

Statistics Education in Kenya: Developments and Challenges

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1. Introduction

In the twenty- first century countries of the world, whether developed or developing are all aiming to become knowledge based economies (World Bank, 2002; Abbas Bazargan, 2005). Kenya is not an exception. In Kenya today greater value is placed on statistical information, statistical skills and statistical knowledge. Student enrollment in statistics education programmes in universities in Kenya has increased rapidly in the past two decades. This expansion has brought with it attendant challenges shared by both developed and developing countries (Godwin Ogum, 1998; Abbas Bazargan, 2005). Odhiambo (2002) reviewed the teaching of statistics at university level in Kenya. In this paper the aim is to examine the developments which have taken place in statistics education and how the rapid increase in student numbers and technological advancement has impacted on the teaching of statistics in the country.

The paper is arranged as follows: In section two we review the development of statistics education in Kenya. In section three we present the teaching of statistics in Universities in Kenya. Here organizational setting, student enrolment, curriculum design, the statistics teaching staff and assessment and quality assurance are presented. In section four we indicate some of the common challenges facing statistics education in Kenya and in section five we present some suggestions for future development of teaching and learning of statistics in universities in Kenya.

2. Statistics Education in Kenya

Kenya runs an 8-4-4 system of education; that is eight years of primary education which most pupils enter at the age of 6 years; four year of secondary education; and four years of university education which leads to the award of a bachelor's degree. Statistics, with some introductory elements of probability is taught in secondary schools. It forms part of the mathematics curriculum. At tertiary level, statistics programmes up to at least bachelor's degree level are offered by all the seven public universities and four private universities. Six public universities offer MSc and PhD programmes in statistics. Courses in applied statistics are also provided for students pursuing studies in education, economics, business studies, actuarial science, agriculture, and natural sciences in universities and colleges in the country. Many first year students take statistics as it is a compulsory course in most social science departments of universities and colleges. Universities

consider statistics to be part of basic and essential academic skills.

The past decade has seen significant developments and changes in statistics education worldwide, putting emphasis on teaching statistical thinking; student centered learning, using real life data, using technology, and communication skills. These global trends have not been embraced in Kenyan universities and colleges to any meaningful extent. Little emphasis is placed on teaching statistical thinking or reasoning. Hence many students find statistics difficult; they lack confidence in their quantitative abilities.

The quality of statistical education in Kenyan universities is adversely affected by inadequate learning resources and shortage of qualified teaching staff. This challenge is more pronounced in public institutions which have to cope with increased student numbers in statistics education programmes without corresponding increased funding from the Government. The difficulty of attracting and retaining qualified staff to teach statistics at universities is a worldwide problem. Most people with higher degree qualifications in statistics are attracted to work in industry where they earn better salaries. In fact universities in Kenya are finding it pretty difficult to attract suitably qualified bachelor's or master's degree holders to undertake masters or PhD studies and opt for academic careers in the universities.

3. Teaching of Statistics in Universities

3.1 Organizational Setting

Statistics is mostly taught in mathematics departments. Two universities have statistics departments. University of Nairobi has a department of statistics within its school of mathematics and Jomo Kenyatta University of Agriculture and Technology also has a statistics department. Maseno University has a sub-department of statistics and actuarial science within mathematics department. Other faculties and departments requiring statistics to be taught to their students as part of their degrees receive service teaching from mathematics or statistics departments in the respective universities. In some universities social science departments employ their own statistics lecturers.

The degree programmes offered are in mathematical statistics, applied statistics, biostatistics, social statistics and biometry. These programs are designed to train statistics professionals to work in public affairs, agricultural and bio-medical research, social research, academics, business and financial sector etc. The degrees currently given in these universities are: BSc(Statistics), BSc(Applied Statistics), MSc(Statistics, Applied Statistics, Social statistics, biostatistics, biometry) MPhil(Statistics), DPhil(Statistics) and PhD(Statistics).

3.2 Student Population

The student population currently enrolled in statistics diploma and degree programmes is distributed as follows: Diploma-10% of which 30% are women; Bachelor's degree-71% of which 20% are women; master's degree-15% of which 21% are women; and PhD degree-4% of which 30% are women. The undergraduate student population comprises of those entering university after completing twelve years of school(8 years of primary school and 4 years of secondary school) and

having an average age of 19 years at entry. In many universities in Kenya, more than 50% of those enrolled in masters programmes are self sponsored students who are studying part-time, the rest are on scholarships or staff development programs of the universities. Nearly all students on PhD programs are sponsored by the universities as part staff development.

