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## Information Literacy, Critical Thinking and Research Productivity of Doctoral Students in Universities in Ogun State, Nigeria

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## **Abstract**

The study investigated the influence of information literacy and critical thinking on research productivity of doctoral students in universities in Ogun State, Nigeria. The study employed a survey research design drawing on a sample of 309 respondents out of a target population of 1,418 doctoral students from six participating universities guided by the Research Advisor's Table. Findings of the study established that research productivity of doctoral students in universities in Ogun State, Nigeria was low. The low research productivity manifested in form of unusually prolonged doctoral education, high attrition rates, difficulties/inability to complete doctoral thesis which is the hallmark of doctoral education and poor research publication measured in quality and quantity. The study also established a positive significant relationship between information literacy and research productivity of doctoral students. Similarly, there was a significant positive relationship between critical thinking and research productivity. The study concluded by recommending periodic review of curriculum to reflect changes in the ever dynamic information landscape.

## **Keywords**

Information literacy, Research productivity, Research Self-Efficacy, Self-Efficacy Doctoral students, Universities, Nigeria

## **Introduction**

The prosperity of any nation is inextricably tied to her research productivity measured in quality and quantity. Seeing in this light, it can be said that the current state of any nation is a reflection of its research productivity. In other words, barely can any society grow beyond the quality and quantity of its research production. Arguably therefore, research can be said to make the difference between the developed and the developing nations of the world. This justifies the renewed and heightened attention being paid to research productivity and the various stakeholders involved in the process. Following Simisaye and Popoola (2019), research productivity is described as the total number of journal articles, textbooks, monographs, conference proceedings, technical reports, chapters in books, theses, dissertations, scientific peer reviews, co-authored textbooks, occasional papers and patents produced by scholars within a specified timeframe. However, when viewed as the process of grooming future researchers, Niehaus, Garcia and Reading (2018), defined researcher development as the process whereby students' capacity and willingness to carry out the research components of their work or studies may be considered to be enhanced.

By virtue of its importance to the prosperity of a nation and the sustenance of scholarship in particular, there is the need to sustain research productivity. As success without successor is short-lived, so is the sustenance of research productivity without adequate plan to mentor and train new generation of researchers that will possibly take over at a point because all categories of academics will eventually bow out of the system at a point. Hence, universities across the world through postgraduate education have put in place a process of training, mentoring and initiating successive generations into the research culture especially at the doctoral level because doctoral training programs are designed to prepare students to take on the rigors of research (Niehaus, Garcia & Reading, 2018).

However, despite the importance of research productivity to the growth and development of a nation in general and the sustenance of scholarship in particular, studies have established that

doctoral students often encounter low research productivity manifesting in high attrition rate, unusually prolonged doctoral education, stagnation, frustration, underdeveloped strategies for thesis writing, leading to academic roadblocks and even suicide (Chesnut, Siwatu, Young & Tong 2015; Niehaus, Garcia & Reading, 2018; Obaseki & Agu, 2019; Pelemo, Onanuga, Ilori. & Ugbala 2020; Poh, Bin & Abdullah, 2019; Rooij, Fokkens-Bruinsma & Jansen, 2019; Sevim & Sarikaya, 2020; Ulibarri, et al., 2014). Also, from Southern Africa, Iwara (2019) reported low research publication output among doctoral students where less than five (5) out of 32 have published a research article in a year. In the same vein, Hepworth and Duvigneau (2012) indicated that samples of postgraduate students from Zambia, Malawi and Botswana displayed low research productivity because of lack of critical thinking and information literacy. In Nigeria, studies like Oyedokun, et al. (2019), Pelemo, et al. (2020) as well as Obaseki and Agu (2019) have established low research productivity of doctoral students.

As noted by Schoole (2011), doctoral education is the core of university research capacity, source of research productivity and innovation in the global knowledge economy stating further that doctoral education is expected to produce new and original ideas and knowledge, through research productivity. Meanwhile, writing and publishing research results are crucial for progressing scientific thought and reaching a broad audience (Derntl, 2014). In carrying out these activities, doctoral students have to sift out information from varied sources such as the Internet, electronic resources, libraries and other sources in unfiltered form. Because research is accretive and builds on information, doctoral students need to be equipped with information literacy knowledge. Information literacy is described as the set of integrated abilities encompassing the reflective discovery of information, the understanding of how information is produced and valued, and the use of information in creating new knowledge and participating ethically in communities of learning (Association of College and Research Libraries (ACRL), 2016, p. 8)

The relationship between research productivity and information literacy has been examined in a number of studies mostly from Nigeria. Few of these studies measured the impact of information literacy on research productivity (Afolabi & Oladokun, 2020; Anekwe, 2018; Igun & Odafe, 2014; Madu & Dike, 2012; Nwosu, Obiamalu & Udem, 2015; Okiki, 2013). Fewer still from Nigeria examined the impact of information literacy on research productivity but ended up dwelling more on information literacy while glossing over research productivity (Oyedokun, et al., 2019; Oyewo & Uwem, 2016). In addition, most of these studies drew their respondents from the academic staff with none focusing distinctly on the impact of information literacy on research productivity of doctoral students in Nigeria.

Apart from information literacy, critical thinking is another variable that can predict research productivity. Research and its productivity often happen as a conundrum and non-linear process. It requires not only information literacy but also critical thinking which is described as active, persistent and careful consideration of the credibility and conclusions of supposed knowledge or information. (Paul & Elder, 2016). Conceptualized this way, critical thinking becomes synonymous with research which is described as careful or diligent search, studious inquiry or examination. As research builds on information, the emergence of a knowledge-based economy over a once dominant manufacturing economy means that positive outcomes in any endeavor are dependent on critical thinking (Ahuna, Tinnesz & Keiner, 2014). Moreover, scholarly research happens as a nonlinear process often requiring the student to define a problem that is only partially known in advance, not knowing whether an answer exists to the chosen problem until that answer is found. Thus, research is not a well-structured problem-solving task, but a challenging problem-finding and problem-crafting task that requires not only creativity but more sophisticated critical thinking for conscious management of the research process (Ulibarri, et al.,

2014). Furthermore, critical thinking involves much more than accumulating information or processing information; rather critical thinking involves analyzing information to yield actionable knowledge required to make effective decisions (Liu et al., 2016).

Critical thinking allows us to question things, and this in turn enables us to construct new ideas from knowledge that we have and to build on that knowledge rather than depending on other people. Unlike information literacy which is easily amenable to assessment and empirical research, critical thinking has been described as not easily amenable to assessment and therefore less studied empirically (Liu, et al., 2016; Shavelson, et al., 2019). However, despite its famed non-amenability to assessment, it has attracted more assessment tests than any of the other 21<sup>st</sup> century skills. These include proprietary, open access, institutional; varying assessment formats including essay, multiple choice as well as performance based formats; and adapted into different languages including Chinese and Taiwanese critical thinking scales (Liu, et al., 2018; Shavelson, et al., 2019; Yuan, et al., 2014).

Also, developing critical thinking needed for success beyond the classroom has been recognized as a primary goal of colleges and universities (Liu, et al., 2016; Shavelson, et al., 2019). Therefore, it might be reasonably expected that the 21st century University is a place where critical thinking might be acquired or at least exemplified at the highest levels of research inquiry and scholarship. However, despite critical thinking being identified as an important educational objective, strong evidence exists indicating that many doctoral students lack critical thinking needed for success in any research activity and where postgraduate dissertations are concerned, do not engage critical thinking effectively enough to successfully complete a research inquiry and an associated writing up process ((Nold, 2017; Richards, 2014). Among the indicators of critical thinking as captured from the literature are analyticity, inquisitiveness, open-mindedness, systematicity, truth-seeking. Available studies on research productivity and critical thinking which were mostly qualitative and quasi-experimental possibly because of its reputed non-amenability to assessment include Anwar, Senam and Laksono, 2017; Brodin, 2014; Bryan, 2014; Donnelly and Fitzmaurice, 2011; Hadi, Susantini and Agustini, 2018; Hepworth and Duvigneau, 2012; Kong, 2014; Liao and Wang, 2016; Moore, 2013; Nold, 2017; Petrucco and Ferranti, 2017; Sevim and Sarikaya, 2020; Ulibarri, et al., 2014. Only one of the reviewed studies from Iran used survey design (Nourizadeh, vahedi & Morsali, 2016). Other studies focused on developing standardized critical thinking evaluation instruments. (Liu, et al., 2018; Shavelson, et al., 2019). To the best of the researcher's knowledge none of these studies focused on critical thinking and research productivity of doctoral students and none emanated from Nigeria. From all indications, information literacy and critical thinking are crucial predictors of research productivity of scholars that should be given keen attention. To this end, there was a need to examine the combined influence of information literacy and critical thinking on research productivity of doctoral students in universities in Ogun State, Nigeria.

