

INCREMENTAL MODERNISATION OF STATISTICS TEACHING AND CURRICULUM AT MASENO UNIVERSITY, KENYA

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Modernisation of statistics teaching is a continual problem the world over. The advances in statistical methods and tools along with the growing demand of applied practitioners creates a dual need of people with the theoretical knowledge to take the subject further and those with the practical knowledge and skills for the many current problems requiring statistical support. The universities in Kenya are largely still teaching theory as was done 40 years ago. Change is possible and initiatives like the RUFORUM M.Sc. in Research Methods show that with sufficient resources a modern curriculum can be created in Kenya in a short space of time. Maseno is a young university, less than 20 years old. With very few resources the department of mathematics and applied statistics has been taking a more gradual approach to modernise their teaching. This paper describes what has been achieved, our current work and what is planned.

INTRODUCTION

Maseno is a new public university in Western Kenya with a department of mathematics and applied statistics in the faculty of science. Undergraduate degrees include applied statistics with 50 students per year, and actuarial science with 40 students per year. Statistic courses are also offered to science, arts and education students taking mathematics as one of their subject areas. There is also a full-time M.Sc. degree in applied statistics.

The applied statistics and actuarial science undergraduate degree programs have both been started within the last 10 years. The initiative for these programs came from within the department and both programs are currently well respected within Kenya. Maseno has also recently committed all undergraduate degree programs to having an IT component.

Current initiatives relate particularly to modernising the teaching of the applied statistics M.Sc. These changes are occurring within the current curriculum and include the use of e-learning short courses and numerous computing resources to give a more applied perspective. The resources include an electronic textbook with a testing system (Stern et al., 2010), numerous statistical software packages that can be freely distributed, and various pre-prepared materials such as case studies and statistical games.

Based on these experiences the department expects to start both a new undergraduate and a new postgraduate degree program, with the first students being admitted in autumn 2010. These degree programs have both been designed to fit in with the needs of the students and employers as well as being feasible within the current capabilities of the department.

We acknowledge the value of having a supportive university administration for changes to be made. This does not have to be financial support. Sometimes a bit of flexibility for an individual member of staff's responsibilities or workload can make all the difference. Being able to use university facilities at convenient times for teaching or seminars is an essential component of hosting visitors and building collaborations. Most importantly an interest in and recognition of the changes encourages an atmosphere of constructive dynamism among the staff.

In Kenya JKUAT, another Kenyan university, have just started an M.Sc. in research methods. This very impressive program is funded through RUFORUM, (Coe et al., 2010). Earlier the University of Nairobi had extensively modernised the teaching of statistics to their agriculture students (Kurji et al., 2010). This paper shows that change is possible without extensive financial support, especially if funded programs lead to teaching resources that can be used more widely.

THE PAST

Maseno University was born in 1991 as a campus of Moi University and made a fully independent University in 2000. It currently has 3 faculties and 4 schools. Undergraduate degrees at Maseno have at least 7 courses per semester, each of which has 30% continuous assessment and 70% exam, with an overall pass mark of 40%. The exams are taken at the end of the semester in which they are taught and typically the continuous assessment consists of CATs (continuous assessment tests) taken in lectures. In 2005 a compulsory IT component was added to all courses at the university so that students are required to take two IT courses each semester.

In 1999 the department of mathematics and applied statistics introduced the undergraduate degree in applied statistics; this has become very successful and includes a placement as well as a practical project. In some cases the placement highlighted the need to make the course more applied and the department used this feedback to update the teaching and revise the program. In 2005 the actuarial science undergraduate program was introduced. This included the successful placement and project components of the existing degrees, and was conceived because of the growing demand from Kenyan financial institutions for trained actuaries. It is currently one of the most demanded courses in Kenya requiring exceptionally high grades for admittance.

In 2000 the department started the applied statistics masters program. The course title represented the desire for change, though originally the course content was traditionally theoretical.

THE PRESENT

Within the last two years steps have been taken to modernise the applied aspect of the masters program. One serious problem was the lack of availability of computers to staff or students and so the lecturers were forced to focus on teaching the theory. Recently computers have become cheaper and more accessible. In the latest intake at least half the M.Sc. students have their own laptop computers.

It is a big breakthrough for postgraduate students to have their own personal computer that they could use at home. This helped in numerous ways:

- The problem of computer literacy was reduced. A number of the postgraduate students were completely computer illiterate when starting the course.
- The student's access to resources was vastly improved. Maintaining an up to date library is very costly particularly at the postgraduate level. However many resources are freely available on-line, and can therefore be made available for students to use, even at home.
- The access to computers improved teaching. It was sometimes problematic to have access to appropriate computers for practical session, or for students to repeat the practical at home.

The importance of computers and particularly laptops is not new. Some postgraduate degree programs, such as the research methods M.Sc. described in (Coe et al., 2010), supply students with laptops. What has changed in the last couple of years is that, given the current cost and availability, students can buy them themselves, even somewhere as remote as Maseno.

Once access to computers is established, the key resources need to be identified such as, an electronic textbook, statistical software, realistic data, and the internet. We opted to use resources which we were free to distribute on a DVD whenever possible so that our solution would be sustainable and the students could continue using the resources after they leave the university. We found some very high quality resources, primarily thanks to work of the biometry unit, University of Nairobi, and SSC, Statistical Services Centre, Reading (Kurji et al., 2010).

Our approach has been to use existing resources. This has some important advantages:

- Changes can be implemented faster.
- Lecturers can focus on the interaction with the students as opposed to creating the resources.
- There is a wide variety of resources since we are not tied to our own creation.
- The resources are of high quality, as they have been developed over a long period of time.

