

A TACIT HEALTHCARE KNOWLEDGE
EXPLICATION INFO-STRUCTURE USING
CONTRIVED KNOWLEDGE ACQUISITION
AND REPRESENTATION APPROACHES

END OF PROJECT REPORT

USM SHORT TERM GRANT

PROJECT LEADER:
CHEAH YU-N

BAHAGIAN PENYELIDIKAN DAN PEMBANGUNAN

CANSELORI

UNIVERSITI SAINS MALAYSIA

Laporan Akhir Projek Penyelidikan Jangka Pendek

- 1) Nama Penyelidik: Dr. Cheah Yu-N

Nama Penyelidik-Penyelidik

Lain (*Jika berkaitan*) : Dr. Vincent Khoo Kay Teong

- 2) Pusat Pengajian/Pusat/Unit: Pusat Pengajian Sains Komputer

- 3) Tajuk Projek Penyelidikan: A Tacit Healthcare Knowledge Explication Info-Structure Using Contrived Knowledge Acquisition and Representation Approaches

- 4) (a) Penemuan Projek/Abstrak

(Perlu disediakan maklumat di antara 100 – 200 perkataan di dalam Bahasa Malaysia dan Bahasa Inggeris. Ini kemudiannya akan dimuatkan ke dalam Laporan Tahunan Bahagian Penyelidikan & Pembangunan sebagai satu cara untuk menyampaikan dapatan projek tuan/puan kepada pihak Universiti).

Projek ini telah menghasilkan suatu Info-Struktur Pengeksplikasian Pengetahuan Kesihatan Tersirat yang mampu memperolehi, menyimpan dan menyebarkan pengetahuan kesihatan tersirat untuk digunakan oleh para pakar dan doktor kesihatan supaya perkhidmatan kesihatan yang berkualiti dapat diberi secara berterusan. Dalam penyelidikan ini, kami telah:

1. Mendefinisikan dan membangunkan suatu Perwalikan Pengetahuan Kesihatan Tersirat menggunakan struktur senario yang diubahsuai.
2. Mendefinisikan dan membangunkan suatu Mekanisma Pengeksplikasian Pengetahuan Kesihatan Tersirat berasaskan teknik pemerolehan pengetahuan secara tak terus, iaitu dengan menjana 'cabaran' di beberapa lokasi persoalan dalam struktur senario.

Struktur senario yang diubahsuai ini lebih mudah berbanding dengan senario asal untuk pemerolehan pengetahuan tersirat dan ia direkabentuk untuk digunakan dalam bidang kesihatan. Struktur senario yang diubahsuai ini dapat menampung binaan-binaan Pembelajaran Berasaskan Masalah manakala Info-Struktur Pengeksplikasian Pengetahuan Kesihatan Tersirat juga memuatkan fungsi-fungsi untuk menyokong pemerolehan pemicu yang kaya dengan pengetahuan tersirat untuk memperkayakan Pembelajaran Berasaskan Masalah.

Project Findings/Abstract

The project has produced a Tacit Healthcare Knowledge Explication Info-Structure that is designed to acquire, store and disseminate tacit healthcare knowledge to be used by healthcare specialists, experts and practitioners to ensure the provision and continuation of expert-quality healthcare services. In this research, we have:

1. Defined and developed a Tacit Healthcare Knowledge Representation Formalism using a modified scenario structure.
2. To define and develop a Tacit Healthcare Knowledge Explication Mechanism based on contrived knowledge acquisition techniques, i.e. by generating challenges at various point of interrogation in the scenario structure.

The modified scenario structure is a more streamlined version of the original tacit knowledge explication scenario and is designed to suit the healthcare environment better. This modified scenario structure has been utilised to incorporate Problem-Based Learning constructs while the Tacit Healthcare Knowledge Explication Info-Structure also incorporates functions to support the acquisition of tacit knowledge-rich triggers to enhance Problem-Based Learning.

(b) Senaraikan Kata Kunci yang digunakan di dalam abstrak:

<u>Bahasa Malaysia</u>	<u>Bahasa Inggeris</u>
Pengetahuan tersirat	Tacit knowledge
Pemerolehan pengetahuan tak terus	Contrived knowledge acquisition
Pengeksplikasian pengetahuan	Knowledge explication
Pengurusan pengetahuan	Knowledge management
Informatik kesihatan	Health informatics

5) Output Dan Faedah Projek



(a) **Penerbitan (termasuk laporan/kertas seminar)**

(Sila nyatakan nejis, tajuk, pengarang, tahun terbitan dan di mana telah diterbit/dibentangkan).

