

To Impart Distance Learning in Statistics Using Mobile Technology

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Abstract Introduction of mobile technology in the last couple of decades has opened up tremendous opportunity to spread distance learning in developed and developing countries. To create infrastructures for mobile technology is much cheaper than that of desktop computer technology. This facilitates the spread of learning in poverty stricken developing countries where to create proper infrastructures for any kind of learning is expensive and unaffordable. It is easier to impart distance learning in non-mathematical topics but for topics in statistics it's much more complex as it demands much more explanations and guidance from teaching point of view. This paper explores the possibility of spreading effective statistical knowledge in poor remote locations of the world in addition to developed parts of the world through mobile technology.

Keywords Distance Learning, Statistics, Mobile Technology

1. Introduction

Statistics is the science of making decisions in the face of uncertainty. Statistical thinking and methods are used over a broad spectrum of industrial, research, educational, business, and government activities[1]. Many Colleges and universities offer undergraduate and postgraduate degrees in statistics that provides state-of-the-art statistical thinking and methods. The role played by Statistics in the decision making systems of many disciplines including science and technology and business in the world is tremendous. This has raised the requirements to spread the knowledge of Statistics globally AL throughout and its importance cannot be overestimated. This makes it necessary to have a look on how to improve upon the system of distance learning in Statistics at present being delivered.

Section one gives an introduction of the area. Section two presents the advancements in mobile technology. Section three presents the existing distance learning courses in Statistics being offered in many countries. We put our concluding remarks in section four as to how to improve upon the existing system of distance learning using mobile technology in an effective way globally.

2. Mobile Technology

With the development of computer industry and internet

networks during the last three decades things have changed and global communication has reached an unprecedented height[3]. With these developments immense scopes have come to the surface to impart learning in a much more efficient and interactive way. Multimedia technology and internet networks have changed the whole philosophy of learning and distance learning and provided us with the opportunity for close interaction between teachers and learners with improved standard of learning materials compared to what were existing only with the printed media. It has gone to such an extent to create a virtual class room where teachers and students are scattered all over the world. Although some of these facilities are expensive still the developed world is in a position to take advantage of these facilities to impart much better distance-learning to students residing in the developed countries. But for developing countries the story is different as computerization and network connections are still very limited compared to the developed world. Use of mobile technology to impart distance learning particularly in Statistics could be an answer to this problem in developing countries[2]. People often think mobile or wireless technologies are the same as mobile wireless technologies[13]. Strictly speaking, mobile wireless technologies are different from mobile or wireless technologies simply because not all mobile technologies are wireless nor are all wireless technologies mobile. According to Malladi and Agrawal (2002), mobile wireless technologies consist of two aspects: mobility and computing. They claimed that mobile computing represents users' continuous access to network resources without limitation of time and location[14]. Wireless means transmission of any form of data-text, voice, video or image which is conducted through radio waves, infrared waves or microwaves, rather

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than using wires [15]. Therefore, mobile wireless technology is defined as any wireless technology that uses radio frequency spectrum in any band to facilitate transmission of text data, voice, video, or multimedia services to mobile devices with freedom of time and location limitation [12].

The freedom of time and location is related to the concept of anytime and anywhere access that represents the two main characteristics of mobile wireless technologies—mobility and reachability [16], [17], [18]. Rismark, Solvberg, Stromme and Hokstad (2007) found that affordance of constant access to LMS by mobile phones may represent new learning opportunities in higher education [19]. Mobile wireless technologies use public stations—antennas or Wireless Access Points (WAPs) that are connected to wired-network in a building or public area to give a way of access for web resources and communication for mobile wireless technology users. With mobile wireless network or service in mobile wireless devices, users can access network information anytime, anywhere [20]. For example, people can carry wireless laptops anytime, anywhere and can access a network in public places, such as an airport and a library. In addition, handheld devices can be carried and connected to a network anywhere, anytime using public stations (e.g., antenna) [12].

It has only been recently that studies of digital libraries [21] have moved outside the classroom Dong and Agogino (2004), [22], concluded that M-learning is most useful when it links real-world situation to relevant information resources [12].

3. Existing Distance Learning Courses in Statistics

Distance education courses and programs provide flexible learning opportunities to both undergraduate and postgraduate students. In this indicator, distance education courses include live, interactive audio- or video conferencing; pre-recorded instructional videos; webcasts; CD-ROMs or DVDs; or computer-based systems accessed over the Internet. Distance education does not include correspondence courses.

