International Journal of Arts Humanities and Social Sciences
Volume 4 Issue 3 ǁ April 2019.
www.ijahss.com

Assessment of Statistical Literacy of Post-Graduate Students in The University Of Port Harcourt

OKORIE, ESTHER NNENNA , INKO-TARIAH, DOROTHY. C. (PhD)
Department of Educational Psychology, Guidance and Counselling, Faculty of Education, Ignatius Ajuru Unive rsity of Education, Port Harcourt, Rivers State, Nigeria.

ABSTRACT: *This study investigated the extent certain demographic variables determine the level of statistical l iteracy among postgraduate students at the University of Port Harcourt. The demographic variables considered included gender, academic level and subject discipline. Three research questions and their corresponding null h ypotheses guided the study. The study adopted the ex post facto research design using a sample of 365 graduate students drawn through stratified random sampling technique. Data for the study was collected using an adapte d Wade (2009) Statistics Literacy Questionnaire, validated by experts in measurement and evaluation. The instr ument was shown to possess suitable reliability of 0.78 using Cronbach Alpha technique. Data analysis was don e using mean and standard deviation for the research questions, while independent t-test and one- way ANOVA were used to analyze the hypotheses. Results revealed that male students had a significantly higher level of stati stical literacy than female students, doctoral students had the highest level of statistical literacy in terms of acad emic level, while science students had the highest reported level of statistical literacy. On the basis of the results Obtained, recommendations were made*

Key words: *Assessment, statistical literacy, statistical reasoning, statistical thinking.*

I. Introduction

Developing and promoting a statistical literate citizenry has been a fundamental pursuit of most develo ped nations as documented in their official educational curriculum including New Zealand (New Zealand Minist ry of Education, 2007) and the United State of America (National Council of Teachers of Mathematics, 2010). S imilarly, the Australian Bureau of Statistics has as its mission the need to promote statistical literacy to directly s upport "informed and increased used of statistics among the Australian people (Australian Bureau of Statistics, ND).In Nigeria, statistical literacy is essential if the primary goal of the National Bureau of Statistics (NBS) whi ch is the "dissemination of statistical data with a wide range of functionalities" will be achieved (NBS, 2015).

The general goal of promoting statistical literacy has been well documented, however as Ben-Zvi and Garfield (2004: 175-186) stated:

Quantitative information is everywhere and statistics are increasingly presented as a way to add credibility to ad vertisements, arguments and advice. Being able to learn to properly evaluate evidence (data) and claims based o n data is an important skill that all post graduate students should learn as part of their educational program, yet many research studies indicate that adults in mainstream society cannot think statistically about issues that affect them.

Although statistical information has been available in print and electronic media, the advent of ICT faci lities, expansion of the internet and the proliferation of social media sites and applications has increased the volu me and frequency of statistical information individuals are exposed to. On social media platforms especially, sta tistical messages regarding health, education, politics, economy, employment, family, relationships etc. are usua lly present. The magnitude and frequency of the information are overwhelming and processing them is even mor e daunting. Yotongyous, Ivaiwichitkhem and Kaemkate (2015) observed that some of this information may be i naccurate and even deliberately misleading. However, many individuals including post-graduate students conclu de that because specific statistical information is in a print newspaper, reported by an electronic news agency or cable network, or stated by a popular person, it is credible and factual, which often leads to poor decision makin g. Being statistically literate therefore is essential as it equips an individual to utilize statistical information critic ally in this present information age (Rumsey, 2002).

To this end, universities and other tertiary institutions have made introductory statistics courses compul sory, especially for those enrolled in educational-related fields or programs. At the undergraduate level at the Un iversity of Port Harcourt, a faculty-wide course titled *Basic Statistics and Research Methods* is taken which aims at helping students understand the relevance of research and statistics to their everyday experiences. Similarly, at the post-graduate level in the Faculty of Education, the six departments' currently running educational progra ms and the Institute of Education, have as part of their requirements for graduation, a pass in the course aimed at

improving students skills in statistical concepts, ideas and methodologies. However, findings from the Guidelin es for Assessment and Instruction in Statistics Education by the American Statistical Association (ASA, 2005) h as shown that emphasis on acquiring statistical knowledge does not translate to statistical literacy. This is becaus e as stated by Yotongyos et al (2015), policies on compulsory introductory courses are only focused on knowled ge, concepts and processes of statistics even in the post-graduate education program, but they do not access or pr omote statistical literacy. It therefore, becomes imperative to ask: assess the statistical literacy of post-graduate s tudents?

