

# FINAL REPORT

## PAIN WEEK IT & E-LEARNING COMPONENTS

**PAIN:** *A Multidimensional Issue*  
 UoT CENTRE FOR THE STUDY OF PAIN - INTERFACULTY EDUCATIONAL OPPORTUNITY



### Project to Examine Cost/Effectiveness of E-Learning for Interfaculty Health Professional Education

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**Author:** Leila Lax  
**View:** E-Learning Pilot Part 3  
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**Last Modified:** Dec 22 2001 (0:15:02)  
**Builds On:** [Clinical Case Scenario 3 - Assessment & Management Consultations](#)

### Neurologist's Electronic Pat

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### E-Report from the Neurologist

**Date:** August 17, 2000  
**Neurology:** Dr. C. Willis

**Patient:** Frank Morris

**History of Present Illness:** This is a 49-year-old man with severe phantom limb pain. On June (dominant) forearm while cleaning a meat grinder at work. He was conscious during through memory of events. He was in St. Elsewhere for a couple of weeks. He was previously well and

**Social and Functional Status:** He is the father of 12-year-old twin girls. He was working full t extracurricular sports activities. He is an ex-smoker and a non-drinker.

**Current Status:** Frank tells me that he has severe pain in the phantom hand. This is present all hand in the phantom is crumpled in a flexed position producing a deep squeeze and cramping

Netscape: E-Case Study

**Clinical Case Video Vignette 3 (Interview)**

**DATE:** August 17, 2000

**DR. C. WILLIS:** Hello Mr. Morris. Can you tell me what your main trouble is today?  
**FRANK:** I have terrible pain in my arm.

**DR. C. WILLIS:** What do you mean? Where is this pain?  
**FRANK:** It sounds crazy but it's where my hand used to be.

**DR. C. WILLIS:** You feel like your hand is still there  
 And you have pain in that hand?  
**FRANK:** Yes. My hand still seems to be there and there is terrible pain.

By Prof. Leila Lax (PI), Dr. Judy Watt-Watson, Dr. Peter Pennefather, Prof. Judith Hunter & Dr. Marlene Scardamalia

## ACKNOWLEDGEMENTS

### **EDUCATION RESEARCH FUNDING**

University of Toronto Centre for the Study of Pain, Dr. Mike Salter (Director) and the Interprofessional Education Management Committee, Dr. Catharine Whiteside (Chair) through the Council of Health Science and Social Work Deans, University of Toronto Academic Priorities Fund is gratefully acknowledged for support and education research funding of the Pain Week Interfaculty Undergraduate Health Sciences IT & E-Learning Research Study.

### **INFORMATION TECHNOLOGY COMPONENTS (Pain Week Website & My.library)**

Dr. Lawrence Spero and the Medical Alumni Association, through the Education Innovation Laboratory, Faculty of Medicine, are gratefully acknowledged for generous support of development of the IT components. In-kind contributions included: development of the Pain Week Website (by Meaghan Brierley and Leila Lax), online Evaluation Forms (by Ju Ho Park) and technical feedback on pilot study and Website (by Rosemary Waterston and Ferdinand Krauss). Special thanks Dr. Spero and the Medical Alumni Association for continued support of website development for Pain Week 2003.

Ms. Sandra Langlands, Head Librarian, Gerstein Library, is gratefully acknowledged for her outstanding contribution to the development of the My.library Resource in Pain for the Pain Week Website, which she continues to update, for the purpose of advancing evidence-based learning for Pain Week 2003.

### **E-LEARNING COMPONENT (Collaborative Knowledge Building in Knowledge Forum & WebCT)**

Prof. Judith Hunter (PT), Dr. Judy Watt-Watson (Nursing) and Dr. Peter Pennefather (Pharmacy) are gratefully acknowledged for authorship of the Phantom Pain Case and outstanding contributions to the E-Learning research project.

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Special thanks to all members of the Interfaculty Education Opportunities Curriculum Committee, University of Toronto for their feedback and support of the IT & E-Learning components. I am especially indebted to the five expert contributors that dedicated their time, energy and wisdom to facilitating the E-Learning groups in this research study.

## **Research Study: Project to Examine the Cost/Effectiveness of E-Learning for Interfaculty Health Professional Education**

**P.I. & Co-Investigators:** Prof. Leila Lax (P.I.), Dr. Judy Watt-Watson, Dr. Peter Pennefather, Prof. Judith Hunter & Dr. Marlene Scardamalia.

### **Executive Summary**

Asynchronous E-Learning was designed to parallel and support the face-to-face interfaculty pain curriculum developed by the University of Toronto Centre for the Study of Pain (UTCSP). Knowledge Forum and WebCT allowed students to discuss the effective treatment of pain, advancing their collective knowledge and understanding of health professionals' roles and of core principles underlying pain assessment and management. Seventy students from six different health sciences faculties/programs (Dentistry, Medicine, Nursing, Occupational Therapy, Pharmacy and Physical Therapy) participated in the Pain Week E-Learning study. A clinical case scenario on phantom limb pain was developed (Hunter, Watt-Watson, Pennefather, Lax, 2002) and unfolded over five days online. Multimedia video vignettes were created using real and standardized patients to trigger intentional learning and collaborative interprofessional knowledge building. Discussion issues and "ideas at the centre" provided cognitive scaffolding to support discourse. Small group and jigsaw collaborative learning strategies enabled uniprofessional and multiprofessional exchange of ideas for comprehensive clinical assessment and management. Information technology (IT) components, the Pain Week Website and My.library, provided just-in-time information and resources to enhance the Pain Week face-to-face curriculum and E-Learning process.

Based on the results indicated in the Preliminary, Initial and Final IT & E-Learning Reports, we can conclude that the Interfaculty Pain Week IT & E-Learning Project was successfully implemented and can successfully support undergraduate interprofessional health sciences education. It is therefore, recommended that the IT & E-Learning components be further explored and expanded, through *full* integration, implementation and evaluation in future Pain Week curricula, other Interprofessional Education (IPE) opportunities and health sciences education initiatives. Key findings from this study answer many questions and raise some new ones. Challenges for future research can be divided into three main areas: pain knowledge/beliefs related to curriculum development, online knowledge building pedagogy and interprofessional collaborative E-Learning for collective advancement throughout the continuum of education including knowledge translation in practice.

### ***E-Learning for Curriculum Development***

This study identifies new ways and poses new questions about how to evaluate and make use of evaluations of interprofessional collaborative online discourse (identifying students' conceptions and misconceptions) for health sciences education curricula feedback and design. The

significance of results herein demonstrated the unique way in which student self-constructed note contributions archived in an E-Learning database can be analyzed for conceptions and misconceptions. These data provide “in vivo” snapshots of students’ knowledge, beliefs and understandings. Misconceptions/conceptions were found in a 3:1 ratio. Concept analysis of students’ conceptions/misconceptions can be used to provide feedback for uniprofessional and interprofessional health sciences curricula design and E-Learning pedagogic development. Initial analyses of these data has demonstrated that much can be mined from this rich resource; E-Learning has been used successfully as pedagogic tool, but it has yet to be explored as a powerful “in vivo” research tool.

### ***Online Knowledge Building Pedagogy***

**E-Learning Content Expert Contributions:** Other questions arising from research herein focus on issues of online pedagogy, such as those concerning E-Learning facilitation. Are self-facilitated groups effective? What is the role of a content expert online facilitator? Who should facilitate IPE? What are the best methods? And what are the barriers and implications of “just-in-time” student feedback? In this study five different styles of facilitator feedback were apparent. E-Learning facilitators were not trained in this study. It is apparent that E-Learning facilitator training is a necessity, even for subject matter experts.

**E-Learning Evidence-based Discourse:** Use of knowledge building socio/cognitive technical supports requires further integration to advance evidence-based discourse. Greater use of embedded hypertext links to evidence-based resources, such as My.library, is needed to enhance evidence-based interprofessional discourse. In addition multiple source simultaneous referencing of evidence is needed. Students indicated they like to reference multiple sources, e.g. my.library, other web-based resources and many of their colleagues E-Learning notes while constructing their own notes. Analogous to spreading books out on a desk, students have requested that an E-Learning environment have a feature for use of simultaneous multiple notes for multiple referencing. We believe use of this technical feature will affect socio/cognitive behaviour promoting evidence-based learning and deeper collaboratively constructed discourse. The only E-Learning environment that enables simultaneous multinote referencing (as opposed to split screens) is the latest version of Knowledge Forum software (KF4). Future use of KF4 is recommended to better support multi-source evidenced-based discourse for collaborative knowledge building. Future research may also address various combinations of synchronous e-based environments (e.g. MSN Chat or Videoconferencing) with asynchronous knowledge building environments as required by pedagogic design plan.

**E-Learning Student Satisfaction by Discipline:** Students from different disciplines demonstrated varying levels of satisfaction with interprofessional education online. The question of how to make IPE more inclusive and not marginalize any group(s) continues to be central. This study found interesting variations in satisfaction ratings from different disciplines, Medicine being highest (90.3% Ex/VG/G) and Physical Therapy being lowest. Most surprisingly, case developers initially thought that a Phantom Pain case would be of especially high interest to PT students. However, as interpreted by researchers, as the online discourse of pharmacological management became an increasingly important focus some students were marginalized. Overall it was found that E-Learning can successfully provide opportunities for interprofessional collaborative knowledge building. Depth of student contributions surpassed researcher

expectations; epistemic agency and commitment to collaborative knowledge building extended well beyond the required minimum. 87% of students rated their E-Learning experience as Excellent (21%), Very Good (33%), Good (33%). This initial IPE E-Learning project was extremely successful, but not equally successful across all disciplines; iterative design modifications to case narrative and knowledge building scaffolds are needed fully support inclusion of all learners.

### ***Interprofessional E-Learning for Collaborative Advancement***

**E-Learning Costs:** Both Knowledge Forum and WebCT were successfully used to support interprofessional education in a cost/effective manner. Cost for new multimedia E-Learning case development is high in comparison to sustainability (modifying/using previously developed cases). Similarly, training costs are currently high, but it is anticipated that training costs will decrease over the coming years as more participants become active and familiar with E-Learning.

**Advantages of Knowledge Forum:** Knowledge Building theoretical approach (Scardamalia and Bereiter, 2002) to online pedagogic design and evaluation was successfully used in this study to support E-Learning in both Knowledge Forum and WebCT. Advantages detailed herein clarify the socio/cognitive dynamics related to the technical/functional differences between KF and WebCT environments. Of particular note, are the strong technical features (e.g. linking, referencing, revising) found in Knowledge Forum (not found in WebCT) that support socio/cognitive advancement in collaborative knowledge building. In addition, the powerful embedded tools for multiple analyses in the Knowledge Forum Analytic Toolkit (lacking in WebCT) have proved extremely useful for in-depth analysis of knowledge building effectiveness. Benefits to knowledge building in KF were demonstrated during the short-term use in Pain Week and it is anticipated that with longer use, these benefits would become magnified.

**Interprofessional Collaborative Knowledge Building:** Overall epistemic agency (intentional, self-directed knowledge building) with respect to student participation surpassed researcher expectations. Activity in both databases, especially the extra-ordinarily high read/write ratios testify to this fact. Strong collaborative knowledge building and depth of contributions were evident in both WebCT and KF databases, e.g. development of Doctor's patient management plans and reflection on interprofessional plans. Overall discourse in both databases exemplified high levels of uni/interprofessional knowledge exchange and shared understanding. The discourse in both databases, is therefore, categorized as *shallow constructive knowledge building discourse*. The challenge is advance toward *deep constructive knowledge building*, moving from knowledge sharing toward knowledge revision, transformation and innovation to enhance interprofessional understanding, teamwork and practice.

### ***Conclusion***

In conclusion, collaborative knowledge building in Knowledge Forum and WebCT successfully supported the face-to-face Pain Week curriculum, by promoting most current pain knowledge and by enhancing interprofessional understanding. However, the future challenge of interprofessional knowledge building is to go *beyond* shared knowledge and understanding of current best practices, by working with idea diversity, the similarities and the contrasts, "to spark

and sustain knowledge advancements” (Scardamalia, 2002). Working toward interprofessional knowledge transformation and innovation beginning in undergraduate health sciences education, sustained throughout professional practice, are goals to be aspired to, and best afforded by collaborative knowledge building in Knowledge Forum.

### ***Dissemination***

Dissemination of these research results is targeted to various audiences through academic and scientific conferences and publications. **Results of the Pain Week IT & E-Learning Project were presented at the following conferences and academic meetings in 2002:**

L.Lax (presenter), Watt-Watson, J., Pennefather, P., Hunter, J. Scardamalia, M. Idea Diversity for Collective Advancement of Knowledge and Understanding, The Centre for Applied Cognitive Science, OISE/UT, Knowledge Forum Summer Institute, August 7, 2002, Toronto, Canada.

L.Lax (presenter), Putting Education into Educational Technology, The Resource Centre for Academic Technology, Round Table, Robarts Library, University of Toronto, March 26, 2002.

