



# The Role of Libraries in the World of Open Access

## The Research Activities of Post-graduate Students in Four Universities in North-Central Nigeria

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### Abstract

The study was carried out to determine the roles of libraries in the world of open access as it correlates to the research activities of post-graduate students in four universities in North-Central Nigeria (NCN). The study was anchored on five objectives: (1) to find out how libraries support open access for research of post-graduate students in NCN; (2) to ascertain the characteristics of open access documents for research in the four universities; (3) to find out the format in which open access content appears in libraries to support post-graduate research; (4) to find out how self-archiving has helped post-graduate students in their research activities; (5) to find out how the open access mandate has helped the post-graduate students bibliographic visibility towards partial fulfilment of their post-graduate degrees. A sampling fraction of 3.8% was used to select 420 post-graduate students from a population of 11 036 as a purposive sampling technique. A hypothesis would be tested at a 0.5 level of significance, and data would be presented using frequency tables and percentages. The hypothesis would be analysed using the Pearson product-moment correlation coefficient to determine the relationship of the compound independent variable to the dependent variable. The findings from the objectives are that the library is an anchor that guides open access for research amongst post-graduate students in all the universities. The study concluded by stating that there is a need for the university authorities to fund the university libraries for robust and not scanty open access, and there must be open access practices for excellent post-graduate research. The study recommended that all the universities in

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Nigeria and globally should have open access to their libraries for enhanced academic achievement and excellent post-graduate research.

**Keywords:** libraries, open access, correlates, post-graduate students, North-Central Nigeria (NCN).

### Introduction

#### *Background to the study*

According to Odeh (2013), research is defined as the creation of new knowledge and the use of existing knowledge in a new and creative way so as to generate new concepts, methodologies and understandings. It is a scientific way of answering a research question, solving a problem or generating new knowledge through a systematic and orderly collection and organisation of facts. Research is also defined as the creation of new knowledge and the use of existing knowledge in a new and creative way so as to generate new concepts, methodologies and understandings. This could include synthesis and analysis of previous research to the extent that it leads to new and creative outcomes (Odeh, 2013). Research is undertaken to discover new facts and find additional information. It is a purposeful search for an identified problem or new knowledge. Research involves recognising a need and having it solved. Kumar (2017) posits that the main aim of the research is finding a hidden truth that has not been discovered and then solving it through systematic procedures (Haruna, 2013).

The research involved in this study is post-graduate research. Post-graduate research activities involve conferences, workshops, seminars, writing theses and dissertations, scientific interactions with students and professors, and publishing in journals: a research output. These foregoing research activities that have been mentioned are what post-graduate students in all the universities in Nigeria are engaged in. They must satisfy all the requirements in post-graduate research before conferring with master's or PhD degrees, respectively. In other words, the presentation of standard research work would make any department in a university award required degrees to individual post-graduate students.

Mullen (2010) and Mercer (2011) posit that the presentation of standard research work will only be made possible if post-graduate students imbibe and align themselves with their university libraries and open access facilities, especially those with good institutional repositories. An open access repository is a collection of full-text documents available on online databases that can be accessed freely and instantly. Open access is freely available on online digital documents. It is the provision of open access, online access,

free toll, full text, and web-wide to their peer review journal articles (Mullen, 2010).

Mullen (2010) and Mercer (2011) believe that open access documents, even though freely available online, should be relevant scholarly literature that is interdisciplinary, global, digital and safely available and not behind technical walls or paywalls to comply with license registration so that open access works would always be freely online. Some characteristics of open access journals are scholarly; therefore, romance, fiction, novellas, magazines, and self-help books are excluded. Most authors are not paid for their efforts since most works like conventional journals are peer-reviewed. They use quality control mechanisms; they are digital, freely accessible and available. Authors could also be allowed to retain their copyrights and use creative commons or other licenses. Open access also implies its free availability on the public Internet, permitting users to read, download, copy, distribute, print, search, or link to the full texts of these articles, read through them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers.

