From cadaver to computer:

incorporating computers into the topographical anatomy laboratory

Kim Issroff,* Mark Osmond* and Paul O'Higgins**

*Higher Education Research and Development Unit, University College, London
**Department of Anatomy and Developmental Biology, University College, London

Traditionally, students have studied human anatomy through dissection and prosection. This requires considerable input from demonstrators, with students working mainly in large groups. Increasing student numbers, decreasing funds for staff, and a need to encourage students to develop independent learning skills that will be of value throughout their professional lives, have meant that the nature of their learning in the Topographical Anatomy Laboratory has had to change. The situation in which groups of students are guided by demonstrators has moved towards a more self-directed learning environment. Several innovations have been introduced at University College London, including a multimedia laboratory which is the focus of this paper. The results of the evaluation and the lessons learned from the early stages of setting up a self-directed learning environment are presented.

Introduction

This paper discusses the establishment of a multimedia facility in the Topographical Anatomy Laboratory at University College London. The aims of using computers in the laboratory are to encourage self-directed learning, to provide students with a means of independent study which allows instant feedback during their learning, and to allow students to progress according to their individual requirements, while achieving the overall objectives of the curriculum.

The traditional approach to the study of anatomy through the dissection of cadavers and the study of prosections requires considerable input from demonstrators, ties students down to working in groups (and therefore at the pace of the group), and can inhibit independent learning. While the approach suits some, it is not an effective learning environment for all students. In addition, considerable changes have been brought to undergraduate medical education in the UK in the last five years. Not only have the number of students passing through each medical school (and therefore each dissecting

room) increased dramatically, with no corresponding increase in staff and availability of demonstrators, but also the General Medical Council has stated that it wishes to reduce the amount of factual knowledge and to encourage students to develop independent learning skills that will be of value throughout their later professional lives.

In order to transform anatomical study from a process of dissection and learning by rote to one of exploration within a multi-faceted laboratory, while maintaining a core level of anatomical knowledge required for safe professional practice, several innovations have been introduced into the dissecting room. These are described in the next section, with particular emphasis on the multimedia laboratory.

Innovations

Laboratory study guides or workbooks have been introduced for each term. These guide students through the dissections and present them with clinical problems in order to focus their study. Students are expected to fill these in with their own diagrams and notes. An extensive collection of potted museum specimens with labels are available for students to explore. Teaching posters addressing specific problems or showing different imaging techniques, such as X-rays, are displayed. The demonstrators who teach the students have discussed self-directed learning, and have been asked to try to avoid lecturing students while dissecting a cadaver. Finally, a computer-based learning facility has been introduced. Rather than placing the computers outside of the Topographical Anatomy Laboratory, a policy decision was made that an area would be cleared within the existing facility, to be devoted to a small cluster of networked multimedia personal computers. This was intended to allow flexibility of study during any one practical session; thus students might dissect, explore prosections, posters, etc., then proceed to use the computer-based learning facilities either to clarify difficult issues or to test the knowledge they believe they have gained within that session.

A multimedia area with five networked Pentium PCs was set up for the academic year 1995/6. A thorough appraisal was made of existing multimedia and other computer-based learning materials in the area of anatomy. Several programs were chosen based on their relevance to the course, the quality and educational value of the graphical and text-based information, and the self-testing facilities. The students had access to ADAM (Animated Dissection of Anatomy for Medicine from ADAM Software), Human Anatomy (from Gold Standard Multimedia), Functional Anatomy of the Heart (from Andromeda Interactive), Interactive Skeleton and Imaging Atlas of Human Anatomy (from Primal Pictures/Mosby Multimedia), and BodyWorks (from SoftKey Multimedia). These six programs are all quite different in their approach, but complementary. Functional Anatomy of the Heart is highly instructional and relies heavily on sound, with a good system for self-testing that takes students back to the relevant material if they answer incorrectly. ADAM, Interactive Skeleton and Imaging Atlas are all strongly based on visuals and allow students to look at structures in detail and label them, but ADAM does not supply any text-based information or self-test facility. Human Anatomy takes a practical approach, guiding students step-by-step through dissections, using both text and images extensively, and offering thousands of practical examination questions. BodyWorks is aimed at a lower level, but provides a good basic introduction to anatomy

and the main body systems. Over 3,000 anatomy and developmental biology multiple-choice questions were made available to the students using LAPT (London Agreed Protocol for Teaching, Gardner-Medwin, 1995). Although there exists a selection of software for gross anatomy, there was nothing for embryology, and the team are currently involved in the design and authoring of interactive tutorials for this area.