M. Scardamalia & L. Lax (presenters), Knowledge Building/Knowledge Forum, Courseware Tools Revealed: Understanding the features, benefits and future of courseware tools, The Resource Centre for Academic Technology, Hart House, University of Toronto, February 17, 2002

Lax, L. (presenter), Watt-Watson, J., Pennefather, P., Hunter, J. Scardamalia, M. Rich Media E-Learning for Collaborative Knowledge Building in an Interfaculty Health Professional Education Initiative. Slice of Life Conference for Medical Multimedia Developers and Educators, June 21, 2002, University of Toronto, Toronto, Canada (Online Poster Demonstration)

Hunter, J. (presenter), Lax, L., Watt-Watson, J., Pennefather, P. Development of a Post-Amputation Pain case as an Interdisciplinary Online Learning Tool. AQIPA/OAAC (Quebec & Ontario Associations for Amputee Care) Joint Congress, May 10-11, 2002, University of Ottawa, Ottawa, Canada

### **To-date abstracts for research posters and presentations have been submitted for the following conferences for 2003:**

Lax, L., Watt-Watson, J. (presenter), Pennefather, P., Hunter, J. Scardamalia, M. The Pain Week E-Learning Project: An Undergraduate Interprofessional Knowledge Building Initiative. American Pain Society – 22<sup>nd</sup> Annual Scientific Meeting, March 20-23, 2003, Chicago IL  
Facilitated Poster Session, H02 Education: Professional and Lay

Lax, L. (presenter), Watt-Watson, J., Pennefather, P., Hunter, J. Scardamalia, M. E-Learning for Strategic Clinical Management: Advancing Beyond Identification of Students’ Conceptions / Misconceptions. Association of Canadian Medical Colleges – Canadian Association for Medical Education Annual Meeting, April 27-29, 2003 – Quebec City, Quebec, Canada. Facilitated poster session: Topic - “Medical Errors: Helping Our Learners”.

Lax, L. (presenter), Watt-Watson, J., Pennefather, P., Hunter, J. Scardamalia, M. E-Learning to Advance Interprofessional Undergraduate Health Sciences Education. Association of Canadian Medical Colleges – Canadian Association for Medical Education Annual Meeting, April 27-29, 2003 – Quebec City, Quebec, Canada. Facilitated poster session: Topic - “Medical Errors: Helping Our Learners”.

Lax, L. (presenter), Watt-Watson, J., Pennefather, P., Hunter, J. Scardamalia, M. Educational Outcomes of the Pain Week Interprofessional E-Learning Initiative. Canadian Pain Society Annual Meeting, May 22 - 24, 2003, Toronto, Ontario, Canada. Research Poster Abstract.

The successful Pain Week KF and WebCT E-Learning models developed are currently being used as exemplars by the University of Toronto, Resource Centre in Academic Technology in a workshop, called Teaching Online, aimed at teaching professors across the university how to develop, integrate and facilitate online learning environments in their own courses.

**Publication of research results presented herein is targeted for the coming year.**

**Research Grants obtained to sustain development, KF iterative design and analysis for 2003 are:**

SSHRC, Initiatives in a New Economy – Beyond Best Practice: Research-based Innovation in Learning and Knowledge Work, OISE/UT Institute for Knowledge Innovation and Technology, Director Dr. Marlene Scardamalia (\$7,000); matched funding through UTCSP, Director Dr. Michael Salter.

CANARIE E-Learning in a Team-based Health Care Environment - Qualifying Statement entitled – Knowledge Building Communities Project in Health Care: A Canadian Collaborative Design Experiment to Advance Beyond Best Practices in Interprofessional Practice, Telementorship and Clinical Care was submitted with OISE/UT Institute for Knowledge Innovation and Technology, Director Dr. Marlene Scardamalia and Ms. Ann Russell, The Qualifying Statement was 1 of 4 selected from 17 for full proposal development The second iteration of the Pain Week E-Learning Project including face-to-face CE initiative with interprofessional experts was included. Funding announcement: mid January 2003.

### **E-Learning Project 3 Year Plan**

The Pain Week IT & E-Learning Project has evolved into a 3-stage plan. The first stage comparative evaluation of E-Learning threaded discourse and knowledge building in Pain Week 2002 was successfully implemented and evaluated, highlighting deep and interesting interprofessional pedagogic results and creating a solid model for future E-Learning implementations.

The second stage implementation, for Pain Week 2003, is dually focused on examination of scalability issues (from 70 to approx. 600 interfaculty students) and technology associated pedagogic issues stemming from the range participants (from technology enthusiasts to the non-enthusiasts). Epistemological objective is enhancement of evidence-based discourse. For convenience and compliance we have chosen to use Blackboard to examine these issues (Rosemary Waterston, Ferdinand Krauss and the Pain Week IT subcommittee are responsible for implementation).

Concurrently, a second research study will be run with Pain Week 2003 Facilitators, examining health professional experts' co-construction of an interprofessional patient management plan. The previously developed Phantom Pain case will be used in the newest version KF4 during facilitator training (in collaboration with Dr. L. Librach and Dr. D. Ryan) for Continuing

Education credit. The challenge of this study is to evoke deep knowledge building aimed at interprofessional knowledge transformation and idea innovation for translation into practice. The intended outcome is to make available a full multimedia case with an expert co-constructed interprofessional management plan for future use in any health sciences program or IPE endeavour for student online collaborative learning. Cost/effective expert contribution to E-Learning will also be reviewed.

These 2 stages of research will result in a comprehensive view of E-Learning from financial, pedagogic and logistical perspectives addressing multiple stakeholders, the students and the experts, moving from a research model to a fully scaled implementation for sustainability and translation in future UT/IPE and other E-Learning endeavours.

Stage 3, proposed for develop in 2004, supports the translation of IPE though E-Learning enabling grassroots involvement of all faculties by providing flexible online collaborative learning opportunities according to the needs. The Phantom Pain case and supporting IT resources in My.library will be the first available case for use by any single or combination of faculties/depts. The Cancer Pain Case (developed in Pain Week 2002) and the Musculoskeletal Case (developed in Pain Week 2003) are or currently are being developed with expert management plans. Multimedia and E-Learning enhancement coupled with theory-based research is needed to advance University of Toronto Interprofessional Education opportunities, throughout the continuum from undergraduate to continuing education, translating knowledge innovations in practice. We set out this plan for your consideration based on the effective model and strong results of the Pain Week IT& E-Learning Project 2002 presented herein.



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### **Results presented in Initial Report (5/30/02) - IT & E-Learning Cost/Effectiveness Results:**

*Report detailed analyses of IT & E-Learning costs and effectiveness of IT & E-Learning components, based on the following educational outcome measures:*

- *Quantitative results of Survey on Students' Attitudes & Opinions of E-Learning (and sample comments),*
- *Quantitative results of Survey on Students' Attitudes & Opinions of Pain Week IT components: Website & My.library (and sample comments),*
- *Pre- & Post-test data on pain beliefs comparing E-Learning cohort to face-to-face,*
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**PAIN: A Multidimensional Issue**  
UofT CENTRE FOR THE STUDY OF PAIN - INTERFACULTY EDUCATIONAL OPPORTUNITY



**Research Study: Project to Examine the Cost/Effectiveness of E-Learning for Interfaculty Health Professional Education**

**P.I. & Co-Investigators:** Prof. Leila Lax (P.I.), Dr. Judy Watt-Watson, Dr. Peter Pennefather, Prof. Judith Hunter & Dr. Marlene Scardamalia.

**Final Report: Sustainability Costs and Comparison of Web Knowledge Forum and WebCT Pedagogic Effectiveness and Outcomes to Support Interprofessional Education,** submitted to the Interprofessional Education Committee and Chair, Dr. Catharine Whiteside; and the University of Toronto Centre for the Study of Pain, Director, Dr. Michael Salter and IFEO Committee in conjunction with Initial Report submitted May 30, 2002 and Preliminary Report submitted April 25, 2002.

### Context

**Interprofessional Study of Pain:** The University of Toronto Centre for the Study of Pain (UTCSP) (<http://www.utoronto.ca/pain>) is a partnership involving the Faculties of Dentistry, Medicine, Nursing and Pharmacy. The UTCSP represents an interdisciplinary collaboration to provide leadership in pain education and research at the University of Toronto. The UTCSP includes many internationally respected clinical and basic scientists as resources whose work has implications for pain management across the lifespan, from neonates to elders. The Education Committee of the UTCSP has been mandated to develop and/or support coordinated educational programs in the study of pain at all levels of student learning. The UTCSP education committee in association with the Interprofessional Education Management Committee of the Council of Health Science and Social Work Deans implemented an Interprofessional Faculty Education Opportunity (IFEO) for undergraduate students in health science professional programs that examines the multidimensional nature of pain assessment and management.

The UTSCP education committee recruited additional members to implement this IFEO. The new UTSCP-IFEO committee was responsible for developing a joint curriculum for undergraduate students in the 4 health profession partner Faculties, including Faculty of Medicine Departments of Physical Therapy and Occupational Therapy. The UTSCP-IFEO committee developed an intensive, 20 hour pain curriculum, titled *Pain: A Multidimensional Issue*, which is designed to increase students' knowledge of the neurophysiological, clinical, social and ethical issues surrounding pain assessment and management. This curriculum was delivered in the form of a 1 week course to all UofT students in 3<sup>rd</sup> yr. Dentistry (n=70), 2<sup>nd</sup> yr. Medicine (n=190), 2<sup>nd</sup> yr. Nursing (n=31), 2<sup>nd</sup> yr. Occupational Therapy (n=58), 3<sup>rd</sup> yr. Pharmacy (n=128) and 2<sup>nd</sup> yr. Physical Therapy (n=63). Other professional students such as those in Social Work have also been invited to participate. In total this educational opportunity was delivered to 500-600 students during the week of March 18 - 22, 2002.

A subset of students were provided with the additional opportunity to participate in the collaborative E-Learning study designed to promote knowledge building and interprofessional understanding. The E-Learning study directly compared two online environments with differing levels of knowledge building support and determined how knowledge building improves educational outcomes. As originally hypothesized online collaborative knowledge building proved to be particularly useful in promoting a major goal of this IFEO, which is to make students aware of the value of interprofessional teamwork.

**Background:** Information technology and the development of E-Learning environments for higher education, including professional education, have been shown to have educational research, logistics and financial advantages (Bereiter & Scardamalia, 1993; Koschmann, 1996; Salomon, 1993). “Virtual” courses currently are being offered on the Internet, (e.g. OISE/UT Distributed Education courses) in many universities. Integration of E-Learning environments to enhance and extend face-to-face teaching and learning in individual courses (e.g. UT/MScBMC 2002Y) and in program curricula are gaining prevalence. This study aimed to develop, implement, and evaluate a cutting-edge E-Learning model to enhance and extend the pain-related curricula, logistically facilitate and reduce overlap in delivery methods, and financially reduce the cost of interprofessional education. The opportunity to connect health professional communities of learners online and engage them in evidence-based, knowledge building discourse provided a novel and highly valued educational experience.

A variety of systems to support E-Learning are currently available. Most are commercial programs based on research (e.g. Erase, Blackboard, Centra, Prometheus and WebCT). Few are educational research projects that have become commercially available programs (e.g. Web Knowledge Forum). Web Knowledge Forum, (KF), formerly known as C-SILE (Computer Supported Intentional Learning Environments) was developed through educational and cognitive psychology research by Drs. Scardamalia and Bereiter at OISE/UT. Their theory-based design of E-Learning environments and knowledge building theory, work hand in hand to further application development and to provide a framework for educational research.

WebCT, a commonly used, threaded discourse bulletin board environment was selected to be compared with KF in this research project. Threaded discourse environments, such as WebCT differ from knowledge building environments, such as KF. One key difference is software interface design; software interface design affects sociopedagogic interactions. For example, threaded discourse environments are organized hierarchically; the structural/functional design relationship is a pattern of individual note response. Some researchers (Hewitt, 1997; Davie, et al, 1998) contend that this hierarchical organization discourages convergence of ideas, resulting in the gradual diffusion of discourse, conversational drift and fragmentation of learning community over time. Scardamalia and Bereiter have attempted to overcome these issues through a networked interface design in KF (rather than a hierarchical design in WebCT) to support knowledge building communities. The common asynchronous computer conferencing practice used in threaded discourse of individual turn-taking response for conversational exchange is replaced by a collaborative, multi-referencing, knowledge advancement approach in KF. A combination of easy to use structural/functional interface capabilities such as simultaneous multinote referencing, link/build-on, co-authoring, multiple editing and visual

overviews in KF, have been designed to discourage diverging branches of discourse, encourage convergence and collective advancement of knowledge, thereby supporting a knowledge building community of learners.

### **Introduction**

**Project Description:** This project involved the development and evaluation of two components, an Information Technology (IT) component, the Pain Week Website and an E-Learning component, the comparative cost/effectiveness study of WebCT and Knowledge Forum. The Pain Week Website (<http://icarus.med.utoronto.ca/pain>) was designed by Meaghan Brierley (technical design) and Leila Lax (conceptual and content design). The Website was composed of eight webpages and provided an overview of Pain Week, the face-to-face schedule, Powerpoint presentations of Pain Week lectures, a linked electronic resource, called My.library, an E-Learning portal linking KF and WebCT, an online feedback forms directory linking five programmed evaluation forms and a final page recognizing all contributors. Of particular mention is the excellent My.library resource, including both electronic and text-based pain references, developed by Ms. Sandra Langland, Chief Librarian, UofT Gerstein Library. The E-Learning portal linking the two online learning environments meant easy access via one URL for students. Similar centralized webpage access to the many online evaluation forms, (programmed by Ju Ho Park, Education Innovation Lab, courtesy of Medical Alumni Association and Dr. L. Spero), made this process easy and organized. The Website unified IT and E-Learning Pain Week components.

Pedagogic theory-based design and evaluation are important to the success of E-Learning. Knowledge Building is a pedagogic theory, defined by Scardamalia & Bereiter in the Encyclopedia of Education (2002) <http://ikit.org/fulltext/inpressKB.pdf>. Knowledge building theory was the pedagogic and analytic framework used in this study, for the design and evaluation of both online learning environments, KF and WebCT. Clinical discussion issues and “ideas at the centre” (Scardamalia, 2002) were developed to guide students’ discourse. “Ideas” were the main pain concepts for discussion. Discussion issues were posed as trigger questions and probing issues. Video vignettes using real and standardized patients enhanced authenticity. The text-based Phantom Pain case was developed by UTCSP content experts and then designed for knowledge building collaborative work (Hunter, Watt-Watson, Pennefather, Lax). The clinical case scenarios, video vignettes, discussion issues and ideas at the centre were the same in both KF and WebCT. The study was piloted with pain experts and feedback was incorporated.