The growing acceptance of open access publishing has given libraries the opportunity to assume the role of publisher. Libraries are given the opportunity to work with faculty authors to explore new methods of communicating and disseminating their research outputs. Open source is computer software released under a licence in which the copyright holders grant users the right to use, study, change and distribute the software and its codes to anyone and for any purpose. Open source is commercially available platforms used to publish open access books, create open access versions of the output of copyright works, and start in-house scholarly journals that highlight the works of faculty authors and students. An increase in open access publication trends could serve as a leveraging tool for libraries against the high cost of journal subscriptions (Chigbu, Njoku & Uzoagba, 2016).

Therefore, it becomes imperative for libraries to take advantage of their good marriage with open access, which exposes post-graduate students to lots of materials for their scholarship and academic advancements to see how their research prowess could be triggered to conduct good and qualitative post-graduate research. Against this backdrop, the researcher has embarked on this study to investigate the roles of libraries in the world of open access as it correlates to the research activities of post-graduate students in four universities in North-Central Nigeria (NCN).

#### *Problem statement*

The problem of the study was derived or emanated from the dependent variable, research activities. Research is conducted to gather more knowledge

or use the existing knowledge in other creative ways to generate concepts, methods and understanding of existing theories in a new light. Many people tend to underestimate the importance of research. However, every activity in our daily lives involves research. Simply put, research is the collection of information, the systematic and detailed gathering of information to boost knowledge on a particular subject or topic. However, while conducting the research, researchers encounter numerous challenges. The top ten challenges, according to Odeh (2013), are:

- A. Lack of proper research ethics.
- B. Ineffective research methodology.
- C. Ineffective education system.
- D. Ineffective library system.
- E. Poor infrastructural management.
- F. Low accessibility of data and information insecurity.
- G. Lack of funds for research.
- H. Poor technological advancement.
- I. Political uncertainty.

These aforementioned problems have been plaguing research activities in Nigeria. Hence, the researcher's primary aim is to use the roles of libraries in the world of open access to correlate the research activities of post-graduate students in four universities in NCN.

### *Objectives*

The broad objectives of the study are to investigate the roles of libraries in the world of open access as it correlates to the research activities of post-graduate students in four universities in NCN.

The study would be anchored on five objectives which are to:

- ◆ Find out how libraries support open access for research of post-graduate students in NCN.
- ◆ Ascertain what the open access documents for research are in the four universities.
- ◆ Find out the format in which open access content appears in libraries to support post-graduate research.
- ◆ Find out how self-archiving has helped post-graduate students in their research activities.
- ◆ Find out how an open access mandate has helped the post-graduate students' bibliographic visibility towards partial fulfilment of their post-graduate degrees.

*Research questions*

- A. How do libraries support open access for the research of post-graduates in these four universities of NCN?
- B. What is the open access document for research in the four universities in NCN?
- C. In what format does the open access content appear for post-graduate research in the four universities in NCN?
- D. How has self-archiving helped post-graduate students in their research activities?
- E. How has the open access mandate helped the post-graduate students' bibliographic visibility towards partial fulfilment of their post-graduate degrees in the four universities in NCN?

*Hypothesis of the study*

One compound null hypothesis was tested at a 0.5 level of significance.

There is no significant relationship between libraries and open access with post-graduate research activities in the four universities in NCN.

*Methodology*

**Research Design**

This study adopted a correlation descriptive survey design, which seeks to establish the relationship that exists between two or more variables. The research design was a correlation descriptive survey design. Going by the title, the work is a correlational direction, and the magnitude of the relationship between the variable was indicated, found to be strong and positive: the effect of the compound independent variable on the dependent variable.

*Population of the study*

The population of the study was 11 036 post-graduate students of the four selected universities in NCN.

