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COMPARATIVE ANALYSIS OF CITATION PATTERNS IN CIVIL AND MECHANICAL ENGINEERING RESEARCH PROJECTS

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ABSTRACT

This study investigated the citation patterns in Civil and Mechanical Engineering research projects in a private university in Nigeria. The study adopted Bibliometric method was used to analyse the research projects submitted by graduates of the Department of Civil and Mechanical Engineering, Landmark University, Omu-Aran, Nigeria from 2016 to 2018. All the references of the research projects were examined. For each research project retrieved, data were obtained manually on some characteristics of cited materials. The findings revealed that the citation in the projects in the two programmes were high. The average number of citation per project was

higher in civil engineering than mechanical engineering. It was also discovered that most of the cited documents were very recent in the two programmes. The findings also shows that the most cited materials in the two programmes was journal articles, followed by books among others. It was also discovered that mechanical engineering students cite more books and internet materials than civil engineering students. Also the result shows that civil engineering students cite more multiple authored materials than mechanical engineering students. Based on the findings, the study concluded and made recommendations.

Key words: Citation Patterns, Research Projects, Civil Engineering, Mechanical Engineering, Information Resources, Undergraduate Projects

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1. INTRODUCTION

The field of engineering engages mathematical and scientific tools in real life applications (Burghardt, 1995 cited in Kuzmar, Muslih & Meredith, 2007) [8]. Engineering is a broad field that encompasses several arms which also have some related and overlapping courses. Specifically, it has been established that mechanical and civil engineering are among the oldest and foremost engineering courses have some of these courses overlap (Muslih, Meredith & Kuzmar, 2005; Kuzmar, Muslih & Meredith, 2007) [9, 8]. Undergraduate students in civil and mechanical engineering departments cite sources by authors in these branches of engineering for their research works. It is therefore necessary to compare average citation, variation and similarities and authorship pattern of cited works in the two fields.

There is also assumption that the tendency may be very high to cite information resources that are readily available irrespective of the expertise of authors, recency and other germane factors that could be used to evaluate information resources as scholarly materials. Ease of accessibility and popularity of sources of information are not enough to make conclusion that such information sources are reliable. Scholarly information sources emanate from peer reviewed works, expert's opinions and professional/technical reports (Yusuf & Owolabi, 2017) [14]. Accessibility to variety of information and sources as a result of the Internet has created the need for information literacy skill. Several scholars have investigated information literacy skills and information seeking behaviors which are key determinants of sources of information cited by researchers (Aregbesola, Owolabi, Eyiolorunshe, & Idiegbeyan-ose, 2018; Blackwell-Starnes, 2016; Bhatti, 2009) [1, 3, 2]. This reasoning is also a fulcrum for investigating the types of materials cited by students in the two fields. Librarians as gatekeepers of information resources have specific role of investigating the relevance of sources of information cited, frequency of use of information sources, the currency, types, authors and several aspects of bibliometric studies. This activity enables librarians to further educate students on information literacy skills. (Idiegbeyan-ose, Nkiko, & Osinulu, 2016; Ilo, Idiegbeyan-ose, Adebayo & Osinulu, 2015) [6, 7].

1.1. OBJECTIVE OF THE STUDY

The general objective of this study is to compare the citation characteristics of Civil and Mechanical Engineering students in Landmark University. Specifically, the study intends to:

1. Find out the types of information sources often cited by students of Civil and Mechanical Engineering
2. Compare average citation counts of research projects in Civil and Mechanical Engineering
3. Investigate the similarities of citation patterns between Civil and Mechanical Engineering research projects
4. Examine the variations in the citation patterns between Civil and Mechanical Engineering research projects

2. REVIEW OF RELATED LITERATURE

Comparative analysis of sources cited by engineering students and experts in the field of engineering has been done by several scholars. Williams and Fletcher (2006) [12] compared citation patterns among sub disciplines in the field of engineering and noticed that that citation practices were not equal especially with respect to age of materials cited and format of citation. A study by Fransen (2012) [5] comparing citation patterns in three Departments: Electrical Engineering, Aerospace Engineering and Computer Science at the University of Minnesota found variation among the cited publications with relation to how recent the materials cited were.