The E-Learning study was “advertised” by the project PI and the educational committee Chair in all Pain Week participating classes. A flyer recruiting volunteers and outlining participation requirements was distributed at each presentation. Interested students were asked to contact the researcher via email. An email reminder to sign up was sent to students. Individual student email responses were confirmed with an information letter, consent form, request for code name, password and selection of convenient training date. Students’ volunteering to participate in the study were randomly divided into KF or WebCT and then stratified by discipline into small groups (team colours). Code names and passwords selected by participants were uploaded into both environments. Training sessions were confirmed by email to all students. Nine one hour student training sessions were conducted. Four WebCT sessions were conducted by Jay Moonah and Leila Lax at the Robarts Library electronic classroom and five KF training sessions were

conducted by Leila Lax at the Medical Sciences Building, Educational Computing Lab. A sheet confirming individual students' login code name, password, E-Learning environment, multiprofessional health care Team colour and Pain Week Website URL was distributed at the training session. All participants were asked to sign a UofT Ethics approved study consent form at the beginning of each session. Multimedia headphones, courtesy of the UTCSP were distributed to all study participants. No students required further technical training after attending one session.

**Knowledge Building Theoretical Framework:** Current exponential knowledge growth and focus on best pain management from perspectives of patient care and teamwork demand practitioner commitment to lifelong learning and investment in interprofessional education. The World Federation for Medical Education addressed this issue in the Edinburgh Declaration (1988). They indicated the need to: "Increase the opportunity for joint learning, research and service with other health and health-related professions, as part of the training for team-work". Internet-based communally accessible technologies, such as KF and WebCT, address this issue in dynamic new ways, not previously possible.

Knowledge building theory (Scardamalia and Bereiter, 2002) offers a methodology for pedagogic design and evaluation of online collaborative learning. Distributed discourse is intended to enhance depth of understanding through multiple perspectives and to raise the knowledge of the collective, not just the individual. Development of expertise is defined by a progressive problem solving process; problems are continually reformulated at increasing levels of complexity (Bereiter and Scardamalia, 1993).

Traditional cognitive psychology literature defines development of expertise in terms of a *staged model*, as in Dreyfus & Dreyfus' 5 Step model from novice to expert (1986). Bereiter and Scardamalia (1993) indicate that the problem with this staged model is that expertise is defined as an end state. The concept of knowledge building reframes development of expertise using a *process model*. The process model of expertise is characterized by the reinvestment of mental resources at higher and higher levels in a collaborative and progressive problem solving process. Collective community responsibility for knowledge building coupled with diverse ideas can stimulate new meaning and shared understanding. In this research study, knowledge building theory was successfully used in the pedagogic design, implementation and evaluation of Knowledge Forum and WebCT in an undergraduate interfaculty health professional education initiative for the study of pain.

### Purpose

This study evaluated and compared the cost/effectiveness of two E-Learning environments, WebCT and Web Knowledge Forum (KF), in facilitating collaborative knowledge building and interprofessional understanding in the context of an undergraduate interfaculty health sciences education initiative for the study of pain. Cost/effectiveness, as distinguished from cost/benefit analysis, is defined as including some consequences in non-monetary terms (Anderson, Aydin & Jay, 1994). This study is an important step in facilitating the unique development of E-Learning across health professional programs and it is intended to lay the groundwork for further research, development and decision-making.

(Please note, the E-Learning components (Knowledge Forum and WebCT) and the Information Technology components (Pain Week Website, including My.library) have been distinguished as such for reporting. Evaluation of the Pain Week Website and My.library components have been presented in the Initial Report (dated 5.30.02) and will only be summarized herein. The focus of this report is on the comparative analysis of Knowledge Forum and WebCT in the E-Learning component of Pain Week.

### Methods

A mixed methodology quasi-experimental case design was used (Creswell, 1994) in the E-Learning research study. Seventy students from 6 health sciences faculty/programs were randomly distributed between the 2 online environments and stratified by discipline into 9 small groups; 5 groups in KF (n=40) and 4 groups in WebCT (n=30). Groups were moderated online by 5 Facilitators, 3 in KF and 2 in WebCT.

#### **E-LEARNING STUDENT PARTICIPATION**

<b>PROGRAM</b>	<b>Student Nos.</b>	<b>KF</b>	<b>WebCT</b>	<b>Total E-Learners</b>	<b>% of Total Students</b>	<b>% of E-Learners</b>
<b>Dentistry</b>	70	4	4	8	11.4	11.4
<b>Medicine</b>	190	18	13	31	16.3	44
<b>Nursing</b>	31	6	4	10	32.2	14.2
<b>OT</b>	58	5	2	7	12.1	10
<b>Pharmacy</b>	128	2	4	6	4.7	8.6
<b>PT</b>	63	5	3	8	12.7	11.4
<b>Total</b>	540	40	30	70	13	

Self-selected voluntary participation in the E-Learning study was not evenly distributed. Faculty of Medicine students made up 44% of the study cohort. Nursing student participation was 14%, while participation from OT, PT, Pharmacy and Dentistry ranged from 9 to 11%. It is important to note the high proportion of medical student participants distributed between the two learning environments and to consider the impact and implications of this, especially in view of the overwhelmingly positive response of this group.

**Analyses:** Data was analyzed both quantitatively and qualitatively. Survey data was collected via the Pain Week Website by an online feedback form, exported to Excel and analyzed using SPSS. Quantitative E-Learning participant activity and knowledge building measures were calculated using the integrated WebCT Tracking Tools and the Knowledge Forum Analytic Toolkit. A selected group of student note contributions from both E-Learning environments were scored and qualitatively analyzed using knowledge building principles and modified grounded theory verification. The same series of note contributions in KF were scored and analyzed for student misconceptions/conceptions of pain. Knowledge Forum Analytic Toolkit and WebCT Tracking Tools were also used to determine Facilitator activity each day and to calculate the effect on student discourse over the week. Results from cost analysis and various dimensions of E-Learning effectiveness were triangulated to determine educational effectiveness and outcomes.

**Limitations:** Two different online learning environments were chosen for comparative examination, WebCT threaded discourse and KF knowledge building environments. Although version 3 of KF was available at the time an earlier version, KF2 was selected to better match features. (KF3 is based on principles of cognitive mapping and is technologically more sophisticated supporting high level user interactions.) Pedagogic design of KF2 and WebCT was created as consistently as possible within the two software environments; the same case, multimedia and pedagogic elements were used.

The strengths of this study include random distribution and stratification of participants, as well as use of qualitative and quantitative data in multiple analyses. This study has several weaknesses. Sample population was self-selected which limits generalizability of the findings. Most participants were electronically literate and enthusiastic about using technology and therefore may have biased results. The survey instrument had face validity. It was written by the PI and revised by research collaborators prior to implementation, but it was not formally validated. This study used self-reported questions of attitudes and opinions, data from quantitative online reports, qualitative knowledge building analyses and triangulation of student comments. Multiple analyses were performed to increase confidence in results.



## RESULTS

The image shows a screenshot of a Netscape browser window titled "Netscape: E-Case Study". The main content area displays a video player with a still image of a doctor (Dr. C. Willis) and a patient (Frank Morris). Below the video player, the text reads "Clinical Case Video Vignette 3 (Asse)".

Below the video player, the text reads "DATE: August 17, 2000".

**DR. C. WILLIS:** Do you mind if I examine particularly here around the stump? I will brush.

**FRANK:** No, that's fine.

**DR. C. WILLIS:** If you would please close eyes. I am going to touch certain areas a arm and just say "yes" when you feel the touch you.

**FRANK:** I can feel that... I feel that...I fee that...Ouch, that hurt. Did you use somet

**DR. C. WILLIS:** No. It's the same brush. It's more sensitive, you are saying, in this area, than over

Below the text, there is a video player window titled "Netscape: E-Case Study" showing a "Video Note" with the text "Electronic Patient File: Frank Morris".

## **SUMMARY OF START-UP AND SUSTAINABILITY COSTS OF PAIN WEEK INFORMATION TECHNOLOGY & E-LEARNING COMPONENTS:**

### **Summary of Start-up Costs for Pain Week IT & E-Learning Components (details in Initial Report)**

#### **E-Learning Software**

- Licensing/Hosting: KF \$500 (OTO hosting)

#### **E-Learning Design & Development**

- Clinical case development: .5 FTEs (multiple contributors)
- E-Pedagogic design & online development: .5 FTEs (single contributor)
- Research design: .8 FTEs (multiple contributors)
- SP/Multimedia costs: \$2736

*[Recommendation: increase budget]*

#### **E-Learning Implementation**

- Registration/research consent (10 hrs. total single contributor)
- Pilot study (4 hrs. total multiple contributors)
- Evaluation of formative feedback & iterative e-learning environment design (40 hrs. total single contributor)
- Training - students & facilitators (approx. 20 hrs. total for 81 students/9 sessions/single contributor and 1.5 hrs. for facilitators)  
*[Recommendation: make student training optional & communicate concepts of collaborative knowledge building; enrich facilitator training beyond technical competency, introduce pedagogic concepts of collaborative knowledge building and review specific methods of facilitating online small group learning.]*
- Technical support/Monitoring (20 hrs. total single contributor)

#### **E-Learning & IT Evaluation & Dissemination**

- Evaluation (40 hrs. total multiple contributors; single contributor, PI, included in .5FTEs)

#### **Website Design & Development**

- Design & development (150 hrs. total 2 contributors)
- Programming (forms, passwords, ppts, in-kind Education Innovations Lab)
- Hosting (in-kind Education Innovations Lab)
- My.library (in-kind UofT Gerstein Library)

### **Projected Sustainability Costs of Pain Week IT & E-Learning Components**

(\*using same clinical case scenario and multimedia elements with text revisions):

#### **E-Learning Software**

- Licensing/Hosting: nil

#### **E-Learning *Iterative* Design & Development**

- E-Pedagogic *iterative* design & updating of text content: .2 FTEs (single contributor)  
*[\*Note: Authoring of a new interprofessional clinical case scenario, online pedagogic design and development of new multimedia elements, e.g. medical illustrations, animations, MRIs,, standardized patient digital video vignettes, etc. represent substantial costs (in-kind or \$) depending on complexity of E-Learning case design.]*

#### **E-Learning Integration**

- Registration/research consent (10 hrs. total single contributor)
- Formative feedback (80 hrs. total single contributor)
- Training - students & facilitators (approx. 550 students/50 facilitators, 30/group, approx. 20 one hr sessions by a minimum of 2 trainers)
- Technical support/Monitoring (20 hrs. total single contributor)

#### **E-Learning & IT Evaluation & Dissemination**

- Evaluation (40 hrs. total multiple contributors; single contributor, PI, included in .5FTEs)
- **Website & My.library *Iterative* Design & Update**
- Updating text (40 hrs. total 1 contributor)
- Programming (evaluation forms, passwords, ppts, video archive 2002 in-kind Education Innovation Lab)
- Hosting (in-kind Education Innovation Lab)
- My.library (in-kind UofT Gerstein Library)

### **Sustainability Recommendations**

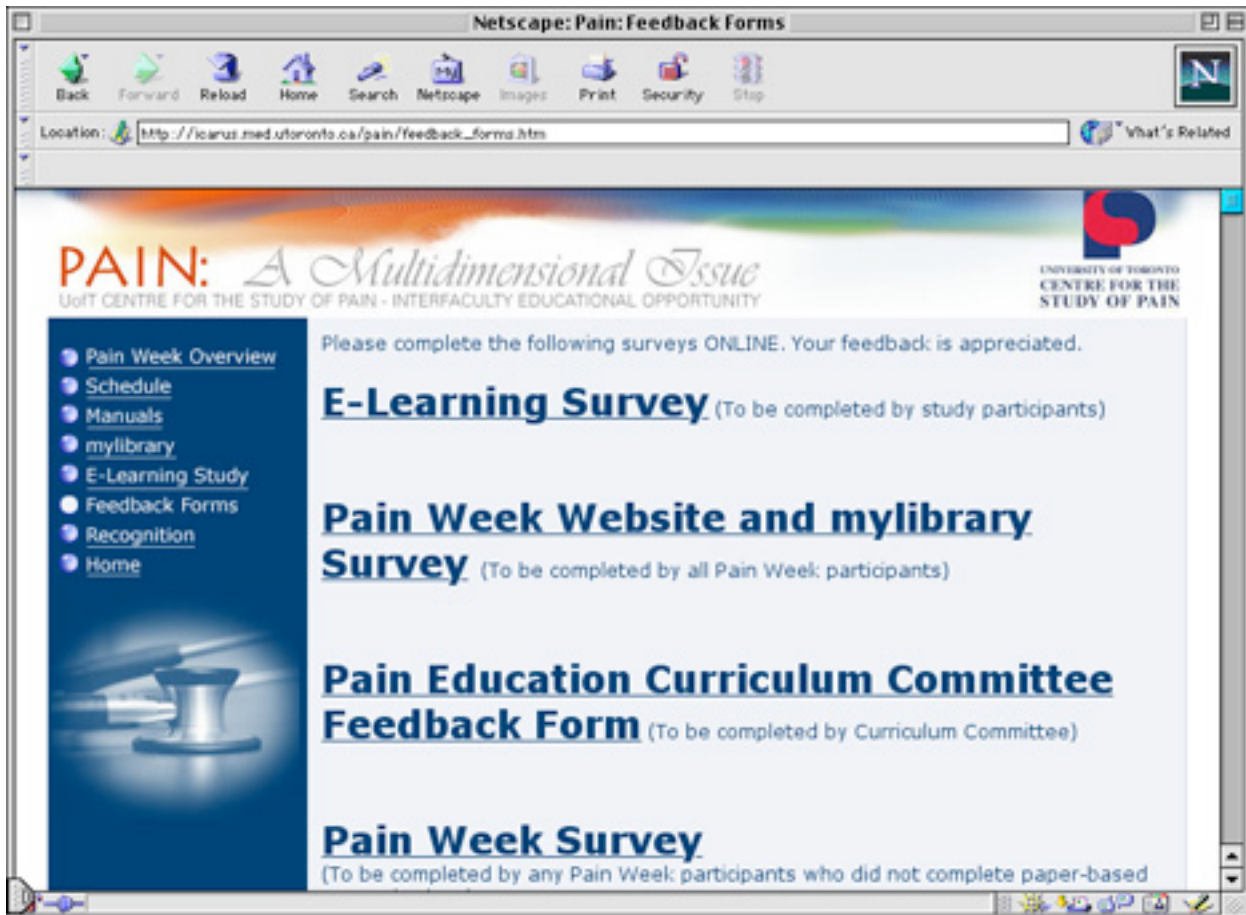
E-Learning sustainability costs fall into three main categories: 1) E-Pedagogic Design: *updating* of current case content and pedagogic structure or development of *new* multimedia clinical cases. 2) E-Learning Integration: the main concern is organizing training sessions for the large number of participants. Our survey indicated that 59.7% of students considered training necessary and 14.9% considered it somewhat necessary. Until E-Learning is integrated in all curricula we will be responsible for training. 3) Evaluation. Similarly, the initial cost for IT components, Website and My.library, development is substantive; both can be sustained and updated annually for relatively small costs.

