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## USING ELEARNING TO ENGAGE MATHEMATICS AND STATISTICS STUDENTS IN A KENYAN UNIVERSITY

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*Two introductory courses to statistics were taught to first year mathematics and statistics students as part of an initiative to introduce them to computers. The courses were offered using a blended approach which included both an eLearning and a face-to-face component. To introduce the students to the learning platform, they first had an “Orientation to Moodle” course. The statistics content of the courses used problem based learning as the instructional approach and the materials were prepared using existing resources. This paper describes the experience of introducing computers to statistics teaching in this manner and the results of the survey on students’ feedback. It also describes the impact of this experience on two other courses taken by the same group after their first year of study.*

*eLearning, undergraduate, statistics*

### INTRODUCTION

Maseno University is one of the seven public universities in Kenya. In the recent past, the University integrated an IT component into all its undergraduate academic programs. The aim of this initiative is to produce a workforce which can match the increasing use of IT in the career world. The courses were first taught by combining students from each year of study into one class. The classes turned out to be very large and with few resources and manpower it was not possible to offer the students a good education. As a result, it was thought that the courses would be of more gain if they were tailored to each of the specific degree programs. This led to some of the University academic departments assuming responsibility of hosting the IT courses and adapting them so that they are more relevant to the needs of their students.

The then Department of Mathematics and Applied Statistics, whose status has now been elevated to that of a school, became the first to design and include a set of new and innovative IT courses into its degree programs. These courses were designed in such a way that computing aspects are taught with application of statistical ideas. The first two IT courses have since been taught to first year applied statistics and actuarial science students at the University in their first year of study. The courses were given using a blended approach which combines online instruction with face to face interaction between the learners and lecturers which is recognized to have a positive impact on students (Charles, Joel, & Patsy, 2004). This was undertaken in collaboration with the directorate of eLearning as part of a series of initiatives (Stern, Ongati, Agure, & Ogange, 2010) designed at improving and modernizing statistics education at the University.

The members of staff who were involved in the development and teaching of these IT courses had acquired the important skills from several initiatives started in the department. The first one involved introducing computers to the MSc teaching of statistics (Musyoka & Stern, 2009). The second initiative came through ongoing collaboration with the Statistical Services Centre (SSC) University of Reading where the members of staff were exposed to and involved in fully online eLearning courses (Dale, Clark, Stern, Leidi, & Stern, 2010). A further one used pre-prepared materials in the teaching of MSc Statistics students to train junior members of teaching staff (Musyoka, Otieno, & Stern, 2010)

This paper will discuss the courses and the actual experience of giving them. The content for these courses were adapted from existing courses in a training pack developed by University of Reading (SSC University of Reading, 2007) which comprises statistics courses developed for the SADC (Southern Africa Development Community) Secretariat funded by the European Union. This training pack is available as an open educational resource which was prepared with a strong emphasis on encouraging problem based learning with relevant problems to the African context. At the end of each course the students completed a questionnaire to provide feedback on the impact of the course. The results of the survey on students' feedback are discussed. The paper also discusses two other courses which did not use an online component but extensively used computers and a problem-based approach in their instruction to the same group of students.

The most outstanding challenge in all these courses was lack of access to computers. It is known that for an eLearning course to work there needs to be a reasonable level of physical access to computers with internet and the motivation to use them (Simpson, 2005). One of the key aims of this paper is to show that in our context the extreme motivation to use computers allowed eLearning to work even where the physical infrastructure was not yet in place. Other challenges included poor internet connectivity and lack of knowledge about computers since most of the students had not used a computer before. Despite these challenges and many others that were experienced, the students were generally enthusiastic about embracing technology in their learning.

## **THE FIRST IT COURSE**

### **About the Course**

The course was called "SMI 101: Multimedia Introduction to Statistics". It is the first IT course offered to freshmen in their first semester. It was designed to be taught as a blended course using materials prepared and made available on the Maseno eLearning Moodle site. An online orientation to Moodle was created to familiarise the students to the eLearning platform. In this facilitated orientation the students learn how to create a profile, upload a photo, post on a forum, complete choices, upload an assignment, take a quiz, write a blog and fill in a feedback questionnaire.