**Sampling technique and sampling size**

A stratified sampling technique was used to select the individual universities, while purposive sampling was adopted to select 402 respondents from the four universities. According to Krejcie and Morgan's (1970) sample table, the selected 420 respondents agreed upon represented the total population well. A purposive sampling technique was adopted to select 105 students from the four universities. A sampling fraction of 3.8% was used to select four-hundred-and-twenty post-graduate students from a population of eleven thousand and thirty-six purposive.

### *Data collection or research instruments*

The questionnaire was the main instrument for the study. It was designed under different research questions. The five-point Likert Scale of strongly agree (SA), agree (A), strongly disagree (SD) and disagree (D) were used to determine the average responses of the respondents.

### *Validity and reliability of the instruments*

In order to ensure the face and content validity of the questionnaire, two professors in the Department of Library and Information Science vetted the questionnaire. It was pretested and corrected by administering some copies to students of the Department of Industrial and Technical Education of the Federal University of Technology (FUT) Minna.

The Cronbach's alpha method was used to determine the reliability coefficients of each research question (RQ). The values obtained were 0.81 for RQ 1, 0.79 for RQ 2, 0.83 FOR RQ 3, 0.75 for RQ 4 and 0.68 for RQ 5. Research questions were used to obtain the alpha values since the work had just two variables.

### *Method of data analysis*

The data in the study were analysed using the Pearson product-moment correlation coefficient to determine the relationship between the variables. The socio-demographic information was analysed using descriptive statistics of frequency, counts and percentages.

### *Analysis of research questions*

This section focuses on analysis and presentations of result tables and graphs on the topic "the roles of libraries in the world of open access as it correlates to the research activities of post-graduate students in four universities in North-Central Nigeria". The IBM® SPSS® Statistics 23.0 statistical package was utilised in this research. A total of four hundred and twenty copies of the questionnaire were distributed to the four selected universities in NCN. Out of the four hundred and twenty copies of the questionnaire distributed amongst the four universities, one hundred and five copies were purposively administered to each of the universities, and a total of three hundred and ninety-two were properly filled and retrieved from the four universities. They were valid for the purpose of the research, representing a 93% return rate; that is  $[(392/420) * 100 = 93.33\%]$ . Table 2.1 shows the breakdown of the return rate.

Table 2.1: Return rate by institutions

<b>Institution</b>	<b>Copies of Questionnaires Administered</b>	<b>Number of returned Questionnaires</b>	<b>Return rates</b>
Benue State University	105	97	92.38
Federal University Technology Minna	105	100	95.24
University of Jos	105	97	92.38
University of Ilorin	105	98	93.33
<b>Total</b>	<b>420</b>	<b>392</b>	<b>93.33</b>

Table 2.1 shows the specific and total return rate of the questionnaires distributed to various schools. The table shows that the Federal University of Technology (FUT) Minna have the highest return rate of 95.24, followed by the University of Ilorin. The research questions have a total return rate of 93.33 which infers that the respondents have a good idea of the topic and the research questions.

Table 2.2: Response on sex and schools of the respondents

<b>Sex</b>	<b>Frequency</b>	<b>Percentage</b>
Male	226	57.7
Female	166	42.3
<b>Schools</b>	<b>392</b>	<b>100</b>
FUT Minna	100	25.5
University of Ilorin	98	25
Benue State University	97	24.7
University of Jos	97	24.7
<b>Total</b>	<b>392</b>	<b>100</b>

From Table 2.2, it could be observed that male respondents contributed largely to the research question with 57.7%, while female respondents have 42.3%. The table also shows the percentage of the sampled respondents from each school.

### Research questions

Research Question 1 addresses how libraries support open access for research of post-graduate students in NCN. From Table 2.3, 383 respondents (97.7%) strongly agreed that open access has made libraries play the role of publishers, making open access journals available to post-graduate students

Table 2.3: Research Question 1: How do libraries support open access for research of post-graduate students in NCN?

