The Need for Statistical Literacy at Grassroots in Kwara State of Nigeria

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ABSTRACT
The ultimate goal was to investigate the reasons for the consistent low number of applicants for Statistics programme in the Federal Polytechnic, Offa Kwara State, Nigeria. Specifically to identify the problems associated with students' orientation that makes Statistics as a course of study so unattractive and proffer solution to the identified problems. The study area was Kwara State of Nigeria. 872 students were studied across 16 schools with a range of 27-96 students from each school. The subjects investigated were students in SSS 1,2,3 in Secondary Schools within the study area. Questionnaires were administered to evaluate students' knowledge on statistics.After the administration of questionnaires, trainings were conducted to expose students on statistics. The content of the training was compiled in a handbook and handed over to the students before the sessions began. At the end of the training, same questionnaires were re-administered to the same group of students that were trained. Simple descriptive statistics was used to organize and analyze data collected from the study. Results show some Senior Secondary School students lacked knowledge on statistics relating to numerical facts and its potentials to improve citizens' welfare and achieve a better society. It could be inferred that the Junior Secondary School students have similar challenges with the Senior Secondary School students as regards limitation on knowledge about importance of statistics and its existence as a course of study in tertiary institutions. This calls for the need to sensitize students on the subject matter from the grassroots. It is recommended that statistics should be introduced to students as a subject at the lower, middle and upper basic levels of education.Similar to international best practices, the nine (9) year Basic Education Curriculum will need to be revised by the Nigerian Educational Research and Development Council to incorporate Statistics as one of the subjects to be studied. In this light, the curriculum will be more practical to meet the country's need in terms of statistical literacy. Ultimately, the number of applicants for Statistics programs at the tertiary levels of education will likely increase in the coming sessions for higher institutions within Kwara State of Nigeria. The students contacted and their contemporaries will be more sensitive to the significance of statistics for individual and societal growth today and in the near future when they take over the mantle of leadership of our great country Nigeria.
Keywords: Curriculum, Education, Statistics

I. INTRODUCTION
Statistics lead to data generation for social, economic and environmental indicators that inform policies for national development. Statistics is the bane for planning, monitoring, evaluation, sound reasoning and correct decisions. Many aspects of societal or human progress depend on correct analysis of numerical figures. To allow for better governance and a guarantee for sustainability, individuals, corporate bodies and governments need to think quantitatively. A government and its citizens have proper understanding of the environment or situations in which they find themselves through the knowledge of statistics. The present increase in demand for data across the globe stems from the realization that a society cannot be governed on anecdotes. Statistical ignorance and fallacies are often widespread and quite as dangerous as the logical fallacies that come under the heading of illiteracy (Cockcroft, 1982). As information becomes ever more qualitative, an innumerate citizen today is vulnerable(Steen, 1997). Citizens need to be statistically equipped to react intelligently and effectively to information. Processing information requires critical and sound thinking with a cognitive ability for enquiry that can be developed through enhancement of statistical literacy.

The Nigerian society do not seem to attach significant importance to Statistics. For instance, candidates' first choice according to Departments for the 2018/19 JAMB admissions for the Federal Polytechnic, Offa, Kwara State, Nigeria for candidates that scored greater than or equal to One Hundred and Forty (140) indicate 15; 290; 571 and 959 candidates for Statistics; Accountancy, Business Administration and Mass Communication respectively (FEDPOFFA,2018). In the more recent 2021/2022 UTME admissions for the Federal Polytechnic, Offa, Kwara State, Nigeria for candidates that scored greater than or equal to One Hundred and twenty (120) indicate 0; 233; 450 and 1031 candidates for Statistics; Accountancy, Business Administration and Mass Communication respectively (FEDPOFFA,2021).

Training in statistics could be poorer and much less valuable than it should be, if we continue with the present dispensation (Moore 1998; Wild, Pfannkuch, Regan and Horton, 2011; Smith, Molinaro, Lee and Guzman-Alvarez, 2014). Teachers who see their main role as dealing with principles of statistics or with rules for inference must know that more work needs to be done precisely identifying the issues, problems or dilemma (Mccall,1998; Batanero, 2002).Statisticians, educators and stakeholders need to pay attention to emphasizing the potential power of statistics for enriching the society as required by the necessities of a rapidly changing world. The correlation between statistical activity and governmental functions need to be given top priority.

