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Bibliometry of Radiography Bachelor theses in University of Maiduguri

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Abstract

- ***Objectives:***

To determine the characterization and trends of topics, methodology, radiography specialty and most researched radiology imaging modality. And in addition, to determine the visibility (volume of publications) of the bachelor theses (research projects) conducted and also to develop a system for easy reference of the theses.

- ***Methodology:***

A retrospective bibliometric analysis of published and unpublished bachelor theses was conducted. All the 33 original articles published in both national and international peer review journals were evaluated. In addition, 417 unpublished theses conducted between 2008 and 2017 were also evaluated. The following information was extracted: Type of Radiology imaging modality, Radiography subspecialty, method of data collection, statistical analysis, publication status and categorization of publication. In addition, some of the variables investigated were presented along with the trend over time.

- ***Results:***

The results of the study revealed that conventional radiography was the most researched radiology imaging modality representing 27.6% (n=124) of the theses, while most of the theses were dominated in the area of Musculoskeletal imaging and this constitute 14.4% (n=65), Radiation Protection representing 13.6% (n=61) and Radiography Education representing 12.9% (n=58) of the theses. The study has also showed that only 7.3% (n=33) of the theses were published.

- ***Conclusion:***

This study has showed trends in radiography bachelor theses in university of Maiduguri. Some areas were over-flogged, some were poorly researched while others were rarely researched. The study has also found that the visibility of the theses was very poor (7.3%). In addition, the study has provided a book of abstracts and a software programme that automate all the available theses (450).

Keywords:- *Bibliometry, Bachelor, Theses, Trend, Publication.*

I. INTRODUCTION

Research is the pursuit of truth with the help of study, observation, comparison and experiment as well as the search for knowledge through objective and systematic method of finding solution to a problem [4]. Therefore, it could be considered that the quest for knowledge is the basic reason for embarking on every research.

In Nigeria, it is required that every undergraduate student of radiography must carry out a bachelor these (research project) on an approved topic under the supervision of a qualified academic staff as part of the requirements for the award of Bachelor Degree in Radiography [2].

Ever since the inception of Radiography program in Northeast in the University of Maiduguri in 2003, series of undergraduate research projects (Bachelor theses) have been conducted with some published and many unpublished.

Attempts have been made by researchers to study research trends and patterns in other professional settings; nursing in China and few other countries [11], education sector in Turkey [3] and dedicated education journal in Turkey [1]. Also Dakshitha *et al*. (2013) studied the pattern and trends of medical students' research and the results showed that there is an increasing number of medical students' authored articles being published and the trend seems to be continuing. These several studies have assessed trends in other fields, except studies by Malamateniou (2009) and Lunden *et al.* (2016) assessed research trends in radiography.

Hence, studies involving assessment of research trends in radiography are rare and no study has been done to investigate research trends in the Northeastern Nigeria and by extension Africa as well as the visibility level of such research work, as research work are meant to contribute to body of knowledge [6] which will provide information on research hotspots and rare areas.

II. METHODOLOGY

A. Study Design

A retrospective bibliometric analysis of 33 bachelor theses and 417 unpublished bachelor theses conducted in the department of Medical Radiography university of Maiduguri between 2008 and 2017 were collected and content analysis was conducted.

A descriptive research design was adopted for this study.

B. Data Collection

A Paper Classification Form (PCF), originally developed by Sozbilir *et. al*, (2012) was adopted for this study. This was revised to contain the following information.

➢ *Paper classification form (PCF) 1*

- List of researchers
- Research topic
- Year
- Research design
- Data collection tool
- Data analysis method
- Publication status

➢ *Paper classification form (PCF) 2*

Classification of the theses into the various imaging modalities

- Conventional radiography
- Computed Tomography (CT)
- Ultrasonography
- Magnetic Resonance Imaging (MRI)
- Non modality based topics

➢ *Paper classification form (PCF) 3*

Classification of the theses into the various Radiography specialty areas:

- Chest
- Abdominal imaging
- Breast imaging
- Genitourinary
- Neuro imaging/Head and neck
- Musculoskeletal imaging
- Sonography
- Radiation protection
- Patient care
- Infection control
- Quality assurance and Quality control
- Interventional Radiology
- Nuclear medicine
- Management
- Radiography education

C. Visibility

The following criteria were used to assessed the visibility of the theses based on the percentage of the work published.