Responses	SA	A	U	D	SD	Weighted Sum	Mean	Std Dev	Decision
A	383(97.7)	5(1.3)	4(1.0)	0(0.0)	0(0.0)	1947	4.97	0.229	Agree
B	187(47.7)	205(52.3)	0(0.0)	0(0.0)	0(0.0)	1755	4.66	0.595	Agree
C	203(51.8)	181(46.2)	4(1.0)	4(1.0)	0(0.0)	1759	4.67	0.576	Agree
D	277(70.7)	100(25.5)	10(2.6)	5(1.3)	0(0.0)	1825	4.66	0.595	Agree
Overall							4.65		
Mean									

From Table 2.3, values in the parenthesis are percentages of the frequency counts. Decisions are made on each response based on the overall mean (4.65). SA = strongly agreed, A = agreed, D = disagreed, SD = strongly disagreed.

Note: Decision rule mean values less than 4.65 are regarded as 'disagreed' or 'strongly disagreed', while those equal to 4.65 are regarded as 'high', and those greater than 4.65 are 'strongly agreed'.

Statements

- A. Open access has made libraries play the role of publishers, making open access journals available to post-graduate students at no cost for research.
- B. Librarians are working with faculty authors to communicate and disseminate their research output through open access hosted by the university libraries for post-graduate research.
- C. The libraries stock in-house scholarly journals that highlight the works of faculty and post-graduate students in the form of an institutional repository for research.
- D. The libraries pay a subscription for online databases and give passwords and user names to post-graduate students, which conforms to supporting open access for research.

Table 2.4: Research Question 2: What are the characteristics of open access documents for research in the four NCN universities in support of post-graduate research?

Responses	SA	A	U	D	SD	Weighted Sum	Mean	Std Dev	Decision
A	384(98.0)	4(1.0)	4(1.0)	0(0.0)	0(0.0)	1948	4.97	0.361	Agree
B	244(62.2)	148(37.8)	0(0.0)	0(0.0)	0(0.0)	1812	4.62	0.485	Agree
C	231(58.9)	147(37.5)	14(3.6)	0(0.0)	0(0.0)	1785	4.65	0.682	Agree
D	197(50.3)	161(41.1)	25(6.4)	9(2.3)	0(0.0)	1722	4.69	0.934	Agree
<b>Overall</b>							<b>4.63</b>		
Mean									

From Table 2.4, values in parentheses are percentages of the frequency counts. Decisions are made on each response base on the overall mean (4.63). SA = strongly agreed, A = agreed, D = disagreed, SD = strongly disagreed.

Note: Decision rule: mean values less than 4.63 are regarded as 'disagreed' or 'strongly disagreed', while those equal to 4.63 are regarded as 'high', and those greater than 4.63 are 'strongly agreed'.

#### Statements

- A. Open access documents are freely available on the Internet to aid post-graduate research
- B. Open access documents are online, that is, digital documents and support post-graduate research
- C. Open access documents are scholarly and are peer-reviewed and support post-graduate research
- D. To aid post-graduate research, material can be accessed by anybody from anywhere without any discrimination

at no cost for research; 5 (1.3%) agreed, 4 (1%) had an undecided response, 187 (47.7%) strongly agreed, that librarians are working with faculty authors to communicate and disseminate their research output through open access hosted by the university libraries for post-graduate research; 205 (52.3%) agreed with the same statement; 203 (51.8%) strongly agreed that libraries stock in-house scholarly journals that highlight the works of faculty and post-graduate students are informed of institutional repositories for research; 181 (46.2%) agreed, 4 (1%) were undecided, and 4 (1%) disagreed. Finally, from the same research question, it was observed that 277 (70.7%) strongly agreed that libraries pay subscriptions for online databases and give passwords and user names to the post-graduate students, which conforms to supporting open access for research; 100 (25.5%) agreed; 10 (2.6%) were undecided; 5 (1.3%) disagreed.

All the weighted mean values to the different responses in RQ 1 were above 4.65, signifying that all the questionnaire statements were either agreed with or strongly agreed with, which implied that libraries support open access for post-graduate research.

