E-learning vs lecture: which is the best approach to surgical teaching?

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Abstract

Aim Most medical teaching is still delivered by traditional face-to-face interaction. E-learning has the potential benefit of instilling deeper learning of topics by virtue of repeated and convenient access to content presented in a range of media. We aimed to evaluate objectively the benefit of educating medical students on a common surgical topic (haemorrhoids), through a website and podcast package vs a traditional lecture.

Method Baseline knowledge was established by a questionnaire given to two different groups of third-year medical students starting their first clinical attachment. Group A (n = 73) was given a lecture and group B (n = 75) was asked to use a website containing text and pictures augmented by a podcast. Students were reassessed using the same preintervention questionnaire, and satisfaction was acquired from details given in a feedback form.

Results There was no difference in knowledge between the two groups at baseline. Both groups demonstrated significant gains in knowledge after intervention (P < 0.0001). Group B (Web/podcast) showed a significantly greater increase in knowledge (P < 0.05) than group A (lecture). Preintervention subjective assessment of knowledge rated by the students showed no difference between the groups. Both groups of students were equally satisfied with the educational method.

Conclusion E-learning supplemented with a podcast results in greater knowledge acquisition when compared with a traditional lecture, without a loss of satisfaction with teaching. Using augmented Web-based educational tools reduces demands on teaching time with no decrease in quality for selected parts of the curriculum.

Keywords Education, podcast, websites, teaching, lecture, surgery

Introduction

In the last decade, interactive multimedia have developed rapidly with the introduction of flash websites and podcasts [1]. Such tools can be innovative and powerful learning methods for teaching medical students [2,3]. E-learning has not yet been widely used in most undergraduate curricula and there is still heavy reliance on the delivery of teaching in a face-to-face format.

Delivery of the curriculum through lectures depends on student and teacher being present in the same place simultaneously for a one-off delivery of content. E-learning overcomes this logistical difficulty by its ability to be accessed from anywhere with Internet access at a time convenient to the learner. In addition, the same content can be delivered repeatedly for reinforcement and revision [4–7].

Schormair et al. [8] have shown that the heavy burden of patient care and increasing administrative tasks has put added pressure on clinicians, which results in poor motivation and enthusiasm to teach. E-learning techniques may relieve some pressure on clinical time.

The Derby Colorectal Surgical Department has developed an informative and interactive website mapped to undergraduate learning objectives, which covers the common colorectal topics with the use of summarized text, clear illustrations, and audio and video podcasts (http://www.learncolorectalsurgery.com). However, new methods for delivery of the curriculum require evaluation before implementation [9–11].

In this study, we aimed to evaluate and compare objectively the effectiveness of traditional lecture-based
teaching with Web-based learning, including an audio podcast, using the common surgical condition of haemorrhoids as an example.

**Method**

All medical students \((n = 148)\) undertaking their first clinical attachment in surgery at the Royal Derby Hospital were included in the study. Students required to retake the attachment following failure were excluded. The students were randomly assigned to either group A or group B using QUICKCALCS online software (1992–2007 GraphPad Software Inc., San Diego, California, USA). Group A was given a face-to-face lecture and group B was given the colorectal surgery website address (http://www.learncolorectalsurgery.com) and asked to use the page on haemorrhoids and the associated podcast to learn about the topic without an accompanying lecture.

Baseline knowledge about haemorrhoids was assessed in each group using a questionnaire that included multiple choice questions (MCQ) and extended matching questions (EMQ) mapped to learning objectives on haemorrhoids. In addition, seven-point Likert style [12] rating scales, where a score of 1 = very poor and a score of 7 = excellent, were used to assess the satisfaction of students with regard to general teaching styles and specific to the teaching method given.

Each group had an educational intervention delivered at different times, 1-week apart. Group A was given a lecture and completed the study in the first week, whereas group B was given the website and podcast information in the second week. This prevented interference and bias created by students from each group.

Students in group A were asked to repeat the questionnaire, along with a satisfaction survey, at the end of the same teaching day. Students in group B were given 24 hours to access the website and podcast. During this 24-hour period, students were given free access to the website and podcast, and multiple logins were allowed. A post-intervention questionnaire was given to students in group B on the same day that access to the website was disabled.

Students were made aware that they had taken part in a study to compare educational methods, but they were not told, until after the information had been delivered, that they would have to repeat the questionnaire.

**Educational intervention**

The learning objectives for haemorrhoids according to the set curriculum were:

1. Define and recognize common presentations of haemorrhoids.
2. Understand the aetiology, possible differential diagnosis and how to investigate haemorrhoids.
3. Describe the different types of management according to the grade of haemorrhoid.