II. Conceptualizing Statistical Literacy

Despite the importance and emphasis on statistical literacy, defining it has remained problematic for tw o major reasons as stated by Garfield and Ben-Zvi (2007): (i.) the field is relatively new (ii) research on the field seems fragmented because of the wide array of disciplines focused on the area such as psychology, science edu cation, adult education, economics, mathematics education, educational technology etc. This broad nature and di fficulty in defining statistical literacy even leads to seemingly neglect of the term by the American Statistical As sociation in the second Guidelines for the Assessment and Instruction in Statistical Education (ASA). These chal lenges notwithstanding, attempts have been made to operationalize statistical literacy within policy documents a nd empirical investigations with a few briefly reviewed here.

One of the earliest definition of the term statistical literacy was offered by Walker (1951) in which he d efined the term as the ability of a social scientist to use quantitative language. To Wallman (1993), in activity-ba sed approach, statistical literacy is defined as the ability to understand and critically evaluate statistical results th at permeate our daily lives coupled with the ability to appreciate the contributions that statistical thinking can m ake in public and private, professional and personal decisions. Adopting the same approach, Chick, Pfannkuch a nd Watson (2005) viewed statistical literacy as the ability to make sense of and use of different representation of data to make sense of the world around them. Schield (1999) adopted a critical-thinking based definition in whi ch he defined statistical literacy as the ability to read and interpret data and the ability to think critically about st atistics as evidence in arguments. Using a content-based definition, GAISE (2005) defined statistical literacy as understanding the basic language of statistics (e.g. knowing what statistical terms and symbols mean and being a ble to read statistical graphs) and fundamental ideas of statistics.

For Garfield, delMas and Zieffler (2010) statistical literacy is conceptualized differently from closely used terms like statistical reasoning and statistical thinking. In clear terms, Garfield, delMas and Chances in Ben-Zvi and G arfield (2007:2) gave the following

- **Statistical literacy** as including basic and important skills that may be used in understanding statistical information or research results such as organizing tables, understanding statistical vocabulary;
- **Statistical reasoning** refers to the method where people use statistical ideas to make sense of statistical information, while;
- **Statistical thinking** involves an understanding of why and how statistical research is carried out as well as the big ideas that guide statistical investigations

To these scholars, statistical literacy is the least complex while statistical thinking is the most complex. The y also used words such as 'critique', 'evaluate' and 'generalize' (which corresponds to the highest level of Bloom's taxonomy) to describe it.

The conceptualization of statistical literacy which this study hinges on is that provided by Gal (2004) which used an ability- and thinking-based approach. In the definition presented as summarized by Sharma (2017), stati stical literacy refers to:

People's ability to interpret and critically evaluate statistical information, data-regulated arguments…to discuss o r communicate their reactions to statistical information, such as their understanding of the meaning of the informa tion, their opinions about the implications of the information, or their concerns regarding the acceptability of give n conclusions In this definition, some components of statistical literacy are worthy of further expatiations, especia lly in relations to students enrolled in a postgraduate program.

i. Statistical literacy involves the ability to evaluate critically: Each day, individuals in any society are confronted with a large volume of information, which often needs not only to be processed immediately but accessed for value and implications. This information comes in the form of medical breakthroughs, crime rates, emergence of new diseases, or spread of new ones, population growth, election result, pollution trends, employment status of youth, educational attainment, marriage and family dynamics, competitions, performances, etc. These messages and information often come with statistical 'evidence' and backings which

are expected to add to the credibility of the information. More so, in the university environment and postgraduate programs, students not only generate data in their areas of specialization but consume statistical data from other fields on recent advances in scientific, cultural and economic fields. All these underscore the importance of critically evaluating statistical information.

ii. Ability to discuss or communicate the conclusions of findings in social situations. Using knowledge critical from statistical messages to engage socially with others is a fundamental aspect of the proposition (Gal, 2004). Postgraduate education programs require students to synthesize information from statistically relevant domains to draw conclusions and then present the same to the university community as contributions to knowledge and advancement in their fields

On the basis of these fundamental elements as proposed by Gal (2004), this study uses this model of statistic al literacy as the framework for this study, which is succinctly presented below.