1. 0= Nil
2. 1-24%= Very poor
3. 25-49%= Poor
4. 50-74%= Adequate
5. 75-100%= Very adequate

This PCF was revised by peers and then expert juries (Supervisors) for validation as well as testing its reliability.

D. Data Analysis

Data was analyzed using a statistical package for social sciences (SPSS) Version 20.0 (IBM, New York, USA), where descriptive statistics such as frequency and percentage were calculated. Pearson's correlation was used to analyzed the trends.

III. RESULTS

The empirical bachelor theses conducted between 2008 and 2017 were four hundred and ninety five (495) but available (450) representing 90.9% were analyzed, the remaining representing 9.1% (n=45) were missing.

S/N	YEAR	FREQUENCY	PERCENTAGE (%)
1	2008	19	4.2
2	2010	20	4.4
3	2011	40	8.9
4	2012	57	12.7
5	2013	78	17.3
6	2014	71	15.8
7	2015	48	10.7
8	2016	45	10.0
9	2017	72	16.0
	TOTAL	**450**	**100**

Table 1:- Available Theses

The above table represents the number of bachelor theses between 2008 and 2017 captured in this study. Figures from the table showed that the department have the highest number of research projects in 2013 (n=78) and the least in 2008 (n=19)

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S/N	IMAGING MODALITY	2008	2010	2011	2012	2013	2014	2015	2016	2017	TOTAL
1	CONVENTIONAL RADIOGRAPHY	5	2	16	18	22	24	12	10	15	**124 (27.6%)**
2	ULTRASOUND	3	7	8	3	13	6	3	3	7	**53 (11.8%)**
3	MRI	1	1	3	5	1	3	0	0	3	**17 (3.8%)**
4	CT	0	0	2	4	6	5	1	2	6	**26 (5.8%)**
5	NON MODALITY BASED	10	10	11	27	36	33	32	30	41	**230 (51.1%)**
	TOTAL	**19**	**20**	**40**	**57**	**78**	**71**	**48**	**45**	**72**	**450 (100%)**

Table 2:- Categorization of the Theses Based on Imaging Modalities

The above table represents the number of theses conducted in each imaging modality. Data from the above table showed that 51.1% (n=230) of the theses were non modality based, while of the modality based theses conventional radiography has the highest frequency (n=124)

S/N	SPECIALITY	2008	2010	2011	2012	2013	2014	2015	2016	2017	TOTAL
1	CHEST	1	1	3	1	4	9	3	2	3	**27 (6.0%)**
2	ABDOMINAL IMAGING	0	0	2	1	4	3	1	3	1	**15 (3.3%)**
3	BREAST IMAGING	0	2	2	1	2	2	1	0	2	**12 (2.7%)**
4	GENITOURINARY	1	1	2	1	1	2	1	0	2	**11 (2.4%)**
5	NEUROIMAGING	0	2	5	6	6	4	1	1	3	**28 (0.62%)**
6	MUSCULOSKELETAL IMAGING	2	0	5	19	10	13	10	4	2	**65 (14.4%)**
7	SONOGRAPHY	3	4	8	3	13	6	3	3	5	**48 (10.7%)**
8	RADIATION PROTECTION	4	2	2	12	9	13	3	12	4	**61 (13.6%)**
9	PATIENT CARE	2	3	3	3	5	4	6	5	3	**34 (7.6%)**
10	INFECTION CONTROL	2	1	0	3	2	2	4	0	12	**26 (5.8%)**
11	QUALITY ASSURANCE AND QUALITY CONTROL	2	1	3	0	4	1	1	5	12	**29 (6.4%)**
12	INTERVENTIONAL RADIOLOGY	0	0	0	0	01	0	0	0	0	**1 (0.2%)**
13	NUCLEAR MEDICINE	0	0	0	0	1	1	0	0	2	**4 (0.9%)**
14	MANAGEMENT	1	1	3	0	7	1	7	3	8	**31 (6.9%)**
15	RADIOGRAPHY EDUCATION	1	2	2	7	9	10	7	7	13	**58 (12.9%)**
	TOTAL	**19**	**20**	**40**	**57**	**78**	**71**	**48**	**45**	**72**	**450 (100%)**

