

Fostering the Practice and Teaching of Statistical Consulting among Young Statisticians in Africa

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Abstract:

Statistical Consulting is unarguably one of the most challenging and rewarding aspects of statistics. It is both an art and a science because it involves both statistical and non-statistical skills. This article considers the usefulness of statistics, importance of statistical consulting and stresses the need to improve the practice of statistical consulting among young statisticians in Africa by including it in the curriculum of statistics programs in all African Universities and institutions of higher learning. The need to establish a statistical consulting unit in all the universities in Africa, whose activities will include providing advice for researchers on a full range of topics including statistical procedures for experiments, statistical and bio-mathematical modeling, statistical computing, and interpretation of results, is also proposed.

Key Words: Empirical data, African Universities, Analysis, Curriculum, Teaching, Skills, Statistician.

1. Introduction

A flurry of papers has been written on the teaching of statistics and training of young statisticians; (see Boen,1982;Barnett,1987;Hogg,1991;Bishop,1964;Federer,1978 and Kirk,1991). Cox (1968) made some observations on the teaching of statistical consulting in a University environment, while Olaomi (2007) made an extensive attempt to relate statistical consulting with the econometrician . Boen (1982), Gibbons and Freund,(1980) wrote extensively on the role and importance of university-based statistical consulting centers. However, not many have emphasized the need to involve statistical consulting in the curriculum of all undergraduate and graduate programs in African Universities (and higher institutions of learning), to train young statisticians on the art and practice of statistical consulting.

According to a recent survey conducted by Thabane et al (2008), there are 53 countries in Africa, including the islands of Madagascar, Comoros, Seychelles, Cape Verde, and Sao Tome and Principe. The study revealed that there are 50 countries with a total of 826 universities or post secondary institutions. There are 249 universities with a web address out of which 97 have statistics or related programs. Many other universities and private institutions of higher learning have since been established in Nigeria and other parts of Africa after that survey. However, Statistical consulting is not taught separately in the curriculum of most of these universities or post secondary institutions. This paper draws the attention of educators, administrators and students to move rapidly to raise the awareness level and fill this wide gap of knowledge in statistical consulting.

According to Boen and Zahn (1982), the perspectives of Statistics are so diversified and few statisticians are knowledgeable about all designs. Statistical consultants are expected to be knowledgeable in their respective disciplines and familiar with relevant methodologies.

Decisions in many areas of modern societies are based on the collection and analysis of empirical data. Examples are experiments in research, market analysis, business or quality control in the industries. Statistics offers a variety of powerful methods and tools 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 gives suboptimal results and eventually wrong decisions are taken.

Therefore, statistical consulting provides various services including giving support in forming research questions, planning of studies, data collection, data management, statistical programming and scientific writing. The goal of teaching statistical consulting to young statisticians is to make them more proficient in applying statistical techniques and to be good communicators of statistical information. The rest of the paper looks at the description and content of statistical consulting in section 2, section 3 considers the need for teaching statistical consulting in African institutions of higher learning, section 4 looks at the advantages of developing statistical consulting skills in Africa while section 5 concludes the paper by suggesting ways to foster the learning, teaching and practice of statistical consulting in Africa.

2. Description and Content of Statistical Consulting

Statistical consulting can be described as the process of providing statistical advice and guidance to clients interested in making decisions through the analysis, collation or interpretation of empirical data. Such clients include students, researchers, administrators and so on, in statistics and non-statistics area. Also, Kirk (1991) defined Statistical consulting as the collaboration of a statistician with another professional for the purpose of devising solutions to research problems. Russell (2001) pointed out that effective communication is a crucial aspect of the successful collaboration between the client and the statistical consultant. Usually, in a consulting relationship, the person requiring help (the client) brings a problem and explains it to the statistician (consultant) who is expected to express the problem in a form where statistical methods can be applied to solve it (Moolman, 2010). In times past, many authors have written on the issues involved in conducting statistical consulting services within a university (see for instance: Boen, 1972; Gibbons and Freund, 1980; Kirk, 1991; Minton and Freund, 1977).