1. Y.-N. Cheah, F.A. Rashid and S.S.R. Abidi. (2003). An Approach to Enrich Online Medical Problem-Based Learning with Tacit Healthcare Knowledge, Medical Informatics Europe (MIE 2003), St. Malo, France.
2. N.A.A. Alim, W.N.W. Hasan, F.A. Rashid and Y.-N. Cheah. (2003). Scope of Telehealth Research Projects in Universiti Sains Malaysia, International Conference on Advancement in Science and Technology (iCAST 2003), Kuala Lumpur, Malaysia. (Poster Paper)
3. P.K. Lye. (2004). An Enterprise Memory for Healthcare Knowledge Management. M.Sc. (Kerja Kursus) Laporan Projek, Universiti Sains Malaysia.

(b) **Faedah-Faedah Lain Seperti Perkembangan Produk, Prospek Komersialisasi Dan Pendaftaran Paten.**

(Jika ada dan jika perlu, sila gunakan kertas berasingan)

Tiada

(c) **Latihan Gunatenaga Manusia**

- (i) **Pelajar Siswazah:** Seorang pelajar Sarjana (Sains Komputer) melalui mod kerja kursus telah membantu dalam usaha membangun sistem ini sebagai keperluan projek beliau.
- (ii) **Pelajar Prasiswazah:** Empat (4) orang pelatih industri telah diambil untuk tempoh lebih kurang 5 bulan (15 Mac 2004 hingga 7 Ogos 2004) untuk membantu dalam usaha penyelidikan berkenaan pengetahuan tersirat dan pengurusan pengetahuan.
- (iii) **Lain-Lain:** Tiada

6) **Peralatan Yang Telah Dibeli:**

Komputer Intel Pentium P4 2.4 GHz

Pencetak Laser Canon LBP 1120

UNTUK KEGUNAAN JAWATANKUASA PENYELIDIKAN UNIVERSITI



T/TANGAN PENGURUS
J/K PENYELIDIKAN
PUSAT PENGAJIAN

DR. BAHARI BELATON
Timbalan Dekan
Pengajian Siswazah Dan Penyelidikan
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APPENDIX A: RESEARCH BACKGROUND AND METHODOLOGY

1 Research Background

Knowledge management (KM) is becoming an important research area especially in terms of how the knowledge capital of healthcare enterprises can be effectively managed and utilised. KM is very relevant in healthcare especially since KM experts have argued that the strategic, intuitive and experiential knowledge of (healthcare) experts are stored tacitly in the minds of the experts.

Traditional and more direct healthcare knowledge acquisition methods are quite effective in procuring explicit healthcare knowledge but they are relatively ineffective in acquiring a healthcare expert's tacit knowledge and do not adequately address the intuitive and innate characteristics of tacit healthcare knowledge. As a result, tacit healthcare knowledge is often unsuccessfully explicated. Furthermore, tacit healthcare knowledge remains elusive due to the lack of adequate tacit knowledge representation schemes.

Related research/publications:

- Baumard, P. (1999). *Tacit Knowledge in Organizations*. London: Sage Publications.
- Nonaka, I. and Takeuchi, H. (1995). *The Knowledge Creating Company*. New York: Oxford University Press.
- Raven, A. and Prasser, S.G. (1996). Information Technology Support for the Creation and Transfer of Tacit Knowledge in Organizations. *Second Americas Conference on Information Systems (AIS '96)*, Phoenix, Arizona.

2 Research Objectives

The objective of the project is to acquire, store and disseminate tacit healthcare knowledge to be used by healthcare specialists, experts and practitioners to ensure the provision and continuation of expert-quality healthcare services. We aim to achieve this through the definition and development of formalisms and applications that can be effectively applied to the area of healthcare. Therefore, in this project, our main aims are:

- To define and develop a Tacit Healthcare Knowledge Representation Formalism
- To define and develop a Tacit Healthcare Knowledge Explication Mechanism based on contrived (or indirect) knowledge acquisition techniques
- To build a Tacit Healthcare Knowledge Explication Info-Structure with application in healthcare Problem-Based Learning

3 Research Methodology

Research efforts for this project was focused on the task of healthcare knowledge creation, in particular, the explication, i.e. the acquisition and representation, of tacit healthcare knowledge from healthcare experts.