III. Gal Framework of Statistical Literacy

Due to the ubiquitous availability of statistical-laden information and messages, Gal (2002, 2004) sees i ndividuals as "data consumers" in diverse life contexts. These contexts include for example "when people are at home and watch TV or read a newspaper when they look at advertisements while shopping, visit internet sites, p articipate in community activities…listen to reports at work" (Gal, 2002:3). As data consumers, two broad comp onents interacts dynamically to enable them to understand, analyze, critically evaluate, react, utilize and commu nicate statistical messages encountered in everyday life. These broad components and their respective elements are:

i. Knowledge components, and
ii. Dispositional components

Knowledge components comprise of literacy skills, statistical knowledge base, mathematical knowledge base, c ontextual knowledge base and critical questioning skills. The dispositional components comprise critical stancbe liefs and attitudes. A figurative representation of the model is presented below

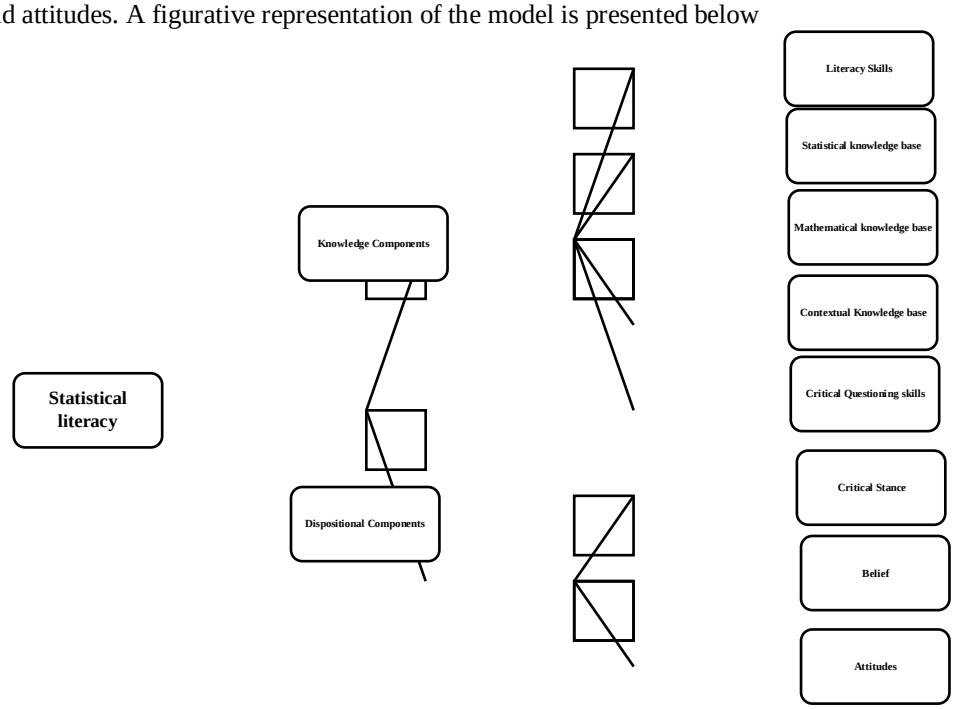

Fig 1: Gal (2002) Model of Statistical literacy.

IV. Knowledge elements

- **Literacy skills:** In the real world, most statistical messages are conveyed through a written or oral medium and demands that readers navigate through graphical or tabular information. Understanding these messages requires text-processing skills which are dependent on an individual's ability to read meaning to everyday language (both written an oral) and/or previous knowledge of technical terms in a broad range of disciplines.