Research Question 2 addresses the characteristics of open access research documents in the four universities in NCN. Table 2.4 shows that 384 respondents (98.0%) strongly agreed that they are freely available online to aid post-graduate research, 4 (1%) agreed, 4 (1%) had an undecided response; 244 (62.2%) strongly agreed, that they are online, that is digital, documents and support post-graduate research; 148, representing 37.8%, agreed with the same statement. Precisely 231 (58.9%) strongly agreed that they are scholarly and peer-reviewed and support post-graduate research, 147 (37.5%) agreed, and 14 (3.6%) had an undecided response. Finally, from the same research question, it was observed that 197 (50.3%) strongly agreed that material could be accessed by anybody from anywhere without any discrimination to aid post-graduate research, 161 (41.1%) agreed, 25 (6.4%) had an undecided response, and 9 (2.3%) disagreed.

All the weighted mean values to the different responses in RQ 2 were above 4.63, signifying that all the questionnaire statements either agreed or strongly agreed as to what constitutes the characteristics of open access documents for enhancement of post-graduate research.

Research Question 3 addresses the contents of open access for post-graduate students in the four universities in NCN. The table shows that 383 respondents (97.7%) strongly agreed that the contents of open access appear for post-graduate students in the four universities in NCN as text and data to software, audio video and multimedia to help post-graduate research, 4 (1%) agreed, 5 (1.3%) had an undecided response and 330 (84.2%) strongly agreed that they appear as preprints and post-prints to aid post-graduate research,

Table 2.5: Research Question 3: In what format do open access documents appear for post-graduate students in the four universities in NCN?

Responses	SA	A	U	D	SD	Weighted Sum	Mean	Std Dev	Decision
A	383(97.7)	4(1.0)	5(1.3)	0(0.0)	0(0.0)	1946	4.96	0.391	Agree
B	330(84.2)	57(14.5)	5(1.3)	0(0.0)	0(0.0)	1893	4.83	0.558	Agree
C	193(49.2)	189(48.2)	5(1.3)	0(0.0)	5(1.3)	1741	4.71	0.653	Agree
D	230(58.7)	154(39.3)	4(1.0)	4(1.0)	0(0.0)	1786	4.72	0.574	Agree
Overall							4.70		
Mean									

From Table 2.5, values in the parentheses are percentages of the frequency counts. Decisions are made on each response based on the overall mean (4.70). SA = strongly agreed, A = agreed, D = disagreed, SD = strongly disagreed.

Note: Decision Rule: mean values less than 4.70 are regarded as 'disagreed' or 'strongly disagreed', while those equal to 4.70 are regarded as 'high', and those greater than 4.70 are 'strongly agreed'.

#### Statements

- A. Open access documents appear as text and data to software, audio video and multimedia to help post-graduate research.
- B. Open access documents appear as preprints and post-prints to aid post-graduate research.
- C. Authors' personal websites help post-graduate research.
- D. Institutional unit archives or repositories controlled by the libraries aid post-graduate research.

Table 2.6: Research Question 4: How have self-archiving or authors making their articles available online helped post-graduate students in their research activities?

Responses	SA	A	U	D	SD	Weighted Sum	Mean	Std Dev	Decision
A	383(97.7)	4(1.0)	5(1.3)	0(0.0)	0(0.0)	1946	4.96	0.391	Agree
B	330(84.2)	57(14.5)	5(1.3)	0(0.0)	0(0.0)	1893	4.83	0.558	Agree
C	193(49.2)	189(48.2)	5(1.3)	0(0.0)	5(1.3)	1741	4.71	0.653	Agree
D	230(58.7)	154(39.3)	4(1.0)	4(1.0)	0(0.0)	1786	4.72	0.574	Agree
Overall							4.70		
Mean									

From Table 2.6, values in the parentheses are percentages of the frequency counts. Decisions are made on each response base on the overall mean (4.68). SA= strongly agreed, A=agreed, D= disagreed, SD= strongly disagreed

Note: Decision Rule: mean values less than 4.68 are regarded as 'disagreed' or 'strongly disagreed', while those equal to 4.68 are regarded as 'high', and those greater than 4.68 are 'strongly agreed'.