## SUMMARY OF E-LEARNING & PAIN WEEK WEBSITE SURVEYS RESULTS AND RECOMMENDATIONS

<b>E-Learning</b>	<b>Barriers / Feedback</b>	<b>Recommendations</b>
Emergent from Pilot	<ul style="list-style-type: none"> <li>• Few case content, pedagogic design &amp; usability issues were identified.</li> <li>• Little feedback on knowledge building.</li> </ul>	<ul style="list-style-type: none"> <li>• Continue expert review of case &amp; include student feedback.</li> <li>• Emulate context more fully with in class and reference materials.</li> </ul>
Emergent from Study	<ul style="list-style-type: none"> <li>• Time.</li> <li>• Pedagogic and usability design focus to support evidence-based discourse.</li> <li>• Provide case synthesis and clinical management plan feedback;</li> <li>• Offer facilitator training to enhance online participation.</li> </ul>	<ul style="list-style-type: none"> <li>• Validate E-Learning=allocate time.</li> <li>• Hypertext links from case to my.library needed. Use multiple window for multi-referencing.</li> <li>• Facilitators debrief case in class.</li> <li>• Train in clinical content, online group process &amp; technology.</li> </ul>
<b>Website</b>		
Emergent from Study	<ul style="list-style-type: none"> <li>• PPT downloads problematic (file size &amp; copyright issues).</li> </ul>	<ul style="list-style-type: none"> <li>• View ppts on website &amp; provide students with printouts.</li> </ul>
<b>My.library</b>		
Emergent from Study	<ul style="list-style-type: none"> <li>• Enhance access to most current evidence &amp; support integration in collaborative discourse.</li> </ul>	<ul style="list-style-type: none"> <li>• Provide internal hypertexts links to references &amp; make more references available online.</li> </ul>

**OVERALL RECOMMENDATION FOR 2003:** Tightly coupled integration of E-Learning and IT components to face-to-face curriculum with a focus on supporting evidence-based discourse.

## WEB KNOWLEDGE FORUM AND WEBCT COMPARATIVE RESULTS



The Pain Week E-Learning ONLINE Survey



## Results of E-Learning Survey of Students' Attitudes & Opinions of Knowledge Forum Compared to WebCT

**Method:** A questionnaire previously developed and used (Lax, 1999) in knowledge building environments was modified for comparative purposes. The questionnaire was reformatted for online use and programming added for online data collection. The feedback form was mounted on the Pain Week website (<http://icarus.med.utoronto.ca/pain/elearning.htm>). Direct links were provided from Knowledge Forum and WebCT for easy student access. Data collected online was downloaded into an Excel file. SPSS was used to calculate descriptive statistics by total E-Learning group (reported in Initial Report), by KF and WebCT groups, and by individual health sciences disciplines. Students were required to complete the survey as one of the responsibilities agreed to in participating in this study. And study participation was rewarded with a \$50 gift certificate. A high response rate was achieved.

### Results:

Total response rate 95.7% (n=67)

WebCT response rate 100% (n=30)

KF response rate 92.5% (n=37) [missing 1 Nursing and 2 PT respondents]

**Summary of Results:** The E-Learning *Process* data indicate interesting differences. Contrary to popular belief, KF discourse notes were highly rated as easy to learn and use (92%). WebCT participants rated discourse notes easy to learn and use somewhat lower (83%). Due to the sophistication of technical features and associated high level pedagogy of knowledge building, KF is often perceived as difficult to learn and use, but apparently this perception is incorrect. Group size (n=7-10) was “just right” in KF (95%) while feedback from WebCT participants indicated some groups were too small (20%) and others were “just right” (77%). High level of reading (KF=95%, WebCT=90%) and referencing/referring back to certain notes (KF=92%, WebCT=97%) was indicated. A large difference was apparent in notes revised. Revision, reflection and refinement of ideas are considered an important part of the progressive problem solving process of knowledge building. This socio/cognitive process is well supported by KF technology, making revision easy. This explains why 51% of students revised notes in KF while only 33% did so in WebCT. In WebCT a note cannot be revised after posting; it must be deleted, re-written and re-posted.

E-Learning *Outcomes* were similarly rated in both environments and rated very highly. Learning in KF and WebCT helped students to reflect on new knowledge (KF=84%, WebCT=87%), different knowledge perspectives (KF=92%, WebCT=90%), and different health professional roles (KF=89%, WebCT=93%). E-Learning was somewhat successful in helping students to synthesize new knowledge (i.e. pain knowledge), but not as successful as it was in supporting interprofessional education. 76% of students participating in KF and 73% of students participating in WebCT indicated that E-Learning helped them to summarize and synthesize new knowledge.

**PROCESS (%)**

	KNOWLEDGE FORUM		WEBCT		
	Yes	No	Yes	No	
<b>Q21 Discourse notes easy to learn &amp; use.</b>	91.9	8.1	83.3	16.7	
<b>Q22 Group size was:</b>	94.6	5.4	76.7	20.0	3.3
	just right	too small	just right	too small	too big
<b>Q23 Read more than 50% of notes contributed.</b>	94.6	5.4	90.0	10.0	
<b>Q24 Read only notes pertaining to my notes.</b>	8.1	91.9	16.7	83.3	
<b>Q25 Referred back to certain notes.</b>	91.9	8.1	96.7	3.3	
<b>Q26 Revised some of my Notes.</b>	51.4	48.6	33.3	66.7	

Feedback from participants in the two environments on various E-Learning *Preferences* was both very similar and substantially different depending on the items. Participants in both KF and WebCT strongly agreed/agreed that they did not prefer E-Learning to face-to-face learning (KF=19%, WebCT=17%) and that they prefer a combination of face-to-face and E-Learning (KF=62%, WebCT=60). Interestingly both groups highly support distance education applications (97%). Substantial differences were reported on many items. For example, 78% of KF participants strongly agreed/agreed with the statement, “the group process record was important to developing understanding of assessment and management issues”, in comparison 57% of WebCT participants strongly agreed/agreed with this statement. 87% of KF participants, in comparison with 70% of WebCT participants, strongly agreed/agreed that “archived notes are important for further reflection”; Similarly, 73% of KF participants indicated it was “easier to cite references online than face-to-face”, whereas only 60% of WebCT participants strongly agreed/agreed with this statement. Many items linking socio/cognitive dynamics and technical support features were rated higher in KF than WebCT. A possible explanation is the availability and usability of KF technological features to support these higher level socio/cognitive dynamics; linking of multiple ideas and references, reviewing hypertext archived notes and reflecting on group process (by idea) is easily accomplished in KF through hypertext embedded note references. Threaded discourse in WebCT makes these processes difficult to accomplish since there are no embedded note links.

Online self and expert facilitation is an issue that requires further clarification and examination. The Phantom Pain clinical case was well received. Improvement to the narrative is needed to address Dentistry and PT concerns. Interestingly when asked if the case unfolded in an organised manner, 81% of participants in KF strongly agreed/agreed, whereas only 67% of WebCT participates strongly agreed/agreed. The clinical case unfolded within the same problem space as the discourse in KF, provided easy access to details, and it was linked to Discussion Issues and the Ideas at the Centre (key ideas provided to guide student discourse). In WebCT the case had to be located in a space separated and disconnected from the Bulletin Board. Discussion Issues and Ideas at the Centre resided in the Bulletin Board but could not be linked to the case scenario. This may

be one reason why the exact same case was perceived to unfold in a more organised manner in KF than in WebCT.

The greatest *Barrier* to E-Learning participation was time to read, write and contribute (KF=87%, WebCT=90%). The greatest *Benefits* were feedback on one’s own ideas (KF=82%, WebCT=83%) understanding colleagues ideas (KF=87%, WebCT=83%) and anytime, anywhere access for group work (KF=89%, WebCT=77%).

Overall, Students highly rated (Ex/VG/G) their Pain Week E-Learning experience, whether they participated in Knowledge Forum (89%) or WebCT (83%). 81% of students that participated in KF and 83% of students that participated in the WebCT E-Learning environments strongly agreed/agreed with the statement, “ I support the idea of integrating E-Learning in other interfaculty health professional education opportunities.

**LEARNING OUTCOMES (%)**

Learning in KF or WebCT helped me to:	KNOWLEDGE FORUM		WEBCT	
	Yes	No	Yes	No
Q27 reflect on new knowledge.	83.8	16.2	86.7	13.3
Q28 reflect on different knowledge perspectives.	91.9	8.1	90.0	10.0
Q29 reflect on different health professional roles.	89.2	10.8	93.3	6.7
Q30 summarize and synthesize new knowledge.	75.7	24.3	73.3	26.7
Q31 synthesize different HP & personal perspectives	78.4	21.6	73.3	26.7
Q32 make explicit my own HP knowledge, attitudes & opinions.	75.7	24.3	66.7	33.3
Q33 be more aware of my colleagues knowledge, attitudes & opinions.	94.6	5.4	93.3	6.7
Q34 self-assess my abilities.	78.4	21.6	83.3	16.7
Q35 compare myself with others to self-assess my abilities.	75.7	24.3	83.3	16.7



**FACILITATION (%)**

	<b>KF</b>	<b>WEBCT</b>
	<b>Strongly Agree / Agree</b>	
<b>Q36 More facilitation was needed.</b>	40.5	50.0
<b>Q37 Self-facilitated groups work well.</b>	43.2	66.6
<b>Q38 Content experts should guide discussion.</b>	78.3	83.3
<b>Q39 Facilitator participation is important.</b>	75.6	93.3

**CLINICAL CASE (%)**

	<b>KF</b>	<b>WEBCT</b>
<b>The case:</b>	<b>Strongly Agree / Agree</b>	
<b>Q40 was interesting.</b>	71.1	76.7
<b>Q41 was challenging.</b>	70.3	63.3
<b>Q42 was appropriately targeted to learning level.</b>	75.7	60.0
<b>Q43 unfolded daily in organised manner.</b>	81.1	66.7

**E-LEARNING PREFERENCES (%)**

	<b>KF</b>	<b>WEBCT</b>
	<b>Strongly Agree / Agree</b>	
<b>Q48 E-Learning to F2F</b>	18.9	16.7
<b>Q49 F2F to E-Learning</b>	59.4	63.3
<b>Q50 Combination of F2F &amp; E-Learning</b>	62.1	60.0
<b>Q51 All participants should use their real names (not code names)</b>	5.4	20.0
<b>Q57 Easier to be more direct online than F2F</b>	59.4	32.4
<b>Q60 Easier to cite references online than F2F</b>	72.9	60.0
<b>Q61 Easier to provide evidence-based comments online than F2F</b>	<b>64.9</b>	<b>40.0</b>
<b>Q64 Archived notes are important for further reflection</b>	86.5	70.0
<b>Q65 Group process record of developing scientific understanding&amp;assessment management is important.</b>	<b>78.4</b>	<b>56.6</b>
<b>Q66 Archived notes are important for further reflection</b>	<b>56.8</b>	<b>36.7</b>
<b>Q67 Multiplicity of perspectives are advantageous to problem solving</b>	86.5	80.0
<b>Q73 My understanding of pain &amp; pain management increased due to feedback received.</b>	50.3	53.3

**BENEFITS & BARRIERS (%)**

	<b>KF</b>	<b>WEBCT</b>
	<b>Strongly Agree / Agree</b>	
<b>BARRIERS</b>		
<b>Q74 Greatest barrier is time (read, contribute &amp; respond)</b>	86.5	90.0
<b>Q75 Lack of home computer &amp; www access</b>	37.8	46.6
<b>Q76 Lack of on campus computer &amp; www access</b>	13.5	20.0
<b>BENEFITS</b>		
<b>Q77 Feedback on ideas &amp; understanding</b>	81.9	83.4
<b>Q78 Understanding my colleagues' ideas</b>	86.5	90.0
<b>Q79 Anytime, anywhere access for group work</b>	89.1	76.7

