Can the Internet widen participation in reproductive medicine education for professionals?

Kate Whittington¹,⁴, Julian Cook², Chris Barratt³ and Julian Jenkins¹

¹Department of Clinical Science at South Bristol, Obstetrics & Gynaecology, University of Bristol, ²Institute for Learning and Research Technology, University of Bristol and ³Department of Reproductive Biology, University of Birmingham, UK
⁴To whom correspondence should be addressed. E-mail: K.Whittington@bristol.ac.uk

BACKGROUND: Traditional campus-based models of education are unsuitable to many, particularly if in full-time employment supporting families, whereas the Internet now permits new models of education. Following an iterative process of development and evaluation in 2001, the University of Bristol launched a masters programme covering reproduction and development delivered principally over the Internet. METHODS: Students attend short biannual residential workshops and the rest of the course is delivered online. In 2003, the 20 active students were invited to complete a structured online questionnaire. RESULTS: The 18 students completing the questionnaire identified distance learning as the key factor in their course selection. Most students felt that residential workshops aided subsequent electronic communication. Discussion of ideas is an essential component of postgraduate courses and web-based discussion forums appeared to provide an acceptable medium for this. The use of web-based audio lectures and computer-assisted assessments was well received. Also these systems may reduce disadvantages overseas students encounter when completing assessments in their non-native language. CONCLUSIONS: The overall positive response from students (and their tutors) to using the Internet for multiprofessional reproductive medicine education is encouraging and has wider potential in the future.

Key words: education/internet/postgraduate/reproductive medicine

Introduction

The importance of continuing professional development (CPD) for all healthcare-related professions is becoming increasingly appreciated both within the UK and internationally. Currently only a limited number of recognised CPD schemes are established within the specialist field of reproductive biology and assisted conception (e.g. Association of Clinical Embryologists). Rapidly evolving fields such as these need mechanisms by which professionals can further their knowledge and keep up to date with current developments. Postgraduate education in this field is also a rapidly expanding area but often the inflexible study models of conventional university postgraduate courses do not fit with people’s career paths or lifestyles. One solution is to offer programmes that allow extended periods of study whilst the student remains in full-time employment. The delivery of such courses via distance-learning models may further widen participation by reducing geographical restrictions. The availability and popular usage of the Internet ideally lends itself to use as a vehicle to deliver and support teaching at a postgraduate level (Jenkins, 1999; Conole et al., 2002). Following a critical review of the place of this technology to support postgraduate education (Draycott et al., 1999), the University of Bristol, Division of Obstetrics & Gynaecology ran a pilot training programme to deliver reproductive medicine education over the Internet (Jenkins et al., 2001). At this time the department had many requests for training from doctors, scientists and others that it was not possible to grant due to many factors including limitations of space, staff and accommodation. When the pilot programme proved successful it was decided to progress to a comprehensive Masters training programme delivered over the Internet, covering both reproduction & development and aimed at a multi-professional international student group (www.ReD-MSc.org.uk).

The purpose of this study was to evaluate the acceptability and effectiveness of teaching reproductive medicine at a postgraduate level via an Internet-based, distance-learning model.

Materials and methods

Course outline

In 2001 the Division of Obstetrics & Gynaecology, University of Bristol introduced a Masters programme in Reproduction & Development limited to ≤20 students at any one time. A broad curriculum was planned, ranging from reproductive physiology, endocrinology, assisted conception, normal and abnormal fetal development right up to birth and the early neonate. It was hoped that this broad syllabus would appeal to students from a diverse range of backgrounds, e.g. scientists, embryologists, andrologists,
course tutor would act as a moderator to direct the discussion where necessary and to answer questions as they arose.

### e-Learning infrastructure

The initial pilot study (Jenkins et al., 2001) suggested that there was no single satisfactory e-learning software solution available and bespoke programming was prohibitively expensive. Therefore a mixture of commercial software was chosen and integrated on a Windows server hosted by an external commercial provider to gain increased support options and lower costs from economies of scale (www.multimediamedicine.co.uk). A commercially available CAA package, QuestionMark Perception (www.questionmark.com), was used in this study and was incorporated into coursework assessments and also used for a proportion of formal exams. Questions in these assessments would take a variety of forms, from simple ‘true/false statements’, ‘selecting the correct option’ and ‘text matching’ to more complex and extended formats.