3.3 Curriculum Design

The universal aim of curriculum for statistics education at all educational levels is to help the student develop statistical knowledge and reasoning skills. An overarching goal of statistics education is that by the time students finish their encounters with statistics, they become statistically literate citizens able to understand and deal with uncertainty and variability, and to participate in the production, interpretation and communication of data that may arise in their professional life (Gal and Garfield, 1997).

Existing statistics curriculum in the universities and colleges in Kenya appear to lay emphasis on procedural skills and mathematical relations than on statistical thinking and reasoning. Little emphasis is placed on developing interpretive skills and statistical literacy; developing ability to communicate statistical information; developing an appreciation of probability, chance and randomness in the world. This state of affairs may be partly due to the fact that in the existing statistics curricula the student learning outcomes are not spelt out or are not clearly stated. The main degree programs are based at University of Nairobi and Maseno University. The survey revealed significant duplication in statistics curricula across universities with no discernible new innovations.

Due to large class sizes in public universities, the lecture is the default method of course delivery in those universities. There is little or no active learning especially at undergraduate level where the classes tend to be quite large. Using real data to enrich the learning experience of students is very rare in many of the universities. In many of the public universities with degree programmes in statistics, students are exposed to programming and use of statistical software in performing data analysis mostly by labs or exercises. Due to the large number of students competing for limited computing facilities statistics students do not have opportunity to gain sufficient practical experience in practical data analysis.

In the private universities, statistics is taught mostly as part of another degree programme. Private universities have ICT resources and there are efforts in some of these universities to embrace newer teaching and learning approaches that encourage active learning. These universities encourage increasing reliance on technology to promote interactive and student centered learning. Students have more access to web resources such as books, journals, and real data bases. The curriculum also spells out clearly the student learning outcomes of each course. The use of real life case studies, collaborative learning and e-learning are promoted to enrich student learning experience especially at masters level.

3.4 Teaching Staff

The minimum qualification to take part in teaching a degree course in Kenya is a master's degree in

the relevant academic field. Persons with Bachelor's degrees only teach in diploma colleges. The proportional profile of people with degrees in statistics and are involved in teaching of statistics at university or college levels is as follows:

Bachelor's degree: Master's degree: PhD degree =4:5:2

In the best of cases 30% of statistics lecturers in the universities are par-time lecturers drawn from other universities or tertiary colleges and a small number from industry. Some statistics departments are experiencing acute short of teaching staff. This has led to overloading full-time staff and thus greatly reducing their capacity to do research and be innovative in teaching. Staff development programs for statistics lecturers are stagnating in most of the universities due to difficulty in attracting graduate students into academic careers in statistics as mentioned earlier.

3.5 Assessment and Quality Assurance

Assessment instruments are very diverse across universities in Kenya. These include continuous assessment tests, mid tem tests, final exams, assignments, class exercises, individual papers, individual projects and group projects. In some universities students evaluate all the courses by means of a questionnaire that permits quantitative ratings. Some universities also use qualitative tools such group discussion. The practice of evaluation of courses by students is more developed in private universities. The evaluation results are used to improve student learning outcomes and subject the courses to a continuous innovation process.

Expansion of student enrollment in statistics has brought greater diversity in student needs and diversity. To promote good practices in quality assurance in statistics education, there should be mechanisms in place to assure and improve the quality. The government of Kenya through the Universities Act (CAP210B) of 1985 established the Commission for Higher Education which is a body charged with quality assurance and quality improvement in higher education in the country. The quality assurance process includes two components: internal quality assessment and external quality review. Many universities in Kenya have yet to put in place this model of quality assurance. However, most universities in the country have maintained the practice of visits by external examiners as an aspect of external quality assessment. Some universities have also strengthened their internal moderation processes of examinations as an element of internal self evaluation. But a systematic process of self evaluation where data pertaining to teaching and learning is collected and analyzed and a report prepared; followed by external quality assessment through which peer reviews are made and the self-evaluation report validated, still do not exist in the majority of universities in the country.