In England statistics was first called political arithmetic in the seventeenth century. The Germans gave it the tittle "Staatenkunde" from which the word "statistics", meaning a collection of facts about the state of importance to statesmen. In 1839, a census of agriculture in France included questions in the production of corn per hectare and the amount of livestock. In the same year, a committee of the Statistical Society of London, which in 1885 became the Royal Statistical Society, was appointed to report on the best method of taking the census of 1841. Thus, for decades the Statistical Society of London was cooperating with the organization of the census. The American Statistical Association in the United States performs similar role. The burst of statistical activity in the 1830's in the continent of Europe was due to interest in the activities and matters that concerned citizens' welfare (William, 1940).

Invariably, these activities and matters led to data generation for social, economic and environmental indicators that informed policies for national development. The basis for measuring and monitoring the developmental goals, targets and indicators of various national and international programmes was firmly established for governance and accountability of governments. Data collection and use did not only become a routine but is done with great passion. This can be linked to the good governance, economic transformation and better living standards in the European continent today.

In Africa, statistical development in the 1960s was driven mainly by a number programmes initiated by statistical offices and statistical training institutions located outside Africa. First was the programme funded by the United Nations Development Programme called Statistical Training Programme for Africa which was adopted in 1978 by the Economic Commission for Africa (ECA) Conference of Ministers. The aim of the programme was to ensure that African region had a permanent supply of qualified statistical staff. The second programme was the Addis Ababa Plan of Action for Statistical development in Africa which was adopted by ECA Conference of ministers in May 1990. The main goals of the Plan of Action were to: achieve national self-sufficiency in statistical production, ensure autonomy of the National Statistical System and improve coordination of all statistical development programmes at national and international levels.

Statistical activity remains a mirage in Africa, citizens have no feel for numbers and governments take no recourse to statistical data. For example, the Federal Government of Nigeria inaugurated Economic Recovery and Growth Plan and projected that Nigeria will make significant progress to achieve structural economic change with a more diversified and inclusive economy in five key areas by 2020 without basic monitoring and evaluation kits nor data to tell citizens the exact position of the economy at take-off. This is a clear indication of the absence of statistical literacy in the Nigeria government and people.

Statistical literacy is required as a form of intervention to undo misinterpretation, misconceptions and misleading information in our society. It exposes citizens to the place of data needed for systematic follow-up and progress reviews that promotes the culture of building a framework for data collection. This will help individuals to understand the statistical underpin required for a task and provide the ability to question claims made without proper justification. For example, the Statistical Society of Australia and the Australian Bureau of statistics have been working on a strategy to ensure Australia school

children acquire a sufficient understanding and appreciation of how data can be acquired and used so they can make informed judgments in their daily lives as children and then as adults (Australian Education Council (AEC), 1991). Ultimately, statistical literacy allows citizens to use numbers most intelligently in taking decisions and has become a basic prerequisite to function effectively in today's age of information, both for everyday life and in the work place.

Active participation in the society is made possible through statistical literacy (National Council of Teachers of Mathematics, 2000). Focus on statistical literacy will speed up the statistical necessities and nuances needed to consume and critically digest the wealth of information in the present political dispensation. Statistical literacy will enable individuals, corporate bodies, stakeholders, policy makers and governments to know what programme should be accompanied not only with achievable goals and quantifiable targets but most importantly be supported with data, performance indicators and a reporting framework for economic growth.

The ultimate goal was to investigate the reasons for the consistent low number of applicants for Statistics programme in the Federal Polytechnic, Offa Kwara State, Nigeria. The focus was on Kwara State. Specifically to identify the problems associated with students' orientation that makes Statistics as a course of study so unattractive and proffer solution to the identified problems.

II. LITERATURE REVIEW

Statistical literacy is a key ability expected of citizens in information-laden societies, often touted as an expected outcome of schooling and as a necessary component of adult's numeracy and literacy. It involves understanding and using the basic knowledge and tools of statistics: knowing what basic statistical terms mean, understanding the use of simple statistical symbols and recognizing and being able to interpret different representations of data (Garfield, 1999; Snell, 1999; Rumsey, 2002). Statistical literacy is the ability to interpret, critically evaluate and communicate about information and messages. It refers to the aspects necessary to establish an awareness of data that must take place in order to reasonably consume information (Rumsey, 2002b). The process allows statistical principles and techniques to be applied in contexts associated with other areas of the curriculum and/or areas outside the school experience in the wider society. The concept involves teaching statistics better for a different or

additional purpose using real world and media-based examples with relevant worry questions.