## **Literature Review**

For a long time, researchers have been interested in the research productivity of scholars and factors that are likely to enhance it. For example, Bland, Center, Finstad, Risbey, and Staples (2005) described and grouped the factors affecting research productivity into three as individual, institutional and administrative. In another study, Hemmings and Kay (2010) examined the factors that influence lecturers' research productivity in Australia; Hemmings, Kay, Sharp and Taylor (2012) conducted a transnational study of lecturers' self-efficacy as a determinant of their

research productivity; Hemmings and Kay (2015) examined the relationship between research self-efficacy, research disposition and publication output of researchers; Heng, Hamid and Khan (2020) examined factors that influence academics' research engagement and productivity from a developing nation's perspective. Similarly, Sevim and Sarikaya (2020) carried out a needs assessment study on doctoral students' research productivity; Lambie and Vaccaro (2011) investigated doctoral counselor education students' levels of research self-efficacy, perceptions of the research training environment and interest in research; Pasupathy and Siwatu (2014) also investigated the research self-efficacy beliefs and research productivity of faculty members at an emerging research university in the USA; Overall, Deane and Peterson (2011) promoting doctoral students' research self-efficacy through a combination of academic guidance and autonomy support; Alhija and Majdob (2017) studied predictors of teacher educators' research productivity

Furthermore, Lambie, Hayes, Griffith, Limberg and Mullen (2014) conducted an exploratory investigation of the research self-efficacy, interest in research, and research knowledge of Ph. D. in education students; Nygaard (2015) investigated the force of publishing and perishing as determinant of research productivity using the framework of academic literacies; Jiang, Yuan and Zhang (2019) examined the influence of self-efficacy on research capacity of clinical nurses in China; Rooij, Fokkens-Bruinsma and Jansen (2019) examined the importance of Ph. D. project characteristics as factors that influence doctoral candidates' success; Reyes-Cruz and Perales-Escudero (2016) investigated research self-efficacy sources and research motivation in a foreign language university faculty in Mexico; Alrahlah (2016) conducted a qualitative study on the impact of motivational factors on research productivity of dental faculty members; Han and Schuurmans-Stekhoven (2016) conducted a pilot study drawing samples from selected international students with the aim of improving higher degree candidates' (HDR) research; Anekstein and Vereen (2018) studied the effect of research mentoring on doctoral students' experiences and research productivity and Callaghan (2016) investigated the impact of family life on academic research productivity. While these and other studies have identified a number of disparate factors that enhance research productivity of scholars at various levels, none of these studies to the best of the author's knowledge have examined the influence of information literacy and critical thinking on research productivity of doctoral students.

The current study, aimed at assessing the influence of information literacy and critical thinking on research productivity of doctoral students in universities in Ogun State, Nigeria conducted a review of extant literature relevant to the variables. Due to the indispensability of research and its productivity to the prosperity of nations, the review shows a heightened interest of scholars from various nations and disciplines in research productivity. Examination of the literature indicates that there are numerous factors which have potential effects on the level of research engagement and productivity of academics. The review also shows that majority of studies on this topic have been carried out mainly in western nations.

On research productivity and information literacy, there were just few available literature, majority of which emanated from Nigeria. Few of those that emanated from Nigeria measured the impact of information literacy on research productivity (Afolabi & Oladokun, 2020; Anekwe, 2018; Igun & Odafe, 2014; Madu & Dike, 2012; Nwosu, Obiamalu & Udem, 2019; Okiki, 2013). Fewer still from Nigeria set out to measure the impact of information literacy on research productivity but ended up dwelling more on information literacy while glossing over its influence on and relationship with research productivity (Omeluzor, et al., 2013; Oyedokun, et al., 2019; Oyewo & Uwem, 2016). Pelemo, et al. (2020) measured the impact of information literacy and library orientation on research productivity of postgraduate students while Udem and Anaehobi (2020) did a correlational analysis of information literacy and research self-efficacy of

LIS students. In addition, most of these studies drew their respondents from the academic staff with none focusing distinctly on the impact of information literacy on research productivity of doctoral students in Nigeria. Also from University of Grenada, Spain, Pinto and Fernandez-Pascual (2010, 2016, 2017a, 2017b) focused on assessing information literacy competence of undergraduate students in Spain while Banik and Kumar (2019) examined the impact of information literacy on students' academic performance in Bangladesh.

The review of literature carried out on critical thinking and research productivity also revealed a number of studies which were mostly qualitative and quasi-experimental possibly because of its reputed non-amenability to assessment (Anwar, Senam & Laksono, 2017; Brodin, 2014; Bryan, 2014; Donnelly & Fitzmaurice, 2011; Hadi, Susantini & Agustini, 2018; Hepworth & Duvigneau, 2012; Kong, 2014; Liao & Wang, 2016; Moore, 2013; Nold, 2017; Petrucco & Ferranti, 2017; Ulibarri, et al., 2014). Only one of the reviewed studies from Iran used a survey design (Nourizadeh, vahedi & Morsali, 2016). Others were critical thinking evaluation instruments. (Liu, et al., 2018; Shavelson, et al., 2019; Yuan, et a., 2014). None of these studies focused on critical thinking and research productivity of doctoral students just as none emanated from Nigeria.

### **Objective of the Study**

The study investigated the influence of information literacy and critical thinking on the research productivity of doctoral students in universities in Ogun State, Nigeria. It also

1. examined the level of research productivity of doctoral students in universities in Ogun State;
2. ascertained the level of information literacy of doctoral students in universities in Ogun State;
3. found out how doctoral students in universities in Ogun State acquire their information literacy
4. examined the frequency of critical thinking engagement of doctoral students in universities in Ogun State

### **Research Questions**

The study was guided by the following research questions:

1. What is the level of research productivity of doctoral students in universities in Ogun State, Nigeria?
2. What is the level of information literacy proficiency of doctoral students in universities in Ogun State, Nigeria?
3. How do doctoral students in universities in Ogun State, Nigeria acquire their information literacy?
4. What is the frequency of critical thinking engagement of doctoral students in universities in Ogun State?

### **Hypotheses**

The following null hypothesis tested at 0.05 level of significance guided the study:

H<sub>01</sub>: Information literacy will not significantly influence research productivity of doctoral students in universities in Ogun State.

H<sub>0</sub>2: Critical thinking will not significantly influence the research productivity of doctoral students in universities in Ogun State.

H<sub>0</sub>3: Information literacy and critical thinking will not jointly influence research productivity of doctoral students in universities in Ogun State.

## Research Design

The study adopted the survey research design using questionnaire as the main instrument to generate data from respondents.

## Population of the Study

The target population of this study consisted of **1,418** doctoral students from universities in Ogun State, Nigeria accredited by the National Universities Commission (NUC) to offer doctoral degrees. These are Federal University of Agriculture, Abeokuta; Tai Solarin University of Education, Ijagun, Ijebu-Ode; Olabisi Onabanjo University, Ago Iwoye; Babcock University, Ilishan-Remo; Mountain Top University, Mowe and Covenant University, Ota.

## Sample Size and Sampling Technique

A simple random probability and proportionate sampling techniques were used to select sample from the population. Specifically, the sample size was drawn from the total number of students enrolled for doctoral studies at the aforementioned universities. Research Advisors (2006) published table was thereafter used to select the sample size for the study. The table at confidence level 95% with margin error of +5.0 was used to select sample size of 309 out of the total population of **1,418** doctoral students for this study. Following the determination of the sample size, proportionate random sampling was used to select the required sample size from each of the universities. This is achieved by dividing the derived sample size by the total population of doctoral students. ( $306 \div 1,418$ ) in all the universities and multiplied by the target population in each of the universities. This is illustrated Table 1

**Table 1: Sample Size of Doctoral Students at Selected Universities in Ogun State**

S/N	Name of University	Population of Doctoral Students	Determined Sample of Doctoral Students
1	Babcock University, Ilishan-Remo	$306 \div 1,418 \times 300$	64.7=65
2	Covenant University, Ota	$306 \div 1,418 \times 211$	45.5=45
3	Federal University of Agriculture,	$306 \div 1,418 \times 170$	36.7=38
4	Mountain Top University, Mowe	$306 \div 1,418 \times 2$	0.4=2
5	Olabisi Onabanjo University, Ago Iwoye	$306 \div 1,418 \times 719$	155.2=155
6	Tai Solarin University of Education	$306 \div 1,418 \times 16$	3.5=4
	<b>Total</b>	<b>1,418</b>	<b>309</b>

**Source: Fieldwork by the Author**

## Research Instrument

The research questionnaire used for this study was titled “**Information Literacy, Critical Thinking and Research Productivity Questionnaire**”. The questionnaire was divided into the following 5 sections: Section A captured the demographic data of respondents. Section B was

self-constructed and measured the research productivity of respondents by indicating the number of times listed research products were produced before doctoral enrolment and in the course of the program. In addition, respondents were required to indicate departmental assessment of their seminar, pre-field and post-field presentations. Section C assessed the degree of information literacy proficiency of respondents. It was further divided into 4 subscales to measure the degree of respondents' knowledge of information search, information evaluation, information processing and information communication and dissemination. Section D aimed to know how respondents acquire their information literacy. Section E measured respondents' frequency of practicing critical thinking abilities when occasion demanded.