Evaluation

The evaluation involved giving students two sets of questionnaires which assessed their experiences and attitudes. Students and the members of staff involved were interviewed. In addition, the multimedia laboratory was observed periodically over the year. The questionnaires were filled in on a voluntary basis. Table 1 shows the number of students, and their year, who filled in the questionnaires.

Table 1: Number of responses

	Total number of students	September 1995	April 1996
First-years	230	220	143
Second-years	200	169	121
Total	430	389	264

The students were asked about their use and experience of computers in the first questionnaire. Ninety-five per cent had used a computer, but only 41 per cent had used a computer for learning (largely second-years who had used LAPT during their first year), and only 23 per cent had used a multimedia application before.

Students' attitudes

The survey of students' attitudes showed that about 10 per cent strongly preferred working on their own, while 12 per cent thought that they did not learn very much in groups. This gives further support to the need to provide a self-directed learning laboratory which allows students to work individually and at their own pace.

The students were asked whether or not they thought computers would/did help them at the beginning and the end of the academic year. The students' attitudes towards computers changed over the year, and, by the end, 30 per cent thought that computers did not help them much, while at the beginning of the year, 10 per cent of the students had thought that computers would not help them. Thus it seems that for some of the students, experience in the laboratory had led to a more negative attitude towards using computers for learning.

Computer use
The multimedia laboratory was usually busy with several groups of students using the computers, and some individuals working on their own. However, the results of the questionnaire showed that only about a third of the students used the computers,

although given that there were only five computers and up to 100 students in the laboratory at one time, it is not surprising that they did not all use the computers, and complained that at times they could not get on a computer or use the appropriate CD-ROM. Closer observations of what the students were actually doing with the software showed that in groups they often experimented with the software, for example trying different views, without really engaging with the material on the screen. Students would often quiz each other about labels on diagrams, but very rarely read the text. However, students who worked as individuals did read the text and appeared to be engaging with the information in a different way from those working in groups.

The students were asked how much they used the different packages, and it was very clear that the multiple-choice questions using LAPT were the most used part of the laboratory. This is not surprising because the questions are part of their final assessments, and using this package has direct relevance to their final results. This was confirmed by the results for the first- and second-year anatomy examinations which were considerably higher than in the previous year.

The students were also asked about the usefulness of various aspects of the packages. They found the diagrams and labels, and especially the questions (particularly first-years) useful, but did not make use of the Help facilities or the text.

Discussion

It is clear from the results of the questionnaires that students were not making effective use of the multimedia packages. There are several reasons for this. First, there was the problem of having access to a computer and the CD-ROMs at the appropriate time. Secondly, as mentioned above, students spent much of their time, using LAPT, answering multiple-choice questions which were part of a bank due to appear in their examinations. Thirdly, the use of the multimedia packages was not sufficiently integrated into the course: students did not know which packages to use at different times, and sometimes were unable to access the information that they needed from the packages. This is linked to the fourth reason, which is that the students did not have much experience of learning with technology, and did not know how to use their time effectively when working with computers. This was exacerbated by the nature of the software, most of which takes a systems approach, with the user looking at different views of the whole body rather than regionally, which is the way in which the course is structured.

For the current academic year, some changes have been made in order to ensure that the students use the computers effectively. In particular, the students' use of the computers is now incorporated into the laboratory study guides, so that the multimedia laboratory is now fully integrated into their course. This has been done by providing an introduction to using the computers and CD-ROMs within the guide, an introduction to each of the packages involved within the context of the week's subject area, and pointers throughout the laboratory guides to appropriate packages for the particular area that the students are studying. The aim is to scaffold the students' use of the software. Initially, the students are provided with an in-depth worksheet for each application which, crucially, is concerned with the topic they are currently studying. After they have used the software, there are pointers to appropriate places within the course at which that software is particularly relevant.

At the time of writing (five weeks into the new academic year), indications are that this new approach has transformed the students' attitudes towards computer-based learning. Usage of the computers has increased dramatically, and the students are much more proactive in their approach.

Conclusions

Multimedia computer programs are potentially very useful for self-directed learning of anatomy, but in order for them to be really effective, students must be guided – at least initially – in how to use them and where to look for the information they require. For medical students, as for most other students, 'What is on the exam?' is a question of primary importance, and they therefore put an emphasis on the resources, such as textbooks and examination questions, that they know will provide them with the fullest answer. In this first year of using computers in the Topographical Anatomy Laboratory, the machines were seen by students as an extra and not relevant for passing the examinations. It is thus essential to integrate the use of computers and the multimedia packages directly into the course material so that they can be seen by the students to be a beneficial and necessary part of the course.

Reference

Gardner-Medwin, A.R. (1995), 'Confidence assessment in the teaching of basic science', *ALT-J*, 3 (1), 80–5.