Some schools and perhaps most post-secondary academic institutions teach statistics to some students as part of mathematics, statistics or science and social studies, yet not in a way that necessarily emphasizes the development of statistical literacy (Wild, Triggs and Pffankuch, 1997; Hawkins, 1997; Moore and Cobb, 2000; Schaeffer 2001; Gal, 2002a; Wild, 2005). Current knowledge base about statistical literacy of school or university students and of adults in general is patchy (Gal, 2002b). Majority of the current adult population in any country has not had much if any formal exposure to the statistical or mathematical knowledge bases given known education levels across the world (Wallman, 1993; Statistics Canada & OECD, 1996; UNESCO, 2000; Ottaviani, 2002). Remarkably, until very recently even economically advanced societies have prized far less the goal of developing a functionally numerate citizenry than one that is functionally literate. Even in these societies it will be a huge task to redress extinct deficiencies. In developed societies, formal teaching aimed expressly at enhancing statistical literacy is still a fledgling enterprise, offered only in scattered locations and to relatively few people. This is even more true in the case of adult learners than it is for young people (Sowey, 2003).

The need to develop statistical and probabilistic knowledge and to empower people from all walks of life to become critical consumers and users of statistical information has been embraced by educators and policy makers in diverse countries as well as by many professional organizations. The focus is in the school curriculum to develop high-level statistical-questioning skills, the cross-curricular nature of data handling, representation and interpretation application applicable in many contexts (Hofstetter and Sgroi, 1996; Kinneavy, 1996; Garfield & Gal, 1999; Watson, 2000; Watson, 2002; Gal, 2002a; Best 2005; Trewin 2005; Gred, 2008; Gerd, 2008; Gould, 2010). For example, a National Statement on Mathematics for Australian Schools (Australian Education Council [AEC] 1991, 178) contains a call for students to understand the impact of statistics on daily life.

For instance, our economy's complexity, growth and structural changes require that public and private leaders have unbiased, relevant information on which to base their decisions. Data on real Gross Domestic Product, Consumer Price Index and the trade deficit, for example, guide

government spending, budget projections, and the allocation of federal funds. They also are essential inputs to monetary, fiscal, trade and regulatory policy. Economic data, such as measures of price change, have a significant influence on interest rates and cost of living adjustments that affect every Nigerian who runs a business and saves for retirement. Similarly, timely, comparable data on the characteristics of the population are crucial in monitoring and responding to societal changes. Also, population counts that come from census are used for reapportionment and allocation of hundreds of millions of naira every year (Willman, 2010a).

Business firms engaged in interrelated set of activities in producing goods, buying materials, employing personnel and making profits should keep consistent production and financial records. For example data on manufacturing shipments, inventories and retail sales, employment, earnings, prices and profits are statistics used to make judgments about current economic conditions and prospects. They are used in combination to compile Gross National Products accounts, estimate productivity figures and to deflate sales and earnings figures (Leontief, 1971). Numbers on employment and changing prices are used in public and private decisions on monetary and business policies. In countries like the US, the stock market rises and falls based on employment numbers (Wallman, 2010b).

Transportation statistics gives details of road usage and where new roads may be needed. Trends and phenomena of rates, population growth, and incidence of diseases, industrial production and employment trends contribute to people's choice in chance-based situations (e.g., buying lottery tickets or insurance advice). Salaries and wages can support informed participation in public debate in many workplaces, given statistical information about the quality of processes and a good understanding of data about the status of the organization (Bown& Lawler, 1992).

Statistics produced for the purpose of monitoring are also increasingly used to direct payment flows to individuals and to political units (Burton, 1973). This should create a powerful interest on the part of data producers/consumers to shape the way in which statistics are defined and collected. The increased use of statistics for directing money flows underscores the crucial importance of preserving the independence of the National Statistical System and insulating it from the pressure of special interest groups.

Some of these notable reasons are responsible for the shift in emphasis in statistics instruction from procedural understanding of statistical techniques, formulas, computations and procedures to developing conceptual understanding and statistical reasoning and thinking. Researchers began to take an interest in studying how children understand basic concepts related to data analysis. Also, how to develop good statistical reasoning and understanding became part of instruction in elementary and secondary mathematics classes. Statistics was added to the mathematics curricula in the US in the 1980s and 1990s (National Council of Teachers of Mathematics, 2000).