Good consulting requires a strong technical background in statistics, good people skills and business sense. Boen and Zhan (1982), in their paper, (Boen et al, 1982) pointed out the skills needed to work with people in a consultation relationship. Strickland (1996) opined that Time, patience, understanding, and empathy are all essential skills for collaboration between the client and the consultant but none can substitute technical competence. The consultant is armed with scientific, statistical, computing and communication skills (which includes verbal and written skills). Cabrera and McDougall (2002).

There is a growing recognition that statistics is a subject whose goal is to solve real-world problems. This is reflected in its link to other academic subjects, and in the opportunity for non-academic employments for those who study statistics. Almost all statisticians get requests for help with problems that involve statistical data analysis and application of statistical methods. In a consulting relationship, Moolman (2010) identified three ways the clients' questions should be asked and the contents of the information that should be supplied to the consultant. He noted that "The client should (a) be precise about the objectives of the analysis and give a brief background to the problem (b) Give a description of the variables and data that are being studied and possible relationships that might have to be investigated and (c) List some questions/hypotheses to be answered/tested..." Statistical consulting is indeed a multifaceted operation which requires sound logic, insightful analytical training and client centered interpersonal communication skills. (Clayton, 1996).

3. The Need for Teaching Statistical Consulting in African Universities

Statistics departments in major universities in developed countries have long operated consulting services that both serve their campuses and train graduate students. Statistical consulting has been included as part

of the curriculum of some advanced countries' universities for more than two decades and this has resulted in the production of better statisticians.(Olaomi,2007).Research in statistical methods is carried out by statistical consultants within major universities in developed countries like universities of Florida, North Carolina, York, Yale, Cambridge, Virginia, Purdue, etc. and within government agencies, research institutes and private industries. Statistical consultants employed in these activities develop new ways to collect, analyze and interpret data and experimental studies encountered in practical settings. Many of these skills are learned earlier as a young statistician under training at the undergraduate and graduate levels in the university. Olaomi (2007) also noted that "the University of North Carolina at Chapel Hill provides a dual training that includes classroom work, but also involves a 'real' practicum (1 credit course on the principles of statistical consulting in second year and a classroom oriented 2 credit course on practice in statistical consulting).This is required of all students and has been part of the curricula of graduate degree programs under supervision of a faculty member."

Also, The Department of Statistics at Virginia Polytechnic Institute, Blacksburg, United States, has a Laboratory for Interdisciplinary Statistical Analysis (LISA) which serves as a statistical consulting unit where there are statistical collaborators who are trained to help design experiments, analyze and plot data, run statistical software, interpret results and communicate statistical concepts in ways non-statisticians can understand. Their areas of expertise include: Multivariate Methods, Biostatistics, Time Series, Bayesian Statistics, Quality Control, Response Surface Models, Publication Preparation, Grant Proposals and various Statistical Packages. A statistical consultant is available at a specified time of the week in the department to answer quick questions or to help with research projects requiring less than thirty minutes. A team of statistical collaborators is assigned to work with the client if the problem requires more than thirty minutes of attention. Although, many of the universities in southern part of Africa has similar units operating on their campuses, there is need for other institutions of higher learning across the continent to follow the same pattern. Recently, a scientific computing laboratory was commissioned in the Department of Mathematics, Obafemi Awolowo University to train and help solve clients' problems from across various faculties and research groups across the campus. This Laboratory is being managed by expert faculty members who are vast in the use of various software like R, SAS, MINITAB, STATA, S-PLUS, MATLAB, MATHEMATICA, SPSS etc. Also, a new group called Young Statisticians' Association of Nigeria (YSAN) of which the author of this article is the chair, has been inaugurated. YSAN is a club of young and vibrant intellectuals (Undergraduates and Graduate Students) from various fields across the university like:

Statistics, Mathematics, Economics, Demography and Social Statistics, Computer Science, Health Sciences, Actuarial Science, Natural Sciences, Biostatistics etc whose aims and activities include but are not limited to the following:

- Regular discussions and training on modern areas of research in Statistics and its applications.
- Various in-house training on current Statistical/Mathematical software and related packages.
- Conducting various developmental seminars and workshops to train Young Statisticians.
- Cross fertilization and breeding of new academic ideas, knowledge and mentorship leading to cutting-edge research and scholarship.
- Participating in quiz competitions, trips and academic excursions in liaisons with other schools and organizations home and abroad.