Table 3:- Categorization of the Theses Based on Specialties

The above table represent the categorization of the theses based on the radiography specialties they belong to and data from the table indicate that musculoskeletal imaging has the highest number of theses (n=65), radiation protection has 61, radiography education has 58 while interventional radiology has the least (n=1)

S/N	RESEARCH DESIGN	2008	2010	2011	2012	2013	2014	2015	2016	2017	TOTAL
1	DESCRIPTIVE QUANTITATIVE	17	19	37	56	78	70	48	43	67	**435 (96.7%)**
2	DESCRIPTIVE QAULITATIVE	0	0	01	0	0	0	0	0	0	**1(0.2%)**
3	EXPERIMENTAL	02	01	02	01	00	01	00	02	05	**014 (3.1%)**
	TOTAL	19	20	40	57	78	71	48	45	72	**450 (100%)**

Table 4:- Categorization of Research Designs

The above table represent the types of research design adopted in the theses and data from the table showed that 96.7% (n=435) of the theses used descriptive quantitative research design while experimental design is the least (n=14)

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S/N	INSTRUMENT	2008	2010	2011	2012	2013	2014	2015	2016	2017	TOTAL
1	QUESTIONAIRE	10	10	08	21	31	23	31	25	32	**191 (42.4%)**
2	DIRECT OBSERVATION	09	10	31	36	47	47	17	19	39	**255 (56.7%)**
3	QUESTIONAIRE & DIRECT OBSERVATION	00	00	00	00	00	01	00	01	01	**03 (0.7%)**
4	INTERVIEW	00	00	01	00	00	00	00	00	00	**01 (0.2%)**
	TOTAL	**19**	**20**	**40**	**57**	**78**	**71**	**48**	**45**	**72**	**450 (100%)**

Table 5:- Method of Data Collection

The above table showed the instruments of data collection used by the theses. 56.7% (n=255) of the theses used direct observation (data capture sheet), 42.4% (n=191) used questionnaire, 0.1% (n=3) used both (data capture sheet and questionnaire) while 0.2% (n=1) used interview.

S/N	DATA ANALYSIS METHOD	2008	2010	2011	2013	2012	2014	2015	2016	2017	TOTAL
1	DESCRIPTIVE	16	15	38	51	70	65	43	39	56	**393 (87.3%)**
2	DESCRIPTIVE AND INFERENTIAL	03	05	02	06	08	06	05	06	16	**57 (12.7%)**
	TOTAL	**19**	**20**	**40**	**57**	**78**	**71**	**48**	**48**	**72**	**450 (100%)**

Table 6:- Statistical Tools Used

The above table showed the statistical tools used by the theses, 87.3% (n=393) of the theses used descriptive statistics while 12.7% (n=57) used both descriptive and inferential statistics.

S/N	YEAR	FREQUENCY	PERCENTAGE (%)
1	2008	04	12.90
2	2010	01	3.23
3	2011	01	3.23
4	2012	03	9.68
5	2013	03	9.68
6	2014	10	29.03
7	2015	05	16.13
8	2016	04	12.90
9	2017	02	3.23
	TOTAL	**33**	**100**

Table 7:- Number of Published Theses

The above table represent the number of bachelor theses published from 2008 to 2017. Of the 33 published theses, 2014 has the highest number of published theses (n=10) while 2010 and 2011 has the least, each with only one published work.

➢ *Automated Inventory of the Theses (Software)*

The researcher and his supervisors in collaboration with the department have with the help of an engineering student developed a software program which will serve as the automated inventory of bachelor theses in the department. The software is a research project management platform which is capable of storing information of research projects conducted in the department, it can accommodate limitless number of entries and it permits editing of wrong entries. It is a web application designed using HTML and PHP. It operations support various browsers such as Microsoft edge, internet explorer, safari, chrome and Mozilla Firefox.