The issues of developing teacher knowledge of statistics as well as methods of helping teachers to understand the big ideas of statistics can be found in the joint IASE-ICMI study (http://www.ugr.es/~icmi/iase_study). TEAM project (Franklin &Mewborn, 2006) have attempted to bring mathematics educators and statiscians together to create new ways to prepare future K-12 teachers of statistics, making sure that these students have a course in statistics as part of their requirements, taught in methods that emphasize conceptual understanding, data exploration, and use of appropriate technology. There is now a growing network of researchers interested in studying the development of students' statistical literacy, reasoning and thinking (e.g. SRTL – The International statistical Reasoning, Thinking, and Literacy Research Forums, http://srtl.stat.auckland.ac.nz/). The topics of these research studies conducted by members of this community reflect the shift in emphasis in statistics instruction, from focusing on procedural understanding (Joan and Ben-Zvi, 2007). Another good example of interest is Jane Watson's web site "Chance and Data in the News (http://www.themercury.com.au/nie/mathgys/merci ndx.htm).

Linking of statistical literacy with other terminologies used in educational circles to attract attention to our course may constitute a challenge. Positioning of statistical literacy within the school curriculum to achieve maximum exposure particularly where many of the staff will have phobias related to past experiences with mathematics and statistics will be a big challenge. The application of what we will be learning from research about statistical literacy into school

students' understanding of statistical literacy may also constitute a barrier (Watson 2002).

Although, creating a measurable change in statistical literacy for the general population is a complex task. Attention is required to the need to develop multiple knowledge elements and dispositions to the nature of the diverse players that can contribute to students' and peoples statistical literacy, and to the unique characteristics and needs of different target groups: specifically current adults outside the purview of any formal education system and future adults served by regular school systems within the formal educational system. Another concern is how to better address statistical literacy as part of current instructional efforts in terms of curriculum design, teaching methods and learning resources given that the infrastructure for instruction already exist and some teachers and students are already engaged in teaching and learning statistics (Cerrito, 1999; Gal 2002a).

It has been observed that many students are not currently receiving instruction in statistics (Schmidt, McKnight, Val Verde, Hovang and Wiley, 1997; Moore and Cobb, 2000). Despite the challenges linked to equipping the populace with knowledge of statistics, several countries and organizations have introduced programs to improve school-level education on data-analysis and probability, sometimes called data handling, stochastics, or chance (Australian Education Council, 1991; National Council of Teachers of Mathematics, 2000; Plante and Reid, 2011). The American Statistical Association and the Royal Statistical Society are two leaders, among professional organizations worldwide, in the design and trialing of curricula and resource materials for courses in statistical literacy at both school and university levels. There are also, of course, many individual initiatives, piloted by foresightful statistics educators around the world (Snell, 2002; Sowey, 2003; Olubusoye, 2014; Olubusoye, 2017; Korter Grace, OlatunjiLateef,Omolehin Joseph, OlubusoyeOlusanya, 2019). More voices should be raised to emphasize the importance of developing statistical literacy skills applicable in many contexts.

Hafiyusholeh, Budayasa and Siswono (2017), described high school students' competencies in reading, interpreting and presenting data. Subjects consist of male and female students who had high levels of mathematical ability. Data was collected in the form of task formulation which was analysed by reducing, presenting and verifying data. Results showed that the students read the data based on explicit explanations on the diagram. In interpreting and summarizing the data, both subjects pay attention to general data trends and use them to predict increases or decreases in data.

III. METHODS

The study area was Kwara State of Nigeria. 872 students were studied across 16 schools with a range of 27-96 students from each school. The subjects investigated were students in SSS 1,2,3 in Secondary Schools within the study area presented in table 1 below:

Table 1: List of Selected Secondary Schools in Kwara State

S/N	SCHOOL
1.	Adeola Model School. Offa
2.	Ajase-Ipo Comprehensive High School, Ajase-Ipo
3.	Anglican Comprehensive College, Offa
4.	Ansarul Islam Secondary School, Omu-Aran
5.	Aperan Comprehensive College, Omu-Aran
6.	Bishop Smith College, Ilorin
7.	Chapel Secondary School, Ilorin
8.	Cherubim and Seraphim College, Ilorin
9.	ECWA Secondary School, Omu-Aran
10.	Government Secondary School, Omu-Aran
11.	Iludun-Oro Anglican Girls College, Iludun-Oro
12.	Offa Grammar School, Offa
13.	Omu-Aran High School, Omu-Aran
14.	Oro Grammar School, Oro
15.	St.Claires Grammar School, Offa
16.	Queen Elizabeth Secondary School, Ilorin

Twenty schools were visited to seek their consent, sixteen schools were engaged at the long run.Questionnaires were administered to evaluate students' knowledge on statistics.After the administration of questionnaires, trainings were conducted to expose students on: the importance of statistics to individuals, societies and the governments. Examples of countries like England, USA, Germany, France, Switzerland among others that have strived better in citizen's welfare due to proper use of statistics were given. The simplicity of statistics as a course of study that does not totally contain mathematics was explained. Also, O 'Level and JAMB requirements to study statistics at the Polytechnic or University level were stated.

The employment/job prospects as a Statistics graduate were explained. The content of the training was compiled in a handbook and handed over to the students before the sessions began. At the end of the training, same questionnaires were re-administered to the same group of students that were trained. Simple descriptive statistics was used to organize and analyze data collected from the study.

IV.   RESULTS OF SURVEY

To evaluate the knowledge of Senior Secondary Students on Statistics, simple questions like the following were asked:

Table 2.Responses to the question: Statistics deal with numerical facts?

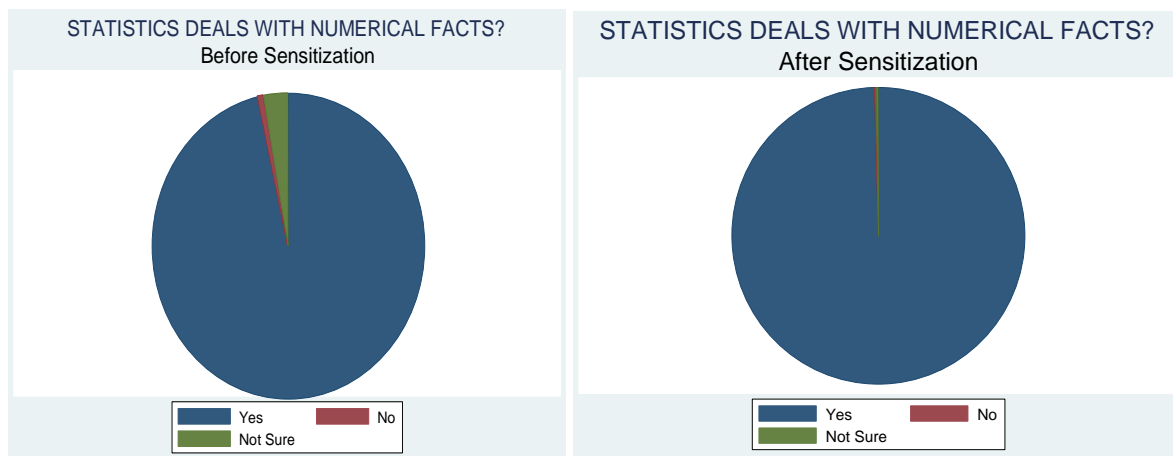| RESPONSES	BEFORE TRAINING		AFTER TRAINING	
	Frequency	Percentage	Frequency	Percentage
Yes	841	96.44	868	99.54
No	6	0.69	2	0.23
Not Sure	25	2.87	2	0.23
TOTAL	872	100	872	100

Figure 1. Responses to the question: Statistics deal with numerical facts?

From the results in Table 2 and Figure 1 above, we discovered the following based on the sample under studied before the sensitization program, 0.69 % of students in SSS did not know that statistics deal with numerical facts while 2.87% were not sure. At the end of the sensitization, 0.69 % of students in SSS that did not know that statistics deals with numerical facts dropped to 0.23% while the 2.87% that were not sure whether statistics deals with numerical facts or not also dropped to 0.23%.

Table 3.Responses to the question: Is it necessary to collect data before making decision?