The course materials were based primarily on an existing course called 'Module B1: The Statistical System' which is available in the SADC training pack. The problems used to teach the key ideas in this course were highly relevant to our students. The ideas and value of

problem based learning are well documented (All Ireland Society for Higher Education, 2005) but it is important that the context is highly relevant to the students.

As with all undergraduate courses at Maseno University, the course evaluation comprised of 30% for continuous assessment and 70% for the final exam. The continuous assessment comprised primarily of regular hand-ins which the students worked on for each of the topics in the course. Group work formed a large component of the student work partly to encourage interaction between the students and help them settle into the University environment.

### **The Experience**

The eLearning ‘Orientation to Moodle’ course was offered on a voluntary basis with the understanding that the students would have to find their own ways of accessing the internet. Over two-thirds of the students signed up for this elective course and it was then agreed that all should undertake it.

Many students had rarely or never used a computer before and as they had no access to the computer lab they were forced to find access any way they could. This included phones, borrowing laptops from other students or staff and most commonly paying to use a cyber cafe. Despite these problems the students were generally excited about embracing technology into their learning.

For the many students that were unfamiliar with computers simply logging on to the eLearning site was a challenge. As with most of the challenges the students faced, the solutions came primarily from the students themselves, and they could often be seen in groups helping one another. There is a growing body of evidence that allowing groups of students to work together on electronic resources without formal teaching is an effective way of not only teaching computer skills but also content material (Sugata & Ritu, 2010). This was certainly our experience where the students adopted very positive attitudes to self learning and formed groups within which they helped one another.

The eLearning component was fully facilitated and the online facilitators were external and the students did not meet any of them until the end of the orientation. The facilitators directed students through the course and encouraged good learning practices as was the facilitation role for the staff orientation, but this time facilitation also played an important role in group building by encouraging certain students to look out for other students and help them move on. In the end the eLearning orientation took the whole semester to complete.

Due to the difficulties with computer access and the orientation it was decided to give the course and its materials without the use of computers. The problem based approach was still maintained by providing handouts which the students photocopied, some of which were transcriptions of the multimedia content. Group work was given on a weekly basis and the lectures served primarily as discussion forums for the hand-ins. The face to face discussions were hard work as students remained reluctant to engage and this led to the idea of having group presentations as part of the class time.

The most visible impact of the course was that a large number of students seem to be moving towards independent learning. A common issue, in Kenyan universities, is that throughout

their school education students are told by teachers what to learn and if they learn what they are told they succeed. This culture is hard to break in a University environment where classes are often large and resources are few. By the end of the course many students had embraced learning from prepared materials which is a good first step towards independent learning. The second step is given by their growing comfort on the computer which gives them access to many such rich resources.

**Feedback**

Student feedback about the course was obtained entirely online through the Moodle environment. At the end of the online orientation course the students filled in a feedback questionnaire on the eLearning component as part of their completion process. After the exam the students were also given access to an optional course evaluation questionnaire on the whole course. In both cases about 80% of students responded, which, given that this was an online evaluation, was already an achievement. In the interpretation of the results it is important to remember that about 20 students did not have a voice and it is likely that they had the biggest problems accessing a computer.

Figure 1: Student evaluation of the blended course shows a summary of the evaluation of the course by the students. The last column shows the average rank for the given question. The ranks are 1 for YES, 2 for Yes, 3 for No and 4 for NO. A lesson from the eLearning course was that words in capital letters are the online equivalent of shouting. It was pleasing to see that for all questions more people were shouting yes than saying no. Discussions have implied that even those who have not responded are feeling computer literate and keen for more but even if everyone who did not respond was assumed to be shouting ‘no’ all results would still average more yes than no.





