & 0.75mm Aluminium Sheet	4.11	3.26	2.59	*11.044***	.000
17.	20mm Aggregates & 40mm Aggregates	4.06	3.42	3.02	*4.843***	.009
18.	12mm Iron Rod & 16mm Iron Rod	4.62	4.41	3.91	*4.378***	.014
19.	Marble Floor & Terrazzo Floor	4.57	3.74	3.93	*5.447**	.005
20.	Nipple & Union Connector	2.34	2.50	2.78	.905	.406
21.	2Gang Switch & 3 Gang Switch	4.30	3.71	4.02	2.203	.114
22.	Concrete 1:2:4Mix & Concrete 1:3:6 Mix	4.55	3.87	3.72	*4.839***	.009

**p<0.05; **p<0.01*

5. Discussion

The significant differences show that there are differences with the knowledge of the construction material among ARCH, BT and QS students. It was also found that student from ARCH scored the highest mean for all materials compared to students from BT and QS. These findings reveal that ARCH students were more familiar with the construction materials examined in this paper compared to BT and QS students. Since all students across the three departments have taught the same construction technology courses to their students, although by different lecturers, two factors could be attributed to the findings of this research. First, it could be that students from the Architectural department are more engaged in construction related activities that enhance their knowledge about construction materials. These students, engagement can be underpinned by Astin's [20] Student Involvement Theory. This theory focuses on four areas: (i) student academic engagement; (ii) student engagement with faculty members, (iii) student engagement with peers, and (iv) student engagement in communities. Second, the nature of Architecture programme could be another factor contributing to high mean score by Architecture students