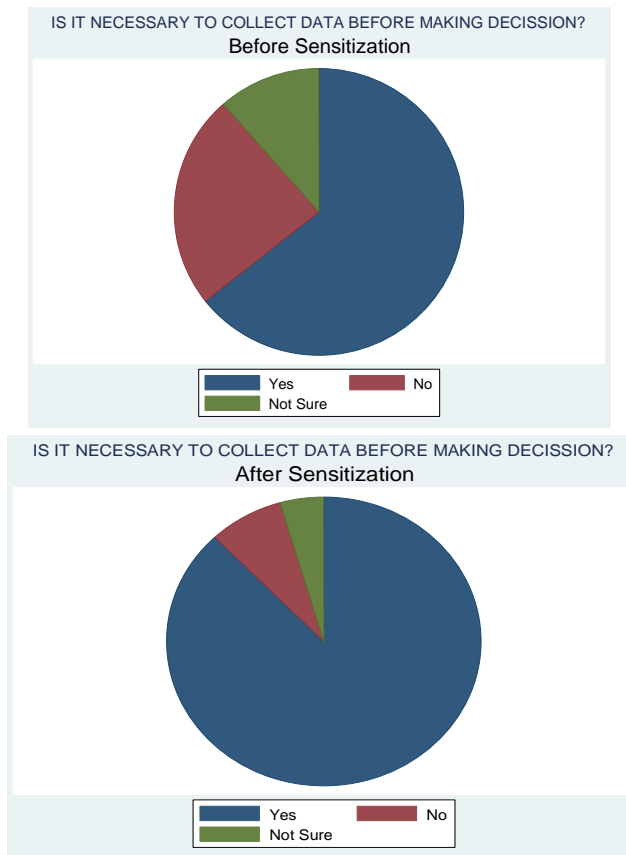| RESPONSES	BEFORE TRAINING		AFTER TRAINING	
	Frequency	Percentage	Frequency	Percentage
Yes	561	64.33	766	87.84
No	211	24.20	67	7.68
Not Sure	100	11.47	39	4.47
TOTAL	872	100	872	100

Figure 2.Responses to the question: Is it necessary to collect data before making decision?

From the results in Table 3 and Figure 2, we discovered the following based on the sample under studied before the sensitization program: 24.20% of students in SSS did not know that it is necessary to collect data before making decision while 11.47% were not sure.The workshop impacted the students such that the following improvements were recorded. From the results we discovered the following, based on the same sample under studied: the 24.20% of students in SSS that did not know that it is necessary to collect data before making decision dropped to 7.68% while the 11.47% that were not sure whether it is necessary to collect data before making decision or not dropped to 4.47%.

Table 4. Responses to the question: Can the use of Statistics make the Nigerian society better?

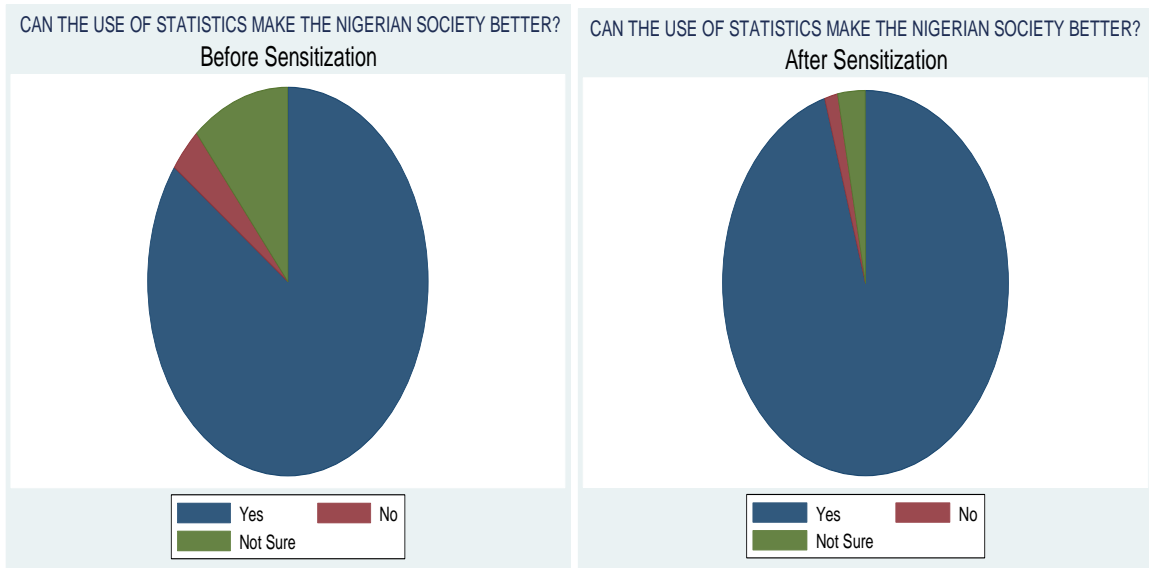| RESPONSES	BEFORE TRAINING		AFTER TRAINING	
	Frequency	Percentage	Frequency	Percentage
Yes	741	84.98	832	95.41
No	33	3.78	13	1.49
Not Sure	98	11.24	27	3.10
TOTAL	872	100	872	100

