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# THE VIRTUAL TEACHING HOSPITAL SYSTEM (VTHS)

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As their course progresses, medical students amass a vast amount of information but must, crucially, develop the skills of diagnosis and patient management. Such skills, learnt at the bedside, necessitate a great deal of time-consuming clinical oversight. The 'Virtual Teaching Hospital System' (VTHS), is essentially a computer-assisted diagnostic system, designed to enable unlimited, unsupervised practise of clerking and diagnosing patients, using real or simulated data. Developed in VB6.0 by Dr Omara, VTHS has been transformed to C-Sharp and PHP by the MCS Department. It has been re-engineered for compatibility with the Medical School's current clinical teaching policy, has focussed initially on a range of respiratory diseases, and is ready for evaluation by medical students. It will be evaluated for impact on medical student group learning in Leicester and, if possible, more widely in the UK. It has broader potential for the improvement of health care in developing countries, including Ethiopia and others in sub-Saharan Africa. Donors such as WHO, UNICEF, SIDA and UNAIDS may sponsor the use of the program, in the fight against HIV/AIDS, and infant and maternal mortality. VTHS was demonstrated to her Majesty the Queen on her recent visit and Elsevier have subsequently made enquiries.

## 1. BACKGROUND

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As a doctor trained within an orthodox medical education curriculum, and now a teacher at the Leicester Medical School, one of us (Dr Omara) finds the Leicester medical curriculum to be the answer to some of the problems inherent in old curricula. However, the Leicester Medical School's electronic learning environment would be greatly enhanced by the incorporation of a large interactive audio-visual clinical database supported by a clinical decision tool for simulated cases. The proposed system would take into account the current curriculum's ethos and strategy and support it with a virtual system in which students can practise clerking, diagnosis and management of patients, using simulated or real patient histories as their starting point. The supporting clinical decision feedback facility would provide immediate feedback on the clinical decisions made by the student after attending to each case thus reducing error and promoting a logical diagnostic mindset. The finest learning is always done at the bedside under the tutelage of an experienced clinician, but the proposed Virtual Teaching Hospital System (VTHS) complements such learning by providing unlimited simulated practise under the effective tutelage of an electronic advisor. Such simulated practice obviates the need for clinical oversight (a commodity in short supply) as students revise and reinforce their clinical reasoning, between bedside teaching sessions.

## 2. PROJECT AIMS AND OBJECTIVES

Leicester Medical School enrolls nearly 290 new medical students onto its two MB ChB courses each year (i.e. 220 school leavers onto its 5-year course and a further 64 Health Science Graduates onto its fast-track, 4-year course). The proposed Virtual Teaching Hospital System (VTHS) would assist student self-learning throughout the course but become particularly valuable from the second year onwards, for it is in the second year that students begin to take patient histories in earnest. The potential benefit of the system would increase with the students' experience of the clinical setting and peak in Phase 2 of the course (the last two and a half years of the course in which full-time clinical work takes place). Staff will benefit in the sense that, as students use the tool for self-directed learning, the ease with which clinical concepts can be explained at the bedside will be enhanced. The development of this system, a system which enables electronic self-learning in a multitude of clinical scenarios, is in keeping with the University Learning and Teaching Strategy's 'Aims for Undergraduate Programmes', in particular those found in section 3.1 (graduates will have developed the necessary skills to learn.... independently.....) section 3.2 (critical appraisal of evidence with appropriate insight) and 3.3 (problem solving).

Dr Omara brought from Zambia a system which was designed to receive extensive clinical data about all body systems in order to make a diagnosis. This system needed to be adapted to the Leicester medical teaching method in which differential diagnoses are successively suggested, not by full-systems data, but by a relatively limited number of presenting symptoms, elicited signs, and investigation data. The aim is that the student, using essential data, rapidly narrows the list of probabilities (hypothetical deductive reasoning).

Students from the Department of Mathematics and Computer Sciences have worked on the system in order to make it more user-friendly. Dr. Omara had designed and built the databases in MS Access; the students converted them to MYSQL or SQL. It was a useful exercise for the students and their tutors as it realistically simulated a real client situation. Some difficulties were encountered on account of the restricted periods over which students were able to conduct projects but much valid development took place.

In order to test VTHS's viability, the Medical School suggested its settings be adjusted to diagnose a limited number of common respiratory diseases, on the basis of a limited number of signs, symptoms, and investigation data. VTHS has been shown to reliably diagnose such respiratory diseases when relevant data is entered.

The system differs from other computer-assisted diagnostic systems in making, storing and finally printing a log of the session/consultation, comparing the student's successive diagnostic decisions with those made by VTHS as successive information was fed into the system. It also has a facility to e-mail these logs to a relevant clinician for further feedback.

### 3. PROJECT OUTCOMES AND ACHIEVEMENTS

VTHS has been developed to a state in which patient data (demographic and pathological) can be entered to yield a conclusive respiratory diagnosis (in most instances) together with differential respiratory diagnoses. It also records the basic dialogue between student and system and reproduces this at the end of the consultation so that the student can reflect on their reasoning; an e-mailing facility permits a tutor to comment if necessary. A facility to link diagnoses to relevant research engines has been incorporated.

VTHS thus has the potential to enhance student history taking, clinical data interpretation, and diagnosis, without making extra demands on the time of teaching staff. Initial instruction from a clinical tutor can be implemented by the student in numerous virtual scenarios. VTHS thus has the potential to improve student satisfaction. The student can be exploratory, investigating numerous 'what if?' situations, without any fear of exhausting tutor patience. The experience is designed to be transferable to the real bedside clinical situation, though this can never be fully emulated. It should make for more effective practice in newly graduated doctors and thus raise patient satisfaction.

### 4. EVALUATION

The VTHS is yet to be evaluated. Such evaluation has been postponed until the system is more user-friendly.

### 5. CONTINUATION OF THE PROJECT

VTHS will be disseminated to Phase 1 and Phase 2 medical students at Leicester via the Clinical Skills Foundation Course leader and via each of the 12 Clinical Block leaders respectively. Seminars and demonstrations will be used as an initial means of introduction. The Head of the Medical & Social Care department will be kept closely informed at all stages and approval from the Curriculum Committee sought whenever appropriate. With time seminars and demonstrations will be used as a means of introducing VTHS to educational leaders in other UK Medical Schools.

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