Civil, mechanical, electrical and chemical engineering theses were compared by Brush (2015) [4], it was found that students in mechanical and civil engineering used more of books, conference proceedings and other internet resources with very low percentage of journals. Books rated highest in the citations of students from electrical engineering. Young (2014) [13] also did an extensive investigation on citation pattern among research students in subfields of engineering and found that while some fields cited very old works, some maintain citing very recent works. However, all the subfields investigated cited several sources, not limiting to a particular source such as books only or journals only taking the highest percentage. Even distribution was observed.

A study found that Korean electrical and electronics engineers mostly cited books, journals and conference proceedings. It was also observed that not less than thirteen core journals and conference proceedings in the field of electrical engineering were cited. However, most of the cited works were very old (Rieh, 1993) [10]. Another study by Sjøberg (2010) [11] pointed out that out of all compared cited works, computer science focused more on recent publication citation compared to the engineering fields. Citing recent works, core journals, texts and conference proceedings for research especially in the field of engineering is necessary in order to monitor recent developments as the fields of engineering is dynamic.

3. METHOD

The study adopted Bibliometric method. A citation analysis of research projects submitted by graduates of the Department of Civil and Mechanical Engineering, Landmark University, Omu-Aran, Nigeria were conducted. The study covered research projects submitted from 2016 to 2018. All the references of the research projects were examined. For each research project retrieved, data were obtained manually on some characteristics of cited materials. MS Excel sheet was used to code and analyse the data. Data collected included type of document cited, number of authors of cited materials, difference between the year of publication of cited document and the research project.

4. DATA ANALYSIS AND DISCUSSION

4.1. Characteristics of the research projects

As shown in table 1, a total of 130 research projects were submitted during 2016-2018, 92 and 38 from Civil and Mechanical Engineering Programmes respectively. These research projects received a total of 4,526 citations; there were 3,646 citations in the 92 research projects from Civil Engineering, while the 38 research projects from Mechanical Engineering had 880 citations, equivalent to a mean of 38.7 and 24.6 citations per project in Civil and Mechanical Engineering respectively. Also, most of the citations (48.2% and 41.3%) for Civil and Mechanical Engineering respectively were made in 2017, 20.0% and 31.8% in 2016 and 2018 for Civil Engineering, while Mechanical Engineering had 38.4% and 20.3% in the same periods..

Table 1 Characteristics of the research projects

Year	Civil Engineering			Mechanical Engineering		
	Research projects	Total citations (%)	Average citations	Research projects	Total citations (%)	Average citations
2016	25	729 (20.0)	29.2	15	338 (38.4)	22.5
2017	40	1,757 (48.2)	43.9	17	363 (41.3)	21.4
2018	27	1,160 (31.8)	43.0	6	179 (20.3)	29.8
	92	3,646	38.7	38	880	24.6

Figure 1 shows that while the average citation in Civil Engineering research projects increases from 2016 to 2017 and then started declining in 2018, citation per research project in Mechanical Engineering programme decreases and later in 2018 increases.