Figure 3.Responses to the question: Can the use of Statistics make the Nigerian society better?

From the results in Table 4 and Figure 3, we discovered the following based on the sample under studied before the sensitization program: 3.78% of students in SSS did not know that the use of statistics can make the Nigerian society better while 11.24% were not sure. The 3.78% of students in SSS that did not know that the use of statistics can make the Nigerian society better dropped to 1.49% while the 11.24% who were not sure if the use of statistics can make the Nigerian society better or not dropped to 3.10% after the workshop.

Table 5. Responses to the question: Is Statistics a profession?

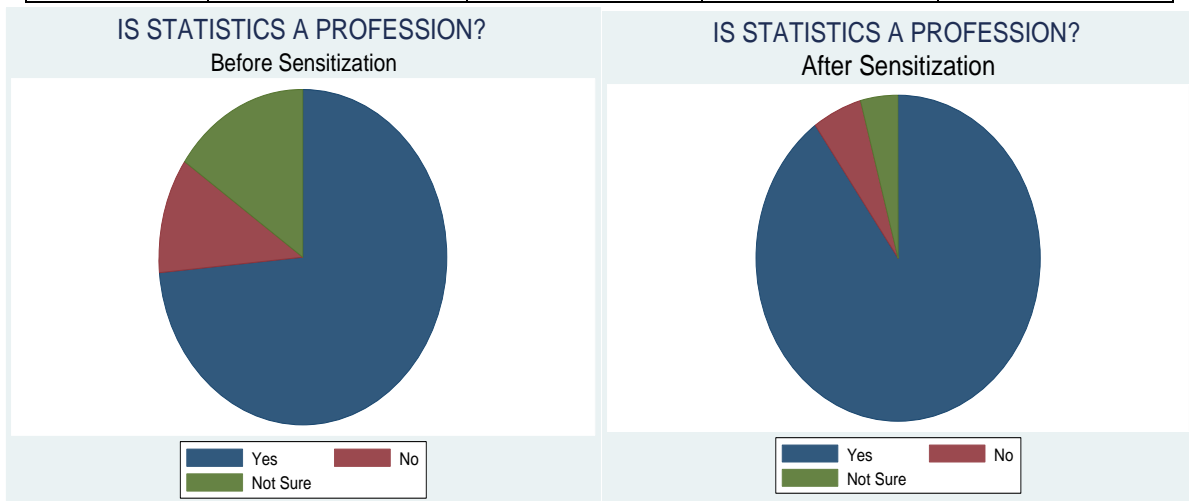| RESPONSES	BEFORE TRAINING		AFTER TRAINING	
	Frequency	Percentage	Frequency	Percentage
Yes	641	73.51	786	90.14
No	97	11.12	49	5.62
Not Sure	134	15.37	37	4.24
TOTAL	872	100	872	100

Figure 4.Responses to the question: Is Statistics a profession?

From the results in Table 5 and Figure 4, we discovered the following, based on the sample under studied before the sensitization program: 11.12% of students in SSS did not know that statistics is a profession while 15.37% were not sure.The workshop impacted the students such that the following improvements were recorded. From the results, we discovered the following based on the same sample under studied: the 11.12% of students in SSS that did not know that statistics is a profession dropped to 5.62% while the 15.37% who were not sure whether statistics is a profession or not dropped to 4.24%.

Table 6.Responses to the question: Will you love to study Statistics as a course in the Polytechnic or University?