### **Reliability of Instrument**

A pilot study was conducted to assess the extent to which the instrument correctly measured the intended variables prior to the real study and sieve out inherent errors. Forty (40) copies of the questionnaire were administered to doctoral students at Bowen University, Iwo, Osun State out of which thirty copies were retrieved and found useful for the analysis. Meanwhile, Bowen University where the pilot study was conducted was not included in the actual study but was selected because the respondents share similar characteristics with the actual study population. Completed copies of the research questionnaire were subjected to Cronbach's Alpha reliability test and results obtained were used as estimates of the internal consistency of the instrument.

**Table 2: Reliability of Instrument**

S/N	Variable	No of Items	Cronbach's alpha coefficient
1	Research Productivity	17	0.76
2	Information Literacy	27	0.92
3	Critical Thinking	27	0.92

### **Method of Data Collection**

Data was collected from respondents through the designed questionnaire administered by the researcher and trained assistants. While the distribution and collection of questionnaire was initially projected to take a month as the selected universities were spread across diverse geographical terrains in Ogun State, Nigeria, it eventually took more than two months as most of the respondents had to be reached online because they were no longer coming to school in compliance with the COVID-19 preventive protocols.

### **Data Analysis**

Data collected was subjected to descriptive analysis involving mean, standard deviation, frequency count, percentages and analyzed using Statistical Package for Social Science (SPSS) version 20.0 for windows. Inferential statistical analysis such as ANOVA, was also applied to determine the influence of the independent variables on the dependent variable.

### **Ethical Consideration**

Ethical consideration has become an important issue for researchers globally. Therefore, the approval of participating universities regarding ethical compliance of study instrument and any other consideration was obtained before the field study. Furthermore, participants were informed of what the whole study was all about based on which their informed consent was sought and obtained. To achieve this, a short introduction detailing the objective of the study and the assurance of anonymity was attached to the questionnaire. Besides, respondents were guaranteed

of the confidentiality of their identity and data provided in this study. Also, respondents were informed of their prerogative to withdraw at any point from the study so as not to feel compelled whatsoever. Moreover, respondents were informed of the potential benefits of the findings of the study which would be made available to them on completion of the study.

## RESULTS AND DISCUSSION OF FINDINGS

### Demographic Data

Although 309 participants were originally targeted for the study, only 284 copies of questionnaire were retrieved and found useful for the analysis representing 92% response rate which was considered adequate for the study. Out of the six (6) selected participating universities, Olabisi Onabanjo University had the highest number of participants numbering 143 (50.4%), followed by Babcock University with 58 (20.4%) respondents. Mountain Top University had the least with just two (0.7%) respondents. The data showed that of the total 284 respondents who participated in the study, 180 (63.4%) were male while 104 (36.6%) constituted female respondents. Moreover, majority of the respondents 139 (48.9%) were within the age bracket of 31-40 years. In addition, 111 (33%) of the respondents had spent 2-3 years on the doctoral program while 122 (43%) of the respondents had spent between 4-14 years on the program. On the status of the program, 42 (14.8%), 86 (30.3), 96 (33.8) and 60 (21.1%) were on course work, pre-field, post-field and viva respectively. On gender distribution, the result indicates that more males than females were enrolling for doctoral program probably because of the enormous challenges associated with it. Looking at the number of years already spent on the program, the result seemed to confirm the unusually prolonged period of doctoral training which might have given room to stagnation and frustration thus precipitating low research productivity among doctoral students in universities in Ogun State. However, looking at the age bracket, majority of the respondents (48.9%) fell within the age bracket of 31-40. This is an indication that despite the challenges associated with doctoral education younger students were still attracted to the program and might actually have started early so they can finish before advancing in age.

### Analysis of Research Questions

**Research Question1:** What is the level of research productivity of doctoral students in universities in Ogun State?

**Table 3 Research Products Produced Before Doctoral Program ( $\bar{x}$ =1.84, SD=1.05)**

S/N	Research Products	0	1-2	3-4	5-7	8>	Mean	SD
1	Scholarly presentation at local, national, regional and international conferences	68 (23.9%)	101 (35.6%)	75 (26.4%)	21 (7.4%)	19 (6.7%)	2.37	1.125
2	Research-based grants received	81 (28.5%)	118 (41.5%)	62 (21.8%)	11 (3.9%)	12 (4.2%)	2.14	1.012
3	Manuscripts accepted for publication in the form of critiques, book reviews and other publications	124 (43.7%)	68 (23.9%)	51 (18.0%)	12 (4.2%)	29 (10.2%)	2.13	1.301
4	Manuscripts accepted for publication in the form of a research study in a peer reviewed journal	162 (57.0%)	74 (26.1%)	29 (10.2%)	10 (3.5%)	9 (3.2%)	1.70	1.005

5	Manuscripts accepted for publication in the form of textbooks	182 (64.1%)	67 (23.6%)	14 (4.9%)	9 (3.2%)	12 (4.2%)	1.60	1.020
6	Manuscripts accepted for publication in the form of book chapters	206 (72.5%)	52 (18.3%)	9 (3.2%)	5 (1.8%)	12 (4.2%)	1.47	.963
7	Citation indices for existing published works	208 (73.2%)	46 (16.2%)	18 (6.3%)	2 (0.7%)	10 (3.5%)	1.45	0.918
Criterion Mean							3	

The results as shown in table 3 revealed that doctoral students in universities in Ogun State scored low in research productivity before the commencement of their doctoral programs as the overall weighted mean ( $\bar{x}=1.84$ ) is lower than the criterion mean ( $\bar{x}=3$ ). A closer look at the items revealed that scholarly presentation at local, national, regional and international conferences had the highest mean ( $\bar{x}=2.37$ ) followed by research-based grants received ( $\bar{x}=2.14$ ); manuscripts accepted for publication in the form of critiques, book reviews and other publications ( $\bar{x}=2.13$ ); manuscripts accepted for publication in the form of research study in a peer reviewed journal ( $\bar{x}=1.70$ ), manuscripts accepted for publication in the form of textbooks ( $\bar{x}=1.60$ ); manuscripts accepted for publication in the form of book chapters ( $\bar{x}=1.47$ ) while citation indices for existing published works recorded the lowest mean ( $\bar{x}=1.45$ ). With doctoral students in universities in Ogun State scoring lower than the criterion mean in all the items, it is apparent that their research productivity was low before the commencement of the doctoral program.

**Table 4: Research Products Produced during Doctoral Program ( $\bar{x}=1.86$  SD=0.91)**

S/N	Research Products	0	1-2	3-4	5>	Mean	SD
1	Citation indices for existing published works	41 (14.4%)	50 (17.6%)	135 (47.5%)	58 (20.4%)	2.74	0.945
2	Scholarly presentation at local, national, regional and international conferences	88 (31.0%)	101 (35.6%)	59 (20.8%)	36 (12.6%)	2.22	1.154
3	Research-based grants received	108 (38.0%)	105 (37.0%)	56 (19.7%)	15 (5.3%)	1.95	.965
4	Manuscripts accepted for publication in the form of critiques, book reviews and other publications	151 (53.2%)	63 (22.2%)	37 (13.0%)	33 (11.6%)	1.91	1.229
5	Manuscripts accepted for publication in the form of a research study in a peer reviewed journal	177 (62.3%)	80 (28.2%)	18 (6.3%)	9 (3.2%)	1.51	.768
6	Manuscripts accepted for publication in the form of textbooks	200 (70.4%)	64 (22.5%)	11 (3.9%)	9 (3.2%)	1.41	.758

7	Manuscripts accepted for publication in the form of book chapters	225 (79.2%)	44 (15.5%)	13 (4.6%)	2 (.7%)	1.27	.575
<b>Criterion Mean</b>						<b>3</b>	

