

Statistics Education in Nigeria: A Recent Survey

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Abstract.

Statistics Education is a new discipline whose popularity has not been widely appreciated in Nigeria and some developing countries of Africa. There is still a large gap with the advanced levels of statistics education in more developed countries. In this paper, we enumerate the importance of statistics, identify some existing problems in statistics education in Nigeria and make some proposals as to how they may be overcome. Result of our empirical survey on the current awareness of the discipline in Nigeria using one of Nigeria's foremost Universities as a case study shows that majority of the respondents agreed that Statistics Education should exist as a separate discipline in Nigerian Universities. We elicit that this research will enhance the development of statistics education in Nigeria, and encourage statistics educators and researchers to help address some important issues raised in this study.

Key Words: Statistics Education, Awareness, Survey, Nigeria, Empirical Research.

1. Introduction

Statistics education is a relatively new discipline which is currently establishing itself as a unique field of study (Garfield and Ben-Zvi, 2007). It emerged from two main disciplines namely: Statistics and Mathematics Education. Despite its usefulness and popularity in some developed countries of the world, the current low state of statistics education in Nigeria is highly worrisome and unimpressive. Nigeria is a developing country and statistics education in Nigeria is also in its developing stage. The adaptation of statistics education to national needs is inadequate and poor, which consequently leads to employment problems for statistics graduates. One of the main causes of such a vicious circle lies in the lack of understanding of statistics education as a separate discipline among educational stakeholders in Nigeria.

There are still many who regard statistics as part of mathematics or mathematics education. However, it is necessary to point out that statistics should not be taught merely as a subject within mathematics. The differences, if not properly understood in early education, can hinder the teaching of statistics. Teaching statistics utilizes the knowledge of mathematics, but its basic objective lies closely in applications and practical data analysis. Although statistics shares some characteristics with mathematics, there are several features unique to statistics. It is hard for many students to grasp the essentials of statistics and explore the differences between mathematics and statistics. By understanding the differences between mathematics and statistics, we can better help students overcome some obstacles to statistics learning.

In 2002, Garfield and her colleagues in the University of Minnesota, USA began to offer a new area of concentration in Statistics Education that includes course work on teaching statistics as well as on current research on teaching and learning statistics. As a matter of fact, statistical learning should start at earlier stages especially at the secondary school level. In other words, an excellent statistics educator must not only teach students what statistics does, but also what it means and how it can be applied. Major Universities in Nigeria now offer Master degrees in statistics, but statistics is taught at a theoretical level, rarely connected to real world applications unlike in the developed countries. The most important challenge in statistics education is to connect statistical thinking with real-world applications at every level.

It is an indubitable fact that quantitative and numerical information abounds everywhere in Nigeria; hence there is an increasing demand for statisticians who can use statistics to solve real- world problems. Application of statistical knowledge has become imperative in virtually all areas of human endeavors. This is because decisions in many areas of modern societies are based on the collection and analysis of empirical data. Statistics education involves a variety of powerful methods and tools to teach students on how to collect; analyze and interpret such data. Without the proper application of statistical methods, the risk increases that data collection suffers from additional costs and efforts; the analysis of research efforts gives suboptimal results and eventually wrong decisions can be taken (Awe, 2012). The development of various computer software and advances in statistical methodologies and teaching/learning aids has brought significant improvement to the field of statistics education.

Many researchers have written extensively and expressed significant concern about the future of Statistics and Statistics Education, for instance; Garfield and Ahlgren, 1988; Garfield, 1993; Garfield, 1995; Moore, 1997; Cox, 1997; Li, 2004; Smith and Staetsky, 2007; Allen *et al*, 2012; Awe and Oguntuase, 2013; among others. The importance of teaching statistics at all levels of tertiary education cannot be overemphasized. In recent years, statistics educators in advance countries like China, USA, Canada, United Kingdom and Germany have focused attention on rethinking the process of statistics education. Attempts are already being made at the elementary and secondary levels to integrate and include statistics education in their mathematics and science curricula (Gal and Ginsburg, 1994). Statistics is unarguably one of the most important and basic subjects student have to learn in higher institutions, unfortunately statistics educators are few in Nigeria. It is also one of those subjects with which students can have a hard time. A list of the reasons why statistics has been identified to be a hard subject to learn and teach is presented in the article of Ben-Zvi and Gartfield (2004). In some developed countries such as the United States and Canada, statistics education is a highly respected discipline. It has already been classified as one of the basic courses in some schools. If we use the United States of America as an example to follow, it is expected that very soon in Nigeria also, as the demand for statistics applications rises, the demand for statisticians will rise to exceed supply.