	Average rank				
	1	2	3	4	
Are you now comfortable using a computer?					1.4
Despite all the problems, did you find this course worthwhile?					1.4
From the skills you acquired during the orientation, do you now feel ready to do a statistics course through eLearning?					1.8
Do you want to do eLearning courses as part of your degree program?					1.7

Figure 1: Student evaluation of blended course

The feedback confirmed that the biggest problem the students faced during the course was access to computer and internet. A large number of comments emphasised that access to computers and internet needed to be provided or improved.

Students were also asked to rank six suggested difficulties in order of importance where one affected them most seriously and 6 affected them the least. Access to computer and internet connection ranked as the most serious difficulties. The comments also provide some insights into how the students surmounted these difficulties with the computer access. The student

feedback suggests that almost all students visited an internet café and used someone else's computer at least once to access the Moodle site and more than half used their phone. Towards the middle of the course the University set up a wireless network for student access, which encouraged students to acquire personal laptops and eased the access problem a bit.

To find out what students felt would help them the most there was a feedback question about possible infrastructure development relating to IT. The students were asked to rank the proposed interventions from one to five, where 1 was the most helpful intervention and 5 was the least helpful. Encouragingly general opinion seems to be that perfect wireless internet coverage and a scheme to get reduced cost student laptops would be the most effective.

	Average rank					
	1	2	3	4	5	
Student access to a wireless network with perfect coverage and internet.		■				1.9
Current wireless internet with a scheme to get reduced cost laptops for students.		■				2.1
Small department computer labs with current internet, to which students have 9am-5pm access.				■		3.4
Large faculty computer labs with current internet, to which students have 9am-5pm access.				■		3.6
A single university computer lab with current internet, to which students have 24 hour access.					■	4.0

Figure 2: Students' opinion on how the varsity can help

One particular comment expresses most of the common perceptions on the eLearning orientation:

“at the beginning of this course i had no idea what to expect. i mean, i was not even sure what this e-learning was all about. at some point i had imagined that we would be learning in a teleconferencing kind of way, where we would interact with our instructors in real time without necessarily going to class. so it bothered me a lot because i worried that i would miss out because i do not have a computer of my own as yet, which meant that accessing the material would be hard. but i am happy to say that i was wrong. this eLearning was a tad bit demanding because most of us do not have easy access to computers but rather enjoyable. it is something i feel proud to have been a part of and definitely something i would like to do again. and scoring 100% in the assignments was quite easy, and i loved that too! probably, next time the content of the course should be made more challenging for those of us who love challenges because to be quite frank, the orientation was too easy.”

Students' opinion on the usefulness of the course shows that the course as a whole was well received. In feedback on various aspects of the course, on average students responded that things were 'just right' with the one exception of group work where the average indicated that students felt there was slightly too much group work.

Students were also asked to give their opinion on the quality of the principal components of the course which include handouts, activities, discussions and online component. Students'

ranking of the four main course components shows that on average all components were perceived to be of a good quality. The comments single out the eLearning component as being the most appreciated but in the evaluation of the quality the eLearning was not rated any differently from the rest.

The student appreciation for the course was one of the main messages from the comments however it was also clear how far these students still have to go. The lack of comfort when handling a computer was still apparent, as was the inexperience in communicating their opinion in writing.

“in my own opinion and understanding i do think and believe that this course comes in handy in the current world of development and research. i therefore feel the course plays a mega role.”

## **THE SECOND IT COURSE**

### **About the Course**

The course was called “SMI 103:Handling Data”. It was offered to the same group of students in the second semester of their first year of study. Unlike the first course, this course was successfully given using as a blended approach with materials prepared and made available on the Maseno eLearning Moodle site. This can be attributed to the fact that the students were now computer literate and could navigate the Moodle site without much difficulty.

The content of the course was adapted from an existing course called ‘Module B2: Handling Data’ in the SADC training pack. The course combines teaching basic spreadsheet and word processing skills with simple statistical and data management ideas. Throughout the course, the flow of data through a scientific research project is explained and students get a practical experience of handling data. Some of the skills that the course provides include data collection, data entry, data organisation, exploratory analysis, report writing and presentation.