Statements

- A. Open access documents appear as text and data to software, audio video and multimedia to help post-graduate research.
- B. Open access documents appear as preprints and post-prints to aid post-graduate research.
- C. Authors' personal websites help post-graduate research.
- D. Institutional unit archives or repositories controlled by the libraries aid post-graduate research.

57 (14.5%) agreed with the same statement, and 5 (1.3%) of the respondents were undecided. Precisely 193 (49.2%) strongly agreed that authors' personal websites help post-graduate research, 189 (48.2%) agreed, 5 (1.3%) were undecided, and 5 (1.3%) strongly disagreed. Finally, from answers to the same research question, it was observed that 230 (58.7%) strongly agreed that institutional unit archives or repositories controlled by the libraries aid post-graduate research, 154 (39.3%) agreed, 4 (1%) were undecided, and 4 (1%) disagreed.

All the weighted mean values to the responses in RQ 3 were above 4.70, signifying that all the questionnaire statements either agreed or strongly agreed about the questionnaire-specified format and that the documents appear to support post-graduate research.

Research Question 4 addresses how self-archiving or authors making their articles available online helped post-graduate students in their research activities. The table shows that 382 respondents (97.4%) strongly agreed that self-archiving helped post-graduate students in their research activities. In the category 'self-archiving or authors making their articles available online satisfies the research needs of post-graduate students', 5 (1.3%) agreed, and 5 (1.3%) strongly disagreed. Precisely 316 (80.6%) strongly agreed that increased institutional visibility builds the research confidence of post-graduate students, 67 (17.1%) agreed with the same statement, 5 (1.3%) of the respondents were undecided, and 4 (1%) strongly disagreed. Precisely 170 (43.4%) strongly agreed that building research confidence of post-graduate students implies that when they self-archive their own works, other students or faculties could use them; 199 (50.8%) agreed, and 23 (5.9%) of the respondents disagreed. Finally, from answers to the same research question, it was observed that 270 (68.9%) strongly agreed, and 122 (31.1%) agreed, that because open access in libraries guarantees long-term cost-effectiveness, post-graduate students do not pay as long as they have their user names and password.

All the weighted mean values to the different responses in RQ 4 were above 4.68, signifying that all the questionnaire statements either agreed or strongly agreed with the questionnaire statements on how self-archiving or authors making their articles available online helped post-graduate students in their research activities.

Research Question 5 addresses how the open access mandate helped the post-graduate students' bibliographic visibility towards partial fulfilment of their post-graduate degrees. Table 2.7 shows that 377 respondents (96.2%) strongly agreed that post-graduate students are mandated to publish before obtaining their master's or PhD degrees, and this upgrades their research; 10 (2.6%) have an undecided response, and 5 (1.3%) strongly disagreed.

Table 2.7: Research Question 5: How has the open access mandate helped the post-graduate students' bibliographic visibility towards partial fulfilment of their post-graduate degrees?

Response	SA	A	U	D	SD	Weighted Sum	Mean	Std Dev	Decision
A	377(96.2)	0(0.0)	10(2.6)	0(0.0)	5(1.3)	1920	4.90	0.544	Agree
B	276(70.4)	116(29.6)	0(0.0)	0(0.0)	0(0.0)	1844	4.78	0.457	Agree
C	301(76.8)	78(19.9)	0(0.0)	13(3.3)	0(0.0)	1843	4.77	0.64	Agree
Overall							4.77		
Mean									

From Table 2.7, values in the parentheses are percentages of the frequency counts. Decisions are made on each response base on the overall mean (4.77). SA= strongly agreed, A=agreed, D= disagreed, SD= strongly disagreed

Note: Decision Rule: mean values less than 4.77 are regarded as 'disagreed' or 'strongly disagreed', while those equal to 4.77 are regarded as 'high', and those greater than 4.77 are 'strongly agreed'.