- **Statistical knowledge base:** Comprehending, as well as interpreting messages with statistical imports requires knowledge of rudimentary statistical and probabilistic terminologies and procedures. In this direction, Gal (2002:9) stated that essential statistical topics that are familiar and aid statistical literacy include: number sense, understanding variables, interpreting graphs and tables, planning a survey or designing an experiment, method of data collection and questionnaire design, data analysis procedures, relationship between probability and statistics, inferential reasoning such as hypotheses testing. However, Gal(2002) emphasized that the list is not a yardstick for identifying statistical knowledge base but should be understood and discussed within the context and unique demographic milieu of operations.
- **Mathematical knowledge base:** The tension and interrelationship between mathematics and statistics have been well addressed by Moore and Cobb (2002) and it has been confirmed that some knowledge of mathematics is essential for statistical literacy. However, the level of mathematical knowledge needed to understand statistics has not been fully resolved, as such any assumptions or suggestions made here should not be seen as a matter of fact, but seen as a guide and be treated with caution. Citing Cobb and Moore, Gal (2002) stated that while statistics makes heavy use of mathematics, statistical literacy should focus on statistical ideas, not on mathematical theories. Some mathematical knowledge needed for a moderate level of statistical literacy includes per cent, fractions, mean, rank and ratio.
- **Context knowledge:** The importance of understanding messages in context cannot be overemphasized. Similarly, statistical messages achieve greater comprehension and interpretation when looked from the context of data generation processes such as study design, sampling plan, instrumentation, method of data analysis and procedure. Details and clarity of these procedures are essential for comprehending statistical information.
- **Critical questioning skills:** The statement that "statistics are no substitute for judgments" attributed to Henry Clay succinctly highlights the importance of critical thinking in statistical literacy. Most statistical-laden information is generated and driven by political, economic, social and religious agenda, as well as produced by various sources such as politicians, journalist, manufacturers, or advertisers. These agendas are seldom aimed at promoting balanced and objective reportage of findings. Therefore critical questioning skills entail ascertaining the validity of the message, credibility of the source, veracity of conclusion presented and reflectively look for plausible alternative interpretations. Ability to deliberately and consciously engage in these processes contributes to and promotes statistical literacy.

These five knowledge components highlighted here do not exist in isolation or operate independent or acts sequ entially. They do overlap and work dynamically to aid understanding, interpretation and judgment of messages t o enhance statistical literacy.

V. Dispositional Component of Statistical Knowledge

In most definitions of statistical literacy (Wallman, 2003; Watson, 2006, α Watson & Callingham, 200 3) a common definitional thread that cuts across is the evaluative component, which implies not just a passive c omprehension and evaluation of statistical information, but also evaluating the information to identify the extent to which the conclusion reached is built upon proper statistical foundation and follow requisite statistical proced ure. Also beyond evaluative stance, statistical literacy involves taking action based on the information. The actio n taken may be overt such as buying a product more, eating less of a particular food, waking up early, exercising more or discussing the findings of statistical research with family, peers and colleagues.

As used by Gal (2004), the term disposition is used to represent three constructs that are related but di stinct: critical stance, belief and attitude. *Critical stance* refers to the deliberate questioning of interpretations, fi ndings or conclusion from theoretical or empirical research or any other statistical assertions. *Belief* refers to opi nions or ideas about a domain, while attitude refers to relatively stable positive or negative emotional response t owards that statistical domain (e.g. government, politics and advertisement). As adults, post-graduate students, especially those in education, are exposed to advanced statistical instruction which they are expected to pass as part of the requirements for their graduation. This instruction in statistical knowledge acquisition is expected to i mprove their ability to conduct advance independent research involving statistical investigations. Implied also is that the statistical instruction they receive should aid their statistical literacy. While these students often take the ir semester examinations in statistical courses, this effort is limited to only course-based material with little atte mpt at transferring the knowledge gained to making both "public and private, professional and personal decision s".

Previous attempts have been made by researchers to investigate the statistical literacy of students using other po pulations. Using statistical information found in media, Martinez-Dawson (2013) found out that a statistical liter acy course significantly improved the ability of 144 undergraduate students to understand the implication of the

information in their everyday life. Reston (2005) further found that among 56 graduate students in the Philippine s who were registered for an education programme, the level of statistical literacy was poor. Among 111 undergr aduate students in the United States, Wade and Goodfellow (2009) obtained that students who had taken a resear ch method course before had significantly better performance in statistical literacy than those who had not taken a research method course. Among undergraduate education students in Thailand, Yotongyos et al (2014) found out that students had a high level of literacy and mathematical knowledge, moderate level of statistical knowled ge and critical questioning, low level of contextual knowledge base, while moderate level was obtained in the di spositional components. It can, therefore, be seen that extensive empirical work has been done in the area of stu dents' statistical literacy. However, to the best of these researchers' knowledge, not much has been done in Nige ria, hence the present study to investigate statistical literacy of post graduate students of University of Port Harc ourt.