**OVERALL EVALUATION (%)**

	<b>KF</b>	<b>WEBCT</b>
	<b>Strongly Agree / Agree</b>	
<b>I support the idea of integrating E-Learning in:</b>		
<b>Q80 Other Interfaculty HP education opportunities</b>	81.1	83.3
<b>Q81 F2F learning in other courses in my faculty/dept.</b>	83.8	76.7
<b>Q82 Distance education applications</b>	97.3	96.6

	<b>KF</b>	<b>WEBCT</b>
	<b>Excellent / VG / Good</b>	
<b>Q85 Overall I would rate my E-Learning experience</b>	89.1	83.3

## Results of Survey on Students' Attitudes & Opinions to E-Learning by Academic Discipline

**Results:**

### E-LEARNING SUPPORT (%) BY HEALTH PROFESSIONAL DISCIPLINE

	DENT.	MED.	NURS.	OT	PHAR.	PT	(Av)
	<b>Strongly Agree / Agree</b>						
<b>I support the idea of integrating E-Learning in:</b>	N=11% of Total	N=16%	N=32%	N=12%	N=5%	N=13%	
<b>Q80 Other Interfaculty HP education opportunities</b>	75.0	77.2	88.9	100	100	66.7	<b>(83.6)</b>
<b>Q81 F2F learning in other courses in my faculty/dept.</b>	87.5	83.9	77.7	71.5	100	50.0	<b>(78.4)</b>
<b>Q82 Distance education applications</b>	87.5	96.7	88.9	100	66.7	100	<b>(90.0)</b>

### OVERALL EVALUATION (%) BY HEALTH PROFESSIONAL DISCIPLINE

	DENTISTRY	MEDICINE	NURSING	OT	PHARMACY	PT
<b>Q85 Overall I would rate my E-Learning experience:</b>	N=11% of Total	N=16%	N=32%	N=12%	N=5%	N=13%
<b>Excellent</b>	12.5	29.0	11.1	28.6	16.7	0
<b>Very Good</b>	37.5	38.7	22.2	14.3	33.3	33.3
<b>(Subtotal)</b>	<b>(50)</b>	<b>(67.7)</b>	<b>(33.3)</b>	<b>(42.9)</b>	<b>(50)</b>	<b>(33.3)</b>
<b>Good</b>	12.5	22.6	44.4	57.1	33.3	66.7
<b>(TOTAL)</b>	<b>(62.5)</b>	<b>(90.3)</b>	<b>(77.7)</b>	<b>(100)</b>	<b>(83.3)</b>	<b>(100)</b>

Statistical analysis of data by academic discipline both within and across disciplines, provides interesting feedback. Overall the E-Learning project was highly rated (*TOTAL*), however this high rating was not equal across all discipline (*Subtotal*). This finding requires deeper examination to determine how best to support interprofessional educational for all disciplines.

Details of within discipline ratings of “E-Learning Support” are specified in first chart above. Of particular concern is the low rating (66.7%) from Physical Therapy student respondents (n=6), indicating a lower level of support for integration of E-Learning in other health professional education opportunities, than respondents from other disciplines. Conversely, of particular note are the high ratings, extending from 75% to 100% support from sample groups from other disciplines (qu.80).

In examining students global rating of their E-Learning experience in the “Overall Evaluation” chart above, similar results are evident. Of concern is the Excellent rating of 0% from the Physical Therapy sample group. In an evaluation debriefing session one facilitator from this discipline indicated a possible reason for this zero rating was that as the E-Learning scenario and online discussions progressed over the week, more focus was placed on pharmaceutical management, that marginalized PT student participation. Similarly the overall rating of 62.5% (Ex/VG/G) from the participants from the Faculty of Dentistry indicates that the clinical case subject matter, phantom limb pain, was not relevant to their learning needs. Therefore, this choice of subject matter was seen to marginalized Dentistry student participation as well. (E-Learning facilitators did point out that the focus is on understanding the treatment of pain in the “whole person not just the tooth”; this seemed to have a positive effect on stimulating participation).

Of particular note are the high Excellent (29%) and Very Good (38.7%) ratings from Faculty of Medicine students. Overall 90.3% of participants within this discipline rated their E-Learning experience as Ex/VG/G. Similar high Excellent rating (28.6%) was given by the OT students. With the exception of Dentistry students, students from all other health professional disciplines highly rated their E-Learning experience (ranging from 77.7% to 100). Overall the Pain Week E-Learning implementation was successful. A solid model has been developed from this first initiative. Research results, as above, provide important feedback to direct new questions and development to improve future E-Learning implementations, to enhance interprofessional education with an experience that is beneficial to all students, across all health sciences disciplines.

## COLLABORATIVE KNOWLEDGE BUILDING QUANTITATIVE MEASURES COMPARING KNOWLEDGE FORUM AND WEBCT



## **Collaborative Knowledge Building Quantitative Measures comparing Knowledge Forum and WebCT**

### **WEBCT TRACKING & KNOWLEDGE FORUM ANALYTICAL TOOLKIT RESULTS**

**Methods:** Tracking tools embedded in WebCT only provide feedback on individual student calculation of notes read and notes posted at time of inquiry. These measures are cumulative. There are no other dimensions or parameters available to the researcher or teacher. Therefore reporting of WebCT tracking results is very limited. Progressive inquiry of daily measures have to be calculated by hand and were done so as indicated in the comparative tables below.

The Knowledge Forum Analytic Toolkit (KF ATK) provides researchers with in-depth and “just-in-time” reports of many different individual and collaborative knowledge building measures. These measures go well beyond simple read/post cumulative measures found in WebCT Tracking. Researchers select individual or group parameters and single or multiple variables to be calculated by the KF ATK. This is a powerful quantitative research tool. Results from various knowledge building measures from the Pain Week Knowledge Forum database are indicated below.

Students were originally randomly divided and stratified by discipline into eight teams, 4 in KF and 4 in WebCT. One additional team primarily composed of medical students was added the afternoon before the study began due to additional interest. This group is the KF yellow team. Thus it should be noted that totals reported herein, represent a greater number of KF participants, a total of 40 participants on 5 teams in comparison to 30 students divided into 4 teams in WebCT.

### **DATABASE OVERVIEW OF STUDENT ACTIVITY FOR PAIN WEEK**

#### **1.1. WebCT Student Tracking (5 days)**

Mean Notes Read = 98.6	Mean Notes Posted = 9.7
Total Notes Read = 3351	Total Notes Posted = 328

#### **1.2. Knowledge Forum Analytical Toolkit Activity Record (5 days)**

Mean Notes Read = 105.5	Mean Notes Saved = 8.6
Total Notes Read = 4128	Total Notes Saved = 363

**Results:** WebCT database overview mean read/save ratio is approximately 10%. The KF ratio is slightly higher. Total notes saved number is higher in KF than WebCT, representative of the fact that 40 students participated in KF distributed in 5 multiprofessional teams, whereas 30 students participated in WebCT distributed into 4 teams. Comparatively there is a larger read/save ratio in KF. KF within note links and referencing may provide greater motivation and easy for reading connected ideas and therefore facilitate more reading on the whole throughout the database. This hypothesis would merit further research.

## COMPARISON OF DAILY ACTIVITY

### 2.1. Daily Total Notes Read and Total Notes Saved

(n=45) KNOWLEDGE FORUM (n=34) WEBCT

Notes:	Total Read	Total Saved	Total Read	Total Saved
<b>Monday (neurophysiology)</b>	992	94	751	99
<b>Tuesday (neurophysiology)</b>	678	67	568	50
<b>Wednesday (uni/multipro)</b>	1266	97	779	80
<b>Thursday (management)</b>	855	79	665	50
<b>Friday (WSIB issues)</b>	337	32	588	49
<b>(total)</b>	(4128)	(369)	(3351)	(328)

### 2.2. Daily Mean Read/Save Ratio

KNOWLEDGE FORUM WEBCT

	Mean Read	Mean Save	Mean Read	Mean Save
<b>Monday (neurophysiology)</b>	22.0	2.1	22.1	2.9
<b>Tuesday (neurophysiology)</b>	19.4	1.5	16.7	1.5
<b>Wednesday (uni/multipro)</b>	27.7	2.2	22.9	2.4
<b>Thursday (management)</b>	21.7	1.8	19.6	1.5
<b>Friday (WSIB issues)</b>	16.9	0.7	17.3	1.4

**Results:** Activity represented by total and mean read/save results is high Monday and Wednesday. Knowledge building qualitative analysis of note contents is needed to distinguish the *quality* of contributions made. (see Knowledge Building qualitative results in following section). The pedagogic strategy of the Jigsaw technique was used on Wednesday where teams were asked to first develop a uniprofessional patient management plan and then share these plans with their multiprofessional groups online. This multidimensional strategy was operationalized successfully and may also explain the high level of activity, knowledge building agency and collaborative contributions on this day.



## KNOWLEDGE BUILDING MEASURES

### 3.1. Daily Knowledge Building Measures – ATK results

	% of Notes Linked	% of Notes Read	Size of Build-on Trees		# Revisions (Yes/No)
			(2-5 notes)	(6-15 notes)	
<b>Monday (neurophysiology)</b>	45.8	22.0	16	3	20 (+22)
<b>Tuesday (neurophysiology)</b>	40.0	19.4	14	2	15
<b>Wednesday (uni/multipro)</b>	37.1	27.7	19	2	22
<b>Thursday (management)</b>	38.6	21.7	17	3	20
<b>Friday (WSIB issues)</b>	18.5	16.9	8	0	5

**Results:** Overall we do not see much change or growth in knowledge building measures over the first four days other than, a notable drop in activity and knowledge building measures on the fifth day. This may be explained by the fact the Pain Week ended at noon and students may not have been motivated to work to the same extent after the formal conclusion of sessions on the last day. The relative stability of knowledge building measures from the first four days may indicate that this short time frame may be too brief to measure changes. However, it should be noted the measures indicated herein are indicative of initial high levels of knowledge building activity. Knowledge building socio/cognitive concepts of linking ideas, building-on ideas and revising ideas using Knowledge Forum technology embedded software features to accomplish these goals are successful employed. Again, particularly high measures of knowledge building activity are demonstrated by Wednesday's results where the Jigsaw method for contributing uniprofessional/multiprofessionals patient management plans was used. For short-term E-Learning this seems to be a particularly good pedagogic strategy to evoke collaborative knowledge building and high levels of contribution. (Please note one exceptional contributor created and revised a group of multimedia notes 22 times and thus this number has been included in parenthesis on Monday).

**3.2. KB Analysis of Uniprofessional/ Multiprofessional Jigsaw Views (Wednesday)**

Analytic Toolkit for Knowledge Forum

Database Overview

Date of Report: September 25, 2002

Database: "Interfaculty Education Initiative on Pain"

For the Group: All groups

(Number of users = 45)

(Number of views = 12)

Time Period: Notes contributed from March 20, 2002 to March 21, 2002

Total number of notes in the selected views: 118

**Activity in the Database by View. View name is followed by:**

**(1) Total notes in view**

**(2) Notes for this group in selected time period**

	<b>(1)</b>	<b>(2)</b>
3rd Clinical Scenario-Wed. start	2	0
3rd Clinical Scenario-Wed.-YELLOW TEAM	7	6
3rd Clinical Scenario-Wed.-BLUE TEAM	4	2
3rd Clinical Scenario-Wed.-GREEN TEAM	9	8
3rd Clinical Scenario-Wed.-RED TEAM	4	3
3rd Clinical Scenario-Wed.-WHITE TEAM	7	6
3rd Clinical Scenario-Wed.- Dentists	9	6
3rd Clinical Scenario-Wed.- Doctors	36	34
3rd Clinical Scenario-Wed.- Nurses	13	11
3rd Clinical Scenario-Wed.- OcTherapists	7	5
3rd Clinical Scenario-Wed.- Phys.Therap.	14	12
3rd Clinical Scenario-Wed.- Pharmacists	6	4

Knowledge Building in the Database (for the selected views and time period):

Number of notes contributed by this group:	97
Number of notes contributed per user:	2.16
Percentage of notes that have been read per user:	28%
Percentage of user's notes that are linked:	37%

### 3.3. Basic Knowledge Building Measures Uniprofessional / Multiprofessional Activity by Individual Participant (code names)

3<sup>rd</sup> Clinical Scenario, 12 Views – same ATK parameters as above.