Strathmore University is among the few universities in the country which have established a quality assurance framework. Strathmore has in place an integrated quality management system that deals with continuous monitoring, auditing and improvement of both academic and management processes through quarterly internal quality assessment and external quality reviews.

The inter University Council of East Africa which has as its members all the accredited universities in the countries comprising the East African community (Kenya, Ruanda, Burundi, Tanzania,

Uganda) working together with the respective higher education councils or commissions in these countries has put in place a quality assurance framework for higher education and all member universities are being encouraged and given support to adopt the framework.

4. Challenges Facing Statistics Education in Kenya

We have identified the following as some of the challenges militating against provision of quality statistics education in Kenyan universities:

- a) Inadequate number of suitably qualified statistics lecturers, which has led to poor teacher/student ratios especially in public universities where student enrolment in statistics courses is large. At graduate level we observed that lack of suitably qualified PhD holders has affected supervision of research students at masters and PhD levels. The completion rates of research thesis in many universities are very poor.
- b) Inadequate or non availability of learning resources such as up to date and relevant textbooks, journals, statistical software, local case studies, real data sets, ICT infrastructure. Difficulty in accessing research journals is a major impediment to quality research output in our universities. Inadequate ICT infrastructure has slowed down the uptake of technology in teaching. Recent intervention by Kenya Educational Network, through a World Bank funded project, to upgrade bandwidth in universities in Kenya, is a most welcome move. This will increase the capacity of these universities to use interactive technologies and e-learning environments to enhance student experience of learning statistics.
- c) Availability of real data sets is essential for teaching statistical literacy and statistical thinking. Gould, Kreuter and Palmer (2006) describe the qualities of data that would be suitable for teaching statistical thinking. They also suggest that students may take greater interest in real data collected by one their lecturers.
- d) There is no research in statistics education or mathematics education taking place in our universities which has contributed to lack of innovation in curriculum development and teaching approaches.
- e) Lack of specification of student learning outcomes including “disciplinary” and “generic skills” in statistics curricula. Generic skills might include statistical reasoning, ability to apply statistical knowledge in practical situations, ability to work in a group or ability to communicate statistical information. Without specification of learning outcomes for each course or programme it is not possible to measure what a graduate has learnt and can apply.
- f) Many first year students take statistics as a required course in most degree programs in social sciences, business sciences and biomedical sciences offered in universities and

colleges. These sorts of students do not take statistics out of their own free choice. They find statistics difficult. The challenge facing universities in Kenya is how lecturers can help students overcome the difficulties they experience in studying statistics. Some authors suggest that putting emphasis on teaching statistical thinking or reasoning and embracing innovative teaching methods that emphasize cooperative and active learning, small group sizes, interactive assignments, use of real data, may be of great help (Chance, 1997; Garfield, 1993; Verhoeven, 2006).

5. Future Developments in Statistics Education in Kenya

The interviews we conducted during this survey reveal that many universities are planning to start degree programmes in statistics. Such moves will increase enrolment of students taking statistics at degree levels. In order to improve and sustain good quality statistics education in Kenya we suggest that universities consider the following approaches:

- a) Promote research in statistics education by providing funding their annual research budgets.
- b) Develop teaching and learning strategies that enhance student learning experience through innovative curriculum design and use of interactive technology to enable blended teaching and learning.
- c) Put in place quality assurance framework which allows internal quality assessment through self-evaluation; and external quality assessment through peer review.
- d) Encourage and support staff to develop local case studies and collect real data sets for use in teaching statistical literacy and statistical thinking.
- e) Invest in ICT infrastructure in order to provide increased access to on-line information resources in university libraries; and increased e-learning capacity in the universities.
- f) Provide lecturers with training on learner-centered pedagogy and interactive technology enhanced pedagogy; case writing and case teaching, as part of their continuing education.
- g) Provide incentive schemes to attract and retain highly qualified statistics teachers.

6. Conclusion

The aim this paper was to describe the developments and challenges in statistics education in universities and colleges in Kenya. The main conclusions are that:

- a) The uptake of technology in teaching and learning of statistics in universities in Kenya is slow.
- b) The quality of statistics education is affected by inadequate number of qualified statistics teachers and insufficient availability of teaching and learning resources.

- c) Future developments to ensure sustainable quality statistics education must include promotion of research in statistics education; establishing quality assurance framework in all universities; embracing interactive technology in teaching and learning; and having viable strategies for staff retention.

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