VI. Research Questions

Three research questions guided the present study:

1. To what extent does gender make a difference in the statistical literacy of post graduate students at the University of Port Harcourt?
2. To what extent does academic level make a difference in the statistical literacy of post graduate students at the University of Port Harcourt?
3. To what extent does subject discipline make a difference in the statistical literacy of post graduate students at the University of Port Harcourt?

Hypotheses

The following hypotheses which were tested at 0.05 significance level were further used to guide the study

1. Gender does not make any significant difference in the level of statistical literacy of post graduate students at the University of Port Harcourt.
2. The academic level does not make any significant difference in the level of statistical literacy of pos graduate students at the University of Port Harcourt.
3. Subject discipline does not make any significant difference in the level of' statistical literacy of post graduate students at the University of Port Harcourt.

VII. Methodology

Design: The study adopted the ex-post facto research design. Participants for the study were drawn from all 167 01 students registered in the School of Graduate Students during the 2017/2018 academic session. Furthermore, only students who were at the research proposal stage were used for the study. This was to ensure that they have already completed their course works and must have undertaken an advanced research methods course. A sampl e of 365 students was drawn through a stratified random sampling technique from the various faculties in the int uition.

Instrumentation: The instrument for data collection was an 18 item questionnaire adapted from Wade (2009) S tatistical Literacy Questionnaire (SLQ). The instrument was adapted by the researchers and various response for mats were used for the different components. The first section is for demographic variables., the second section of the instrument was made up of 10 items constructed using a four-point Likert scale of Strongly Agree (SA), Agree(A), Disagree (D), and Strongly Disagree (SD) which were scored 4, 3, 2, and 1 point(s) respectively. On t he basis of the scoring, the maximum and minimum scores obtainable from the instrument were 40 and 10 respe ctively. The third section of the instrument was made up of 8 items scored in a multiple-choice format with one correct option. The maximum score obtainable from this section is 8. Therefore the total possible score from bot h sections is 48, while the minimum is 10.

Validation of the Instrument: The instrument was validated by expert judgment of three lecturers in measurem ent and evaluation. Their suggestions were reflected in the final version of the instruments before the administrat ion was done. For reliability, the Cronbach Alpha technique was used in line with the suggestions of Nwankwo (2013). To do this, the instrument was administered on 30 graduate students of Rivers State University, one of th e areas that will not be used for this study. Thereafter Cronbach analysis was applied to the scores they got, whi ch yielded an alpha coefficient of 0.78 considered suitable in the opinion of some experts (Crutzen & Kuntche, 2 013).

Data Collection Procedure: The instrument was administered and collected by the researchers who gave the in struments to the students at their dissertation or theses defense venues. Each respondent was informed on the pur pose of the study, provided instructions for responding and given ample time to complete the instrument and the instruments were collected on the spot.

Data Analysis: For answering the research questions, mean and standard deviation were used. For testing of the null hypotheses, independent samples t-test was used for testing hypothesis one, while hypotheses two and thre e were tested using one-way Analysis of Variance.

VIII. Results

Table 1: Mean, Standard Deviation and Independent T-test of Gender and Students' Statistical Literacy

Gender	N	Mean	StD	df	t	p	α	Decision
Male	136	25.16	4.50	363	5.89	0.000	0.05	Reject HO 1
Female	229	21.52	6.310					

From the result shown in Table 1, it can be seen that male students (n = 136) had a mean value of 25.1 6 with a standard deviation value of 4.50 on the Statistical Literacy Questionnaire (SLQ), while female students had a mean value of 21.52 and a standard deviation of 6.31. From this information, it can be deduced that male g raduate students had a higher level of statistical literacy than female graduate students. When these mean values were subjected to independent samples t-test, the result obtained showed that a t-value of 5.89 was gotten at 363 degrees of freedom, with an associated p-value of 0.000 which was lesser than the chosen alpha of 0.05. This im plies that there is a significant difference in the statistical literacy of male and female graduate students at the Un iversity of Port Harcourt.