<b>User name</b>	<b># notes created</b>	<b>% notes linked</b>	<b>% notes read</b>	<b># revisions</b>
Facilitator1	6	17%	56%	5
Facilitator2	2	50%	67%	4
Facilitator5	11	73%	47%	0
alice	2	50%	41%	0
bluebabs	3	33%	20%	0
bunny	1	0%	40%	0
clorets	1	100%	39%	0
dragon	0	0%	20%	0
emboli	0	0%	0%	0
epsilonii	1	100%	46%	0
giggles	2	50%	34%	1
hailey	1	0%	2%	0
hannington	2	50%	21%	0
happy	2	50%	26%	0
hedgehog	2	50%	28%	0
homer	4	100%	43%	0
iceman	3	67%	21%	0
island	3	0%	42%	1
keyomesh	3	0%	42%	0
kumari	3	33%	24%	0
livi	5	60%	31%	4
luke	4	50%	18%	0
manju	1	100%	63%	0
mcmug	1	100%	15%	0
miguel	1	100%	44%	0
missy	5	60%	29%	0
nbwonder	2	50%	28%	0
okdook	2	0%	30%	2
pk	0	0%	0%	0
pyramid	2	50%	19%	3
redcity	1	0%	22%	0

<b>User name</b>	<b># notes created</b>	<b>% notes linked</b>	<b>% notes read</b>	<b># revisions</b>
researcher	0	0%	0%	0
shadow	2	0%	16%	1
sibbs	1	100%	16%	0
skogrun	0	0%	3%	0
sonic	1	0%	19%	0
sparkle	4	50%	19%	0
spiral	4	0%	18%	1
ss	0	0%	19%	0
sunshine	0	0%	0%	0
supastar	3	0%	30%	0
tinkerbel	1	0%	14%	0
turtle	1	100%	14%	0
wing	4	25%	24%	0
Leila Lax	0	0%	99%	0

### Results:

ATK results in section 3.2. KB Analysis of Uniprofessional/ Multiprofessional Jigsaw Views (Wednesday) and section.3.3. Basic Knowledge Building Measures Uniprofessional / Multiprofessional Activity by Individual Participant (code names), indicate overall strong group and individual knowledge building activity. The pedagogic Jigsaw strategy enabled collaboration within disciplines and across disciplines. This strategy provided the pedagogic scaffolding necessary to ensure interprofessional collaboration. In addition, it enabled an extremely active level of uniprofessional knowledge building discourse. Samples of uniprofessional collaborative management plans are provided in Appendix 7. The Jigsaw was particularly successful in provoking interprofessional collaboration in the very short time period of Pain Week. In longer term use of E-Learning emergent collaboration and a more unstructured approach of the Jigsaw can be used. Overall the pedagogic Jigsaw was an extremely effective method of supporting interprofessional collaborative discourse.

What the *quantitative* measures do not tell us is about the *quality* of the note contributions. Quality of contributions must be analyzed in two dimensions: (1) using qualitative analysis of knowledge building indicators to determine uni/interprofessional collaboration (e.g. through measures such as “Collective Responsibility”) and (2) using rater analysis of content, in this case, pain knowledge conceptions/misconceptions. Qualitative analyses on these two dimensions are reported in the following pages to further enhance meaning of quantitative indicators presented above.

## Knowledge Building Indicators: Comparing Knowledge Forum and WebCT

**Method:** Green Teams from both E-Learning environments, KF and WebCT, were the samples chosen for scoring since the multiprofessional composition of both were the same: 1 Dental, 4 Medical, 2 Nursing, 1 OT, 1 Pharmacy and 1 PT students made up each team. All notes were scored in the Monday and Thursday views. A grounded theory approach was used to verify knowledge building principles. Theoretical sampling, sample sufficiency and saturation were extended to analysis of all notes in these online views. The categorization structure evolved along side scoring of data.

The following Knowledge Building (KB) principles were selected for scoring: Community Knowledge/Collective Responsibility, Idea Diversity and Epistemic Agency. Overlapping and closely related exemplars were found in individual notes and therefore these three KB principle nodes were clustered into one conceptual category, called Knowledge Building Discourse. All notes within this category were also rated as “knowledge sharing” (ks) or “knowledge transforming” (kt). Knowledge sharing is a defining characteristic of shallow constructive Knowledge Building and knowledge transforming is a defining characteristic of deep constructive Knowledge Building (Scardamalia and Bereiter, 2002). A second category was scored as a “free node”, the KB principle, called Constructive Uses of Authoritative Resources (use of evidence/references).

A three point scale was used to score each note in the team views in the two E-Learning environments: 0=no evidence, 1=some evidence, 2=clear evidence (Russell, 2002). All notes were scored by one rater.

### Results:

#### KNOWLEDGE BUILDING ANALYSIS

Category	Green Team				Exemplary Notes	
	Knowledge Forum		WebCT		KF	WebCT
	Day 1	Day 4	Day 1	Day 4	Numbers	
<b>Knowledge Building Discourse</b>	24/24 note = 48 points  (kn sharing)	8/8 notes (+1) = 16 points  (kn sharing)	26/31 notes = 52 points  (kn sharing)	16/17 notes = 32 points  (kn sharing)	Day1: #498, 502, 513, 547, 528, 531, 532, 552, 555	Day1: #155, 192, 197, 199, 200, 203, 205, 219
<b>Constructive Use of Authoritative Sources</b>	4/24 notes = 7 points	3/9 notes = 6 points	6/31 notes = 11 points	10/17 notes = 18 points	Day1: #498,  <b>(Appendix 5)</b>	Day1: #155, 192 <b>(Appendix 6)</b>

Knowledge Building discourse exemplified by the principles of Community Knowledge/Collective Responsibility (collaboration), Epistemic Agency (intentionality) and Idea Diversity (multiplicity of views/understandings) began at a high level in KF and remained so. This is most likely due to the superior technical supports of linking and referencing embedded in KF software. Most notes in WebCT showed high levels of KB discourse. The number notes with evidence of KB principles progressed over the week. However the number of KB indicators in notes decreased over the week. Therefore as the week progressed in WebCT the strength of

knowledge building discourse did not. Again this may be due to the lack of technical features in WebCT to support socio/cognitive collaborative knowledge building processes.

This study is limited by the few days of use (n=5). In all environments the knowledge building discourse was rated as “knowledge sharing” as opposed to “knowledge transforming”. A true knowledge building community needs time to gel and advance beyond knowledge sharing. It is therefore, hypothesized since students began working in KF at a high level of socio/cognitive interaction that that level would be sustained and most probably surpassed through deeper forms of constructivism and knowledge building discourse with longer use.

Students use of authoritative sources, e.g. my.library resources, embedded links, Pain Week manual readings, websites and other references, also increased over the week. More evidence was cited and used to support knowledge building discourse later in the week. More than 59% of notes in WebCT contained evidence of authoritative sources. Integration and easy sourcing of evidence to support discourse should be a key focus for future development.

**Conclusion:** The discourse of this knowledge building community resulted in the sharing of knowledge and understanding, satisfying one of the key goals of this initiative. In knowledge building terms, “knowledge sharing or exchange” is defined as shallow constructivist knowledge building discourse (Scardamalia, 2002). Deep constructivist knowledge building discourse goes beyond knowledge sharing and is characterized by refinement and transformation knowledge. This remains a goal for future E-Learning development for interfaculty health professional education.

It is recommended that the pedagogic Jigsaw be enhanced in the future to support deeper knowledge building over a short period of time. This study required collaborative development of a uniprofessional plan, followed by reflective discourse on how these uniprofessional ideas could be brought together in a multiprofessional plan. It is recommended that this be taken one step further in the future. In addition to the uniprofessional plan, it is recommended that students follow up with the collaborative construction of an interprofessional clinical management plan online. It is also recommended that the uniprofessional and interprofessional management plans be debriefed with experts for in-depth feedback. Expert feedback is necessary on both uni- and interprofessional patient management plans to critique team interactions and pain knowledge conceptions and misconceptions. This recommendation is simple to implement online by spreading the collaborative construction of two clinical management plans over two days.

## **Defining Knowledge Building: Constructivism and theoretical principles**

### **Knowledge Building – Defining Shallow vs. Deep Constructivism**

Scardamalia & Bereiter in Encyclopedia of Ed. (2002) define Knowledge Building. They write: “Learning is an internal, unobservable process that results in changes of belief, attitude or skill. Knowledge building by contrast, results in the creation or modification of public knowledge”. The goal is to advance the frontiers of knowledge as perceived; the frontiers perceived by our students will be different from those perceived by professionals. It was the goal of the UofT Pain Week project to engage students in discourse at the most cutting edge knowledge of pain, mechanisms, assessment and management while offering the opportunity to interact across health science faculties to enhance collective knowledge and understanding of individual contributions to health care teams with the idea to effect better patient outcomes.

Scardamalia and Bereiter (2002) distinguish between shallow and deep constructivism in defining knowledge building discourse. “The shallowest forms engage students in tasks & activities in which ideas have no overt presence but are entirely implicit. ...In the deepest forms of constructivism people are advancing the frontiers of knowledge in their community. This purpose guides and structures their activity: Overt practices such as identifying problems of understanding, refining goals, continually improving ideas, innovation” characterize deep constructivist knowledge building.

The focus of knowledge building in an online environment, such as Knowledge Forum, is on improvement of ideas where problems are continually “reformulated at more complex levels that bring a wider range of knowledge into consideration”. Knowledge building as a pedagogic approach is centred on connecting the discourse of ideas, within and between communities, to open new possibilities for advancement. As Scardamalia and Bereiter (2002) state: It is the fact that knowledge building involves students directly in creative and sustained work with ideas that makes it especially promising as the foundation for education in the knowledge age”.

### **Defining Key Knowledge Building Principles and Implications from this Study:**

Twelve socio/cognitive principles are coupled with technological support features to define knowledge building (Scardamalia, 2002). These are stated in relation to Knowledge Forum technology but the theory of knowledge building can be applied more generally as a pedagogic approach. In this study analysis of knowledge building principles has been applied to both online learning environments. (Further details on the effect of technical features on socio/cognitive processes are noted in the section on pedagogic design.) Many exemplars of knowledge building principles were evident in the WebCT and Knowledge Forum Pain Week databases and are summarized below. As indicated in the previous section, three principles of particular note are: Community Knowledge/Collective Responsibility, Idea Diversity and Epistemic Agency, and are explained in detail first.

“Community Knowledge, Collective Responsibility” is defined as: “Contributions to shared, top-level goals of the organization are prized... as much as individual achievements. Team members produce ideas of value to others and share responsibility for the overall advancement of knowledge in the community.” In terms of technological dynamics: “...collaborative workspace holds conceptual artifacts that are contributed by community members. ...(reading, writing, building-on, linking/referencing). More generally, effectiveness of the community is gauged by the extent to

which all participants share responsibility for the highest levels of the organization's knowledge work." Community knowledge and collective responsibility to the sharing of knowledge is evident in both WebCT and Knowledge Forum as indicated by analysis. This is a key aspect of knowledge building to advance interprofessional education and practice.

Equally important aspects of an interprofessional knowledge building community are the concepts of "Epistemic Agency and Idea Diversity" (Scardamalia, 2002). Epistemic agency is defined as follows: "Participants set forth their ideas and negotiate a fit between personal ideas and ideas of others, using contrasts to spark and sustain knowledge advancements..." . The knowledge building principle of epistemic agency was evident both across and within communities. Of particular note are exemplars from the Medical students uniprofessional discourse (Appendix 7), distributed via the Jigsaw method to multiprofessional online groups on the third day in both online environments.

Scardamalia (2002) indicates "To understand an idea is to understand the ideas that surround it, including those that stand in contrast to it. Idea diversity creates a rich environment for ideas to evolve into new and more refined forms." In this case study the principles of Idea Diversity, Epistemic Agency and Community Knowledge, Collective Responsibility are strongly correlated. Idea diversity across disciplines incited discourse around new perspectives, enhancing interprofessional understanding, and stimulating collective responsibility to advance knowledge of the larger community; thus achieving one of the main objectives of this project, enhancing interprofessional understanding of professional contributions to the health care team and patient management. Many exemplars were found throughout both the online databases (Appendices 5 & 6).

### **Evidence and Implications for Interprofessional Education of Additional Knowledge Building Principles in Knowledge Forum and WebCT:**

The twelve knowledge building principles work as a system (Scardamalia, 2002). Most of the principles relate to others and consequently are evident within the student-self constructed E-Learning databases in this study. The additional principles will be defined and briefly discussed in terms of the evidence from the WebCT and Knowledge Forum databases and the implications for interprofessional education.

One related principle is called "Rise Above" and in terms of knowledge building socio/cognitive dynamics, it is defined as:

"Creative knowledge building entails working toward more inclusive principles and higher-level formulations of problems. It means learning to work with diversity, complexity and messiness, and out of that achieve new syntheses. By moving to higher planes of understanding knowledge builders transcend trivialities and oversimplifications and move beyond current best practices." In general, advances in both databases on pain knowledge and interprofessional understanding were indicative of inclusion of broad interprofessional perspectives and acknowledgement of the usefulness of idea diversity and the possibility of not one, definitive correct answer. The challenge of deeper synthesis through student construction of interprofessional management plans is recommended to move beyond current best practices, for future implementations.

"Improvable Ideas" is another key knowledge building principle. Again many exemplars are found in both WebCT and Knowledge Forum indicative of the socio/cognitive dynamics where



“Participants work continuously to improve the quality, coherence & utility of ideas” within a culture of psychological safety.

Unlike lectures or even small group learning, E-Learning provides more democratic participation. “Democratizing Knowledge” is another key knowledge building principle. This was a particular challenge in this study. This principle is defined as “All contribute, shared community goals, diversity does not lead to separation, but to inclusion and enrichment & more empowered knowledge innovation.” This study was especially successful in that all students across all disciplines actively participated and contributed to the knowledge building discourse. Some Dentistry students registered their dissatisfaction early on with case content and after minimal encouragement to “treat the patient not just the tooth” they became active contributors in online.

The principle of “Symmetric Knowledge Advancement” is demonstrated in both online databases. “Expertise is distributed within and between communities. Symmetry in knowledge advancement results from knowledge exchange and from the fact that to give knowledge is to get knowledge.” Co-construction of knowledge and understanding across teams, within and between communities, in the broad context of interprofessional learning was a feature of both online environments.

“Pervasive Knowledge Building” was limited in this study by the fact that the clinical case used online was not the same case used in the face-to-face Pain Week curriculum. Use of E-Learning as an “add-on” to the main curriculum does not provide opportunities for pervasive knowledge building. Knowledge building opportunities should be fully integrated with the face-to-face curriculum – “not confined to particular occasions”. It is recommended that the E-Learning component be fully integrated to enhance opportunities for deeper constructivist knowledge building.