Source: Field Survey (2022)

**Decision Rule: Research productivity is low if weighted mean is lower than criterion mean**

As shown in table 4, for research products produced during doctoral program, respondents still scored low as the weighted mean for all the items ( $\bar{x}=1.86$ ) is lower than the criterion mean ( $\bar{x}=3$ ). Details showed that citation indices for existing published works had the highest mean ( $\bar{x}=2.74$ ) followed by scholarly presentation at local, national, regional and international conferences ( $\bar{x}=2.22$ ); research-based grants received ( $\bar{x}=1.95$ ); manuscripts accepted for publication in the form of a research study in a peer reviewed journal ( $\bar{x}=1.51$ ); manuscripts accepted for publication in the form of textbooks ( $\bar{x}=1.41$ ) while manuscripts accepted for publication in the form of book chapters recorded the lowest mean ( $\bar{x}=1.21$ ). Although, doctoral students still scored low in all the items, there was a slight improvement on citation indices for existing published work moving from the lowest mean before the commencement of doctoral program to the highest mean during the program. This improvement might not be unconnected with the positive impact of the whole gamut of doctoral education on the doctoral students. However, other research products like publication in the form of a research study in peer reviewed journal, book and chapter publications remained unchanged.

**Table 5: Research Components of Doctoral Program ( $\bar{x}=3.15$ ,  $SD=1.03$ )**

Research Activity	Not Applicable (1)	Repeat Presentation (2)	Accepted After Major Corrections (3)	Accepted After Minor Corrections (4)	Accepted without any correction (5)	Mean ( $\bar{x}$ )	SD
Thesis Post-field Presentation	5(1.8%)	7(2.5%)	43(15.1%)	106 (37.3%)	123 (43.3%)	4.18	0.901
Thesis Pre-field Presentation	62 (21.8%)	46 (16.2%)	103 (36.3%)	64 (22.5%)	9 (3.2%)	2.69	1.138
Seminar Presentations	64 (22.5%)	46 (16.2%)	123 (43.3%)	50 (17.6%)	1 (0.4%)	2.57	1.036
<b>Criterion Mean</b>						<b>5</b>	

Source: Field Survey (2022)

As shown in table 5, even for research components of their doctoral programs, doctoral students in universities in Ogun State still scored low as the weighted mean ( $\bar{x}=3.15$ ,  $SD=1.03$ ) is still lower than the criterion mean ( $\bar{x}=5$ ). A breakdown of the results showed that thesis post-field presentation had the highest mean ( $\bar{x}=4.18$ ) followed by thesis pre-field presentation ( $\bar{x}=2.69$ ) and seminar presentations ( $\bar{x}=2.57$ ). As shown in the result there were improvements from seminar works to pre-field and eventually post-field presentations where majority indicated that their post-field presentations were accepted without any correction. It could thus be inferred that number of years already spent on the program could mediate on the research productivity of doctoral students in universities in Ogun State, Nigeria as they seemed to improve upon previous performance.

**Research Question 2:** What is the level of information literacy proficiency of doctoral students in universities in Ogun State?

**Table 6: Information literacy level of doctoral students in universities in Ogun State**

S/N	Information Literacy Items	NP=1	BP=2	MP=3	P=4	HP=5	Mean	SD
<b>Information Search (<math>\bar{x}=4.1</math>, <math>SD=0.86</math>)</b>								
1	Find electronic sources of information (Library OPACs, e-databases, e-journals, etc.)	0	5 (1.8%)	35 (12.3%)	94 (33.1%)	150 (52.8%)	4.37	.766
2	Find printed sources of information (books, papers, etc.)	0	5 (1.8%)	31 (10.9%)	108 (38.0%)	140 (49.3%)	4.35	.744
3	Know information-search strategies (descriptors, Boolean operators, etc.)	0	2 (.7%)	31 (10.9%)	123 (43.3%)	128 (45.1%)	4.33	.695
4	Search for and retrieve internet information (advanced searches, directories)	6 (2.1%)	19 (6.7%)	63 (22.2%)	95 (33.5%)	101 (35.6%)	3.94	1.017
5	Use informal electronic sources of information (blogs, social media, wikis, listservs)	13 (4.6%)	20 (7.0%)	82 (28.9%)	92 (32.4%)	77 (27.1%)	3.70	1.082
<b>Information Evaluation (<math>\bar{x}=4.2</math>, <math>SD=0.75</math>)</b>								
6	Assess the quality of information resources	1 (.4%)	1 (.4%)	23 (8.1%)	142 (50.0%)	117 (41.2%)	4.31	.665
7	Recognize the author's ideas within the text	1 (.4%)	4 (1.4%)	45 (15.8%)	134 (47.2%)	100 (35.2%)	4.15	.759
10	Know the most relevant authors and institutions within your subject area	1 (.4%)	3 (1.1%)	44 (15.5%)	140 (49.3%)	96 (33.8%)	4.15	.739
8	Know the typology of scientific information sources (thesis, proceedings, etc.)	0	12 (4.2%)	43 (15.1%)	136 (47.9%)	93 (32.7%)	4.09	.801
9	Determine whether an information resource is updated	1 (.4%)	7 (2.5%)	52 (18.3%)	133 (46.8%)	91 (32.0%)	4.08	.794
<b>Information Processing (<math>\bar{x}=3.9</math>, <math>SD=0.876</math>)</b>								
14	Use bibliographic reference managers (Endnote, Reference Manager, etc.)	1 (.4%)	2 (0.7%)	18 (0.3%)	114 (40.1%)	149 (52.5%)	4.44	0.677
11	Systematically arrange and abstract information	1 (.4%)	7 (2.5%)	51 (18.0%)	146 (51.4%)	79 (27.8%)	4.04	.767
13	Use database managers (Access, MySQL, etc.)	10 (3.5%)	27 (9.5%)	66 (23.2%)	122 (43.0%)	59 (20.8%)	3.68	1.019

12	Recognize text structure	16 (5.6%)	41 (14.4%)	93 (32.7%)	101 (35.6%)	33 (11.6%)	3.33	1.041
<b>Information Communication and Dissemination (<math>\bar{x}=4.2</math>, <math>SD=0.688</math>)</b>								
17	Know the laws on the use of information and intellectual property	1 (.4%)	13 (4.6%)	110 (38.7%)	160 (56.3%)	0	4.51	0.621
15	Communicate in public	0	4 (1.4%)	12 (4.2%)	131 (46.1%)	137 (48.2%)	4.41	0.642
16	Know the code of ethics in your academic/professional field	1 (.4%)	2 (.7%)	27 (9.5%)	134 (47.2%)	120 (42.3%)	4.30	0.698
18	Create academic presentations (PowerPoint, etc.)	6 (2.1%)	12 (4.2%)	50 (17.6%)	119 (41.9%)	97 (34.2%)	4.02	0.938
19	Disseminate information on the internet (webs, blogs, etc.)	2 (0.7%)	4 (1.4%)	80 (28.2%)	198 (69.7%)	0	3.67	0.541
<b>Overall Weighted Mean</b>							<b>4.1</b>	
<b>Criterion Mean</b>							<b>3</b>	

NP (Not Proficient)=1; BP (Barely Proficient)=2; MP (Moderately Proficient)=3; P (Proficient)=4 and HP (Highly Proficient)=5

As shown in table 6, with an overall weighted mean ( $\bar{x}=4.1$ ) higher than the criterion mean ( $\bar{x}=3$ ), the information literacy level of doctoral students in universities in Ogun State is adjudged high. A closer look at the results also revealed that for all the subconstructs, doctoral students still scored high. For information search subconstruct with the highest mean ( $\bar{x}=4.37$ ), an item by item analysis showed that respondents' finding electronic sources of information (Library OPACs, e-databases, e-journals, etc.) recorded the highest mean ( $\bar{x}=4.37$ ). Others are finding printed sources of information (books, papers, etc.) ( $\bar{x}=4.35$ ); knowing information-search strategies (descriptors, Boolean operators, etc.) ( $\bar{x}=4.33$ ) and searching for and retrieving internet information (advanced searches, directories) ( $\bar{x}=3.94$ ). The implication is that doctoral students in universities in Ogun State considered themselves proficient at finding information from different sources which is the bedrock of research and its productivity. However, using informal electronic sources of information (blogs, social media, wikis, listservs) recorded the lowest mean ( $\bar{x}=3.70$ ) under information search items. This might just be a pointer to the fact that respondents were not aware of the importance of these alternative sources of information to boosting their research productivity. For instance, for scholars to increase the impact factor of their publications, such publications must be visible on these informal electronic sources of information which is known as almetrics.