Table 2: Mean and standard deviation of Academic Level on Students' Statistical Literacy

Level	**N**	**Mean**	**Std. Deviation**
PGD	116	20.22	6.188
MASTERS	145	23.23	5.272
PhD	104	24.90	5.711
Total	365	22.88	5.963

From the result displayed in Table 2, it can be observed that students who were enrolled in a Post Graduate Dipl oma (n = 116) had a mean of 20.22 (Std = 6.18), those in a Masters program (n = 145) had a mean of 23.23 (Std = 5.27), while those in a doctoral program (n = 104) had a mean of 24.90. This result indicates that those in a do ctoral program had the highest level of statistical literacy. To test the difference in the statistical literacy of grad uate students based on their academic level, a one-way ANOVA was conducted with the result displayed in Tabl e 3.

Table 3: One-ANOVA of Academic Level on Students' Statistical Literacy

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1233.888	2	616.944	19.075	.000
Within Groups	11708.468	362	32.344		
Total	12942.357	364			

From the result shown in Table 3, it can be observed that after a one-way ANOVA was conducted, an F -value of 19.075 was gotten at 2 and 362 degrees of freedom with an associated p-value of 0.000, which was les ser than 0.05. This result, therefore, indicates that academic level made a significant difference on post graduate students' statistical literacy, therefore, the null hypothesis was rejected. On the basis of the rejection of the null h ypothesis, a post-hoc multiple comparison test was conducted which is displayed below in Table

Table 4: LSD Post Hoc Multiple Comparison Test of Statistical Literacy Based on Academic Level

(I) ACA_LEV	(J) ACA_LEV	Mean Difference (I-J)	Std. Error	Sig.
PGD	MASTERS	-3.019*	.727	.000
	PHD	-4.680*	.767	.000
MASTERS	PGD	3.019*	.727	.000
	PHD	-1.662*	.712	.020
PHD	PGD	4.680*	.767	.000

MASTERS	1.662*	.712	.020

The result of the multiple comparison test using Least Square Difference (LSD) shows that there was a significa nt difference between the statistical literacy of PGD and Masters Students (mean difference = 3.019, p = 0.000), PGD and PhD (mean difference = 4.68, p = 0.000), and between Masters and PhD (Mean Difference = 1.662, p = 0.000). This result, therefore, indicates that doctoral students had a significantly higher level of statistical liter acy than both masters and post-graduate diploma students, while masters' students had a significantly higher lev el of statistical literacy than post-graduate diploma students.

Table 5: Mean and SD of Statistical Literacy Based on Academic Discipline

Discipline	N	Mean	Std. Deviation
SCIENCE	121	23.76	5.563
HUMANITIES	93	21.55	5.029
SOCIAL SCIENCE	151	23.39	6.674
Total	365	22.88	5.963

From the analysis shown in Table 5, it can be seen that graduate students in the sciences, had a mean of 23.76 (S td = 5.56) on the Statistical Literacy Questionnaire, while those from humanities had a score of 21.55 (Std = 5.0 3), while those from social science had a mean of 23.39 (Std = 6.67). This result indicates that students in the sci ences had the highest level of statistical literacy, followed by those from social sciences and lastly those from hu manities. To ascertain if the difference in the statistical literacy of postgraduate students based on subject discipl ine was statistically significant, a one-way ANOVA was conducted which is displayed below in Table 6

Table 6: One-ANOVA of Subject Discipline on Postgraduate Students' Statistical Literacy

Source of Variation	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	221.111	2	110.556	3.146	.044
Within Groups	12721.245	362	35.142		
Total	12942.357	364			

From the result shown in Table 6, it can be observed that after a one-way ANOVA was conducted, an F-value of 3.146 was gotten at 2 and 362 degrees of freedom with an associated p-value of 0.044, which was lesser than 0. 05. This result, therefore, indicates that subject discipline made a significant difference in graduate students' stati stical literacy. Therefore, the null hypothesis was rejected. On the basis of the rejection of the null hypothesis, a post-hoc multiple comparison test was conducted which is displayed below in Table 7

Table 7: LSD Post Hoc Multiple Comparison Test of Statistical Literacy Based on Academic Discipline

(I) SUBJECT	(J) SUBJECT	Mean Difference (I-J)	Std. Error	Sig.
SCIENCE	HUMANITIES	1.711*	.817	.037
	SOCIAL SCIENCE	-.128	.723	.860
HUMANITIES	SCIENCE	-1.711*	.817	.037
	SOCIAL SCIENCE	-1.839*	.781	.019
SOCIAL SCIENCE	SCIENCE	.128	.723	.860
	HUMANITIES	1.839*	.781	.019

The result of the multiple comparison test using Least Square Difference (LSD) shows that there was a significa nt difference between the statistical literacy of science and humanities students (Mean Difference = 1.711, p = 0. 037), humanities and social sciences (mean difference = 1.83, p = 0.019), but no significant difference was obtai ned between science and social science (mean difference = 0.128, p = 0.860).