The following are the information required for each entry:

- Topic
- Concentration area
- Year
- Researchers and
- Publication status.
- Journal of publication

Below is the front screen of the software

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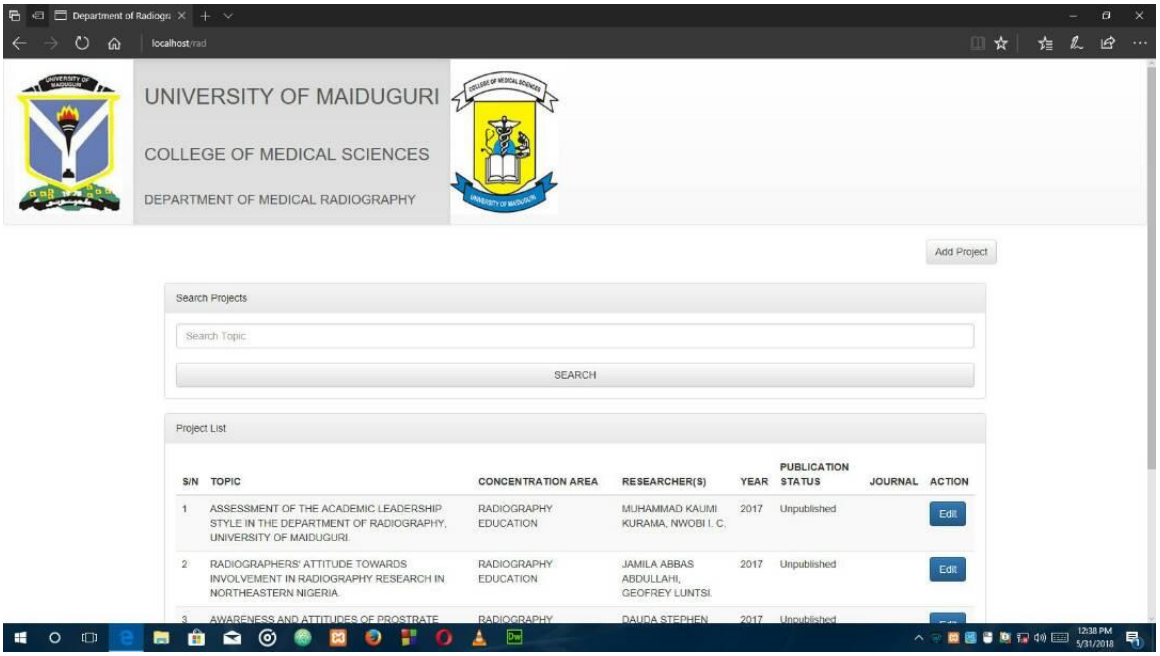

Fig 1:- Front Screen of the Software

➢ *Compilation of the Book of Abstracts*

The book of abstracts is a book that contained the abstracts of all the available bachelor theses in the department. It was compiled by photocopying all the abstracts of the research projects (from 2008 to 2017) and spiral binding them into two books.

IV. DISCUSSION

Research in radiography provides input into various activities such as knowledge generation, providing core radiographic practice, evidence-based radiography, improvement in patient care and ensuring high level of professionalism [9]. This input is important for the radiography profession in order to ensure patients received the best possible diagnosis and treatment.

This study assessed the characterization, trends and visibility of radiography bachelor theses in university of Maiduguri.

The empirical bachelor theses conducted between 2008 and 2017 were four hundred and ninety five (495) but available (450) representing 90.9% were analyzed, the remaining representing 9.1% (n=45) were missing, possibly due to poor archiving system. There is no missing project in 2008, the number of missing projects have declined from 12 in 2010 to 4 in 2017, suggestive of improved archiving system. There was a significant increase in number of theses conducted from 19 in 2008 to 74 in 2017 and this may be attributed to the increase in students enrollment (admission) into the programme and increase in the academic staff numeric strength.

Results from this study showed that conventional radiography was the most researched imaging modality and there was an increasing trend of theses in conventional radiography from 5 in 2008 to 15 in 2017, giving a p-value of 0.237 and this was possibly due to students' interest and the fact that conventional radiography facilities are the most widely available and also most likely because of the limited time allocated for undergraduate bachelor theses which will not permit research in higher energy imaging modalities.

This is followed by ultrasound, which also showed increasing trend from 3 in 2008 to 7 in 2017 given a P-value of 0.009 this may be attributed to the increase in the availability of ultrasound scan centers/facilities.

Radiotherapy/Nuclear medicine and Angiography were the least researched modalities with a frequency of 4 and 1 respectively. And this may be attributed to lack of interest from students, lecturers and lack of functional facility in the Northeast.