Under information evaluation subconstruct with a weighted mean of ( $\bar{x}=4.2$ ), assessing the quality of information resources recorded the highest mean ( $\bar{x}=4.31$ ) while recognizing the author's ideas within the text and knowing the most relevant authors and institutions within your subject area followed with ( $\bar{x}=4.15$ ) each. Items bordering on determining whether an information resource is updated recorded the lowest mean ( $\bar{x}=4.8$ ). In this age of information overload with its concomitant tendency for misinformation, scholars not only require information search skills but more importantly, information evaluation skills that will enable them sift through the whole mass of available information. Results as shown in this table clearly indicated that doctoral students in universities in Ogun State were able to differentiate facts from fictions when it comes to information authentication. Further analysis of the results revealed that under

information processing subscale with a weighted mean of  $\bar{x}=3.9$ , item on the use of bibliographic reference managers (Endnote, Reference Manager, etc.) scored the highest mean ( $\bar{x}=4.44$ ) followed by item on systematically arranging and abstracting information ( $\bar{x}=4.04$ ), using database managers (Access, MySQL, etc.) ( $\bar{x}=3.68$ ) while item on recognizing text structure recorded the lowest mean ( $\bar{x}=3.33$ ). Because research builds on information, ability to process information meaningfully is a basic requirement for researchers especially in this information-driven age. As shown in the results, while it is apparent that doctoral students in universities in Ogun State scored high in information processing with a weighted mean of  $\bar{x}=3.9$  which is still higher than the criterion mean ( $\bar{x}=3$ ), it revealed some form of weaknesses among the respondents in their abilities to execute those information processing items.

Pertaining to information communication and dissemination subconstruct, doctoral students in universities in Ogun State scored high as indicated in the results. Taking a closer look at the items under it, results revealed that knowing the laws on the use of information and intellectual property scored the highest mean ( $\bar{x}=4.51$ ), closely followed by communicating in public ( $\bar{x}=4.41$ ), knowing the code of ethics in your academic/professional field ( $\bar{x}=4.30$ ) and creating academic presentations (PowerPoint, etc.) ( $\bar{x}=4.02$ ). The item pertaining to the dissemination of information on the internet (webs, blogs, etc.) recorded the lowest mean ( $\bar{x}=3.67$ ). It could be inferred from these analyses that doctoral students in universities in Ogun State recognized the sanctity of intellectual property rights and allied issue of plagiarism, can communicate well in the public and were aware of ethical consideration in the conduct of research. However, it could be gleaned from the result that they were not so proficient at creating academic presentation and disseminating information on the internet. These deficiencies one way or the other would have affected their research productivity.

**Research Question 3:** How do doctoral students at universities in Ogun State acquire their information literacy?

**Table 6 : Information Literacy Acquisition Methods of Doctoral Students in Universities in Ogun State**

	Item	SD	D	A	SA	Mean ( $\bar{x}$ )	SD
	Information literacy course	14 (4.9%)	30 (10.6%)	158 (55.6%)	82 (28.9%)	3.08	.766
	Info literacy workshops/seminars	25 (8.8%)	49 (17.3%)	116 (40.8%)	94 (33.1%)	2.98	.926
	Library orientation	39 (13.7%)	39 (13.7%)	127 (44.7%)	79 (27.8%)	2.87	.975
	Assistance from colleagues	28 (9.9%)	51 (18.0%)	138 (48.6%)	67 (23.6%)	2.86	.890
	Online Tutorials	69 (24.3%)	64 (22.5%)	97 (34.2%)	54 (19.0%)	2.48	1.058
	Training offered by my faculty/department	71 (25.0%)	64 (22.5%)	97 (34.2%)	52 (18.3%)	2.46	1.06
	One on one consultation with librarians	60 (21.1%)	73 (25.7%)	114 (40.1%)	37 (13.0%)	2.45	.966
	Self-help	83 (29.2%)	63 (22.2%)	106 (37.3%)	32 (11.3%)	2.31	1.013

Source: Field Survey (2022)

SA=Strongly Agree=5; A=Agree=4; D=Disagree=3; S=Strongly Disagree=4; D=Standard Deviation

As seen in table 6, in response to the research question bordering on how they acquire their information literacy, information literacy course being one of the options recorded the highest mean ( $\bar{x}$ =3.08). Coming on its heels was info literacy workshops/seminars ( $\bar{x}$ =2.98). Others were library orientation ( $\bar{x}$ =2.87), closely followed by assistance from colleagues ( $\bar{x}$ =2.86), online tutorials ( $\bar{x}$ =2.48), faculty/departmental training ( $\bar{x}$ =2.46), one on one consultation with librarians ( $\bar{x}$ =2.45) while self help recorded the lowest mean ( $\bar{x}$ =2.31). From indications, it seems doctoral students in universities in Ogun State acquired their information literacy through regular course experience. This underscores the need to sustaining existing information literacy programs across schools and constant review of information literacy curriculum to reflect the rapidly changing information landscape. Moreover, it might just confirm the belief that most students are adept at using ICTs but are not necessarily information literate.

**Research Question 5:** What is the frequency of critical thinking engagement of doctoral students in universities in Ogun State?

**Table 7 Frequency of critical thinking engagement of doctoral students in universities in Ogun State**

S/N	Critical Thinking Items	N (1)	R (2)	O (3)	A (4)	Mean ( $\bar{x}$ )	S D
<b>Analyticity <math>\bar{x}</math>=3.6, SD=0.559</b>							
1	I make sure that a piece of information is reliable before taking it into consideration	0	12 (4.2%)	85 (29.9%)	187 (65.8%)	3.62	.568
2	I am able to read between the lines, and find out any conflicting or contradictory statements in an article	0	5 (1.8%)	97 (34.2%)	182 (64.1%)	3.62	.521
3	I draw conclusions by logical thinking and methodological analysis	0	6 (2.1%)	102 (35.9%)	176 (62.0%)	3.60	.532
4	I am able to determine the value of a piece of information by evaluating the reasonableness of the conclusion accordingly	0	11 (3.9%)	101 (35.6%)	172 (60.6%)	3.58	0.586
5	I examine the pros and cons of each opinion I am exposed to	0	14 (4.9%)	97 (34.2%)	173 (60.9%)	3.56	0.588
<b>Inquisitiveness <math>\bar{x}</math>=3.6, SD=0.572</b>							
6	I try to learn as much as I can about a subject	0	6 (2.1%)	57 (20.1%)	221 (77.8%)	3.76	.476
7	I push myself very hard when trying to master a new idea	2 (.7%)	6 (2.1%)	91 (32.0%)	185 (65.1%)	3.62	.568
8	When solving a problem, I manage to keep myself updated with everything relevant	0	11 (3.9%)	86 (30.3%)	187 (65.8%)	3.62	.561

9	Before making an important decision, I make every effort to collect all relevant information	1 (.4%)	10 (3.5%)	96 (33.8%)	177 (62.3%)	3.58	.580
10	I always learn as much as possible even if I do not know when I will put it to use	1 (.4%)	15 (5.3%)	94 (33.1%)	174 (61.3%)	3.55	.613
11	I try to delve into anything, or any viewpoint, that is new and novel	1 (.4%)	16 (5.6%)	130 (45.8%)	137 (48.2%)	3.42	.615
<b>Open-mindedness <math>\bar{x}=3.7</math>, <math>SD=0.528</math></b>							
12	I feel comfortable learning from others		5 (1.8%)	54 (19.0%)	225 (79.2%)	3.77	0.459
13	I seek clarification for whatever I do not understand	0	5 (1.8%)	63 (22.2%)	216 (76.1%)	3.74	0.476
14	I will correct my viewpoint immediately when there is enough evidence to prove that it is biased.	1 (.4%)	9 (3.2%)	73 (25.7%)	201 (70.8%)	3.67	.554
15	When I am thinking, I am able to tolerate different viewpoints or opinions.	0	8 (2.8%)	81 (28.5%)	195 (68.7%)	3.66	.531
16	I take into consideration evidence that goes against my opinions	3 (1.1%)	7 (2.5%)	79 (27.8%)	195 (68.7%)	3.64	.587
17	During discussions, I am able to raise questions and respond to others' opinions while remaining calm.	0	10 (3.5%)	98 (34.5%)	176 (62.0%)	3.58	.561
<b>Systematicity <math>\bar{x}=3.7</math>, <math>SD=0.531</math></b>							
18	I assess information/situations systematically and comprehensively	0	3 (1.1%)	77 (27.1%)	204 (71.8%)	3.71	.478
19	Before deciding on a course of action, I consider multiple ideas, explanations and solutions	1 (.4%)	3 (1.1%)	81 (28.5%)	199 (70.1%)	3.68	.510
20	When finding solutions, I identify both problems and their underlying cause(s)	2 (.7%)	6 (2.1%)	79 (27.8%)	197 (69.4%)	3.66	.557
21	Having assessed available information, I draw reasonable conclusions — giving evidence to support them	0	6 (2.1%)	86 (30.3%)	192 (67.6%)	3.65	.519
22	When presented with information, I recognize missing links	1 (.4%)	11 (3.9%)	101 (35.6%)	171 (60.2%)	3.56	.589
<b>Truth-seeking <math>\bar{x}= 3.6</math>, <math>SD=0.567</math></b>							
23	Before deciding to take action, I creatively explore multiple possible solution paths	0	11 (3.9%)	89 (31.3%)	184 (64.8%)	3.61	.563
24	When presented with new information, I judiciously revise decisions as appropriate	0	9 (3.2%)	95 (33.5%)	180 (63.4%)	3.60	.551