Statements

- A. Post-graduate students are mandated to publish before obtaining their master's or PhD degrees and upgrade their research output and activities.
- B. This mandatory publication helps their research visibility.
- C. The publication helps them become bibliographically viable and spurs them on for more research output.

Precisely 276 (70.4%) strongly agreed that mandatory publication helps their research visibility, and 116 (29.6%) agreed with the same statement. Precisely 301 (76.8%) strongly agreed that the open access mandate helped the post-graduate students' bibliographic visibility towards partial fulfilment of their post-graduate degrees, helping them to become bibliographically viable, which spurs them on for more research, 78 (19.9%) agreed, and 13 (3.3%) disagreed.

All the weighted mean values to the different responses in RQ 5 were above 4.77, signifying that the respondents either agreed with or strongly agreed with, all the questionnaire statements' on how open access mandate in university libraries helped the post-graduate students' bibliographic visibility towards partial fulfilment of their post-graduate degrees.

*Presentation of hypothesis/ hypothesis testing*

Table 2.8: Hypothesis 1. Correlation analysis showing a relationship between libraries and open access versus post-graduate research activities in the four universities in NCN.

<b>Variables</b>	<b>N</b>	<b>Mean</b>	<b>Std. Dev</b>	<b>DF</b>	<b>R</b>	<b>p-Value</b>
Open access	392	5.6046	1.31070	391	0.546**	0.000
Libraries for Research	PG 392	5.2577	1.34276			

\*\* . Correlation is significant at  $p < 0.05$  level (2-tailed)

This table shows the relationship between libraries and open access versus post-graduate research activities in the four universities in NCN. From Table 2.8, it can be observed that the result of the Pearson product-moment correlation coefficient (PPMC) shows a significant positive relationship between libraries and open access versus post-graduate research activities. Since the  $p$ -value = 0.000 is less than 0.05 level of significance.  $R$  (correlation coefficient) is a value that shows the degree of association between two variables. The table shows that  $R = 0.546$ , which infers a strong positive correlation between libraries and open access with post-graduate research activities.

Discussion of findings based on research questions

Research Question 1 sought to find out how libraries support open access for research of post-graduate students in NCN. The study revealed that:

- ◆ Open access has made libraries play the role of publishers, making open access journals available for research at no cost to post-graduate students.
- ◆ Librarians are working with faculty authors to communicate and disseminate their research output through open access hosted by the university libraries for post-graduate research.
- ◆ The library stocks in-house scholarly journals that highlight the works of faculty and post-graduate students in the form of an institutional repository for research.
- ◆ The library pays a subscription for online databases and gives passwords and user names to post-graduate students, which conforms to supporting open access for research.

These findings agree with the views of Jain (2010), Ward and Lavoie (2016) and Engesner (2014) regarding the support libraries give to open access for research and scholarship. In summary of the three authors' views, Jain (2010), Ward and Lavoie (2016) and Engesner (2014) all agree to the fact that libraries pay a subscription for online databases and give passwords and user names to their post-graduate students in a bid to support open access for their research.

Research Question 2 sought to discover the characteristics of open access documents for research in the four universities in NCN in support of post-graduate research. The study revealed that:

- ◆ Open access documents are freely available online to aid post-graduate research.
- ◆ Open access online resources are digital documents and support post-graduate research.
- ◆ Open access documents are scholarly and peer-reviewed and support post-graduate research.
- ◆ Open access materials can be accessed by anybody from anywhere without discrimination to aid post-graduate research.

These findings agree with the views of Ward and Lavoie (2016) and Boufars and Harviainen Tuomas (2021) as being the characteristics of open access materials seen in libraries.

Research Question 3 sought to find out the format in which the contents of open access appear for post-graduate students in the four universities in NCN.

- ◆ The study revealed that the open access content appears as text and data to software, audio video and multimedia to help post-graduate research.
- ◆ Open access appears as preprint and post-prints to aid post-graduate research.