The principle of “Real Ideas, Authentic Problems” is central to the pedagogic design and implementation of this study. The Phantom Pain clinical case scenario was presented in narrative and video format, based on a real patient with real problems, provoking discussion of real issues and ideas on pain assessment and management. The case was vivid. Issues and discussion dealt with authentic problems.

The importance of the principle of “Constructive uses of Authoritative Sources” was highlighted by the analysis performed on this principle in this study. Knowledge building depends on “understanding of authoritative sources, combined with a critical stance toward them.” In this study students asked for technical functionality to be provided in the future for multi-notes referencing of multiple sources to enhance evidence-based discourse. Researchers commend this strong and perceptive recommendation. Knowledge Forum 4 is the only E-Learning environment available to support this high end socio/cognitive and technical employ of multi-sourced evidence-based discourse; therefore KF4 is highly recommended for future use.

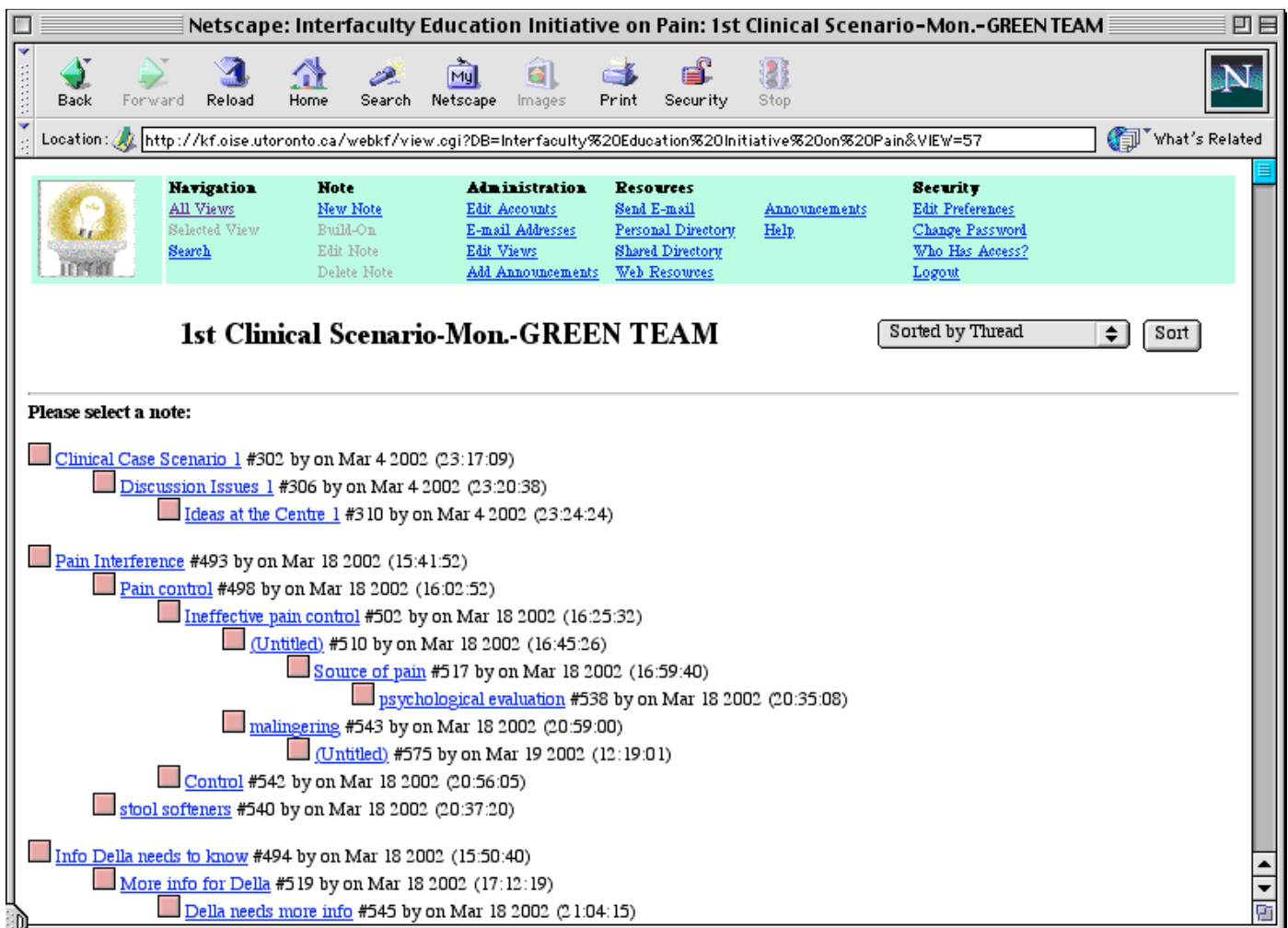
The socio/cognitive dynamics of “Embedded and Transformative Assessment” is a principle that was not focussed in this study. It is defined as “Assessment is part of the effort to advance knowledge and it is used to identify problems as the work proceeds and is embedded in the day-to-day workings of the organization. The community engages in its own internal assessment, which is both more fine-tuned and rigorous than external assessment, and serves to ensure that the

community's work will exceed the expectations of external assessors." This principle can be integrated in future knowledge building environments through reflective assessment on self-, team- and larger interprofessional community contributions to knowledge building.

Knowledge Transforming, "Knowledge Building Discourse", is a principle that characterizes the discourse of knowledge building communities. Knowledge building discourse "results in *more than* the sharing of knowledge; the knowledge itself is refined and transformed through the discursive practices of the community practices that have the advancement of knowledge as their explicit goal." As stated earlier knowledge sharing and exchange is classified as shallow constructivist discourse and characterizes the community knowledge building discourse in both online environments in this study. Deep constructivist knowledge building discourse, through refining and transforming interprofessional knowledge and practices remains a goal to work towards. It is with confidence based on this initial research effort that we anticipate advancement towards this goal.

## E-Learning Pedagogic Design Reflections Comparing Knowledge Forum and WebCT

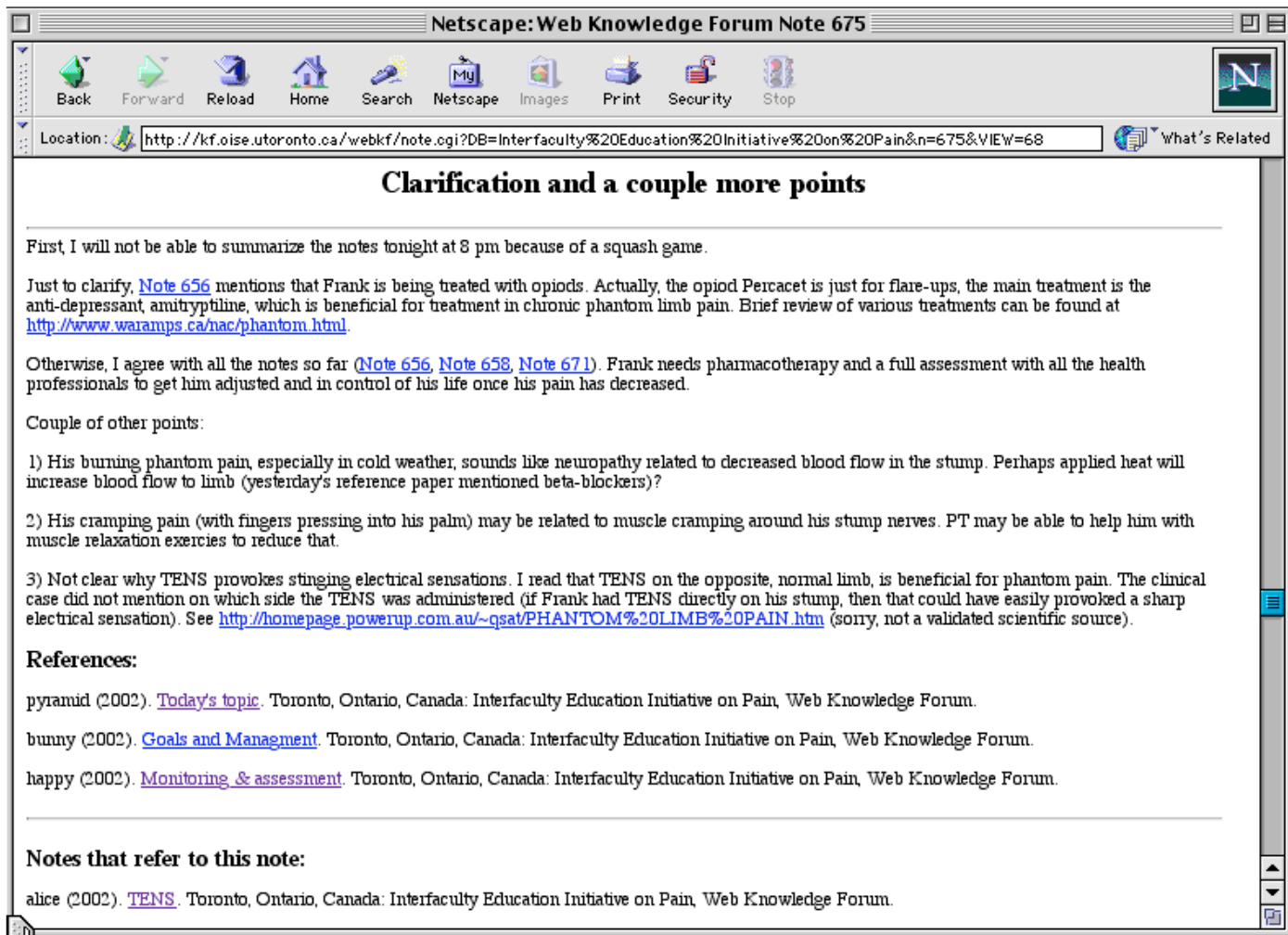
Bulletin board environments using threaded discourse, as in WebCT are often confused or not distinguished from knowledge building environments, such as Knowledge Forum. Evidence from the Pain Week E-Learning Study demonstrates these differences and the advantages of knowledge building in Knowledge Forum. The following examples are based on this PI's experience and reflections from this E-Learning pedagogic design experiment. E-Learning pedagogic design based on knowledge building pedagogic theory in these two environments, WebCT and Knowledge Forum, was evaluated in terms of pedagogical (socio/cognitive) and technological supports afforded by these two environments.



Example 1: (Pedagogical / Technological)

Knowledge building through evidence-based discourse and diversity of ideas is technologically supported in Knowledge Forum (KF) by hypertext links making possible referencing of multiple ideas, contributors and research evidence. There is no technical provision for hypertext links in the WebCT Bulletin Board (BB). WebCT supports threaded discourse but not linking of ideas for deep knowledge building. In addition, the technical supports are not available to sustain high level social/cognitive synthesis, like "rise above" views that are possible in the most version software, KF4).

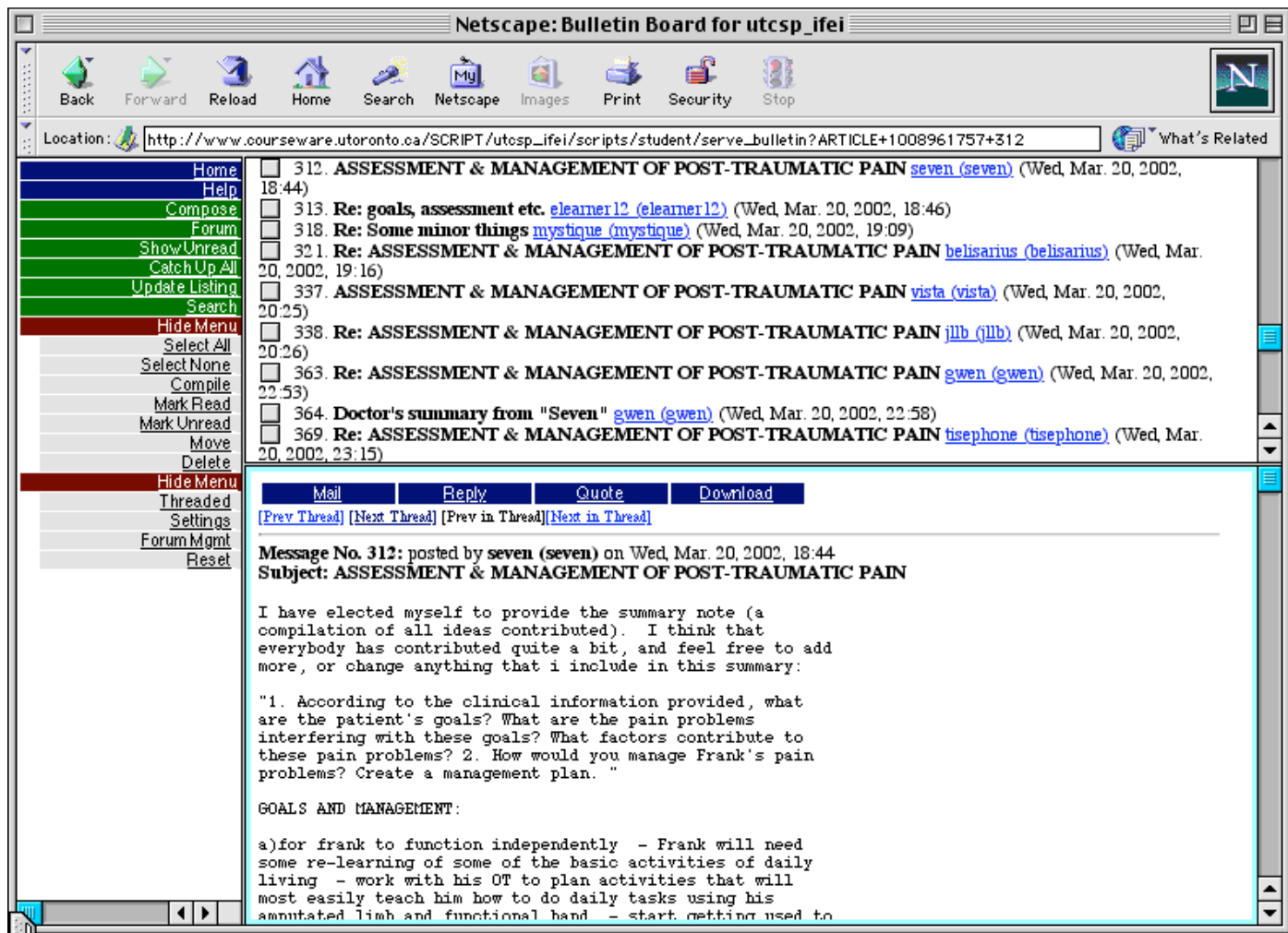
KF Linked and Within Note Referencing



Example 2: (Pedagogical / Technological)

Discourse notes cannot be revised in the WebCT BB; they can be, many times over, in KF. This is important in thinking about ways that communities work with knowledge, their collective responsibility to improvable ideas and progressive problem solving. Evidence-based discourse is better supported in KF. When new evidence is found, a KF note can be revised to cite this evidence. In WebCT an old note would have to be deleted and a new note would have to be created.

