

E-LEARNING OF STATISTICS IN AFRICA

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Some general conclusions are drawn from the experience of converting two face-to-face statistics courses into facilitated, part-time e-learning courses, and running them for several cohorts of African students. The 'Statistics in Applied Climatology' course is for National Meteorological Services staff who need to strengthen their statistical skills for the analysis of climatic data. Part of SIAC was turned into an e-learning course in 2005, and since then it has been completed by over 200 people from 29 African countries. The 'Statistics Made Simple' course was initially developed for UK science students starting a research degree, who have not yet successfully learned key statistical concepts. A number of MSc Statistics students in Kenya also participated: they appreciated both the learning approach and the course content. The success of the courses can be attributed to the enthusiasm and determination of the participants, the high-touch facilitation, and the good quality of the materials.

INTRODUCTION

Two face-to-face statistics courses were converted into facilitated, part-time e-learning courses and offered to several cohorts of African students. The 'Statistics in Applied Climatology' (SIAC) course is for National Meteorological Services staff who need to strengthen their statistical skills for the analysis of climatic data. Part of SIAC was turned into an e-learning course in 2005, and since then has been completed by over 200 people from 29 African countries. The 'Statistics Made Simple' (SMS) course was originally developed for UK science students starting a research degree, who have not yet successfully learned key statistical concepts. A group of Statistics MSc students in Kenya also participated.

The e-SIAC and e-SMS courses follow a similar mode of operation: they are both highly facilitated courses taken part-time over a period of weeks by students based at their normal workplace, or at home. Each week, students are expected to devote between half-a-day and one day to the coursework. For many, the course was their first experience of e-learning, which made an 'orientation' period necessary: this was provided in the form of a one-week 'orientation course' that preceded the main statistics course, and covered the technicalities and 'netiquette' of on-line communication. It also gave time for software and hardware issues to be identified and resolved.

BACKGROUND: THE SSC AND E-LEARNING

The Statistical Services Centre (SSC) is a self-financing centre established in 1983 at the University of Reading. It offers short (one- to three-day) courses to professional statisticians and to others who need to do statistical analysis as part of their work. It also provides a series of commissioned courses tailored to the needs of specific clients.

From its inception, the SSC has worked in a range of specialist areas. One area that has become steadily more important is the analysis of historical climatic data. Between 1983 and 1999 the SSC's training programme included a ten-week Summer Course called SIAC–'Statistics in Applied Climatology'. This course was handed over to a regional training centre in Kenya from 2000 and has run annually in Kenya since then. A version of this course was also run in French in a regional centre based in Niger, in 2002 and 2004. This work in statistical climatology has been consistently supported by the UK's Department for International Development (DFID) and the Met Office, among others.

More African participants were able to take the SIAC course following its move to Nairobi and Niamey. But the numbers were still low compared to the demand, which led to the development of an e-learning component, called 'e-SIAC': this has been offered since 2005.

The e-SIAC course was designed to cover the materials previously offered in the first few weeks of the training. A four-week face-to-face course–named 'f-SIAC'–continues to be run in Nairobi, with participation restricted to those who have completed the e-learning course.

The Statistics Made Simple (SMS) course also developed from the SSC's international interests. In 2001 an experimental three-day course was offered in Reading, with support from the Universities International Office, to incoming international postgraduate students. It was designed particularly to help students who had had little or no applied statistics training as undergraduates. Often they had received courses in statistics, but had no experience of using the computer to put statistical theory into practice. This course ran for two years and then stopped because of funding limitations, though it continued as a course for incoming agricultural research students at the University of Nairobi.

In 2002, the Robert's report on science skills in the UK identified a mismatch between the skill sets of postgraduate students and those required by employers. In response to this report the UK government created the Science and Innovation Framework (2004-2014) and provided additional funding for Universities to deliver additional training for UK postgraduates in transferable skills.

The University of Reading identified 'basic statistical skills' as a need for their science postgraduates. The Statistics made Simple course was then updated, and since 2007 has been provided as a face-to-face course. In 2008 the University supported an initiative by the SSC to turn SMS into an e-learning course. This was partly to give a choice to Reading postgraduates in the way they could take the course, and also to provide a version that could be offered more widely.

The e-SMS course was first used in Reading in early 2009. A request was made by the University of Maseno (Kenya) for four of their MSc Statistics students to join the course. This was a surprise, because the course was designed for students who were not specialising in Statistics. Nevertheless, the students' response was very positive, and led to e-SMS being offered to two groups of Statistics MSc students in Kenya in October 2009.

STATISTICS MADE SIMPLE

This course runs over six weeks, following the one-week orientation. Usually it is the first e-learning course taken by participants in Africa, so the orientation course is important. Typically, to complete it takes about four hours, split over a few days. From their previous face-to-face courses, most students expect the lecturers to 'pour wisdom' into them, in the ways criticized by many texts on modern approaches to learning (e.g., see the review by Kane, 2007).

The orientation activities cover the basic etiquette of where and how to interact with colleagues and resource persons over the web site. Students are often unused to obeying instructions in a precise and professional manner, certainly over the web. Even less are they used to the expectation that they themselves should contribute to discussions and answer questions from their fellow participants. Usually they expect only the lecturers to provide answers.

The orientation course is graded or marked in a way that ensures students complete all the activities. They must obtain the necessary marks before being permitted to start the main course.

The introduction to the main course serves to define the subject of statistics, and to introduce five typical but fictitious students, each with a data analysis problem and some with corresponding data.