### Student evaluation

In order to determine how effective it was to use the Internet to teach reproductive medicine, the group of 20 students actively studying on the programme in 2003 (first enrolled on the course between 2001 to 2003) were invited to complete a web-based questionnaire about aspects of the programme. The aim of this was not only to evaluate the course and the student’s perceived effectiveness of the teaching methods used but also to explore the motives of students enrolling in distance-learning courses.

### Results

Following the introduction of the MSc course, >260 direct enquiries were received regarding this programme from across the world (Table II). The actual number of people expressing interest is likely to be higher than this figure as many will visit the open section of the course website, in which answers are provided to the questions that potential students have asked in the past together with details of the application process including application forms. This enquiry rate translated into 36 applications each year (Table II). In July 2003 the course had four full and 16 part-time students with nine students ready to start in the September of 2003 and two students that deferred their entry to September 2004. Since the course has started, only two students have withdrawn from the programme. Forty-eight per cent of students are based outside the UK from as far apart as the Sudan, China, the Philippines, Saudi Arabia and Canada. The academic mix of students accepted onto this programme each year since its start is shown in Figure 1.

### Table I. Examples of workshop teaching sessions

<table>
<thead>
<tr>
<th>Session</th>
<th>Examples</th>
</tr>
</thead>
</table>
| Lectures: to give a basic grounding in the topic | (a) Hypothalamic–pituitary axis of any postgraduate education. During their first workshop session, clinicians, nurses and midwives. Topics were grouped into six taught modules (20 credits each) with the seventh module being a research project (60 credits). Aware that not all students would achieve or choose the standard of a Masters degree (180 credits), options were also provided at diploma (120 credits) and certificate (60 credits) levels. Both full-time (1 year) and part-time (2 years) study options were available with all students expected to attend Bristol-based workshops twice per academic year. The length of each workshop would vary depending upon the year and option of study but students would spend a total of 9 weeks in Bristol by the end of their programme. Workshops would be scheduled for the beginning of each academic year (September/October) and 6 months later (March). In general, each taught module would be allocated a 1 week slot of workshop time and, although there were variations between modules, this time was to be filled with lectures, research seminars and practical sessions (see Table I for examples).

Each taught module was to be assessed via coursework (60%) and written exams (40%). Coursework would be carried out in the periods between workshops, whilst students were in their ‘home’ location away from Bristol and each student was provided with a timetable detailing the tasks to be completed and dates for their submission. Coursework for each module would take the form of an essay, questions linked to practical sessions and computer-assisted assessment (CAA). In addition to structured coursework, a monthly web-based discussion board would be run to discuss, evaluate and critique current papers, which is viewed as an essential component of any postgraduate education. During their first workshop session, students were to be introduced to this concept and shown how to view and add their comments to the site. For all web-discussions, a...
Factor 1802 postgraduate programme (Reproduction & Development Masters programme. 83% (15/18) agreed that more could not learn effectively from web-based audio lectures. This difficulty was not linked to language problems as there was little difference in the response to this question between home and overseas students (1/11 versus 1/7 students respectively).

Evaluation of computer-assisted assessments
All students felt that they learned a lot from completing CAA tasks and only one student objected to doing assessments by computer rather than writing essays, laboratory reports or short answers. From coursework marks to date, it appears that home students (whose first language is English) outperform their overseas peers [the majority (67%) of whom do not have English as their first language] in tasks that are more dependent on an ability to build complex sentences, such as essays. The median essay mark (across all modules) for the 12 home students was 70% (range of 42–98) versus 56.5% (range of 49–80) for the six overseas students. Even when their marks were ranked, to take into account any outlying values, the median rank was 41 versus 16 for home and overseas respectively. When the marks from CAA were compared, this difference between home and overseas students did not occur, with median marks of 84.9% (range 66–98.7) versus 87% (range of 75.5–95.8) respectively.