Graduates in statistics education are in high demand and well paid. They can be employed in industries, banks and insurance companies, and high tech companies as well as in the academia. They also play an important role in many areas of government planning, such as population census, educational and psychological measurement, economics policies, and environmental policies. Nigerian schools and educators at all levels therefore must ensure that we are well-positioned for a bright future of statistics education. Our experience gained during this research shows that it is very useful for students to understand and pick up statistics education as a separate discipline. Accordingly, we make some proposals for improving the discipline of statistics education in Nigeria.

The rest of this paper is organized as follows: Section two discusses the materials and methods, section three is on the empirical analyses carried out in the study, section four discusses the results, while section five is on conclusion and recommendation.

2.0 Material and Research Methodology

Two Hundred and Sixteen (216) questionnaires were administered in this research through a simple random sampling (SRS) approach. Students from seven departments in Faculty of Education, Obafemi Awolowo University participated in this survey. We compute simple percentages, Correlation Analysis, Regression and Analysis of Variance (ANOVA) on the variables affecting statistics education in Nigeria. Participants' opinion in the survey were rated on a five-point likert scale as follows: Strongly Agree (5), Agree (4), Don't Know (3), Disagree (2) and Strongly Disagree (1).

3.0 Empirical Analyses and Results

In this section, we present the results of the various analyses carried out in this survey.

Table 1: Distribution of respondents according to department ($n = 216$)

Department	Frequency	Percent
EFC	37	17.1
IED	39	18.1
SEC	35	16.2
EAP	21	9.7
DET	28	13.0
DCE	30	13.9
PHE	26	12.0

Out of 216 respondents considered for this study, 37 (17.1%) of them were from the department of Educational Foundations and Counseling (EFC), 39 (18.1%) were from the Institute of Education (IED) 35 (16.2%) were from Special Education and Curriculum (SEC), 21 (9.7%) were from Educational Administration and Planning (EAP) 28 (13%) were from Department of Educational Technology (DET), 30 (13.9%) were from Department of Continuing Education (DCE) while 26 (12%) were from Physical and Health Education (PHE) department (Table 1).

Table 2: Distribution of respondents according to the Level of Study ($n = 216$)

Level of Study	Frequency	Percent
Part 1	50	23.1
Part 2	55	25.5
Part 3	55	25.5
Part 4	56	25.9

Data collected on the level of study of respondents (Table 2) showed that 56 (25.9%) were in their final year, 50 (23.1%) were fresh in-takes of the University, while 55 (25.5%) were in Parts 2 and 3 respectively.

Table 3: Respondents' Awareness of Statistics Education ($n = 216$)

Response	Frequency	Percent
Yes	66	30.6
No	150	69.4

Results of the data analysis indicated that 66 (30.6%) respondents have heard of Statistics Education as a Discipline, but surprisingly 150 (69.4%) respondents have never heard of Statistics Education as a Discipline (see Table 3).

Table 4: Respondents' willingness to study Statistics Education ($n = 216$)

Response	Frequency	Percent
Yes	100	46.3
No	116	53.7

In Table 4, majority of the respondents 116 (53.7%) said that they would not like to study Statistics Education as a course if given a chance now or in future, while 100 (46.3%) respondents reported that they would.

Table 5: Respondents who offered Statistics related courses ($n = 216$)

Statistics Related Courses	Frequency	Percent
None	96	44.4
One	58	26.9
Two	35	16.2
Three	20	9.3
Above three	7	3.2

As Table 5 displays, majority of the respondents 96 (44.4%) considered in this research had never offered any Statistics related courses. This is followed by those 38 (26.9%) that had taken one Statistical related course. 35 (16.2%) respondents had taken two Statistics related courses and 20 (9.3%) respondents had offered three Statistics related courses, while 7 (3.2%) respondents had offered more than three Statistics related courses.