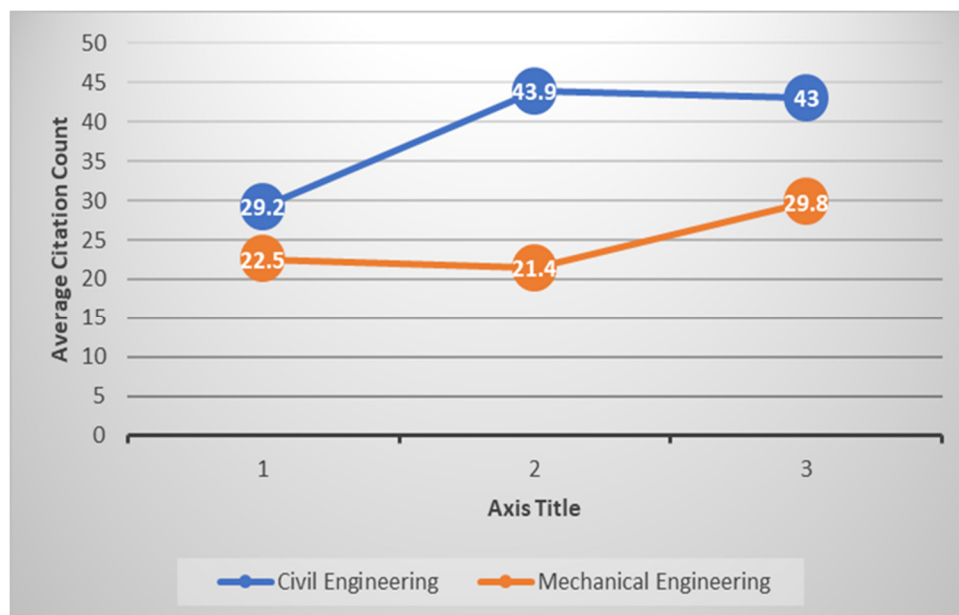


Figure 1: Average citation counts from the two programmes

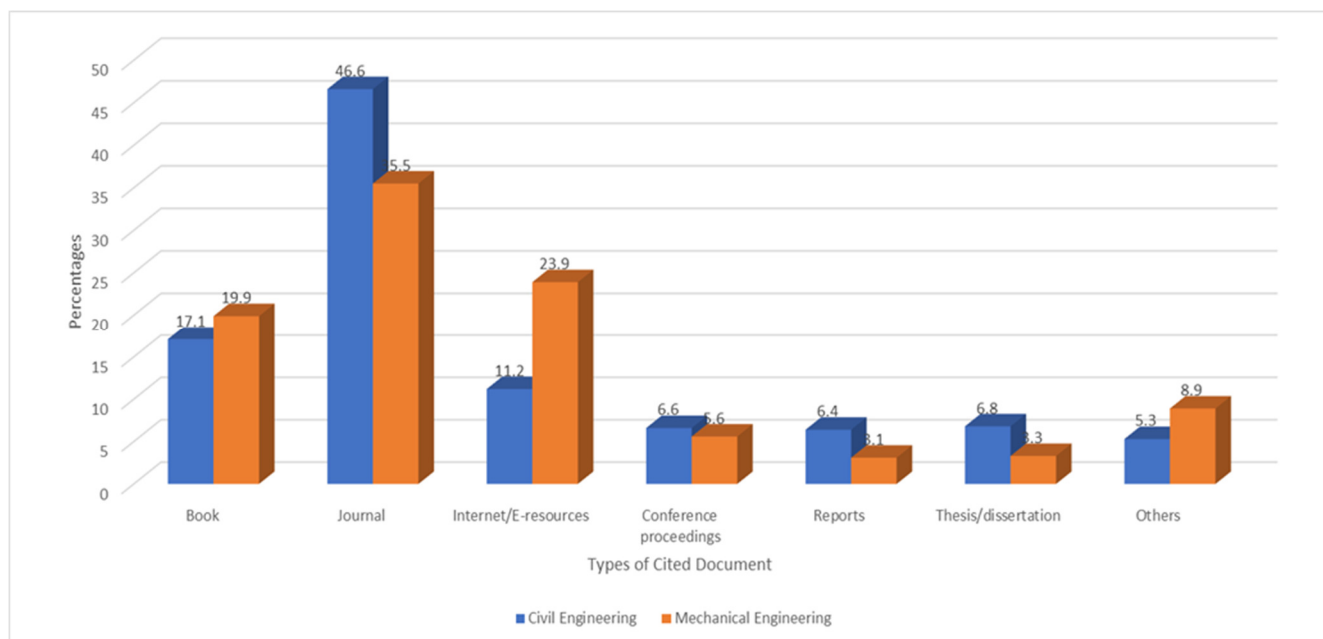


Figure 2. Distribution of citations according to information sources

With regard to the type of information sources consulted – whether they were books, journals, internet/e-resources, conference proceedings, reports, thesis/dissertation and others. Figure 2 shows that 46.6% and 35.5% of the cited materials in research projects from Civil and Mechanical Engineering programmes respectively were journals articles and the most frequently cited source of information. Mechanical Engineering students cited more books (19.9%) than Civil Engineering students (17.1%) in their research projects. Similarly, Internet/e-resources were cited more in Mechanical Engineering research projects (23.9%) than in Civil Engineering (11.2%). Also, conference proceedings, reports and theses/dissertations contributed to Civil Engineering research projects more than did those in Mechanical Engineering, while other documents such as working paper, workshop/seminar paper, standards, manual, newspaper, patents e.t.c were prominent in Mechanical Engineering research projects than they were in Civil Engineering.

Data on age of cited documents were also collected as shown in table 2. Altogether over 30% of the cited materials in Mechanical Engineering research projects were published in over 20 years before the research projects were conducted, students in Mechanical Engineering cited more recent materials -materials less or equal to 5 years- (35.6%) than their Civil Engineering counterparts (23.0%). It was also found that more than 23% of the publications cited in Civil Engineering projects and 14% of Mechanical Engineering were published within 6-10 years before their research projects were conducted. Even though there is need for increased citations of current literature in research projects conducted by these students from both Civil and Mechanical Engineering, it appears Mechanical Engineering students prefer and cited more current literature than Civil Engineering students in their research projects.

Table 2 Age of cited documents

Year	Civil Engineering		Mechanical Engineering	
	Citations	Percentage	Citations	Percentage
