

Exploring the use of a web-based virtual patient to support learning through reflection

By

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Preface

This submission is my own work, and to the best of my knowledge and belief, it contains no material previously published nor material which to a substantial extent has been accepted for the award of any other degree or diploma of a university or other institute of higher learning, except where due acknowledgment is made in the text.

In 2001 and 2002, parts of this project, including the question and answer, and the review interfaces, formed the focus for a number of group projects by computer science students from the University of Sydney. The design concepts and software developed by one group, limited to the chart review component, form part of the software described in this thesis, and was developed collaboratively with the author. The members of that group were Anthony Dang, Mathew Attlee, Steve Edmondson, and David Tanner.

Approval for the study involving medical students in 2003 was obtained from the University of Sydney Human Research Ethics Committee, as well as the Graduate Medical Program Research Committee

Publications and presentations arising from this work are listed below.

Chesher, D, Kay J and King N. (2003). A Web-Based Virtual Patient to Support Reflective Learning. Bull, S, Brna P and Dimitrova V (eds). Proceedings of Learner Modelling for Reflection Workshop. Volume V of the AIED2003 Supplementary Proceedings. 209-218.

Chesher, D, Kay J and King N. (2002). Teaching system for management of chronic illness, Proceedings of Adaptive Hypermedia 2002 Workshop on Adaptive Systems for Web-Based Education. 143-149. <http://www.lcc.uma.es/~eva/WASWBE/main.html>

Chesher, D, Kay J and King N. (2002). A Web-based Medical Case Simulation for Continuing Professional Education Proceedings of ITS Workshop: Individual and group modelling methods that help learners understand themselves. 26-31.

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Secondly, I would like to thank all those undergraduate computer science students who have contributed to the project. In particular, I must thank Anthony Dang, Mathew Attlee, Steve Edmondson, and David Tanner for their contributions to the design and coding of the chart review components of the software.

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Abstract

This thesis explores the support of learning through reflection, in the context of medical students and practitioners, working through a series of simulated consultations involving the diagnosis and management of chronic illness.

A model of the medical consultative process was defined, on which a web-based patient simulation was developed. This simulation can be accessed over the Internet using commonly available web-browsers. It enables users to interact with a virtual patient by taking a history, examining the patient, requesting and reviewing investigations, and choosing appropriate management strategies. The virtual patient can be reviewed over a number of consultations, and the patient outcome is dependant on the management strategy selected by the user.

A second model was also developed, that adds a layer of reflection over the consultative process. While interacting with the virtual patient users are asked to formulate and test their hypotheses. Simple tools are included to encourage users to record their observations and thoughts for further learning, as well as providing links to web-based library resources. At the end of each consultation, users are asked to review their actions and indicate whether they think their actions were critical, relevant, or not relevant to the diagnosis and management of the patient in light of their current knowledge. Users also have the opportunity to compare their activity to their peers or an expert in the case under study.

Three formal cycles of evaluation were undertaken during the design and development of the software. A number of clinicians were involved in the initial design to ensure

there was an appropriate structure that matched clinical practice. Formative evaluation was conducted to review the usability of the application, and based on user feedback a number of changes were made to the user interface and structure of the application. A third, end user, evaluation was undertaken using a single case concerning the diagnosis and management of hypertriglyceridaemia in the context of Type 1B Glycogen Storage Disease. This evaluation involved ten medical students, five general practitioners and two specialists. The evaluation involved observation using a simplified think-aloud, as well as administration of a questionnaire.

Users were engaged by the simulation, and were able to use the application with only a short period of training. Usability issues still exist with respect to the processing of natural language input, especially when asking questions of the virtual patient. Until such time that natural language recognition is able to provide satisfactory performance, alternative, list-based, methods of interaction will be required.

Evaluation involving medical students, general practitioners, and specialist medical practitioners demonstrated that reflection can be supported and encouraged by providing appropriate tools, as well as by judiciously interrupting the consultative process and providing time for reflection to take place. Reflection could have been further enhanced if users had been educated on reflection as a learning modality prior to using SIMPRAC. Further work is also required to improve the simulation environment, improve the interfaces for supporting reflection, and further define the benefits of using this approach for medical education and professional development with respect to learning outcomes and behavioural change.

Abbreviations

CBX	Computer Based Examination
CKMB	MB fraction of Creatine Kinase
CT	Computerized Tomography
GSD	Glycogen Storage Disease
HDL	High Density Lipoprotein
HMG CoA	3-Hydroxy-3-methylglutaryl Co-enzyme A
JRE	Java Runtime Environment
JSDK	Java Software Development Kit
LDL	Low Density Lipoprotein
LFT	Liver Function Tests
MAUT	Multi-Attribute Utility Theory
NBME	National Board of Medical Examiners
PBL	Problem Based Learning
TFT	Thyroid Function Tests

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