The main premise of our methodology is that tacit healthcare knowledge can best be explicated by provoking healthcare experts to act and apply their knowledge, experience and skills to solve novel or atypical healthcare problems. Therefore, contrived or indirect knowledge acquisition techniques are deemed more suitable as compared to direct knowledge acquisition methods. For this purpose, we have defined and developed a knowledge representation formalism that is suited for tacit healthcare knowledge explication based on existing tacit knowledge explicating scenarios.

This streamlined scenario-based tacit knowledge representation formalism was then used as the basis for the definition and development of a contrived knowledge explication tool. Based on our main premise and the original content of the tacit knowledge base, the knowledge explication mechanism would then generate healthcare scenarios and situations, or challenges, to provoke the healthcare experts into using their tacit knowledge to produce the solutions. To do this, specific points of interrogation are applied.

We have also defined a Tacit Healthcare Knowledge Acquisition Info-Structure (TKAI) that integrates the knowledge acquisition tools with other possible components (e.g. a knowledge validation/crystallisation tool) into a framework that utilises the JAVA platform. The TKAI was then experimented on a Problem-Based Learning environment where existing triggers can be enriched with tacit knowledge.

4 Project Timeline

The research was carried out in 4 phases

Phase I – Literature Review

- Knowledge management
- Contrived knowledge acquisition techniques

Phase II – Tacit Healthcare Knowledge Representation

- Formalism of tacit knowledge
- Conceptual design of contrived knowledge acquisition strategy using this formalism

Phase III – Tacit Healthcare Knowledge Explication

- Implementation of contrived knowledge acquisition strategy

Phase IV – Tacit Healthcare Knowledge Explication Info-Structure

- Consolidating implementation with other possible knowledge-based components

5 Project Outcome

Key deliverables include:

- Tacit Healthcare Knowledge Representation
- Tacit Healthcare Knowledge Base
- Tacit Knowledge Explication Tool
- Tacit Healthcare Knowledge Acquisition Info-Structure (TKAI)

APPENDIX B: CONFERENCE PAPERS

1. Y.-N. Cheah, F.A. Rashid and S.S.R. Abidi. (2003). An Approach to Enrich Online Medical Problem-Based Learning with Tacit Healthcare Knowledge, Medical Informatics Europe (MIE 2003), St. Malo, France.
2. N.A.A. Alim, W.N.W. Hasan, F.A. Rashid and Y.-N. Cheah. (2003). Scope of Telehealth Research Projects in Universiti Sains Malaysia, International Conference on Advancement in Science and Technology (iCAST 2003), Kuala Lumpur. (Poster)

An Approach to Enrich Online Medical Problem-Based Learning with Tacit Healthcare Knowledge

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Abstract

Existing Problem-Based Learning (PBL) problems, though suitable in their own right for teaching purposes, are limited in their potential to evolve by themselves and to create new knowledge. Presently, they are based on textbook examples of past cases and/or cases that have been transcribed by a clinician. In this paper, we present (a) a tacit healthcare knowledge representation formalism called Healthcare Scenarios, (b) the relevance of healthcare scenarios in PBL in healthcare and medicine, (c) a novel PBL-Scenario-based tacit knowledge explication strategy and (d) an online PBL Problem Composer and Presenter (PBL-Online) to facilitate the acquisition and utilisation of expert-quality tacit healthcare knowledge to enrich online PBL. We employ a confluence of healthcare knowledge management tools and Internet technologies to bring tacit healthcare knowledge-enriched PBL to a global and yet more accessible level.

Keywords:

Problem-Based Learning; Healthcare Scenarios; Tacit Healthcare Knowledge

1. Introduction

Problem-Based Learning (PBL) is a cognitive paradigm in which a student learns through solving a certain problem. The rationale for posing problems is so that the student is motivated to hold discussions and independently learn new knowledge in order to solve the problem at hand [1]. PBL has been utilised to train medical students since the 1960s in view that students found it difficult to apply the relevant skills and knowledge into the real-life practise of medicine [2].

Presently, medical PBL problems are based on textbook examples of past cases and/or cases that have been transcribed by a clinician. We argue that these existing PBL problems, though suitable in their own right for teaching purposes, are limited in their potential to evolve by themselves and to create new knowledge. Furthermore, healthcare institutions are sometimes faced with the problem of procuring PBL problems. We believe that current healthcare PBL problems can be brought to a higher level of abstraction that will allow healthcare experts to use their tacit knowledge to generate PBL problems that are of added-