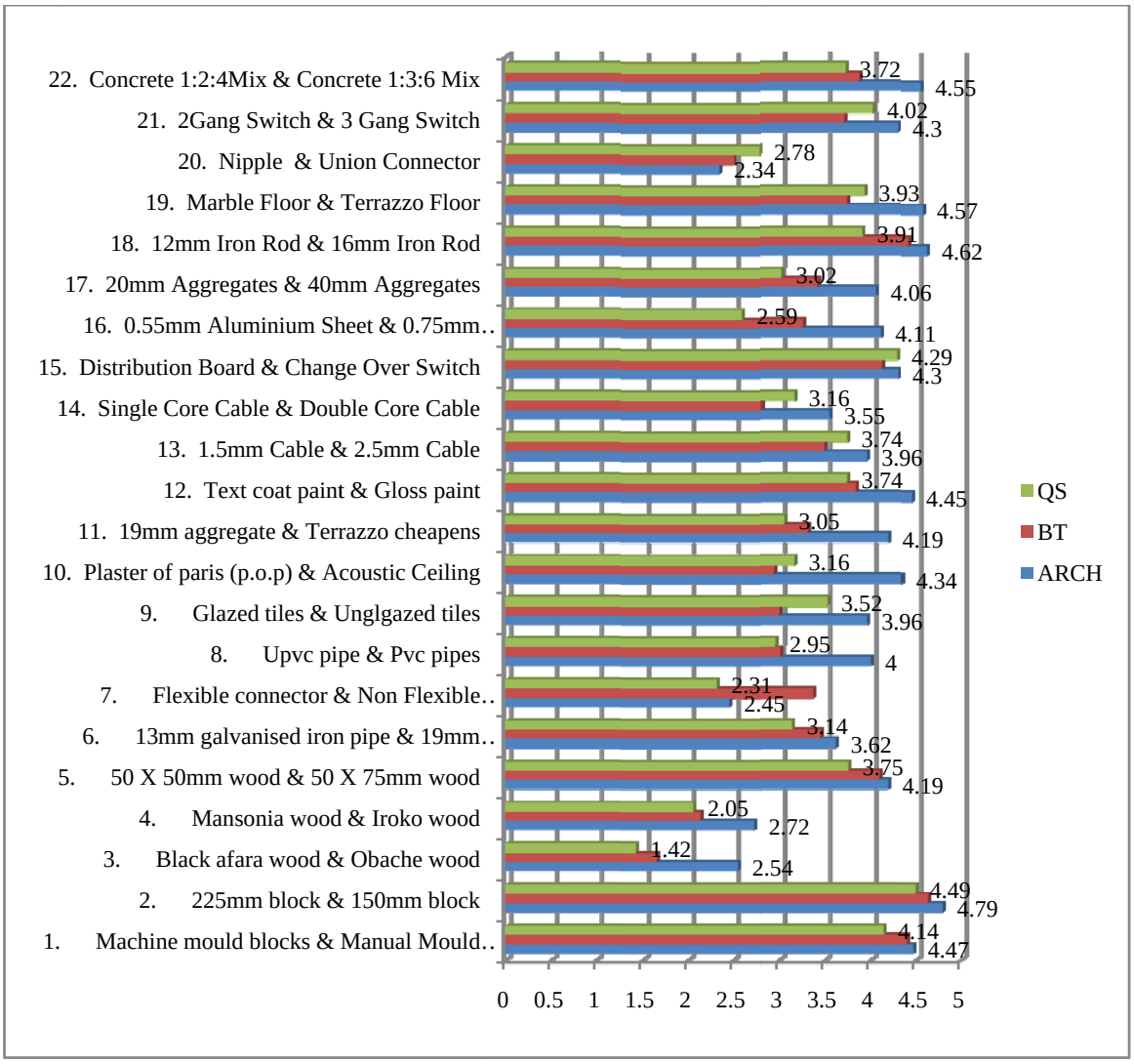

Figure 2: Mean score for knowledge of building materials among Arch, BT and QS students

We observe that architectural students are always busy with their design even during the early few weeks of semester break. They spend extra hours and efforts on semester studio design project, which perhaps involve the selection of building materials for specifications and particularly in the modelling of the Architectural design.

It is not surprising that few construction materials have mean scores of 4.00 – 4.63 as shown in Figure 2. These construction materials (block, reinforcement bar, wood examined based on size, electrical service equipment) are common and are easily seen. While wood size was scored 4.63, wood type received the least score (1.18). Different sizes of wood can be easily observed, but it is difficult to differentiate between Black Afara wood, Obeche wood, Mansonia and Iroko wood. To differentiate between them, one will need to understand their colour, texture and biological features

6. Conclusion and Recommendation

While scholars have examined in student learning among in higher educational institutions due to its importance for sharing of knowledge and advancement in educational sectors, Nigerian Polytechnic students have not received much attention. In recognition of this need, this paper seeks to determine whether there is any significance difference among students from three departments in the same polytechnic.

Knowledge of construction materials is essential for students in the built environment related programmes. It is required for effective material selection during design, measurement of building work and estimation, as well as management of materials on site. This paper therefore examines this requirement among polytechnic students in the school of Environmental Studies. We suggest that level of involvement in construction related activities such as building design can enhance the student familiarity of construction materials. In order to enhance the understanding of construction materials in Building and Quantity surveying departments, student should be motivated and encouraged to consistently participate in the construction related assignments, such as market survey, construction site visit and producing albums of construction materials. Future research should adopt a qualitative approach and longitudinal research design to explore a fundamental or common course that is taught to all students in the same school or college as the case may be.

Reference

[1] Swee-Choo, P., W. Kung-Teck and O. Rosma, 2012. Student-teachers approaches to learning, academic performance and teaching efficacy. Malaysian Journal of Learning and Instruction,Vol. 9, pp: 31-46.

[2] Handelsman, M. M., W.L. Briggs., N. Sullivan, and A. Towler, 2005. A measure of college student course engagement. TheJournal of Educational Research, Vol. 98 No. 3, pp. 184-191.

[3] Rosna, A. H., and M.S. Azlina, 2008. A confirmatory factor analysis of a newly integrated multidimensional school engagement scale. Malaysian Journal of Learning & Instruction, Vol. 5,pp. 21-40.

[4] Sharifah, A.S., and A.H. Rosna, 2011. The role of social support in promoting Adolescents' classroom cognitive engagement through academic self-efficacy. Malaysian Journal of Learning & Instruction, Vol.8, pp.49–69.