Evaluation of communication
All students either agreed with, or were neutral to, the suggestion that meeting other students at the start of the course encouraged subsequent electronic communication. All but one student agreed (14/18) or were neutral (3/18) to the suggestion that meeting the tutors at the start of their course made them seem more approachable and encouraged them to request support when required.

During workshop sessions, students are introduced to the concept of using web-based discussion forums in a journal club format. This enabled >85% of students to agree that they understood how to submit a comment to the discussion board from their home location. These discussion boards were generally well received, with only 4/18 students (22%) feeling that these boards did not help them to learn how to critically appraise a paper and spot technical errors. Viewing rates to such discussion forums were higher than contribution rates, indicating that many students visit the site to view other student’s comments rather than add their own. Only two students (11%) felt that this online method of discussion was more difficult than a face-to-face journal club.

Evaluation of resources
Our current cohort of students is dispersed across the world and the majority (14/18) are able to access >5000 full text electronic publications using a web browser to authenticate through a University of Bristol proxy server service.

![Figure 1](https://example.com/f1.png)

**Figure 1.** The academic background of students enrolled onto the Reproduction & Development Masters programme.

**Table III.** Frequency of factors rated ‘very important’ in selecting this postgraduate programme (n = 18)

<table>
<thead>
<tr>
<th>Factor</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance-learning option</td>
<td>10 (56)</td>
</tr>
<tr>
<td>Reputation of the Division</td>
<td>8 (44)</td>
</tr>
<tr>
<td>Reputation of the University</td>
<td>8 (44)</td>
</tr>
<tr>
<td>Cost</td>
<td>7 (39)</td>
</tr>
<tr>
<td>Location of workshops</td>
<td>2 (11)</td>
</tr>
</tbody>
</table>

Student evaluation
Eighteen out of 20 students studying the programme in 2003 completed the web-based evaluation questionnaire assessing the effectiveness of teaching methods and student motivation. Fourteen (78%) of this group were part-time.

The use of distance learning was the main reason students gave for selecting this course and was rated as more important than the reputation of the University, the Division or the overall cost of the programme (Table III). Eleven of the 14 part-time students (79%) felt that they would not have been able to attend the course if it were arranged as a 1 year conventional, campus-based study. Furthermore, 64% (9/14) of the part-time students would like more of the course to be delivered online with minimal requirement to physically attend workshops in Bristol. This was in comparison to 0/4 of full-time students.

The majority (83%) of students felt that the multi-disciplinary mix of students was a positive aspect of the course as it aided their learning and they could learn from their peers and see various other viewpoints.

Evaluation of teaching and learning
During workshop sessions, lectures were delivered in a traditional face-to-face manner and each was also converted to web-pages to act as a resource for students. The majority of students (12/18) felt that these web lectures were really only useful if they had a soundtrack explaining the slides. When it was suggested to the students that more of the lectures be delivered as web-based audio lectures and the workshops be more for discussion, 83% (15/18) agreed that more interactive workshops would help them pull their knowledge together and make more sense of what they had learnt. Furthermore many students (83%) would like to have web-based audio lectures on topics covered by face-to-face teaching. Only a small proportion of students (2/18) felt that they could not learn effectively from web-based audio lectures.

During workshop sessions, lectures were delivered in a traditional face-to-face manner and each was also converted to web-pages to act as a resource for students. The majority of students (12/18) felt that these web lectures were really only useful if they had a soundtrack explaining the slides. When it was suggested to the students that more of the lectures be delivered as web-based audio lectures and the workshops be more for discussion, 83% (15/18) agreed that more interactive workshops would help them pull their knowledge together and make more sense of what they had learnt. Furthermore many students (83%) would like to have web-based audio lectures on topics covered by face-to-face teaching. Only a small proportion of students (2/18) felt that they could not learn effectively from web-based audio lectures. This difficulty was not linked to language problems as there was little difference in the response to this question between home and overseas students (1/11 versus 1/7 students respectively).