25	In making judgments, I fully and accurately interpret the data used	0	9 (3.2%)	98 (34.5%)	177 (62.3%)	3.59	.553
26	I clearly and concisely frame problems being addressed	0	11 (3.9%)	116 (40.8%)	157 (55.3%)	3.51	.573
27	When solving a problem, I properly identify relevant ethical and legal criteria to use	0	15 (5.3%)	111 (39.1%)	158 (55.6%)	3.50	.597
<b>Overall Weighted Mean</b>						<b>3.62</b>	
<b>Criterion Mean</b>						<b>2.5</b>	

Source: Field Survey (2022)

N (Never)=1; R (Rarely)=2; O (Occasionally)=3; A (Always)=4; SD= Standard Deviation

Decision Rule: Critical thinking is low if overall weighted mean is lower than criterion mean

As shown in table 7, with an overall weighted mean of ( $\bar{x}=3.62$ ) that is higher than the criterion mean ( $\bar{x}=2.5$ ), critical thinking engagement of doctoral students in universities in Ogun State is considered high. Measured from five (5) dimensions, the breakdown shows that analyticity subscale has a weighted mean of ( $\bar{x}=3.6$ ), with item mean ranging from the highest ( $\bar{x}=3.62$ ) for the items 'I make sure that a piece of information is reliable before taking it into consideration and I am able to read between the lines, and find out any conflicting or contradictory statements in an article' to the lowest ( $\bar{x}=3.56$ ) for the item 'I examine the pros and cons of each opinion I am exposed to'. Similarly, for inquisitiveness subscale with a weighted mean of ( $\bar{x}=3.6$ ), item mean ranging from the highest ( $\bar{x}=3.76$ ) for the item 'I try to learn as much as I can about a subject' to ( $\bar{x}=3.62$ ) for the items 'I push myself very hard when trying to master a new idea and when solving a problem, I manage to keep myself updated with everything relevant', Responses to the item 'I try to delve into anything, or any viewpoint, that is new and novel' polled the lowest mean under the subscale The trend is similar for open-mindedness subscale with a weighted mean of ( $\bar{x}=3.7$ ). Responses to the item 'I seek clarification for whatever I do not understand' polled the highest mean of ( $\bar{x}=3.74$ ) while responses to the item 'during discussions, I am able to raise questions and respond to others' opinions while remaining calm attracted the lowest mean ( $\bar{x}=3.58$ )

For systematicity sub-scale with a weighted mean of ( $\bar{x}=3.7$ ), item mean peaked from 'I assess information/situations systematically and comprehensively' ( $\bar{x}=3.71$ ); 'before deciding on a course of action, I consider multiple ideas, explanations and solutions' ( $\bar{x}=3.68$ ) and 'when presented with information, I recognize missing links; gains more data as needed' ( $\bar{x}=3.68$ ) been the lowest under systematicity subscale. As shown in the table, truth-seeking subscale recorded a weighted mean of  $\bar{x}=3.6$  and had item mean ranging from  $\bar{x}=3.61$  for the item 'before deciding to take action, I creatively explore multiple possible solution paths'; when presented with new information, I judiciously revise decisions as appropriate ( $\bar{x}=3.61$ ) to the lowest ( $\bar{x}=3.50$ ) for the item 'when solving a problem, I properly identify relevant ethical and legal criteria to use. As noted earlier, while it appeared that doctoral students in universities in Ogun State engaged in critical thinking always as gleaned from the analyses, results of their research productivity did not reflect this claim which could still be hinged on human tendency for bias in self-appraisal especially when there is no documentary evidence to ascertain the veracity of respondents' claims.

## Analysis and Presentation of Research Hypotheses

Ho<sub>1</sub>: Information literacy will not have significant influence on research productivity of doctoral students in universities in Ogun State

Table 8: Linear regression showing the influence of information literacy on research productivity of doctoral students in universities in Ogun State

Variables	<i>B</i>	<i>T</i>	<i>Sig.</i>	<i>R</i> <sup>2</sup>	<i>F</i> ( <i>df</i> )	<i>ANOVA</i> ( <i>Sig.</i> )
(Constant)	18.759	5.385	.000	0.076	4.582 (1,282)	.033
Information Search	-.145	-1.848	.066			
Information Evaluation	.086	.977	.330			
Information Processing	.259	3.015	.003			
Information Communication and Dissemination	-.059	-.753	.452			

Dependent Variable: Research Productivity

Predictor: Information Literacy

T Statistics = (283) 2.141

F Statistics (DF) =1, 282

Table 8 presents the regression result on the influence of information literacy on research productivity of doctoral students in universities in Ogun State. The result revealed that information literacy ( $R^2= 0.076$ ,  $F(1,282) = 4.582, p<0.05$ ) has significant influence on the research productivity of doctoral students in universities in Ogun State. The regression coefficient ( $R^2=.076$ ) indicates that information literacy could only account for 7.6% of the changes in their research productivity. By implication, other variables not included in this model may have accounted for the remaining variance. Consequently, the null hypothesis was rejected and restated thus: information literacy will have a significant influence on research productivity of doctoral students in universities in Ogun State, Nigeria. The import of this result, among others, is that the higher the information literacy possessed by doctoral students in universities in Ogun State, the greater will be their research productivity. On the relative contribution of the indicators, the result revealed that information processing ( $\beta=.259$ ,  $t=3.015$ ,  $p<0.05$ ), has significant influence on research productivity of the doctoral students while information search ( $\beta=-.145$ ,  $t=-1.848$ ,  $p=.066$ ), information evaluation ( $\beta=.086$ ,  $t=.977$ ,  $p=.330$ ), and information communication and dissemination ( $\beta=-.059$ ,  $t=-.753$ ,  $p=.452$ ) did not have any significant influence on research productivity.

Ho<sub>2</sub>: Critical thinking will not have significant influence on research productivity of doctoral students in universities in Ogun State

Table Table 9: Linear regression showing the influence of critical thinking on research productivity of doctoral students in universities in Ogun State

Variables	<i>B</i>	<i>T</i>	<i>Sig.</i>	<i>R</i> <sup>2</sup>	<i>F</i> ( <i>df</i> )	<i>ANOVA</i> ( <i>Sig.</i> )
(Constant)	19.895	4.609	.000	0.032	10.381 (1,282)	.320
Analyticity	.012	.141	.888			
Inquisitiveness	.035	.409	.683			
Open-mindedness	.032	.384	.701			
Systematicity	-.112	-1.142	.254			
Truth-seeking	.107	1.156	.249			

Dependent Variable: Research Productivity

Predictor: Critical Thinking

T Statistics = (283) 3.129

F Statistics (DF) =1, 282

Table 9 revealed a significant influence of critical thinking on research productivity of doctoral students in universities in Ogun State ( $R^2 = 0.032$ ,  $F(1, 282) = 10.381$ ,  $p < 0.05$ ), although only 3.2% of the variation in research productivity of doctoral students was accounted for by critical thinking (adjusted  $R^2$  of 0.032). This connotes a low contribution from critical thinking to modification in research productivity of doctoral students. It is evident that other variables not included in this model may have accounted for the remaining variance. Consequently, the null hypothesis was rejected and restated thus: critical thinking will have significant influence on research productivity of doctoral students in universities in Ogun State, Nigeria. The import of this result, among others, is that the higher the critical thinking engagement of doctoral students in universities in Ogun State, the greater will be their research productivity. Similarly, on relative contribution of the indicators, the result revealed that the indicators of critical thinking had no individual contribution to the changes in research productivity of doctoral students in universities in Ogun State.