Table 6: Distribution of Respondents' desire for a separate Department of Statistics Education ($n = 216$)

Response	Frequency	Percent
Strongly Agree	89	41.2
Agree	76	35.2
Don't know	31	14.4
Disagree	18	8.3
Strongly Disagree	2	0.9

It is interesting to see in Table 6 above that 89 respondents with a large percentage of 41.2 strongly agreed that there should be a separate department of Statistics Education in the University. 76 (35.2%) respondents admitted also that the need for the department of Statistics is imperative. 18 (9.3%) students did not agree to have the department of Statistics Education while only 2 (0.9%) students strongly disagreed. The number of students that neither agreed nor disagreed was 31 with a percentage of 14.4.

Table 7: Distribution of Respondents' Desire for Statistical literacy ($n = 216$)

Response	Frequency	Percent
Strongly Agree	76	35.2
Agree	91	42.1
Don't know	22	10.2
Disagree	25	11.6
Strongly Disagree	2	0.9

On their opinion on the necessity of statistical literacy for all the undergraduate students, Table 7 revealed that 76 (35.2%) students agreed strongly. 91 (42.1%) students agreed that the statistical literacy is necessary for all undergraduate students. Only 2 (0.9%) students strongly disagreed that Statistical literacy is no necessary, but 25 (11.6%) of the students disagreed as well, while 22 (11.6%) of them neither agreed nor disagreed.

Table 8: Distribution of sample to have Statistical Educated Graduates ($n = 216$)

Response	Frequency	Percent
Strongly Agree	82	38.0
Agree	109	50.5
Don't know	15	6.9
Disagree	9	4.2
Strongly Disagree	1	0.5

It is very amazing to reveal that majority of the respondents i.e 191 (88.5%) agreed that there is a critical need for statistically educated graduates in this age of information explosion. Out of this, 82 (38.0%) agreed strongly while 109 (50.5%) of them agreed. Only 1 (0.5%) respondent did not agree strongly while 9 (4.2%) respondents disagreed. 15 (6.9%) respondents neither agreed nor disagreed.

Table 9: Statistics Education as a reform-oriented pedagogy($n = 216$)

Response	Frequency	Percent
Strongly Agree	60	27.8
Agree	111	51.4
Don't know	39	18.1
Disagree	6	2.8
Strongly Disagree	0	0.0

Table 9 reveals that 60 (27.8%) respondents agreed strongly that Statistics Education can be a reform-oriented pedagogy in Higher Institutions in Nigeria while 111 (51.4%) respondents also agreed. 6 (2.8%) respondents agreed that Statistics Education cannot be a reform-oriented pedagogy in Higher Institutions while 39 (18.1%) respondents neither agreed nor disagreed.

Table 10: Distribution of sample on the existence of Statistics Education Department ($n = 216$)

Response	Frequency	Percent
Strongly Agree	85	39.4
Agree	96	44.4
Don't know	16	7.4
Disagree	15	6.9
Strongly Disagree	4	1.9

From Table 10, we can see that 85 (39.4%) students agreed strongly that since we have Mathematics Education, there should also be Statistics Education floated as a Discipline in Nigerian Universities while 96 (44.4%) of the students also agreed. Only 4 (1.9%) students were strongly against the establishment and 15 (6.9%) students also disagreed. 16 (7.4%) students neither agreed nor disagreed to the floating of Statistics Education as a discipline.

3.1 Further Analyses

To measure the amount of relationships among 4 variables: Y (Awareness of Statistics Education) ; X_1 (Department); X_2 (the level of study); X_3 as the number of statistics related courses offered. We employed Pearson correlation and the results of the correlational analysis are summarized in Table 11.