Less or equal to 5	837	23.0	313	35.6
6-10	860	23.6	126	14.3
11-15	596	16.3	72	8.2

16-20	430	11.8	93	10.6
21-25	602	16.5	94	10.7
26 and above	321	8.8	182	20.7
Total	3,646	100	880	100*

Approximated

Table 3 shows the authorship pattern of the studied research projects. It was found that Civil Engineering students tend to cite more multiple authored materials in their research projects (59.1%) than Mechanical Engineering students (46.1%). However, more cases of citations without authors (16.4%) were recorded from Mechanical Engineering research projects while only 1.2% of such cases were found in Civil Engineering projects. Even though no corporate author was cited in Mechanical Engineering projects during the years under consideration, only 4.6% of the total citations in Civil Engineering projects were corporately authored.

Table 3 Distribution of authorship pattern

Authorship pattern	Civil Engineering	Mechanical Engineering
	Citations (%)	Citations (%)
No author/ author not given	42 (1.2)	144 (16.4)
Corporate authorship	166 (4.6)	-
Single author	1,283 (35.2)	330 (37.5)
Two authors	809 (22.2)	194 (22.0)
Three authors	500 (13.7)	110 (12.5)
More than three authors	846 (23.2)	102 (11.6)
Total no. of multiple authors	2,155 (59.1)	406 (46.1)
Total citations	3,646	880

5. CONCLUSION

The essence of citation analysis in research and publications cannot be overemphasized. It is a method of identifying the quality of research publication including students' projects. Therefore, institutions including library and information centres should constantly carryout this research activities so as to improve the quality of researches including students projects in higher institutions of learning.

6. RECOMMENDATIONS

1. The University Library should continue the annual subscription to books and journals both in prints and electronic formats.
2. The University Library should improve on the teaching of the information literacy/users education programmes so as to increase the usage of the information resources in the library.
3. Mechanical engineering students should be advised to cite more of journal articles than books.
4. Mechanical engineering students should be advised to cite more multiple authored materials than single authored.

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