In 2007–08, about 4.3 million undergraduate students, or 20 percent of all undergraduates, took at least one distance education course. About 0.8 million, or 4 percent of all undergraduates, took their entire program through distance education. The percentage of undergraduates who took any distance education courses rose from 16 percent in 2003–04 to 20 percent in 2007–08; over the same period, however, the percentage who took their entire program through distance education decreased from 5 to 4 percent. In addition to these undergraduate students, about 0.8 million, or 22 percent, of all postgraduate students took distance education courses in 2007–08. The percentage of postgraduate students who took their entire program through distance education (9 percent) was higher than the percentage at the undergraduate level [4].

In Medical Science the Master of Medical Statistics

program provides graduates with the skills to use statistical methods to investigate problems in health and medicine. Statistics is one of the essential requirements for high quality medical research, and is vital to public health research. The programs are designed to provide depth of knowledge in the application of statistical methods to the analysis of health related data. Graduates will develop a strong capacity to work effectively as integral members of a collaborative team to investigate problems in health and medicine. The program fills the gap between current programs in public health and epidemiology (which train users of bio-statistical methods, not professional biostatisticians), and general statistics courses (which do not cater to the increasingly diverse and specialized needs of health research) [5].

In another case the Department of Statistics offers its regular MS degree online. They also offer individual online statistics courses to individuals who want to continue their education in statistics without pursuing the MS degree. Course lectures and other materials are delivered electronically via the web, so students can watch lectures and review materials when they can fit it into their schedules. Assignments and projects can be submitted electronically and contact with instructors is provided through email and web-based communication.

The degree offered is the same as the degree offered on campus, so it requires a serious commitment. Students taking courses online see the same lectures and complete the same assignments, projects, and exam as students on campus. The typical load for a student with a full time job is one course per semester, so it takes about five years to complete the MS degree. Students generally begin the MS program by either taking the Stat 500 and Stat 511 sequence or taking the Stat 542 and Stat 543 sequence in the first year [6].

The Macquarie University Statistics Department is Australia's largest Statistics department. They offer a full range of statistical subjects, from introductory statistics, suitable for all Macquarie University students, through to Masters level courses, for those who wish to become professional applied statisticians.

They teach courses useful to those needing to apply Statistics to many fields, including medicine, the social sciences, biology and finance. Statistics can be a study in itself with majors in Statistics and Decision Sciences which may be taken in B.Com, B.Sc and BA degrees. The department is active in both theoretical and applied research and supervise a large number of PhD students, from Australia and abroad. [7].

Rochester Institute of Technology (RIT) has distinguished itself as one of the premiere online learning programs in the nation. Since 1979, when RIT offered its first distance learning course, the Institute has been a leader in the use of electronic forms of communication for course interaction. Their online-learning courses have the same objectives, rigorous workload, tuition and academic credit as other on-campus courses. Both the MS degree and the advanced certificates are available through online learning. There is no distinction made between taking courses on

campus or through online learning. In particular, programs earned partly or entirely through online learning are registered by the New York State Education Department and are accredited by the Middle States Association of the Council for Higher Education. Every online-learning course offered by the center meets the rigorous standards required by RIT. Each course typically features either CDs or streaming video. Courses also include live chat sessions or asynchronous discussion groups, using an electronic medium that allows students and the instructor to interact.

Because online-learning courses are designed for the motivated professional who is not able to attend on-campus classes, they recommend enrolment of online learners to those over 25 years of age with at least 3 years of professional employment [1].

The Department of Statistics at Texas A&M University, one of the premier Statistics departments in the world, offers quality online Statistics degree and certificate programs. This online Statistics program is an integrated extension of the renowned on-campus program at Texas A&M University. It provides the same instruction, course materials, and exams - with the flexibility to fit students' schedule.

Homework Submission.

Homework will need to be in PDF format to upload into a course management site they use for homeworks and exams in their distance learning statistics program.

There are several options for getting the homework into a PDF:

- Scan the pages into PDF using a scanner.
- Use a word processor and then print to PDF using PDFcreator or similar PDF printer software.
- Use a fax-to-PDF service (you pay the cost of the service from third party).

Exam

Each exam will be proctored. For each exam, student will need access to a printer to print the exam and then scanner or fax machine (if using fax-to-PDF option) for submitting the exam. Exams will be downloaded from a course management site they use for homework and exams. The exams will be password-protected, with student's proctor receiving the password prior to the exam. The completed exam will then be uploaded into the same location it was downloaded from. Completed exams will need to be in PDF format for upload[8].