Table 11: Results of correlation among 4 variables ($n = 216$)

Variables		Y	X ₁	X ₂	X ₃
Y	Pearson Correlation	1.000			
X ₁		.145*	1.000		
X ₂		-.020	.069	1.000 -	
X ₃		.039	-.054	.357*	1.000
Y	Sig. (1-tailed)				
X ₁		.017			
X ₂		.383	.157		
X ₃		.286	.214	.000	

* Correlation is significant at the 0.05 level (1-tailed)

The findings indicate that awareness of Statistics Education is associated with the department of the respondents ($r = .145, p < .05$) and the level of study is negatively associated with the number of statistics related courses offered ($r = -.357, p < .05$). No significant correlations were found between the awareness of Statistics Education and the level of study, awareness of Statistics Education and the number of statistics related courses offered, the department of the respondents and the level of study, and the department of the respondents and the number of statistics related courses offered.

To further analyze the data, we utilized ANOVA, Table 12 illustrates a non-significant difference among the 4 variables.

Table 12: Results of one-way Analysis of Variance

Source	DF	SS	MS	F	P
Regression	3	1.072	.357	1.693	.170
Residual	212	44.761	.211		
Total	215	45.833			

The test statistic and P-value are 1.693 and .170, respectively ($F = 1.693, p > .05$). Since the P-value is greater than the level of significance 0.05, we do not reject the null hypothesis. There is not enough evidence in the sample to conclude that awareness is related to department, level of study and number of statistics related courses offered. This implies that the independent variables (department, level of study and number of statistics related courses offered) did not contribute to the awareness of Statistics Education.

The regression equation is $\hat{Y} = 1.551 + .034X_1 - .007X_2 + .011X_3$

Table 13: Table of Multiple Regression Analysis

Predictors	Coeff	SE Coeff	T	P
Constant	1.551	.131	11.810	.000
X ₁	.034	.015	2.178	.031
X ₂	-.007	.030	-.219	.827
X ₃	.011	.019	.565	.573

Std error = .4595 R-sq = 2.3% R-sq (adj) = 1.0%

4.0 Discussion of Results

As important as Statistics Education is, it is noteworthy that more than half of the respondents reported that they have never heard about Statistics Education as a Discipline, whereas it is already existing in the developed countries of the world like USA, United Kingdom, China and Germany, to mention a few.

One of the major discoveries of this study is the low level of awareness among the respondents. This may be due to the fact that Statistics Education is unpopular in Nigeria. Majority of the respondents have never offered any statistics related courses which should not be so for students in the Faculty of Education (Mother of all Faculties) and in Nigerian's foremost University (Obafemi Awolowo University, Ile-Ife).

The results of the study on the necessity of statistical literacy for all undergraduate students show that most students did agree that all the undergraduate students should be literate in Statistics. This is true because all fields of study in the university requires being literate in Statistics. Research studies span on a broad range of topics/fields like business, sports, health, architecture, education, entertainment, political science, psychology, history, criminal justice, environmental studies, transportation, physical sciences, demography etc. It is very amazing to reveal that majority of the respondents concluded that there is a critical need for statistically educated graduates in this age of information explosion. Statistics is used in almost all fields of human endeavor. Majority

of the respondents agreed that Statistics Education can be a reform-oriented pedagogy in Higher Institutions in Nigeria, if the stakeholders can implement it. This trend has been reported in many previous studies of Statistical Education in many countries of the world. For instance, Tishkovskaya and Lancaster (2012) reported that there is a recognized need in China for continuing review of the teaching and learning process in this complex domain of teaching. As it is in the developed countries, the case of Nigeria should not be an exception; the students agreed strongly that since we have Mathematics Education, there should also be Statistics Education floated as a separate discipline in Nigerian Universities.

5.0 Concluding Remarks and Recommendations.

From our Analysis it is unequivocally indisputable that there is still a long way to go for statistics education in Nigeria to catch up with what obtains in some developed countries of the world like USA and UK. Its practice and awareness is abysmally low. Through extensive international cooperation and exchanges, we can use the successful experience of other countries as a stepping stone and guide.