IX. Discussion Of Findings

The results from the analysis showed that male graduate students reported a significantly higher level o f statistical literacy than female post-graduate students at the University of Port Harcourt. This result was not sur prising but expected because male students have been known to be more mathematically inclined than female st udents. Furthermore, the result of the study indicates that this difference was not due to error or chance but prov en to be statistically significant.

The result from this study is similar to that obtained by Hafiyusholeh et al (2018) who found out that st udents' statistical literacy differed significantly based on gender among high school students in Indonesia. They found that male students performed significantly better than female students in statistical knowledge component s, as well as the dispositional components of critical thinking and evaluation. However, Hafiyusholeh et al (2018) in their study used samples that were drawn from high school, while the sample of this study was drawn univer sity graduate students.

The result as seen from the analysis of research question two showed that graduate students in the doct oral program had a significantly higher level of statistical literacy than masters and post-graduate diploma stude nts. This result is not surprising because it is this researchers' belief that doctoral students must have gotten a hi gher level of appreciation for statistical concepts. Also, due to their increased knowledge of discipline-related co nstruct and greater awareness of social issues, doctoral students are in a better position to understand the interpla y of statistic and everyday life. In addition, because in their academic trajectory, they may have understood the r elationship between statistical concepts and its importance in various disciplines and academic endeavors. The r esult agrees with the work of Yotongyos et al (2014) who found out that 9^{th}-grade high school students had a sig nificantly higher level of statistical literacy than those in 6^{th} grade.

From the result analyzed in relation to research question three, on table 5 shows that subject discipline had a significant influence on the statistical literacy of graduate students at the University of Port Harcourt. This result implies that students from various discipline had varying levels of statistical literacy which was shown to be statistically different when tested with one-way ANOVA. From the analysis conducted, it was shown that stu dents in Science related disciplines had a significantly better level of statistical literacy than those from humaniti es, but not those from social sciences. The result that individuals from science had a significantly higher level of statistical literacy than those from other disciplines was not surprising but expected because these students are more in areas where mathematical concepts, of which statistics is among, are often used in the discussion of iss ues.

The result from this study is similar to that obtained by Oliveira et al (2016) who found that students engaged in pre-service teacher development program, who specialized in science-related fields had a significantly higher le vel of statistical literacy than those from the arts.

Recommendations

From the result obtained, the following recommendations were made:

1. Statistics being a general course in most Universities should be thought to make relevance in everyday life so that post graduate students in all disciplines will be more interested in it.
2. Greater attention should be paid to female graduate students in terms of their statistical literacy and competence. This is to ensure that they are not marginalized from mainstream statistical practices in school.
3. Female students should be made to develop more interest in statistics to improve their literacy.
4. Governmental agencies such as the National Bureau of Statistics should conduct sensitization program on the relevance of statistical literacy in everyday life.

Conclusion

The major conclusion drawn from this study was that post-graduate students of the University of Port Harcourt v aried in their level of statistical literacy. This can be attributed to various factors such as gender, academic level and area of specialization. However, it is further required that greater effort is directed at helping students see th e relevance of their statistical understanding of their private lives.

REFERENCES

[1]. American Statistical Association (2005). *Guidelines for assessment and instruction in statistics educati on*. Retrieved from https://www.amstat.org//asa/files/pdfs/gaise/gaiseprek-12_full.pdf

[2]. American Statistical Association (2016). *Guidelines for assessment and instruction in statistics educati on*: *College report*. Retrieved from https://www.amstat.org/asa/files/pdfs/GAISE/GaiseCollege_Full.pd f

[3]. Ben-Zvi, D., & Garfield, J. B. (2004). Statistical literacy, reasoning and thinking: Goals, definitions, an d challenges. In D. Ben-Zvi &J. B. Garfield (Eds.), *The challenge of developing statistical literacy, rea soning, and thinking* (pp. 3-16). Dordrecht: Kluwer.