The lecturer had formal training in effective clinical teaching and was given the learning objectives described above. A well-illustrated Powerpoint presentation was used to deliver the lecture.

The website was mapped to the objectives and used summarized text, illustrations and a podcast. The podcast was recorded by the same clinician who gave the lecture.

Questionnaires were marked to provide a total mark out of 25. The papers were marked by an individual blinded to the teaching method given, using a preagreed marking schedule.

**Results**

Seventy-three students were randomized to group A and 75 to group B. Analysis was carried out on those students who completed the haemorrhoid questionnaire before and after teaching was given. Sixty-one students completed preteaching and post-teaching questionnaires in both groups (Fig. 1). The demographics of the groups is shown in Table 1.

**Preintervention knowledge**

The majority of students knew little about haemorrhoids (group A, 60%; group B, 58%) whereas approximately one-third in each group were confident that they had a fair amount of knowledge on the topic (group A, 32%; group B, 33%). Their understanding of haemorrhoids had been consolidated by other sources of information, mainly magazines, leaflets and knowing people suffering from the condition.

![Figure 1](https://example.com/figure1.png)

**Figure 1** Flow diagram of the study.
There was no significant difference in knowledge between the students in the two teaching conditions at baseline, as rated by mean scores on the questionnaire [maximum score = 25; group A, mean = 15.00 (95% confidence interval: 14.25–15.75); group B, mean = 15.47 (95% confidence interval: 14.80–16.23); unpaired t-test $P = 0.35$]. Scores on knowledge increased significantly for both groups after teaching [the scores for group A increased from a mean of 15.00 to a mean of 18.23 (95% confidence interval: 17.56–18.90), $P \leq 0.0001$; and the scores for group B increased from a mean of 15.47 to a mean of 19.13 (95% confidence interval: 18.57–19.69), $P \leq 0.0001$]. Following the teaching there was a significant increase in the marks gained in group B (E-learning) compared with group A (lecture-based learning) [the mean for group A was 18.23 (95% confidence interval: 17.56–18.90) and the mean for group B was 19.13 (95% confidence interval: 18.57–19.69); unpaired t-test $P = 0.04$].

Using the Likert scale of 1–7 (where a score of 1 = very easy and a score of 7 = very difficult) the median score was 2 for the ease of use of the website. The usefulness of both the podcast and the quality of written material on the website and lecture received a median score of 6 (1 = poor, 7 = excellent).

**Knowledge gain**

IQR, interquartile range.

**Internet access**

All students reported that they had ease of access to a computer and the Internet both at the University and the Hospital. In addition, 75% had access to the World Wide Web at their domestic residence.

**Discussion**

This study shows that E-learning may be more effective than a lecture at delivering information about a common surgical topic. Subjective assessment of knowledge regarding haemorrhoids from students in both groups was similar, although objective assessment demonstrated significantly better results in students who used the E-learning package. Taking the University pass mark of 50%, at least 95% of all students would have passed the assessment after the intervention (group A, 95% confidence interval: 17.56–18.90; group B, 95% confidence interval: 18.57–19.69). There was less variation in marks in the E-learning group (marks in group B: 13–22; marks in group A: 7–22), although the maximum mark achieved in both groups was the same. All students using the E-learning package achieved more than 50% of the correct answers whereas 2% in the lecture group would not have achieved the University pass mark.

The same teacher delivered both the lecture and the podcast, and therefore the differences in learning may be attributed to the medium employed. It is possible that the information on the website was highly structured, clearly summarized and could be accessed repeatedly.

When creating informative and educational websites for students, accessibility should be examined. In our group, this issue did not present as a major problem because all students had access to the Internet at the University or Trust. Furthermore a high proportion of students using the E-learning package achieved more than 50% of the correct answers whereas 2% in the lecture group would not have achieved the University pass mark.

E-learning uses time and resources when setting up. However, an established package may be reused without further input and delivered to many students repeatedly. Further input is only required when revisions are required, or in response to feedback. E-learning packages, if at least as effective as lecture-based learning, may be used to replace selected parts of a lecture-based timetable to ease pressure on the time of clinicians delivering the teaching without a loss in satisfaction or knowledge gained.

**Table 1** Demographics of both groups.

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Group A (lecture)</th>
<th>Group B (website and podcast)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total no. of students participating</td>
<td>146</td>
<td>146</td>
</tr>
<tr>
<td>Total no. of students completed study</td>
<td>121</td>
<td>121</td>
</tr>
<tr>
<td>Median age (IQR)</td>
<td>22 (21–25) years</td>
<td>22 (21–27) years</td>
</tr>
</tbody>
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**References**