The course evaluation comprised of the standard 30% for continuous assessment and 70% for the final exam. The continuous assessment comprised primarily of online tasks for each of the topics in the course. There were no offline submissions for this course and as such grading and feedback to assignments were also given online. The assessment activities mainly included quizzes, graded discussion forums and assignments. Throughout the course, the students worked in groups of five and hence it was easy to manage the learning and assessment activities. Each group had a mini-project which they applied key ideas taught in the course.

### **The Experience**

Like the first course, a computer lab was not allocated for the course. But this did not pose a threat to the intended aim of the course because it was found out on the first lecture that 33 out of 97 students had acquired personal laptops. This was very interesting and encouraging given that computer access among students in the University is 10% on average (700 computers for 7000 students). This implies that there was an improvement of access from 10% to 30% within a semester in the University. It is evident that the first course had

succeeded in changing the attitudes of the students towards the importance of computers for their own education.

The online component was created largely due to student demand, which was expressed at the beginning of the course. The course page on the Moodle site was created which comprised of aims and objectives, resources, activities and assessments for each topic. Each week's work was organised into one topic and there were a total of 10 topics. The course was facilitated by the course lecturer. Since the students were already familiar with the Moodle site, most of them were active online throughout the semester. This course succeeded in using a blended approach.

Lecture hours comprised of discussions and practical work. Access to computers was needed for practical work and sometimes for access to online material in the Moodle site. With 33 laptops between them, the students were willing to share and work in groups during the lecture hours. Each group comprised of 4-5 students who shared at least one laptop and this size was enough to allow everyone to participate actively. The department was very supportive in providing a room with access to power sockets to facilitate the use of the laptops. This room is usually reserved for postgraduate teaching.

The problem of internet access was partly solved because the allocated room for lectures also had access to internet ports. The technician was always ready to assist configure the laptops to the LAN network. This was useful whenever access to online materials was needed during the lecture. Outside the lecture hours, a wireless network was also available for students which had a number of hotspots within the University premises. Often groups of students were spotted working together in these hotspots. There were still challenges; the wireless network is usually weak, and as a result the students had to resort to alternative ways of accessing the internet such as cyber cafes.

A notable challenge that affected the online component was the instability of the online learning system, Moodle. During the course period, the site was down a couple of times and sometimes crashed. It was reported for most of the times that the main problem was related to where the site was hosted. Through this experience, the stability of the site was found to be of paramount importance for successful online learning and the University decided to host its site with a professional server in the UK.

By the end of the course, one of the most important skills the students learnt was how to engage in discussions in both classroom and online environments. Classroom discussions were possible because the online component allowed for access to materials beforehand. Confidence in the use of computers and the Moodle site had also grown immensely.

### **Feedback**

In the same way as the first course, a feedback questionnaire was administered to the students to evaluate the usefulness of the course. More than 80% of the students participated in the online evaluation, but only half of the data collected from the respondents is available. The loss of data was caused by the instability of the Moodle site.



At the end of the course, discussions with the students revealed that the course was very useful and important to them. It was unanimous that they enjoyed learning using this approach and would like future courses to run in the same way. This information is clearly depicted by the data that was salvaged from the evaluation exercise.

The students were first asked about the usefulness of the course. In general, they seemed to have found the course very useful. Many of the comments indicate that the students appreciate the fact that the skills taught by the course are important and widely applicable.

“The course is very helpful as we get to know what to do after data has been collected. how to analyse it and all. these are the basis of the statistics course”

“The course has given me confidence when working with computer in areas like excel,microsoft office and the internet. The course is very realistic, you get to have an experience of handling data.”

The students were also asked to rate the quality of course materials, activities, support from staff and their own effort on a given scale. The quality of each of the components was thought to be good on average. The comments emphasize that the course materials are very good. On average, students also thought that the course was fair in terms of difficulty and amount of work as shown by figure below. The comments, however, indicate that the course is demanding in both cases mainly because of factors such as problems with internet access etc.

“The course is just about right in the sense that we are learning more about handling data using excel.”