Table 10 :Regression Analysis showing the joint effect of the independent variables (information literacy and critical thinking) on research productivity of doctoral students in universities in Ogun State

A N O V A							
Model	Sum of Squares	DF	Mean Square	F	Adj. R <sup>2</sup>	Sig.	Remark
Regression	1815.911	3	605.304	9.207	0.090	0.000	Sig.
Residual	18409.113	280	65.747				
Total	20225.025	283					

Dependent Variable: Research productivity

Predictors: (Constant), information literacy, research self-efficacy

As shown in Table 10, the joint effect of the independent variables (information literacy and critical thinking) on the research productivity of doctoral students in universities in Ogun State was significant. The result also showed a coefficient of multiple correlations ( $R = 0.300$ ) and a multiple  $R^2$  of 0.09. This means that 9% of the variance was accounted for by the predictor variables when taken together. The significance of the composite contribution was tested at  $p < 0.05$ . The table also showed that the Analysis of Variance (ANOVA) for the regression yielded an F-ratio of 9.207 (significant at 0.05 level). This implies that the joint contribution of the independent variables to the dependent variable was significant and that other variables not included in this model may have accounted for the remaining variance. Consequently, the null hypothesis was rejected and restated thus: information literacy and critical thinking will jointly influence research productivity of doctoral students in universities in Ogun State, Nigeria. The import of this result, among others, is that the higher the information literacy and critical thinking possessed by doctoral students in universities in Ogun State, the greater will be their research productivity.

## Resultant Model

### Independent Variables

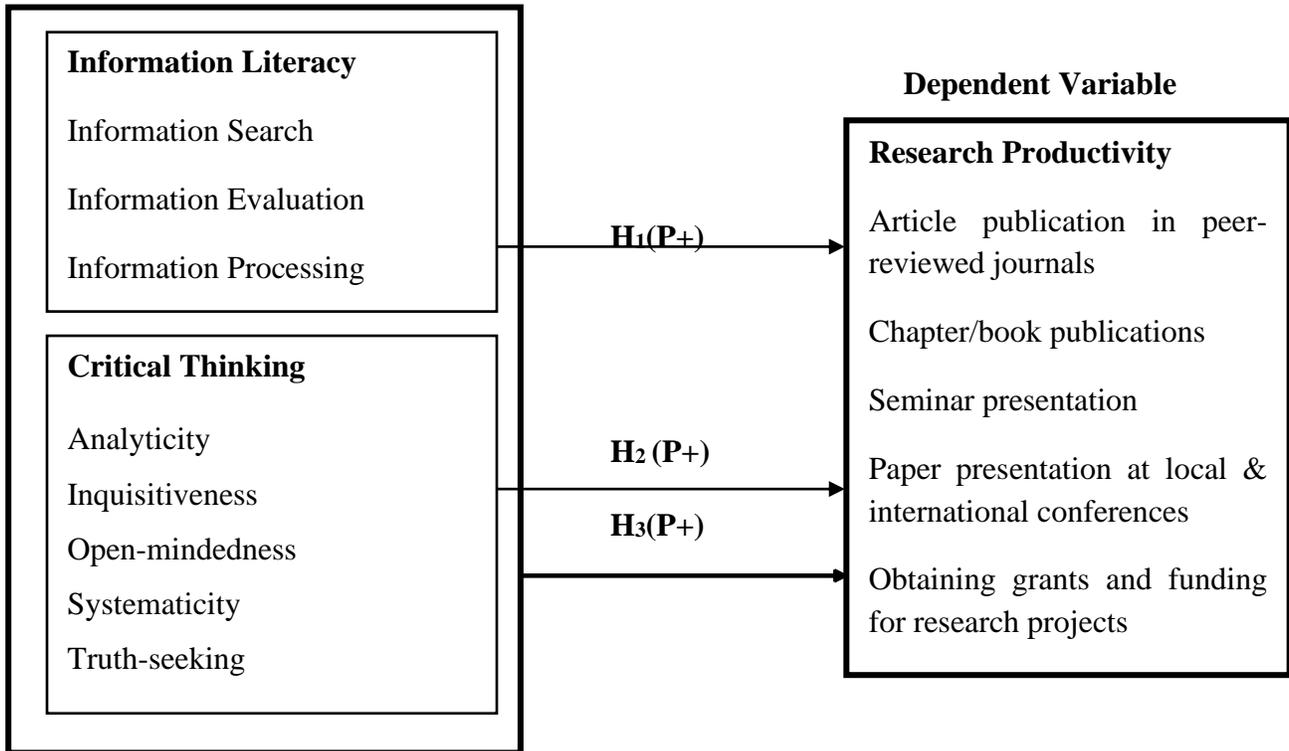


Figure 2.3: Conceptual model of Information Literacy,

Source: Adekunle & Madukoma (2022)

The resultant model (Fig.1) shows that information literacy had positive influence on the research productivity of doctoral students in universities in Ogun State, contrary to formulated null hypothesis consequent upon which the null hypothesis was rejected and restated that information literacy will significantly influence research productivity of doctoral students in universities in Ogun State, Nigeria. Similarly, the resultant model also showed that the second null hypothesis formulated was rejected and restated thus: critical thinking will significantly influence research productivity of doctoral students in universities in Ogun State, Nigeria. Finally, the third hypothesis was also rejected and restated that information literacy and critical thinking will jointly influence research productivity of doctoral students in universities in Ogun State, Nigeria.

### Discussion of Findings

This study assessed the influence of information literacy and critical thinking on research productivity of doctoral students in universities in Ogun State. This section presents findings and discussion of the study in line with related studies.

Findings from this study revealed that research productivity of doctoral students in universities in Ogun State, Nigeria is low. For scholarly presentation at local, national, regional and international conferences, 169 (59.9%) of the respondents produced between 0-2 before the commencement of their doctoral studies which fell below the criterion mean of 3. The same applies to manuscripts accepted for publication in the form of book chapters and citation indices for existing published works with 258 (90.8%) and 254 (89.4%) respondents falling below the

criterion mean respectively. This was corroborated by the studies of Poh, Bin and Abdullah (2019) as well as Niehaus, Garcia and Reading (2018) which reported low research productivity among a cohort of doctoral students in Malaysia and the United States with majority of the participants struggling to complete their thesis. Specifically, McGaskey (2015) found that despite their rising number, Black doctoral students exhibited low research productivity in terms of presentation, submission and publication output with stage in doctoral program playing a significant role in students' research output where those at the dissertation stage were found to have presented, submitted and published than those still taking courses. Similarly, Chesnut, et al. (2015) further confirmed that level of study indeed influenced research productivity of doctoral students.

In Nigeria, studies like Pelemo, et al. (2020), Afolabi and Oladokun (2020), Oyedokun, et al. (2019), as well as Obaseki and Agu (2019) had established low research productivity among study sample. Findings from Afolabi and Oladokun (2020) showed that despite the availability of information resources, sampled academics from Lead City University scored low in research productivity while inference drawn from Pelemo, et al. (2020) indicated that research productivity of doctoral students at Federal University of Abeokuta was low in terms of research output where majority (90.7%) of the respondents had challenges completing their dissertations and theses. Also, Iwara (2019) reported low research publication output among doctoral students in Southern Africa where less than five out of the 32 study participants had published a research article within a year. Also, Yazon, Ang-Manaig, Buama and Tesoro (2019) in a study of academics across selected institutions in Philippines revealed that only two, out of the seven colleges surveyed showed moderate research productivity based on the study's pre-determined productivity index. Furthermore, Oyedokun, et al. (2019) showed that despite possessing high information literacy skills and scoring high in general research competence, respondents scored low in handling research methodology, data analysis and discussions of findings.

However, Nwosu, Obiamalu and Udem (2019) and Anekwe (2018) reported high research productivity among respondents who were faculty members. In addition, studies like Horta and Santos (2016) as well as Pasupathy and Siwatu (2014) also established high research productivity among respondents. Results from Horta and Santos (2016) showed that those who published during Ph. D. program had greater research production and productivity and greater numbers of yearly citations throughout their career compared to those who did not publish during Ph. D. program. In Pasupathy and Siwatu (2014), respondents who were faculty members were more productive in presenting at conferences and less productive in publishing manuscripts in the form of book chapters. The differences in findings might just be as a result of differences in study respondents. Likewise, Okiki (2013) revealed that the research productivity of academics from selected universities in Nigeria was high particularly those in the North East and South West of Nigeria. As revealed in the results, it was only at the thesis post-field presentation that 106(37.3%) respondents indicated that their theses were accepted after minor corrections while 123 (43.3%) indicated that their theses were accepted without any correction. This improvement according to Chesnut, et al. (2015) was attributable to positive course experiences, mentoring and research training environment.