- Posting of various E-books, research and tutorial materials on our proposed website and
- Engaging in Statistical consulting services, etc.

Obviously, statisticians and statistical methods play an important role in scientific studies to seek knowledge and to improve our lives generally. Therefore, for a young statistician or mathematician in Africa, the learning and practice of statistical consulting offers a wide variety of professional opportunities which give solution to several life issues. Teaching Statistical consulting at the undergraduate and graduate levels aims to develop the next generation of statisticians armed with the necessary skills for jobs in government, industry or in academics. Therefore, we suggest in this article that the age long practice of teaching and offering statistical consulting services on campus done in advanced countries as pointed out above should be done likewise in all African Universities, especially in West Africa.

4. Advantages of Developing Statistical Consulting Skills in Africa

The key point in this paper is the contextual training of young statisticians in Africa. It is believed that if the training and teaching of statistical consulting skills is upheld in African Universities (and other institutions of higher learning), the following advantages will be achieved as also opined by Thabane et al (2008):

- Producing graduates who have a sound knowledge of the major areas of statistical methodology, founded on rigorous theoretical principles which equip the graduate to acquire further knowledge for the benefit of Africa.
- Enhancing the practical use of statistics by contributing to the body of fundamental statistical science through research.
- Promoting the use and knowledge of statistics in all fields in which statistics can contribute to a better understanding of scientific and social phenomena.
- Enhancing the quality of decisions and conclusions made on the strength of the statistical approach to research and broader issues.
- Making statistics a more rewarding profession by increasing its utility and value to society.
- Improving the educational experience for students and enhancing their career decision making process and outcomes.
- Boosting the self image of statisticians and ensuring that statistics continues to grow as a field.

5. Concluding Remarks and Suggestions.

If the opinion of Tulya-Muhika (1990) who posited that: "the statistician of the future will have to be a multi-faceted, knowledgeable, public relations officer. He (or she) will need the capacity to do statistical work; be knowledgeable in data processing and conversant with development issues; be able to work with policy makers, data processors, and other groups... form an effective bridge between statistical information and users of statistics, including the general public" as also quoted by Thabane et al (2008) will be fulfilled in Africa, frantic efforts must then be made to develop key skills and promote the practice of statistical consulting among young statisticians in African Universities and other institutions of higher learning.

Finally, we hereby suggest the following in order to foster the practice, teaching and learning of statistical consulting among young statisticians in Africa:

- All African Universities (and other higher institutions) should include statistical consulting as a course in their teaching curriculum.
- More mentors should arise within and outside Africa to tutor young statisticians in Africa on the art and practice of statistical consulting.
- Funds should be made available by governments and agencies for authorities in all African Universities, research institutes and higher institutions of learning to establish statistical laboratories, and equip the already available ones. Also, young statisticians should be sponsored on short courses abroad to learn fundamental statistical consulting skills.
- Students, educators, administrators, academicians and consultants in Africa should organize, promote and embrace seminars, conferences, training sessions and workshops in order to enhance statistical consulting skills among young statisticians in Africa.
- Collaborative studies should be encouraged among young statisticians in some Southern African Universities and beyond (where statistical consulting is more prominent) and other institutions of higher learning in Africa in order to improve statistical consulting skills all over Africa.
- Finally, a statutory statistical consulting service office should be established in all the institutions of higher learning in Africa. The functions of this office should include providing advice to researchers on a full range of topics like choice of experimental design, management of data, statistical procedures for analyzing data, bio-mathematical modeling, statistical computing and interpretation of research results, among others.

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