- ◆ Authors' personal websites help post-graduate research.
- ◆ Institutional unit archives or repositories controlled by the libraries aid post-graduate research. These agree with the views of Watson (2016) and Suber (2010) regarding the format in which open access content appears.

Research Question 4 sought to determine how self-archiving or authors making their articles available online helped post-graduate students in their research activities.

The study revealed that:

- ◆ Self-archiving satisfies the research needs of post-graduate students.
- ◆ Self-archiving increases institutional visibility and builds research confidence of post-graduate students.
- ◆ Self-archiving builds research confidence of post-graduate students, implying that when they self-archive their own works, other students or faculties could use them.
- ◆ Open access in libraries guarantees long-term cost-effectiveness.
- ◆ Post-graduate students do not pay as long as they have their user names and passwords.

These are in consonance with the views of Boufarss and Harviainen Tuomas (2021) and Watson (2016).

Research Question 5 sought to determine how the open access mandate helped the post-graduate students' bibliographic visibility towards partial fulfilment of their post-graduate degrees.

The study revealed that:

- ◆ Post-graduate students are mandated to publish before obtaining their master's or PhD degrees, which upgrades their research output and activities.
- ◆ This mandatory publication helps their research visibility.
- ◆ It helps them become bibliographically viable and spurs them on for more research output.

These findings agree with the views of Mullen (2010), Peekhaus and Proferes (2016), and Boufarss and Laakso (2020) to the effect that open access documents helped the post-graduate students' bibliographic visibility needed for attaining their post-graduate degrees.

## Discussion of findings based on the tested hypothesis

Table 2.8: Hypothesis 1: Product-moment correlation analysis showing a relationship between libraries and open access versus post-graduate research activities in the four universities in NCN.

Variables	N	Mean	Std. Dev	DF	R	p-Value
Open access	392	5.6046	1.31070	391	0.546**	0.000
Libraries for research	PG 392	5.2577	1.34276			

\*\* . Correlation is significant at  $p < 0.05$  level (2-tailed)

Table 2.8 shows the relationship between libraries and open access versus post-graduate research activities in the four universities in NCN. From Table 2.8 it can be observed that the result of PPMC shows that there is a significant positive relationship between libraries and open access versus post-graduate research activities since the p-value = 0.000 is less than 0.05 level of significance. The correlation coefficient (R) is a value that shows the degree of association between two variables. The table shows that  $R = 0.546$  which infers a strong positive correlation between libraries and open access with post-graduate research activities. In other words, a statistically significant relationship was found between libraries and open access and post-graduate research activities. Therefore, the null hypothesis has been rejected. The strong positive relationship agrees with all the findings of the study, summarising that libraries and open access must work together for excellent post-graduate research.

## Conclusion

Based on all the findings of the study, the conclusion is that open access documents help in making libraries play the role of publishers. Open access documents are scholarly and peer-reviewed. They support post-graduate research and are free online. The self-archiving encouraged by open access documents has helped post-graduate students in their research. The open access mandate has helped post-graduate students in their research and curriculum activities, and open access documents help make libraries play the role of publishers. Therefore, libraries and open access must work together for excellent post-graduate research and curriculum activities.

### *Recommendations*

Based on the findings of this research, the author makes the following recommendations:

- ◆ All university libraries should be encouraged to become involved in open access activities and play prominent publishing roles to further help post-graduate students in their research and curriculum activities because open access documents are scholarly and peer-reviewed.
- ◆ Since open access documents are scholarly, libraries should become institutional depository centres for developing countries like Nigeria to use their university libraries to support open access activities for all intellectual and artistic documents emanating from the university faculties.
- ◆ Developing countries like Nigeria should have strong expertise to build strong open access-based university libraries since the self-archiving that accompanies open access helps post-graduate students in their research activities.
- ◆ The open access mandate should be aggressively embraced in university libraries since it helps post-graduate students in their research and curriculum activities.

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## Academic Libraries in Africa

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