[5] Kamran. M., T. Ochinowski, and Q. Abbas, 2014. An empirical investigation of vocational education and training programs: A case of vocational training institutes of Southern Punjab, Pakistan. World Applied Sciences Journal, 31 (4): 562-572.

[6] Ahmad, T., A. Ullah., S. Sherwani and A. Neelam, 2014. Knowledge, attitude and practices of school going children towards malaria. World Applied Sciences Journal, 31 (4): 406-408.

[7] Miroshnichenko, O., Y. Gaivoronskaya and T. Samusenko, 2014. Competence-based approach in modern juridical education experience of far-eastern federal university. Part 4, World Applied Sciences Journal, 30 (1): 116-119.

[8] Saudabayeva. G., G. Alnazarova and M. Aitbayeva, 2014. Educational diagnosis in modern education: A systems approach to cognitive-converting activity teacher. World Applied Sciences Journal, 29 (9): 1183-1186.

[9] Wang, W., R. Zmeureanua, and H. Rivard, 2005. Applying multi-objective genetic algorithms in green building design optimization. Building and Environment, Vol. 40. No. 11, pp. 1512-1525.

[10] Do-Kyoung, K., 2006. The natural environment control system of Korean traditional Architecture: Comparison with Korean contemporary architecture. Building and Environment, Vol. 41 No. 12, pp. 1905-12.

[11] Nassar, K., W. Thabet and Y. Beliveau, 2003. A procedure for multi-criteria selection of building assemblies. Automation in Construction, Vol. 12 No. 4, pp: 543-560.

[12] Graham, T., F. Roger., I. Benedict and L. Peter, 2001. Building materials selection: greenhouse strategies for building facilities. Facilities, Vol. 19. No. 3/4, pp: 139-149

[13] Peter, O. O. and Paul, 2012. Development of sustainable assessment criteria for building materials selection, Engineering, Construction and Architectural Management, Vol. 19 No. 6, pp: 666-687.

[14] Godfaurd, J., D. Clements-Croome, and G. Jeronimidis, 2005. Sustainable building solutions: a review of lessons from the natural world. Building and Environment, Vol. 40. No. 3, pp: 319-28.

[15] Marcella, R., M. McConnell., G. Moore and M. Seton, 1996. Rural business information needs in the northeast of Scotland. Library Management, Vol. 17 No. 7, pp: 3-16.

[16] Tibar, A., 2000. Information needs and uses in industry: The implications for information services. The New Review of Information Behaviour Research, Vol. 1, pp: 185-200.

[17] Krejcie, R. and D. Morgan, 1970. Determining sample size for research activities. Educational and Psychological Measurement, Vol. 30, pp: 607- 610.

[18] Sekaran, U., 2006. Research method for business, A skill building approach (4th Ed.), John Willey & Sons, New Delhi, India.
[19] Nunnally, J., 1978. Psychometric theory, McGraw-Hill, New York.
[20] Astin, A., 1999. Student involvement: A developmental theory for higher education. Journal of College Student Development, Vol. 40 No. 5, pp: 518–529.

Author Profile

Corresponding author:
Dr. Ahmed Mohammed Kamaruddeen, qamaruddeen@yahoo.com

Dr. Ahmed Mohammed Kamaruddeen obtained his B-Tech Quantity Surveying from Federal University of Technology, Minna; MSc. And Ph.d in Project Management from Universiti Sains Malaysia. He is currently a Senior lecturer at Universiti Utara Malaysia.

Bldr. Halimat Omuya Chatta obtains her BSc. Building and MSc. Construction Management from Ahmadu Bello University Zaria, Nigeria and currently a Lecturer I at Federal Polytechnic Nasarawa.

Bashir Hussain Yahaya obtained his Postgraduate Diploma in Construction Management from AbubakarTafawa Balewa University Bauchi; MSc. Project Management from Universiti Sains Malaysia and currently the head of Quantity Surveying department, Federal Polytechnic Nasarawa, Nigeria.