**Evaluation of computer-assisted assessments**
All students felt that they learned a lot from completing CAA tasks and only one student objected to doing assessments by computer rather than writing essays, laboratory reports or short answers. From coursework marks to date, it appears that home students (whose first language is English) outperform their overseas peers [the majority (67%) of whom do not have English as their first language] in tasks that are more dependent on an ability to build complex sentences, such as essays. The median essay mark (across all modules) for the 12 home students was 70% (range of 42–98) versus 56.5% (range of 49–80) for the six overseas students. Even when their marks were ranked, to take into account any outlying values, the median rank was 41 versus 16 for home and overseas respectively. When the marks from CAA were compared, this difference between home and overseas students did not occur, with median marks of 84.9% (range 66–98.7) versus 87% (range of 75.5–95.8) respectively.

**Evaluation of communication**
All students either agreed with, or were neutral to, the suggestion that meeting other students at the start of the course encouraged subsequent electronic communication. All but one student agreed (14/18) or were neutral (3/18) to the suggestion that meeting the tutors at the start of their course made them seem more approachable and encouraged them to request support when required.

During workshop sessions, students are introduced to the concept of using web-based discussion forums in a journal club format. This enabled >85% of students to agree that they understood how to submit a comment to the discussion board from their home location. These discussion boards were generally well received, with only 4/18 students (22%) feeling that these boards did not help them to learn how to critically appraise a paper and spot technical errors. Viewing rates to such discussion forums were higher than contribution rates, indicating that many students visit the site to view other student’s comments rather than add their own. Only two students (11%) felt that this online method of discussion was more difficult than a face-to-face journal club.

**Evaluation of resources**
Our current cohort of students is dispersed across the world and the majority (14/18) are able to access >5000 full text electronic publications using a web browser to authenticate through a University of Bristol proxy server service.
For those that are unable to use the facility the library offers a service for distance-learning students.

Discussion

Despite a very low level of marketing, the high enquiry and application rate for this programme suggests that there is a large international market for Internet courses in the field of reproductive medicine. Although other courses in this field are available, the fact that the distance-learning aspect of this programme was a key factor in student course choice illustrates the need for more flexible study options. This is likely to be especially true for part-time learners who are usually in employment and have enrolled in postgraduate education to further their knowledge and career prospects. Reverting back to full-time study is often impractical, whether it is for career or personal reasons, thus illustrating an important role for flexible study options within distance-learning courses in widening the participation of such groups in education. The fact that study options were rated so highly also indicates that universities should not assume that their reputation alone will always attract sufficient students, especially in light of the potential increase in university fees. A high proportion of student enquiries from Middle Eastern countries suggests that this Internet-based distance-learning model may be especially suited to students from specific cultural situations (Whittington et al., 2004).

This programme links scientific knowledge to clinical application, which makes it suitable for clinicians, scientists and nurses. Although other programmes tend to cater for specific specialities within the field, the student feedback confirms that students liked the multidisciplinary aspect of the course. Indeed this is likely to enhance their learning environment and may reflect the heterogeneous nature of this profession. When implementing courses that utilize novel teaching styles, it is important not to let this technology dictate how the course runs and not to be confined by restrictions imposed by certain softwares. Instead, teaching methods should be developed to suit many styles of learning without detracting from the topic being covered (Gibbs, 1988; Honey and Mumford, 1992). Thorough course evaluation allows assessment of these teaching methods, thus ensuring that learning requirements are not compromised in favour of technological concepts. The implementation of this programme has enabled us to comment on those areas in which teaching applications delivered via the Internet are most and least effective in supporting.

Traditional campus-based courses deliver the majority of their syllabus via face-to-face lectures, tutorials and practical sessions. With Internet-based distance-learning courses there is the opportunity to deliver more factual content via web-based audio lectures and the students on this programme were receptive to this model. This would then enable precious workshop time to be given over to discussion after students have reviewed and reflected on the learning material. The posting of lecture slides onto the web is common practice for many courses around the world and the suggestion that these need an explanatory sound track to aid learning is not surprising. The request for increased availability of web-based audio lectures as a resource, even for lectures previously given in a face-to-face manner, is interesting and illustrates the usefulness of this teaching method, and suggests a role for such technology in courses other than distance-learning ones. Only a small proportion of students felt that they could not learn effectively from web-based audio lectures and this did not appear to be linked to language issues. It is likely that this illustrates differences in learning styles between students and further confirms the need for all courses to encompass a range of teaching methods. This overall positive response to web-based lectures is encouraging to any course wishing to expand the use of self-directed learning in its teaching methods. Due to this feedback we are currently developing more web-based audio lectures, using compression technology, for students to view during periods of home study (see www.red-msc.org.uk for examples). This will reduce the need for didactic teaching during workshops and thus allow more discussion and interaction.