[4]. Chick, H., Pfannkuch, M., & Watson, J. (2005). Transnumerative thinking: Finding and telling stories within data. *Curriculum Matters, 1*, 86-107.
[5]. Crutzen, B. & Kuntche, A. 2013). *The use of statistics in the enhancement of elementary education in t he Philippines.* Report submitted to the Statistical Research and Training Center. Curriculum Matters, 1 , 86-107.
[6]. Gal, I. (2002). Adults' statistical literacy: Meanings, components, responsibilities. *International Statisti cal Review, 70(1),* 1-25.
[7]. Gal, I. (2004). Statistical literacy: Meanings, components, responsibilities. In J. B. Garfield & D. Ben-Z vi (Eds.), *The challenge of developing statistical literacy, reasoning and thinking* (pp. 47-78). Dordrech t: Kluwer.
[8]. Garfield, J., delMas, R., & Zieffler, A. (2010). Assessing statistical thinking. In P. Bidgood, N. Hunt, & F. Jolliffe (Eds.), *Assessment methods in statistical education: An international perspective* (pp. 175-1 86). Milton: John Wiley & Sons.
[9]. Hafiyusholeh, M. & Budayasa, K., Siswono, T. Y. E. (2018). Statistical literacy: High school students i n reading, interpreting and presenting data. Retrieved from https://iopscience.iop.org/article/10.1088/17 42-6596/947/1/012036/pdf
[10]. Martinez-Dawson, R. (2013). Challenging statistical claims in the media: Course and gender effects. R etrieved from http://www.statlit.org/pdf/2013-Martinez-Dawson-ASA.pdf
[11]. Moore, K. & Cobb, H. (2002). A generation of statistics education: An interview with Frederick Mostel ler. *Journal of Statistics Education, 1*(1),
[12]. New Zealand Ministry of Education (2007). *The New Zealand curriculum for English-medium teaching and learning in years 1–13.* Wellington, New Zealand: Learning Media.
[13]. Nwankwo O.C. (2013). *A Practical Guide to Research Writing.* Port Harcourt: University of Port Harc ourt Press
[14]. Reston, E., Jala, L., & Edullantes, T. (2006). *Probing college statistics teachers' instructional goals an d classroom practices within a statistical literacy framework*. In A. Rossman & B. Chance (Eds.), Proc eedings of the Seventh International Conference on Teaching Statistics. [CD-ROM]. Salvador (Bahia), Brazil: International Association for Statistical Education and International Statistical Institute
[15]. Rumsey, D. J. (2002). Statistical literacy as a goal for introductory statistics courses, *Journal of Statisti cs Education,* 10 (3). Online: www.amstat.org/publications/jse/
[16]. Schield, H. (2017). Statistical literacy: Thinking critically about statistics. *Of Significance,* 1(1), 15-20.
[17]. Schield, M. (1999). Statistical literacy: Thinking critically about statistics. *Of Significance,* 1(1), 15-20.
[18]. Sharma, S. (2017). Definitions and models of statistical literacy: a literature review. *Open Review of Ed ucational Research, 4*(1), 118-133 Wade, B. & Goodfellow, M. (2009). Confronting statistical literacy in the undergraduate social science curriculum. *Sociological Viewpoints*, 75-90.
[19]. Wade, P. (2009). Statistical thinking in empirical enquiry. *International Statistical Review,* 67(3), 223-248.
[20]. Walker, H. M. (1951). Statistical literacy in the social sciences. *The American Statistician, 5*(1) 6–12.
[21]. Wallman, Y. (1993). *Toward a statistically literacy citizenry: What statistics everyone should know.* In B. Phillips (Ed.), Proceedings of the 6th International Conference on Teaching of Statistics: Developin g a Statistically Literate Society. Voorburg, The Netherlands: International Statistical Institute.
[22]. Watson, J. M. & Callingham, R. (2003). Statistical literacy: A complex hierarchical construct. *Statistics Education Research Journal, 2*(2), 3–46.
[23]. Watson, J. M. (2006). *Statistical literacy at school: Growth and goals*. Mahwah, NJ, US: Lawrence Erl baum Associates Publishers.
[24]. Yotongyous, M., Tvaiwichitkhem, D & Kaemkate, W. (2015). Undergraduate students' statistical litera cy: a survey study. *Procedía - Social and Behavioral Sciences 191* (2015) 2731 – 2734.