The subsequent five topics are each covered over a week and involve—as a reasonable minimum—about half-a-day of work. The topic titles are as follows:

- Thinking statistically: Describing data well.
- Thinking statistically: Making good generalizations.
- Which hypothesis test should I use?
- Statistical modeling.
- Putting your skills into practice.

Topic 2 covers the normal and binomial models, plus standard errors and confidence intervals. The title of Topic 3 is facetious—it is not intended to be taken at face value. Statisticians are often asked "Which hypothesis test should I use?" One objective of Topic 3 is to help students to recognize that this is not in fact a good question. There is much more to data analysis than significance testing. Topic 3 includes the interpretation of a p -value and the difference between a 'research hypothesis' and a 'statistical hypothesis'.

For e-SMS, students are able to choose to use one of several statistics packages. It is emphasized however that this is a statistics course, and not one to teach the use of a statistics package. Courses on 'How to use package x' are much less necessary now that most statistics packages can be used via menus and dialogues. Currently students may choose from five statistics packages, and the recommendation is made that they should choose the one that will be supported later for their research work.

At the University of Reading, this course is the first of four short statistical courses offered to science postgraduates. The others—all currently face-to-face courses—are:

- Managing research data,
- Statistical graphics and modelling with R,
- Writing up your data analysis.

In the January 2009 run of e-SMS, the Maseno statistics students appreciated both the new ideas on teaching methods that it introduced, as well as the fact that it consolidated ideas covered with a different approach in their MSc course. They suggested that it could usefully be offered to a wider audience than the students in the UK for whom the materials were originally prepared. They also recommended that the course be given to Statistics MSc students at the start of their MSc course, rather than at the end.

The run that began on 12 October 2009 was for two separate cohorts of MSc students. One group comprised nine MSc students from Maseno University who started their MSc in September 2009; the other comprised 29 students who are following the new Research Methods MSc course described by Coe et al. (2010: see the proceedings of this conference). This run of the course makes full use of CAST (Computer Assisted Statistical Textbooks), including the tests described by Stern et al. (2010: see the proceedings of this conference), which was a popular component on previous runs of the course.

STATISTICS IN APPLIED CLIMATOLOGY

The Statistics in Applied Climatology course, e-SIAC, runs in a similar way to e-SMS. There is an orientation week, followed by eight one-week topics. Likewise it is intensively facilitated. The coursework requirement is more substantial, demanding at least one day per week to cover the materials in each Topic.

The audience is also more specialized, being those who are concerned with the collection and use of historical climatic data. However, this is becoming a larger group due to the increasing level of interest in climate variability and climate change. Also, climatic data has a broad range of applications, with examples in the course from agriculture (dates of planting crops), solar energy, and road building.

The e-learning began in 2005, and the way the course runs is described in detail by Butcher and Dale (2007). When the course started it was not clear that the internet facilities would enable participants to take the course effectively. The effects of slow lines were partially mitigated by supplying a CD that contains all the materials that can be done off-line. The effectiveness of the training was evaluated by Kane (2007). Her conclusion was that the slow internet lines were a problem, but the practical difficulties were compensated for by the enthusiasm and determination of the participants to learn the methods and to complete the training.

Over 200 staff, from Meteorological services in 29 African countries, have completed the training, and many still keep in touch on their 'alumni site'—which is effectively a network-based 'community of practice'.

The most recent run of the course included seven Statistics MSc students from the University of Maseno, who had each chosen to work on climatic data from Kenya for their research project. They found the course illuminating but challenging. In particular the final Topic demands that students prepare a short report to a professional standard. This was a new experience for most of the students, as it is for some of the staff from the National Meteorological Services (NMS). The challenge is valuable, however, because it helps prepare them for their Master's thesis.

This trial on the Statistics students helped to highlight a number of very valuable aspects of the e-SIAC course:

The skills are as important as the content. The content is designed for NMS staff but the skills are more general. Provided the students have an interest in the content, they will be able to learn the skills.

The facilitated e-learning mode of delivery benefits from having a varied class. Having students of different standards, nationalities, backgrounds, and interests in a well-facilitated e-learning course can broaden the understanding and awareness of the students, as they are expected to try to help each other learn. This contrasts with a short face-to-face course which works best when all the participants have a similar starting level and can learn at a similar speed.

Transferable skills benefit from an e-learning approach. Much of the facilitation time and effort goes into emphasizing transferable skills, such as good writing, presentation, organisation and communication. This emphasis is possible because the statistical subject matter is all built in to the course content, which allows the facilitator to help students who need the transferable skills.

The e-SIAC course has the potential to be of value to a wide audience, dealing as it does with statistical analysis of risks arising from climatic variability.

CONCLUSIONS

These conclusions are based on our direct experience of running statistics e-courses over several years. Firstly, it has been very noticeable that the improving internet connections in Africa and increasing availability of computers make e-learning increasingly viable.

Our experience is that a good first e-learning course requires a serious investment in time to prepare and in facilitation to give. An intensive orientation to online learning is essential, though as the mode of teaching becomes more common, e-learning courses will become more efficient and cost-effective because the mode of learning is no longer new to students.

Statistics has proved to be a good subject for e-learning because it is both a practical subject with many areas of applications, and provides a set of transferable skills that are always in demand. For a lengthy course like e-SIAC, the 'alumni site'—which is developing into a networked 'community of practice'—is a demonstrable benefit, and encourages life-long learning.

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