The ease with which pictures and video-clips can be digitized and shown electronically, either via the web or CDs, further expands the scope of the Internet to direct and support learning. This may be especially true in topics such as assisted conception and embryonic/fetal development, where the interpretation of pictorial images is a key skill requirement. We are currently expanding our use of digitized images and video clips to provide students with rudimentary knowledge on practical skills such as basic laboratory techniques (e.g. western blotting) and clinical procedures (see www.redmr.org.uk). With any distance-learning programme, time in face-to-face workshops is restricted and often practical skills cannot be covered comprehensively in a ‘hands-on’ manner. In reality, few students would be able to repeat these skills after a single teaching session. We hope that this ‘online’ approach will give students a basic understanding of the theoretical background to the technique, an overview of the practical steps involved and an ability to interpret data produced. However, it is essential that the facilities to which students are likely to have access in their home environment is always borne in mind when designing such online activities. An easy method to allow students to check their computer suitability should be available with options to download essential software (see www.red-msc.org.uk/open/ptest/default.htm). When incorporating video clips it is essential not to assume that students have access to fast internet access, but this problem can be overcome by supplying such clips on CD. Computer-assisted assessment proved to be very popular, probably reflecting the benefits of instant marking and feedback these systems offer. As with many postgraduate courses, this programme has a significant number of overseas students, whose first language may not be English. One point to note is that the term ‘overseas’ refers to the student’s fee-paying status, and thus a proportion of these students will be English-speaking. Therefore the results presented in this paper are likely to be an underestimate of the degree to which non-English speaking students are disadvantaged by tasks such as essays. Although these students have obtained the University’s stipulated English language

Reproductive medicine education and the Internet

1803

Downloaded from https://academic.oup.com/humrep/article-abstract/19/8/1800/2356392 by guest on 27 March 2019
requirement, it appears that assessing such students by tasks that are dependent upon their ability to build and structure complex sentences does put them at a significant disadvantage. Our results suggest that using CAA reduces this bias and puts all students on a more equal footing from which their knowledge and understanding of the syllabus can be tested. In addition, these packages offer much potential for substantially reducing staff time spent on marking, but this must be balanced against the staff time needed not only to write questions but also to peer-review questions written by others. Since computers are unable to make allowances for students’ interpretation of questions, and students cannot interrogate the computer about the meaning of a question or the accuracy of the feedback, any ambiguity or inaccuracy is poorly received by students—which we believe implies a need for thorough peer-review of questions and feedback.

One advantage of Internet-based distance-learning courses is the ease with which assessed coursework can be checked for plagiarism. This is a major cause for concern throughout education as a whole, but it is a commonly held misapprehension that Internet-based courses may promote plagiarism. We believe that these courses make it easier to detect plagiarism due to the requirement for coursework to be submitted electronically; ultimately this could reduce plagiarism. All coursework that is not assessed via CAA must be submitted electronically, thus allowing rapid checking for plagiarism by feeding a few selected sentences of the student’s assignments into web search engines (e.g. www.google.com) or dedicated plagiarism detection software.

When introducing distance-learning courses, a difficult issue to address is 'How much is face-to-face contact essential for effective learning?' As outlined previously, our current course format is for students to attend Bristol for a total of ≤10 weeks for residential workshops. Student feedback shows that this initial face-to-face contact did encourage subsequent electronic communication. Provision of adequate tutor and peer support on distance courses is often an issue and these data suggest that students on distance-learning courses do benefit from face-to-face contact. Nevertheless part-time learners in particular prefer to minimize their time spent in residential workshops due to other commitments. This presents course organizers with conflicting priorities and needs which have to be balanced and it would be interesting to determine the minimum frequency and duration of face-to-face contact that is required to achieve an adequate support network.