Concerning the level of information literacy possessed by respondents, findings revealed that doctoral students in universities in Ogun State possessed high level of information literacy. This finding was corroborated by Oyedokun, et al. (2019) which revealed that postgraduate students in Olabisi Onabanjo University (OOU), Ago-Iwoye and Federal University of Agriculture, Abeokuta (FUNAAB), Nigeria possessed high information literacy skills. Also, Nwosu, Obiamalu and Udem. (2015) showed that information literacy skills possessed by respondents were moderate. Okiki, (2013) in a study involving faculty members from selected universities in

Nigeria reported that information literacy skills of academics in Nigerian federal universities were high and contributed significantly to their high research productivity. However, several other studies contradicted the current study. These included Pelemo, et al. (2020); Afolabi and Oladokun (2020); Banik and Kumar (2019); Anekwe (2018); Rezaee, et al. (2016) as well as Omeluzor, et al. (2013). In Pelemo, et al. (2020) as well as Afolabi and Oladokun (2020), sampled postgraduate students and faculty members were reported to possess low information literacy with majority of them unable to access library automated catalogue unless assisted by a librarian. Finding from Banik and Kumar (2019) showed that most of the participants scored low in information literacy skill which precipitated poor academic performance. While Anekwe (2018) found that web-based information literacy had enhanced research productivity of academics in both federal and state universities studied, respondents were reported to have scored low in web-based information literacy competence. Furthermore, findings from Rezaee, et al. (2016) and Omeluzor, et al. (2013) demonstrated that students did not have enough ability and skill in all five standards of information literacy skills, scoring below average.

For critical thinking abilities, findings of the study revealed that doctoral students in Ogun State universities possessed a high level of critical thinking abilities. This finding was supported by Liao and Wang (2016) as well as Holmesa, Wiemana and Bonn (2015) that found that students exposed to critical thinking learning methods were twelve (12) times better than a control group, under the traditional learning methods. Similarly, Nold (2017) as well as Petrucco and Ferranti (2017) in separate quasi-experimental studies indicated tremendous improvement in participants' research skills after they were exposed to extensive critical thinking sessions.

Furthermore, the test of hypothesis revealed a positive and significant relationship between information literacy and research productivity of doctoral students in universities in Ogun State ( $R^2 = 0.076$ ,  $F(1,282) = 4.582, p < 0.05$ ). This implies that an increase in information literacy will lead to a rise in research productivity among doctoral students in universities in Ogun State. This position was supported by Afolabi and Oladokun (2020); Pelemo, et al. (2020); Oyedokun, et al. (2019); Yazon, Ang-Manaig, Buama and Tesoro (2019); Banik and Kumar (2019); Anekwe (2018) as well as Nwosu, Obiamalu and Udem (2015). Findings from these studies showed that information literacy skills positively influenced research productivity of the respondents. However, Udem and Anaehobi (2020) revealed a negative relationship between information literacy skills and research self-efficacy scores of LIS postgraduate students in Southeast Nigerian Universities indicating that LIS postgraduate students' information literacy skills acquisitions had an inverse relationship with their research self-efficacy. Similarly, Simisaye and Popoola (2019) in a study establishing the relationship between information literacy skills and research productivity of researchers in Nigeria found an indirect relationship between information literacy skills and research productivity of the respondents with socio-economic factors (monthly salary, academic status, age, highest educational qualification, work experience and employment nature) having mediating effects on the relationship between respondents' information literacy skills and research productivity.

On critical thinking and research productivity of doctoral students, test of hypothesis showed a positive and significant relationship between critical thinking and research productivity of doctoral students in universities in Ogun State ( $R^2 = 0.032$ ,  $F(1,282) = 10.381, p < 0.05$ ). This implies that as critical thinking increases, research productivity of doctoral students in universities in Ogun State also improves. This is confirmed by Liao and Wang (2016) which established a positive and significant relationship between critical thinking skills and students' academic performance and by implication, research productivity. Likewise, Petrucco and Ferranti (2017) in a mixed methods study revealed that critical thinking laboratory sessions significantly boosted the research skills of participants. In the same vein, Nold (2017) in an

action research project indicated significant relationship between critical thinking experimental sessions and participants' academic improvement and by extension research productivity..

According to the findings of the study, the joint effect of the independent variables-- information literacy and critical thinking on the research productivity of doctoral students in universities in Ogun State was significant (Adj.  $R^2=.090$ ,  $F(3,280)=9.207$ ,  $p<0.05$ ). This means that 9% of the variance was accounted for by the predictor variables when taken together. The significance of the composite contribution was tested at  $p<0.05$ . The table also shows that the Analysis of Variance (ANOVA) for the regression yielded an F-ratio of 9.207 (significant at 0.05 level). This implies that the joint contribution of the independent variables to the dependent variable was significant and that other variables not included in this model may have accounted for the remaining variance.

## **Conclusion**

The study which examined the influence of information literacy and research self-efficacy on the research productivity of doctoral students in universities in Ogun State has succeeded in establishing the fact that the research productivity of the respondents was indeed low. In addition, information literacy was found to have positive significant relationship with research productivity of doctoral students in universities in Ogun State, Nigeria. Consequently, learning environment that fosters further development of information literacy should be maintained. Universities should strive to always update academic curriculum to reflect the ever dynamic information landscape. Seeing the importance of research and its continued production to the prosperity of a nation in general and the sustenance of scholarship in particular, attention should be focused on unveiling the predictors of research productivity of doctoral students.

## **Recommendations**

The following recommendations are made based on the findings of the study:

### **Research Mentorship**

Faculty should ensure that every doctoral student have access to a faculty advisor or mentor who is approachable and accessible. This will provide doctoral students with a roadmap for practice and constructive feedback. By strengthening doctoral students-faculty relationships, more opportunities arise for aspiring researchers to learn the general practices and procedures for conducting and designing studies, collecting and analyzing data, and writing a well-organized manuscript.

### **Strengthening Research Capacity and Productivity of Doctoral Students**

Policy makers and university administrators should focus on building the research capacity of doctoral students by exposing them to periodic trainings, workshops, tailored course works, conference attendance and research collaboration with experienced researchers and teams.

### **Building Positive Course Experiences**

Universities should engage in periodic review of academic curriculum that will be at par with changing times. Also, since the process of grooming and nurturing competent and productive researchers is a major goal of doctoral education, faculty should ensure good teaching, appropriate assessments, set clear goals and standards and appropriate workload that will create time and space for research.

## **Research Funding**

In recognition of the importance of research and its productivity to the wellbeing of a nation, government should increase funding to education and by extension research activities of doctoral students most of whom may be financially handicapped. Existing funding arrangement should be well publicized and made easily accessible to doctoral students. Experienced faculty members should also be involved in connecting their students to funding agents and grooming them to come up with winning proposals. Moreover, doctoral education could be offered free as a form of encouragement to indigent students.

## **Sustaining and Improving Existing 21<sup>st</sup> Century Skills**

Information literacy has been recognized as a 21<sup>st</sup> century skills and considered important educational outcome. Universities therefore should constantly strive to sustain and possibly improve upon existing training platforms to ensure that doctoral students remain relevant and up-to-date in an ever changing and dynamic information society. Periodic workshops, seminars and hands-on-practical sessions should be organized while student-centered teaching and learning methods should be encouraged.

## **Suggestions for Further Studies**

The current study investigated the influence of information literacy and research self-efficacy on the research productivity of doctoral students in universities in Ogun State. To further broaden this area of research, the following are suggested for further studies:

1. Conduct a qualitative investigation of information literacy, research self-efficacy, critical thinking and research productivity of doctoral students. This may unveil more in-depth data not captured in the current study.
2. The current study can also be replicated in other states of the nation and other parts of the world as research productivity and its predictors cut across nations
3. Further studies can investigate other combinations of research productivity predictors

## **Limitations of the Study**

### **Covid-19 and its Effect on Academic Institutions**

The devastating and disruptive effect of the dreaded COVID-19 took its toll on the administration of the research questionnaire. Doctoral students who were the respondents of the study were not physically accessible in the participating universities.

### **Societal Apathy**

Societal apathy for research and knowledge rubbed off greatly on data collection. There was so much disdain for research even among learned people.

### **Data Objectivity**

Another limiting factor is bias associated with self reported data. Studies have established human tendency to overestimate themselves when prompted for self-assessment especially those that have to do with competence and thinking abilities.

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