Figure 3 shows student opinion on group size for practical work. Most of the students (90%) thought that a group size of 4 – 6 was ideal for practical work. This was evident from the experience during the lecture hours.

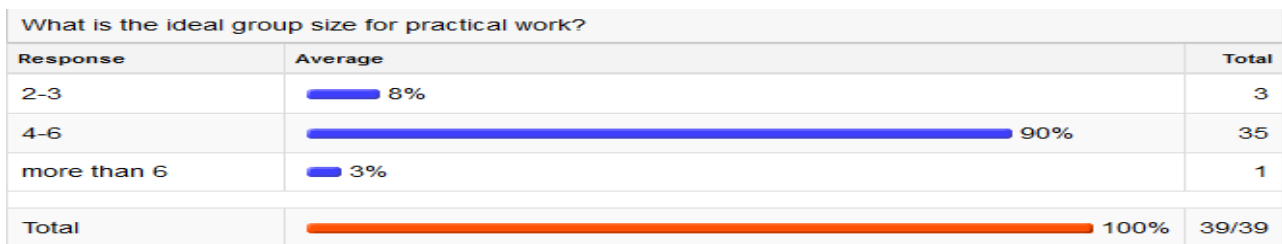


Figure 3: Students' opinion on ideal group size

Most of the students also thought that the class was too big for practical sessions. According to the data, they preferred a class of size 30. In theory it would be ideal to split classes to groups of small numbers but this is not possible in practice because of lecture load. In Kenyan Universities all lecturers teach a minimum of three full courses in a semester so splitting big classes would mean increasing the workload which is already too high.

For practical work what is the ideal class size?		
Response	Average	Total
less than 30	54%	21
30-60	41%	16
more than 60	5%	2
Total	100%	39/39

Figure 4: Students' opinion on ideal class size

## THE OTHER COURSES

### Descriptive Analysis and Presentation

The course was offered to the students who had completed a Descriptive Statistics course which introduced them to the methods of describing data. The difference between the two courses had to be made clear to the students at the onset. In the earlier course the methods were taught but not related to practical aspects. Data used in this course were field data collected to meet specified objectives. The students were introduced to descriptive analysis to meet these objectives. The datasets were larger, including both categorical and numerical variables, and required manipulation using the computer.

However due to instability of the learning environment, only four sessions were posted online and the rest of the sessions were conducted as complete face to face sessions. The practical sessions were instructions on how to use Excel and Instat to carry out specified analysis. Most of the students had never used the computer for statistical work using statistical software and the instruction and tips provided were enough for them to carry out specific analysis. The course eventually turned out to be different from the earlier Descriptive Statistics course because the students had to decide which methods would be appropriate in particular cases.

### Statistical Computing

This was one of the courses offered in the first semester of their second year of study. Its description implies that it is mainly a statistical course taught using statistical software. Some of the ideas included in the course description include random number generation and probability distribution ideas. Instat was the chosen statistical software for this run of the course. The course was offered purely using a face-to-face approach without an online component.

Each lecture hour comprised of a short presentation of key ideas after which a computer-based practical followed. The practicals involved using Instat to apply the ideas taught to real data sets. There were no step-by-step instructions given for the software use and the students had to learn their way on how to use the software. This was only possible because of the experience the students had in their first year of study.

## CONCLUSION

The overall objective of this initiative was realised incrementally over the different courses that have been offered to this group of students. In the first course, eLearning never got beyond the orientation and as such the objective of introducing eLearning and computers to teaching was not fully realised. But this experience was useful and is the reason why the second and subsequent courses were successful in meeting the objectives of this initiative.

One of the most rewarding moments of this initiative is that over half of these students now have laptops. Through group work, computer access is now possible in lectures which include practical sessions. One of the key lessons we can draw from this experience is that we don't need to wait for the right infrastructure to modernise our teaching at University. Experience has shown that the right infrastructure will follow from the need.

The small changes that were implemented on the first two courses were found to have a knock-on effect on the other courses. This experience shows that implementing such small improvements in our teaching could have lasting benefits on the overall education of the students.

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