In any postgraduate course, the opportunity to discuss ideas should be an essential and integral part of the programme. Special consideration must be given to this topic in distance-learning courses to overcome any obstacles that may be present due to geographical location. We have previously shown that the use of e-mail and discussion boards can be a suitable forum for such communication (Cahill et al., 2003). With our current course structure, students are introduced to the use of such discussion boards during workshop sessions and it is unclear how important this is in ensuring the future success of such forums. Our results suggest that the presence of mediators in these introductory sessions helps students to feel comfortable and confident in using the technology before they return home. The lower contribution rate in comparison to viewing rate on these web-based discussion forums appears disappointing and it may be tempting to assume that this means such forums are an unsuccessful teaching method. However, it is important to remember that this style of learning will only suit a proportion of students and it is likely that students still learn via a 'viewing only' activity (Salmon, 2000). In addition, it is important to ensure that a broad range of papers is included so as not to disadvantage any one group of students, e.g. clinicians, if many discussions need scientific background and vice versa. Unfortunately it is difficult to know how to encourage active participation by all students in activities such as these. In the past we have tried to match students into groups to allow discussion of the paper via 'private' e-mail prior to the discussion forum. The thinking behind this was that it may improve the academic confidence of all students, especially by ensuring a mix of backgrounds, and thus may promote participation. Unfortunately the informal feedback on this system was negative—students found it too time-consuming and did not feel it encouraged them to participate. The reality is that it is likely that some students find the online environment more threatening and that they fear being exposed as ignorant in front of their peers (Cahill et al., 2003). Tutors and students can opt to receive an e-mail automatically once a post is made to the bulletin board, so they can be updated with an ongoing discussion without the need to keep visiting the bulletin board when no changes have been made. To aid the process, students’ faces appear automatically next to the messages they post. Although it is possible that similar web-based communication could be established with a group of students who had never met, our results indicate that initial face-to-face contact helps to facilitate and encourage web-based discussion groups.

There is little doubt that the worldwide web provides the biggest source of resource material available, including access to online full text journals. The availability of relevant material can be achieved via the sourcing of websites already available or the generation of one’s own web pages. The use of this platform to provide students with basic information pertaining to their programme of study is a step that many courses have taken to reduce the need for time- and cost-consuming photocopying and allows the generation of one 'master' copy available to all. The potential of the web to distribute resources ideally lends itself to use in distance-learning programmes.

One area of concern for any distance-learning course is the limitation on students’ access to textbooks and current peer-reviewed literature. This can be partly overcome by limiting recommended textbooks to one or two key textbooks and providing these from course fees. Despite this, a vital aspect of postgraduate courses is the requirement for students to review and critically appraise current articles and journal material. The development of electronic libraries, especially with regard to full text peer review journals, is an area that has greatly facilitated the introduction of distance-learning courses at a postgraduate level. Students can view the University’s
electronic journals via the use of an authenticated proxy server service. Those unable to use this service can contact the University of Bristol library which provides to their distance-learning students copies of requested papers, to be sent either via electronic or postal mail.

The introduction of a novel, Internet-based, distance-learning Masters programme in Reproduction & Development over the previous 2 years has successfully allowed the widening of participation in postgraduate courses in comparison to standard, campus-based methods of study and the first cohort of students on this programme has recently graduated. The technology used for this course has been rapidly accepted by students (and even tutors) after being introduced during preliminary face-to-face teaching workshops to build familiarity and confidence. The use of residential workshops within a distance-learning environment needs careful planning to ensure that they are used effectively to give maximum support to student learning. Lectures can be effectively delivered ‘online’, thus allowing precious residential workshop time to be given over to interaction and practical sessions. Adoption of such a format does require forward planning and good levels of student motivation to ensure that relevant topics are reviewed prior to the workshop session. Although there are many pitfalls in the use of the Internet to deliver teaching, most notably issues over discussion and communication, these can be overcome with careful planning and consideration. The increased availability of current, peer-reviewed articles via electronic libraries makes this teaching model suitable for use by universities and other institutions to deliver all levels of courses and also as a vehicle to deliver continuing professional development programmes.

References


Submitted on January 27, 2004; accepted on April 30, 2004