The last point is important in our context. Development of high quality resources takes continued investment of time and support over long periods. Our lecturers have a normal lecturing load of three courses a semester with numerous other responsibilities. As such it is near impossible to find sufficient time to produce a high quality product independently. Our problem is not unique; most Kenyan, and possibly African, lecturers are in a similar situation.

Not having the time or support to create independent resources does not prevent us from contributing to resource development. For example CAST (Computer Assisted Statistics Textbooks <http://cast.massey.ac.nz/>) has recently become more than just a textbook by adding an imaginative online testing system, (Stern et al., 2010). This testing system was used by our postgraduate statistics students, in a trial from which everybody gained, as follows:

- The CAST developers gained from the bug fixes and feedback we were able to give.
- The students gained from having access to cutting edge resources and being involved in the resource development process.
- For Maseno University the skills gained from the experience can be used for future e-learning development as well as for the teaching of large undergraduate classes.

Through collaboration with SSC Reading, some of our postgraduate students were able to participate in some highly professional e-learning short courses, (Dale et al., 2010). This is another instance where we have been able to give feed-back and help in the development.

The continuous assessment part of the M.Sc. course has traditionally been given as a midterm style exam. As part of our efforts to make this course more applied some courses introduced mini-projects, in a variety of different ways, (Musyoka et al., 2009). In some courses we based the projects on Statistical games, (Stern et al., 2009), in others the students used their own real data. This was an instance where we were able to introduce transferable skills through student presentations and report writing.

Any visitor to Maseno recognises the many positive points to being a university which straddles the equator in a beautiful location, and that one serious downside is the isolation. The positive points and enthusiastic students have tempted a few lecturers from the UK to give one week intensive courses in exchange for the flight and accommodation. This worked particularly well when the visiting lecturer prepared a full course with lecture notes, slides and materials, because this led to further staff development. In the following year two junior staff, who had attended the course as students, were given the opportunity of giving it, with a more experienced lecturer being an observer in the lectures, and taking responsibility for the course (Musyoka et al., 2009).

So far the students have been most receptive to the changes, because they realise the value of the more applied education to their future professional development. Tempting the staff to change is sometimes harder. Our solution has been to let the members of staff who do not wish to change, continue with their traditionally-taught courses. We do not see this as a compromise as much as moving steadily towards the type of course we are aiming for.

THE FUTURE

Maseno is starting a new 'mathematical science' undergraduate degree program in 2010. This includes the diverse areas taught in the department in a single flexible degree. It responds to comments from prospective and current students that some do not know how to differentiate or choose between the various degree programs.

In the first and second year, this degree will give students a broad foundation, exposing the students to pure and applied mathematics, pure and applied statistics, actuarial science, and IT. Most courses will be core but the students will be permitted to include any course offered by the department as an optional course.

In later years students have a wide range of courses to choose from, since all courses offered by the mathematics department are open to them, if they have done the required prerequisites. This allows students to graduate from the 'mathematical science' degree with knowledge equivalent to our applied statistics, actuarial science, or mathematics students depending on their personal preference and choices. So we are feeding off our existing programs.

In developing the program we concentrated the changes in certain key courses. This has the advantage that the department can still realistically teach the program with existing staff and minimum additional input. If successful some of the changed courses can also be offered in the existing programs. The two types of course which are to be changed the most are:

- The IT courses. It was deemed essential to create highly relevant IT courses which would be taught within the department. Most of these courses relate to statistics and will be taught by lecturers who were involved in the lecturers training mentioned above.
- First year foundation courses. To help students make well informed decisions about their areas of specialisation some new first year courses were introduced which aim to give the students a broader overview.

The new IT courses include material related to the 'International Computer Driving Licence' (<http://www.ecdl.com>) and the RSS, Royal Statistical Society, accreditation examinations (<http://www.rss.org.uk>), in a way which is relevant for our students. In the future it is hoped that these might lead to accreditation with the respective organisations.

Maseno University has recently committed itself to e-learning by establishing the e-learning centre and employing an e-learning coordinator. Given the existing e-learning experience, through SSC Reading (Dale et al., 2010), the department of mathematics and applied statistics will work with the e-learning centre to introduce blended learning in all the courses offered on-campus. It is hoped that with this approach, emphasis will shift from assimilation of information from the lecturers as has been the case, to active learning on the part of the students (Ginns & Ellis, 2007; Garrison & Kanuka, 2004). This will also enable us to gradually expose the lecturers to the on-line environment.

We are therefore preparing the statistics IT materials for the new 'Mathematical Sciences' degree on Moodle, the University's choice of Learning Management System. Once prepared, the materials will be adapted to be offered as facilitated e-learning modules. These modules could be grouped together into e-learning certificate courses, or diplomas.

The goal is to offer our degree programs through e-learning in line with the Maseno University E-learning Strategy (2007-2012). This would give people access to our education and improve our existing programs through the creation of the e-learning resources.

CONCLUSION

For a long time it has been recognised that change in the teaching of statistics is needed, and the world over people have been striving to modernise their teaching. Our main conclusion is that change is now possible anywhere, but is never easy. With sufficient funding, and effort it is possible to push boundaries, create resources, and change fast (Coe et al., 2010).

When funding is not available change is still possible if there is the effort and a desire to change. In this it is important to identify what is feasible and push the boundaries more slowly, taking smaller steps. It is vital to progressively feeding off materials that have already been created. It may be much less work to get an existing resource improved rather than starting from scratch, and the end result is often more valuable.

We have found value in alternating between updating the curriculum and updating the teaching. Many changes can be made within any existing curriculum by changing the way individual courses are taught, which can feed constructively into changes in the curriculum.

Change is never easy, but we have found it to be infectious, particularly given the enthusiasm of our students. So we are taking small steps, but aiming high.

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