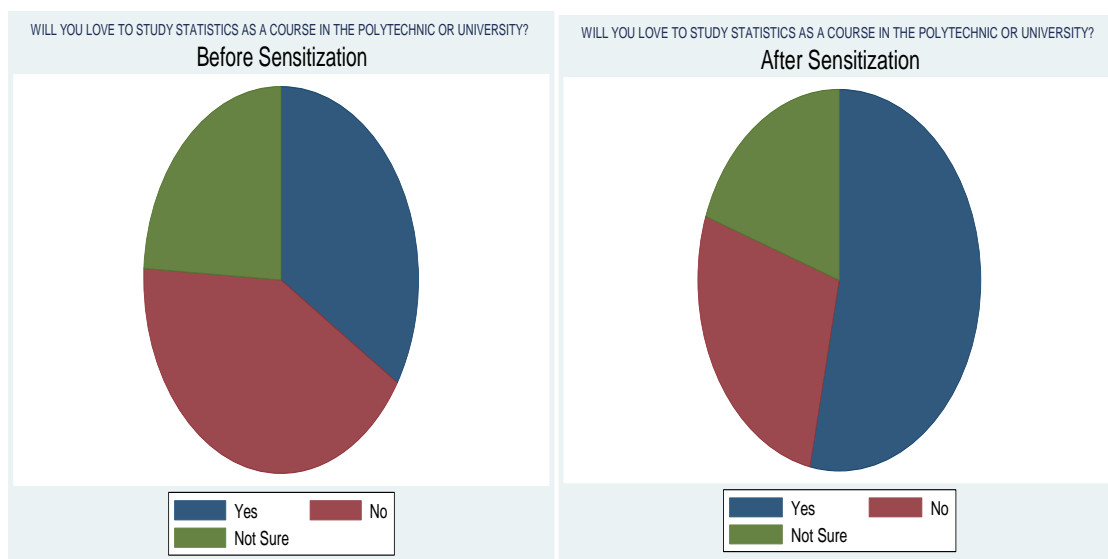| RESPONSES	BEFORE TRAINING		AFTER TRAINING	
	Frequency	Percentage	Frequency	Percentage
Yes	296	33.94	465	53.33
No	366	41.97	236	27.06
Not Sure	210	24.08	171	19.61
TOTAL	872	100	872	100

Figure 5.Responses to the question: Will you love to study Statistics as a course in the Polytechnic or University?

From the results in Table 6 and Figure 5: we discover the following based on the sample under studied before the sensitization program: 41.97% of students in SSS did not want to study statistics in the University or Polytechnic while 24.08% were not sure. From the results we discovered the following based on the same sample under studied: the 41.97% of students in SSS that did not want to study statistics in the University or Polytechnic dropped to 27.06% while the 24.08% that were not sure of their interest in studying statistics or not dropped to 19.61%.

V. DISCUSSION

Some Senior Secondary School students lacked knowledge on statistics relating to numerical facts and its potentials to improve citizens' welfare and achieve a better society. Also, there were students who didn't know Statistics is a profession talk less of thinking about it as a course of study be it at the University or Polytechnic. No wonder the low number of applicants for Statisticsprogramme. In the course of this study, the Senior Secondary School students' knowledge about Statistics was improved upon through sensitization and training. The number of applicants likely to apply to study Statistics at the Universities and Polytechnics is expected to increase in the coming academic sessions. Invariably, it is expected that the students contacted and their contemporaries will be more sensitive about the significance of Statistics for individuals and the society today and in the near future when they take over the mantle of leadership of our great country Nigeria.

IMPLICATIONS OF FINDINGS

It could be inferred that the Junior Secondary School students have similar challenges with the Senior Secondary School students as regards limitation on knowledge about importance of statistics and its existence as a course of study in tertiary institutions. This calls for the need to sensitize students on the subject matter from the grassroots.

RECOMMENDATION

Statistics should be introduced to students as a subject at the lower, middle and upper basic levels of education.

POLICY IMPLICATION

Similar to international best practices, the nine (9) year Basic Education Curriculum will need to be revised by the Nigerian Educational Research and Development Council to incorporate Statistics as one of the subjects to be studied. In this light, the curriculum will be more practical to meet the country's need in terms of statistical literacy.

VI. CONCLUSION

Ultimately, the number of applicants for Statistics programs at the tertiary levels of education will likely increase in the coming sessions for higher institutions within Kwara State of Nigeria. The students contacted and their contemporaries will be more sensitive to the significance of statistics for individual and societal growth today and in the near future when they take over the mantle of leadership of our great country Nigeria.

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