Teaching Medical Statistics over the Internet

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INTRODUCTION

The potential for computers to assist learning has been recognised for many years (Jenkins, 1997), with reproductive medicine benefiting greatly from Internet technology (Jenkins, 1999). Following a detailed survey of information technology facilities and skills for postgraduate education (Draycott, 1999), a pilot Internet training programme in reproductive medicine demonstrated effective methods to deliver online teaching (Jenkins, 2001). Based on this experience, in 2001 the Obstetrics and Gynaecology in the University of Bristol, U.K. launched a postgraduate masters course in human reproduction and development, delivered principally over the Internet (Jenkins, 2002). This course has been under continuous evaluation and development since its launch, refining the application of learning technology to most appropriately meet students' needs (Cahill, 2003). A particularly challenging module of the course considers research methods and statistics. This module was independently evaluated from both a student and tutor perspective, with the objective of identifying learning priorities and optimal educational methodology. This article presents strengths and weaknesses of delivering statistics education online, considering how best to develop this in the future.

BACKGROUND

Teaching statistics to medical and allied healthcare undergraduates and post-graduates has been a challenging area in higher education (Marantz, 2003). Traditionally taught early in the medical course by colleagues from the mathematics department, basic statistical principles are not retained by many medical graduates. A number of reasons have been postulated for this, including the timing of the teaching and lack of practical implications at this stage of training, and lack of motivation among the students (Marantz, 2003; Romero, 2000; Astin, 2002).

As medical students progress through undergraduate education to post-graduate education, the requirement for medical statistics knowledge increases and ranges from day-to-day needs to critique published literature to the ability to design and evaluate research proposals. The knowledge from undergraduate courses is often inadequate to deal with the increased responsibility, and statistics update courses are difficult to attend while working full time as a clinician (Astin, 2002). Many medical statistics textbooks are available; however, they cannot be individually tailored to meet each student's needs. Many candidates report medical statistics as a difficult subject to learn, and the students notoriously lack motivation with regards studying (Romero, 2000). The practical aspects are not always relevant to the clinical aspects of medicine being studied; thus, retention of knowledge is poor (Astin, 2002). Evaluations of the current methods of teaching medical statistics in undergraduate curriculum have focused upon the need for clinical relevance when teaching at earlier levels. Courses based around data analysis have been criticised, while a greater emphasis upon critical appraisal and data presentation has been recommended (Romero, 2000; Astin, 2002; Bruce, 2002). One course reported improved student preparation and participation when a case discussion method was employed to teach epidemiology and bio-statistics (Marantz, 2003).

The Internet provides a comprehensive range of statistics resources that could be used to support an Internet biomedical statistics training programme. Table 2 contains many of the more popular resources, but is by no means an exhaustive list. To highlight several of the Web sites: Statistics at Square One is an online version of a statistics text available via the British Medical Journal Web site. This is an easy-to-read text regarding basic statistics, and has clinical examples at the end of each chapter. Clara is a Web-based computer statistics program that enables the user to perform basic statistical calculations. This assumes some knowledge with regard to the most appropriate test for the data set. Although the scope of this article does not permit discussion of the many other Internet statistics resources, Table 2 provides a guide to many Web sites that may be of interest.

BRISTOL APPROACH

The University of Bristol course aimed to address some of the above challenges of delivering biomedical statistics by providing more student-centered learning delivered over the Internet, with emphasis on clinically relevant practical exercises. This section presents a course evaluation of the Bristol approach to date, identifying the problems that need to be considered with suggestions for future research and possible solutions for Web-based training.

Methods

In 2003, during the second year of the Reproduction & Development MSc in the University of Bristol, an online survey was completed by 18 of the 20 registered students who had completed the statistics and research methods module. Prior to starting the course, students had been sent a copy of the statistical computer programme Stats Direct (wwww.Statsdirect.com) with explanatory reference material, and were advised to complete simple tasks to familiarise themselves with statistics prior to a workshop. During the workshop, students were taught by lectures in small groups and completed specific exercises. Following the workshops, further information was delivered online, with interactive questions provided to allow reflection on workshop learning and to develop and test their understanding of statistics. Assessed practical exercises provided an opportunity to apply their knowledge to relevant tasks. Following the period of Internet teaching, students returned for a formal examination by computer-marked assessments, short answers and data analysis exercises.

The online student survey evaluated the distance education component of the course, with particular emphasis on the teaching of the statistics and research methodology module. The students were presented with statements about online learning and asked to respond by grading their views using: strongly agree, agree, neutral, disagree and strongly disagree. Statements specifically targeting the statistics module were

Table 1. Student demographics

Student characteristics	Total respondents N=18 n (%)	Part-time subgroup N=14	Clinician subgroup N=12
Full time	4 (22%)	-	2 (17%)
Part time	14 (78%)	-	10 (83%)
Clinicians	12 (67%)	10 (71%)	-
Scientists	6 (33%)	4 (29%)	-
Male	5 (28%)	5 (36%)	5 (42%)
Female	13 (72%)	9 (64%)	7 (58%)
UK based	11 (61%)	9 (64%)	6 (50%)
Overseas based	7 (39%)	5 (36%)	6 (50%)