

Committee for the Advancement of University
Teaching

FINAL REPORT FOR A 1995 NATIONAL TEACHING DEVELOPMENT GRANT

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1 Identification

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Project Title

Learning Physiology from Cardiac Surgery Patients

2 Project Summary

Physiological recordings made from patients during open-heart surgery were used as the basis of a package for teaching cardiovascular physiology. The aim was to illustrate real human physiological situations of clinical relevance so that physiological principles would be appreciated in a relevant context. The package presented background information, and computer-based multimedia records of entire open-heart procedures brought the operating theatre to the classroom. Exercises encouraged observation, analysis, interpretation, and problem solving, drawing on basic and applied physiological principles.

What students learnt was very relevant to their course (medicine). Students were forced to think and develop a deeper understanding of the cardiovascular system. Acceptance of computer-based learning was not universal. There was resistance to departure from traditional didactic teaching methodology. There were also problems with cognitive overload, which will be addressed.

3 Suggested Applications

The teaching materials developed in this project could be directly applied to the education of medical students in other schools, nursing students, intensive care nursing staff, and anaesthetic and surgical registrars. There is no single comparable resource which deals with the practical interpretation of haemodynamic physiological data in a simple and thorough way.

The principles applied in this project, namely getting away from the didactic, text-book approach, and basing study on the illustration of relevant examples of real situations, could be applied to numerous discipline areas, the important principle being the relevant context of the knowledge.

4 Output

Two tutorials have been developed. One tutorial covers haemodynamic traces, including interpretation of venous and arterial waveforms. The other tutorial details rhythms/arrhythmias, with particular emphasis on haemodynamic effects. Both tutorials utilise data collected from cardiac patients.

The tutorials developed are available on the World Wide Web at:
<http://www.healthsci.utas.edu.au/physiol/Physiology>

An updated version of the tutorials is nearing completion and will be available in a stand-alone format on CD-ROM.

Annotated patient records, which students can use in conjunction with printed written notes, shall also be available shortly on CD-ROM.

A paper to be submitted to the American Journal of Physiology is in preparation.

5 Major Objectives of the Project

The principal objective of this project was to develop a package for the teaching of cardiovascular physiology based on genuine human physiological data and thus emphasise real human physiological situations of clinical relevance so that physiological principles would be appreciated in a relevant context. This was to be done in a way which encouraged development of group-learning skills and self-directed learning. It was also hoped to encourage development of sound mental models of the cardiovascular system and deep learning of cardiovascular principles, by emphasising analysis, interpretation and problem solving, rather than rote learning.

6 Major Achievements of the Project

Physiological data was successfully recorded from patients during open-heart surgery. These records were annotated with appropriate comments, written exercises were developed, and they were incorporated into the second-year physiology teaching course in 1995 as two three-hour practicals sessions, replacing animal-based practicals. Subsequent to this it was decided that more background information was required and so two tutorials were developed and are accessible on the World Wide Web.

In 1996 second-year physiology students worked through the tutorials before attempting the patient record exercises, which were revised and updated with graphic and video annotations to illustrate more clearly procedures and instrumentation.

The format and content of the tutorials have been enthusiastically welcomed by both students and academics in Australia and overseas. There appears to be a gap in published resources in this area and our initial attempts at production of tutorials appears to be a considerable step forward.

Observation of students working through these tutorials illustrated a major benefit of computer-based learning. Each student appeared to take a different approach, with some going home and working via modem, some taking copious notes, some working together, others alone, some trying to understand everything the first time, and others going through several times, and some deciding to leave and do the work later. Comments from students indicated that they were made to think, which they preferred not to do. They could not simply remember every situation because, being genuine clinical data, there was too much variation, so they appreciated the benefits of gaining a deeper understanding of the systems and principles involved. They also found the clinical relevance of the data of great significance. One problem with the tutorials was that the students were scheduled for a three hour session, which resulted in cognitive overload. Shorter sessions would have been more effective.

The annotated patient records were better handled by the students in 1996, after having worked through the tutorials, than by the students in 1995. The exercises built on the knowledge gained from the tutorials and concentrated on analysis and interpretation. Students were encouraged to work in pairs and to make interpretations without assistance from demonstrators. Again it was commented that they were made to think. Some students took to the challenge better than others. Formal evaluation of the project shall be carried out in July 1996 by questionnaire and also through discussions with students. Updated versions of the tutorials and annotated patient records will be transferred to CD-ROM and sent to other universities for evaluation and comment.

The main objectives of this project have been met. Instructive and challenging materials have been produced from human physiological records and have been incorporated into the teaching program. Students are learning material that is more relevant to their course and they appear to be learning more deeply. The material is transferrable to other institutions, and the methods used are transferrable to other subject areas.

7 The Teaching Development

This teaching development used recordings from physiological monitors in a hospital setting. Physiological monitoring is a routine procedure in any hospital around the world, and yet it seems that many doctors and nursing staff have only a rudimentary understanding of what those traces represent and how to interpret them. The tutorials developed in this project explain simply, using images from a monitor, what the waveforms are and how to interpret them. The two tutorials on the World Wide Web are accessible to any student or academic with access to the internet. Feedback from these tutorials has been extremely positive, both from students and from international academics who have accessed the Web site. The following are two of the many positive comments we have received:

“...my compliments for a job well done...you have turned what many students interested in physiology believe to be an intimidating subject into an enjoyable one...”

John Parker, Calgary, Canada

“Thanks for the work you’re doing with the cardiac tutorials on the web. I am a nursing student and when I found your page I came close to calling my instructor in excitement...”

Kathy Jacobson, Ohio University

These comments illustrate the gap that exists in teaching material available in this area and that our initial attempt to produce tutorials in this area is a significant advance. The tutorials on the Web are already available for others to take advantage of. We are also producing the tutorials in a stand-alone format for distribution on a CD-ROM. The dearth of resources in this particular area will ensure that teaching outcomes will be improved.

The transfer of the annotated patient records onto CD-ROM will also result in a transferrable package complimented by the tutorials. The patient record exercises will be readily transferrable to other institutions.

The most significant advance in teaching offered by the patient records is the human clinical relevance of the material and the integration of basic physiological principles into a meaningful context. We believe that this has resulted in a better and more integrated understanding of physiology with an appreciation that the physiology cannot be considered in isolation from the patient. The patient record exercises have also been conducive to cooperation in solving clinical problems and have encouraged development of deep learning.

This project has achieved the goals that were set, and the materials have been incorporated into the second-year course. However it is necessary to continually evaluate any teaching program, and it is anticipated that this material shall undergo further revision and refinement, both in content and implementation, over time. It is also anticipated that other areas of the syllabus may undergo revision, with similar emphasis on clinical relevance and utilising human physiological data. The University has been strongly supportive of this project from its inception.

Final formal evaluation of the project is yet to be carried out. This will occur in July 1996. One of the difficulties of implementation and evaluation of a CAUT project is the timescale in which the project must be carried out. A period of 12 months leaves little time for planning, doing, implementation and evaluation.

8 Personnel Outcomes

One person was employed to work on this project.

The reference group provided some useful suggestions. There were seven members of our project reference group. Some advice was obtained regarding technical aspects of the project, and advice on the integration of the project into the course. Otherwise the reference group was probably underutilised.

9 Networks

Interest has been received from other physiologists and nurse educators. Especially useful have been contacts made at CAUT workshops. Funding to purchase computer hardware was received from the Apple University Development Fund (\$8 000)