In another case Foundations of Statistics (Previously STA15) is offered online. The aim of Foundations of Statistics is to develop the capacity to carry out independent statistical investigation, together with an awareness of the assumptions and limitations involved with the generalization of the results of such investigations. Students are expected to summarize data, identify research questions, determine and identify appropriate research designs, analyze the data using the statistical package SPSS for Windows and interpret the results in a report writing format.

Assessment

- Assignments — (15%-25%)
- Invigilated Exam — (50%-65%)

•Test — (15%-25%)

Learning Outcomes

At the completion of this unit students would be able to:

1.pose the question:

- a) make a clear statement of the objectives of a study
- b) specify and classify according to level of measurement the variables of interest in a study

2.collect the data:

- a) identify the research design (observational study/experiment) used in a study
- b) determine the appropriate research design (observational study or experiment) for a study
- c) identify/specify the data to be collected
- d) identify/specify the method(s) of measurement
- e) be familiar with some appropriate methods of sample selection

3.analyse the data:

- a) describe the distribution of a single categorical variable using frequency tables, and where applicable generalize to the population using hypothesis tests and/or confidence intervals for a single proportion

- b) describe the distribution of a single interval variable using histograms, stemplots, boxplots, summary statistics and, where applicable, generalize to the population using hypothesis tests and/or confidence intervals for a single mean

- c) describe the relationship between a categorical variable and an interval level variable using parallel boxplots, back-to-back stemplots, sets of summary statistics and, where applicable, generalize to the population using the t-test for two means

- d) describe the relationship between two metric variables using scatterplots, correlation coefficient (Pearson's r), the coefficient of determination (r^2), and a line of best fit and, where applicable, generalize to the population using hypothesis tests for Pearson's r

- e) describe the relationship between two categorical variables using cross-tabulation (tables), percentages as necessary and, where applicable, generalize to the population using the chi-square test

4.interpret the results:

- a) use the outcomes of data analysis to answer a question[9].

4. How to Go from where We are at Present?

The above discussion throws light on how distance learning in Statistics is being carried out at present internationally. We see distance education courses include live, interactive audio- or videoconferencing; pre-recorded instructional videos; webcasts; CD-ROMs or DVDs; or computer-based systems accessed over the Internet. Also course lectures and other materials are delivered electronically via the web, so students can watch lectures and review materials when they can fit it into their schedules.

Assignments and projects can be submitted electronically and contact with instructors is provided through email and web-based communication. Online-learning courses have the same objectives, rigorous workload, tuition and academic credit as other on-campus courses. In some cases homework is assigned to students. Also assignments and invigilated exams are also arranged for the students in distance learning. Most of the abovementioned facilities are available to students coming from the developed world. But for developing world many of these facilities are not yet available to students. But mobile technology can make available many if not all of these facilities to students even in the remote locations of the developing countries as we know the modern technology has converted a mobile phone into a pocket computer where internet can be accessed from mobile phones and study materials including book can be downloaded in mobile phone these days. That's why we stress on mobile technology as a cheap and effective way to impart distance education in Statistics in developing countries.

To use mobile technology the course materials need to be quite elaborate and easily understandable. We should start a statistical topic from our daily life experiences. A very easy example is given here. Like teaching the Probability Theory we could write the study materials in a fashion of discussion. How many sides a coin has? Answer from students should be two. If you want to choose the tail side of the coin how many ways you could do that? Answer should be one. So the probability of selecting a tail from a toss of the coin would be one divided by two. Another example could be to calculate the mean. If four students' scores from a test of hundred marks are 85, 70, 58 and 52 than how do we calculate the mean? To calculate the mean students should be advised to add all the four figures first. The answer would be 265. After that another question should be: how many students are there in this case? Answer should be four. Now students should be advised to divide 265 by 4 to get a result of 66.25. Another example is of calculating the mean from 2000 students' scores. Students should be advised that to calculate the mean of 2000 students is time consuming. Then how to achieve it quickly? The answer is to take at random scores of only 15 students out of 2000. Add all these 15 scores and then divide by $(15 - 1 = 14)$ where 15 is the number of students taken in the sample and subtract 1 to take care of any errors in the estimate from the sample. In this case 15 is the sample size. For any calculation involved we can always take a small sample and make calculations based on this sample instead of taking the whole population. This is a very important concept of statistical calculations.

Any topic of Statistics however complex could be written in the study materials in a very easy way starting from our daily life experiences. This way we could provide statistical knowledge through distance learning in an effective way for the students coming from remote locations of developing countries where they have to take courses on statistics as part of their curriculum.

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