On the classification of the theses into various specialties, the results revealed that the theses were dominated in the area of musculoskeletal imaging constituting 14.4% (n=65) and this may be attributed to the fact that most of the radiological examinations request are for musculoskeletal imaging. Other highly concentrated specialties were Radiation Protection which constitute 13.6% (n=61) and radiography education which constitute 12.9% (n=58). This is due to the fact that majority of lecturers' subspecialties is in radiation protection. There was an increasing trend of theses in radiography education from 1 in 2008 to 11 in 2017, giving a P-value of 0.029 and this may be attributed to students and lecturers research interest in radiography education.

The least concentrated specialty was interventional radiology which has only one research, and this may be attributed to lack of the facilities and expertise.

The most adopted research design was descriptive quantitative research design which constitute 96.7% (n=435) of the theses, Theses that used qualitative and experimental designs were very few.

Questionnaires and direct observation were the most used data collection tools, interview based researches were rare. This is similar to a study by Goktas *et. a*l, (2012) on educational technology research trends in Turkey which also find that questionnaires were mostly used as data collection tool. However this contradicted the finding of a study conducted by Lunden *et a*l., (2016) on topics and epistemological trends in Swedish bachelor theses in radiography, which found that a reasonable number of the theses were interview based.

Descriptive statistics was the most used statistical tool, and this may be attributed to the nature of the researches which were mainly descriptive.

On the issue of visibility, this study revealed that the visibility of undergraduate bachelor theses in the department was very poor, as only 7.3% (n=33) of the theses were published. This contradict the finding of a study in China by Dakshitha *et al.,* (2013) on patterns and trends of medical students' research which found that there was an exponential increase in medical students authored articles being published and the trend seem to be continuing. 60.6% (n=20) of the published works were published in international journals while 39.4% (n=13) were published in local journals. This suggest that researchers in the department prefer international journals for their publications, and this contradicted the finding of a study conducted by Goktas *et al.,* in 2012 on educational technology research trends in turkey which revealed that 314 representing 68.26% of the total (460) researches were published in Turkish national journals.

V. SUMMARY OF FINDINGS

- Conventional radiography and ultrasound were the most researched imaging modalities.
- Musculoskeletal imaging, radiation protection and radiography education were the most researched radiography specialties.
- Interventional radiology and radiotherapy/nuclear medicine were the rare areas (with very few researches)
- Descriptive quantitative research was the dominant research design adopted.
- Qualitative and experimental study designs were very few.
- Questionnaires and direct observation were the most used data collection tools, interview based researches were very few.
- The visibility (publication) of the research works done in the department was very poor.

VI. CONCLUSION

This study has characterized and showed trends of radiography bachelor theses in university of Maiduguri of Northeastern Nigeria. Some areas were over-flogged, some were poorly researched while others were rarely researched, and that the visibility of undergraduate bachelor theses in the department was very poor (7.3%). In addition, the study has also provided a book of abstracts for all the 450 theses captured in this study and a software programme that automate all the available theses (450).

- *Limitations of the Study*

The limitations encountered in the study are:

- Missing records.
- The study was not able to validate the appropriateness of the research designs, data collection, statistical tools adopted and interpretation and conclusion of results.

- *Study Contribution to Knowledge*

- The study was able to characterized and showed trends and visibility of radiography bachelor theses in University of Maiduguri. The first ever to be conducted in Nigeria and by extension the whole of Africa.
- The study has come up with an automated inventory of bachelor theses in the department as the researcher and his supervisors in collaboration with the department with the help of an engineering student have developed a computer software that can be used to easily track undergraduate bachelor theses conducted in the department, the software will serve as a research archive for undergraduate research projects in the department now and in future.
- In addition, the study has also come out with a book of abstract which will also serve as a reference system for undergraduate research projects in the department.

RECOMMENDATIONS

- The department should develop a means to promote increasing trends of theses in the rare areas.
- In order to improve the visibility of the theses the department should henceforth be forwarding reasonable number of theses for publication each year.
- The software and the book of abstract provided by this study should be properly use during the course of allocation or approval of project topics and in making decision during publication of the conducted researches.
- This study should be repeated after every five years.

AREA OF FURTHER STUDIES

- This study should be repeated using both qualitative and quantitative approach (triangulation research).
- This study should also be conducted in each radiography department across the nation universities.
- An all-encompassing study should be carried out involving all radiography departments to study undergraduate research project trends in the country.

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