We hereby make the following recommendations/proposals based on our findings in this research:

1. Statistics Education should be included as a program (course of study) in Nigeria Universities.
2. Since we have Mathematics Education in many schools, there should also be a separate field of Statistics Education floated in Nigerian Universities.
3. In this age of information explosion, there is a critical need for Nigerian Universities to produce more statistically educated graduates.
4. More statistics lecturers with area of specialization in statistics education should be recruited to train students on the importance of statistics education.
5. Students (undergraduate and graduate students) should be encouraged by stakeholders concerned to pick up statistics education as a field.
6. Funds should be made available by the government and educational stakeholders to establish statistics education programs/institutes in Nigeria.
7. We must change our teaching mode from a lecture-and-listen format to one that engages students in active learning. Appropriate computer-aided tools that can stimulate students' interests and stimulate their experimental ability must be adopted. Using software that allows students to visualize and interact with data appears to improve students' understanding of statistics education and appreciation of data science.

Many Universities in Nigeria can afford more software and hardware purchases, so we are optimistic that they will be utilized well. It is important to update statistical learning/teaching methods to meet the needs of the society. We need to take a more balanced approach, and make sure that our educational practice reflects the emerging trends in modern statistics education.

Finally, we hope that our proposals and recommendations in this study will stimulate the interest of educators and students in Nigeria to embrace the emerging discipline of Statistics Education. With the glaring facts, figures and results in this research, the stage is now set for the field of Statistics Education to begin to thrive in Nigeria.

References

- Awe, O.O. (2012). Fostering the Practice and Teaching of Statistical Consulting among Young Statisticians in Africa. *Journal of Education and Practice (USA)*.Vol. 3(3).
- Awe, O.O. & Oguntuase, D.M. (2013). Acquisition and Utilization of Statistical Consulting/Collaboration Skills among University Students in Nigeria: A Recent Survey. *International Journal of Computer and Electronics Research* Vol.2 (2).
- Gal, I., & Ginsburg, L. (1994). The role of beliefs and attitudes in learning statistics: towards and assessment framework. *Journal of Statistics Education*. Vol.2(2).
- Garfield, J. (1995). How students learn statistics. *International Statistical Review*, 63(1), 25-34.
- Garfield, J., & Ahlgren, A. (1988). Difficulties in learning basic concepts in probability and statistics, *Journal for Research in Mathematics Education*, 19, 44-63.
- Garfield, J.B. & Ben-Zvi, D. (2007). *Developing Students' Statistical Reasoning: Connecting research and teaching practice*. Emeryville, CA: Key College Publishing.
- Gnanadesikan, M., Scheaffer, R. L., Watkins, A. E., and Witmer, J. A. (1997), An activity-based statistics course, *Journal of Statistics Education*.Vol.5(2).

- Li, J. (2004). Statistics education for junior high school in China. *Curricular Development in Statistics Education*, 219-228.
- Liang, Z.-S. (1990). Statistics in China, ICOTS-3, 416-422.
- Perney, J., & Ravid, R. (1991). The relationship between attitudes towards statistics, math self-concept, test anxiety and graduate students' achievement in an introductory statistics course. Unpublished manuscript, National College of Education, Evanston, IL.
- Schoenfeld, A. H. (1992). Learning to think mathematically: Problem solving, metacognition, and sense making in mathematics, in *Handbook of Research on Mathematics Teaching and Learning*, ed. D. A. Grouws, NY: Macmillan, pp. 334-370.
- Serradó, Ana, Azcárate, Pilar & Cardeñoso, José M. (2005). Randomness in textbooks: the influence of deterministic thinking. In M. Bosch (Ed.), *Proceedings of the CERME 4: Fourth Conference of the European Society for Research in Mathematics Education*, Sant Feliu de Guixols, España.
- Shi N.-Z., & Liu H.-M (2007). Quality oriented education: fundamental objective and implementary approach, *Educational Research*, 8, 10-14 (in Chinese).
- Shi N.-Z., Geng Z., Guo J., & Tao, J. (2008). A project of applied statistical methods in China: review and outlook, *Statistics and its Interface*, 1, 197-207.
- Shi, N, He,X. & Tao,J. (2009). Understanding Statistics and Statistics Education: A Chinese Perspective. *Journal of Statistics Education*. Vol.17(3).
- Tishkovskaya, S & Lancaster, G.A.(2012). Statistical Education in the 21st Century: a Review of Challenges, Teaching Innovations and Strategies for Reform. *Journal of Statistical Education*.Vol.20(2).
- Wang, J. L., & Zhang, Y. (2002). Development of the higher statistics education in China, ICOTS-6, 1-4

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