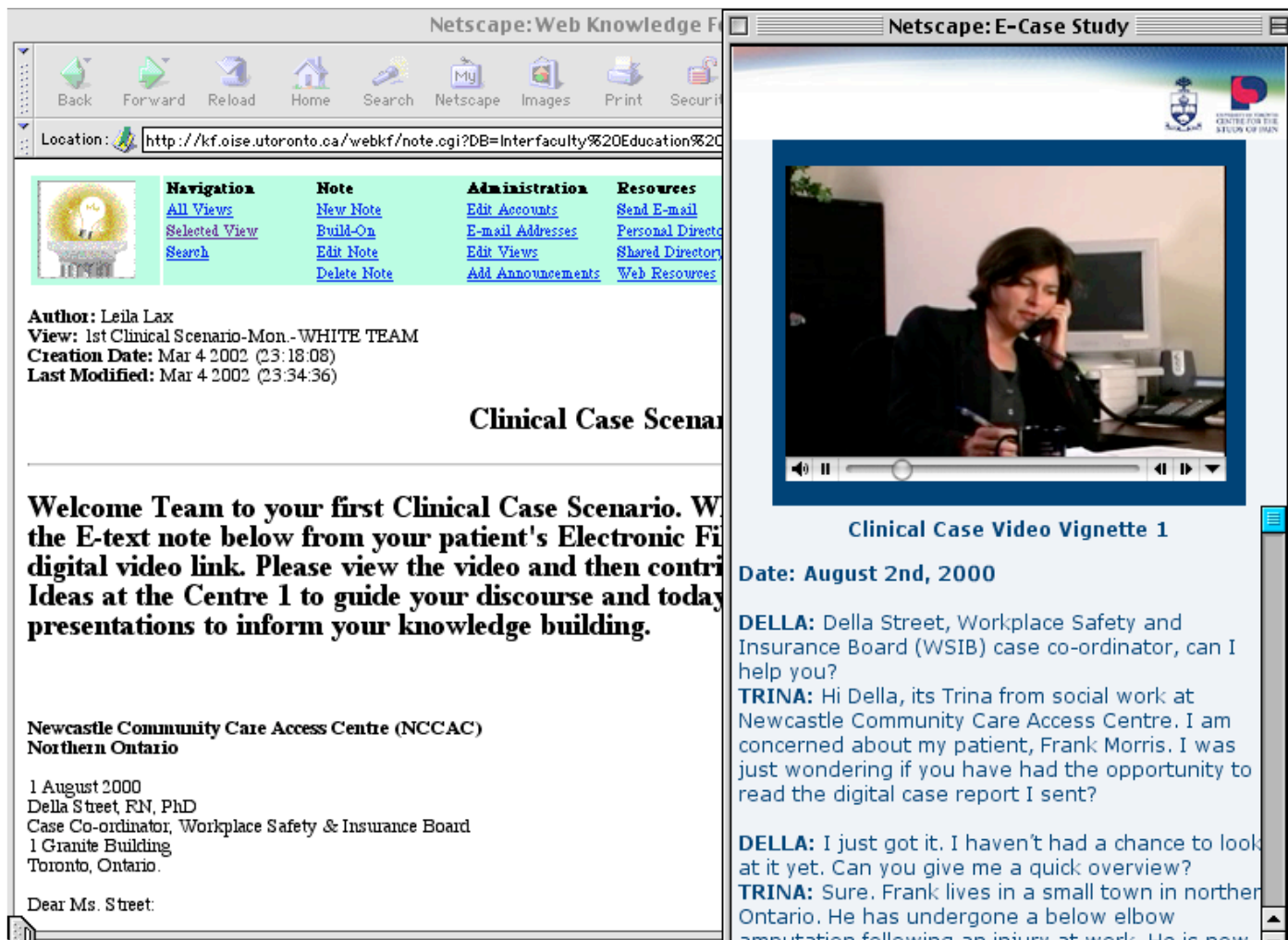
WebCT Threaded Discourse Bulletin Board



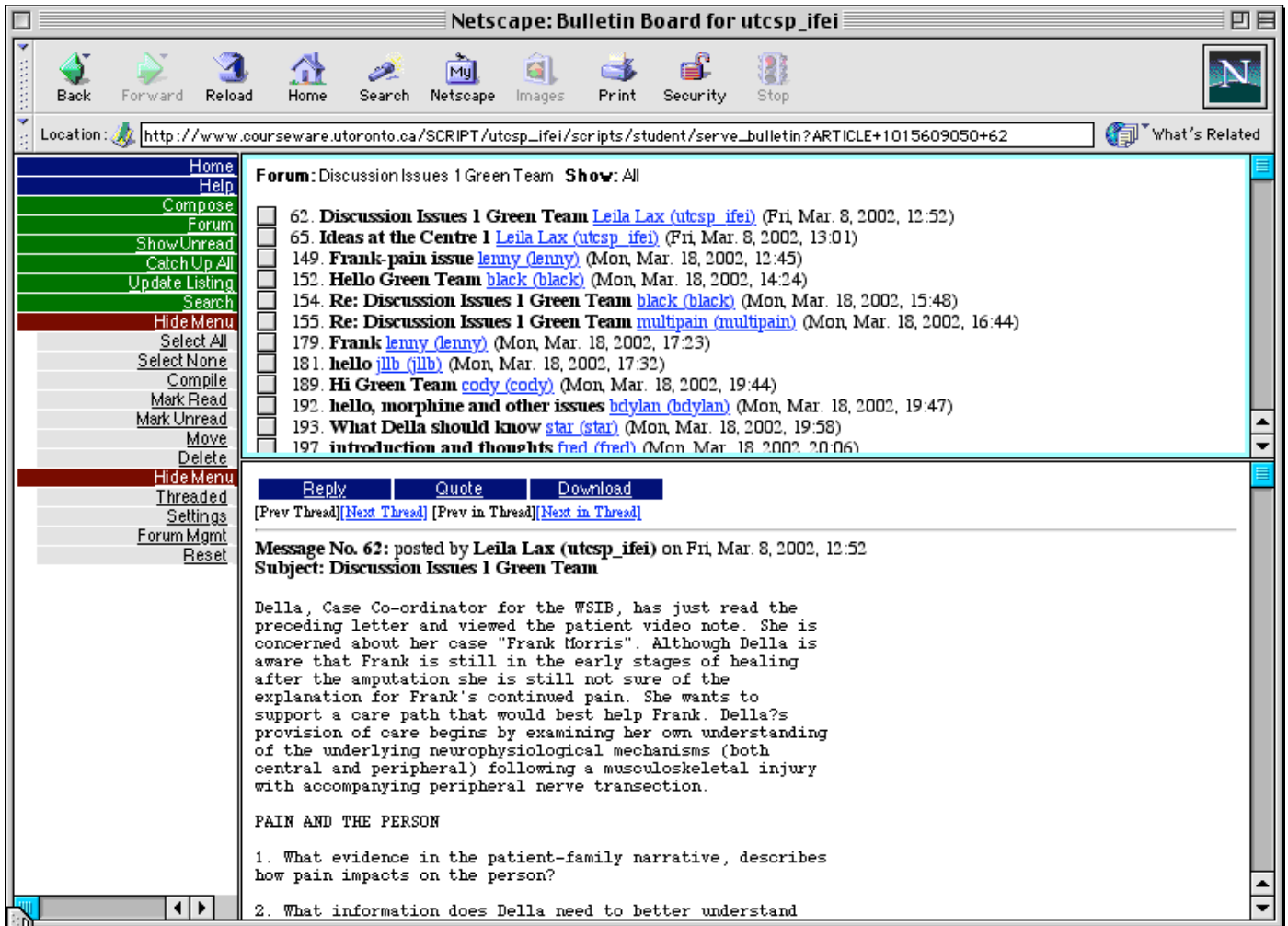
Please note, students could not link notes in WebCT so they created an ingenious method of using titles and upper and lower case text to distinguish threads; this is helpful but not as effective as KF hypertext links. One of the main disadvantages of WebCT is that it does not support multiple referencing of ideas and evidence, as is most effectively supported by KF technology.

Example 3: (Design)

In WebCT, multimedia knowledge objects are separated and disconnected from the BB text-only discourse notes. The graphic and text objects reside in different sections and cannot be accessed or linked in a WebCT BB. This structure creates silos. In comparison KF supports richly textured multimedia knowledge representation and discourse, within and across all views. KF supports artifact creation and knowledge work, in all forms of representation within the same problem space; therefore, connecting ideas and information is easier.



**Summary:** Knowledge Building is a pedagogic theory, defined by Scardamalia & Bereiter in the Encyclopedia of Education (2002) <http://ikit.org/fulltext/inpressKB.pdf>. Pedagogic theory-based design and evaluation are important components of E-Learning. Knowledge building theory was the



pedagogical framework used in this study, in both environments. Discussion issues and “ideas at the centre” were developed to guide students’ discourse. “Ideas” were the main pain concepts for discussion. Discussion issues were posed as trigger questions and probing issues. Video vignettes using real and standardized patients enhanced authenticity. The text-based Phantom Pain case was developed by UTCSP content experts and then designed for knowledge building collaborative work and media (Hunter, Watt-Watson, Pennefather, Lax). Note KF technical software features have been developed to support socio/cognitive dynamics of collaborative knowledge building; WebCT software features have been designed from a *knowledge transmission* framework. Therefore it stands to reason that KF more successfully supports collaborative knowledge building. KF goes beyond affording collective communication, it provides a community with the opportunity to advance towards deeper constructivism, innovation and knowledge transformation. This study has allowed us to articulate the reasons for these differences between software and socio/cognitive implications of these differences.

## Tracing Student Conceptions/Misconceptions of Pain in an E-Learning Database

**Method:** Green Team first day student contributed notes (n=24) from the KF E-Learning environment were randomly selected for initial coding and analysis of student conceptions and misconceptions of pain. Day four notes from the same team were also selected to be scored and analyzed for change over time, however this second procedure was not performed. Day 1 Green Team notes were scored by one pain expert who was also a key member of the Pain Week educational curriculum committee and the UTCSP.

The KF multiprofessional Green Team was composed of 1 Dental, 4 Medical, 2 Nursing, 1 OT, 1 Pharmacy and 1 PT students. All notes coded were contributed during the first afternoon and evening of Pain Week. Students had attended the first 3 hour block of lectures on pain mechanisms and received a manual containing reading references. This sample, therefore is only representative of students' conceptions and misconceptions as of the first day of Pain Week. At some future time it would be important to trace specific pain concepts coded from this first day data and compare it with notes on similar concepts later in the week, to track changes in conceptions/misconceptions. However at this time this was not possible.

Reliability of results may also be limited since notes were scored by only one rater. A detailed coding scheme (Appendix 3) for conceptions/misconceptions was developed and refined (Lax, Watt-Watson, Pennfather). Construction of this analysis posed dual challenges: to develop a reliable and valid method to conduct, code and analyze students' pain conceptions and misconceptions in an E-Learning database, and to deriving informative results from the analysis. Both aspects were developed and demonstrated. Results of analysis of 24 notes from 8 participants are indicated below.

### Results:

#### A. Frequency of:

- |   |    |
|---|----|
| 1. Relevant knowledge/concept(s) in comment(s)                        | 43 |
| 2.a. Misleading knowledge/concept(s) in comment(s)                    | 15 |
| 2.b. Knowledge gap (s) [formulated into a <i>problem of inquiry</i> ] | 1  |

#### B. Enquiry about Misconceptions &/or Knowledge Gaps

- |   |   |
|---|---|
| 3. No awareness of misconception stated in comment(s) | 7 |
| 4. Awareness of misconception stated in comment(s)    | 1 |
| 5. Awareness of knowledge gap stated in comment(s)    | 1 |

#### C. Responses to Misconceptions

##### *The misconception was:*

- |                                     |  |
|-------------------------------------|--|
| 6. Reinforced by other contributors | 1  |
| 7. Not addressed further            | 1  |
| 8. Partially resolved               | 3 (by others), 1 (by self) and<br>0 (by facilitator) |
| 9. Resolved                         | 0  |

#### D. Responses to Relevant Concepts

##### *The concept was:*



10. Reinforced by other contributors	9
11. Not addressed further	4
12. Partially reinforced, queried or expanded	20 (15 by others)
13. Misinterpreted	1

Coding of notes indicated relevant knowledge and concepts appeared in notes approximately 3 times as often as misleading concepts. However, a large number of misleading concepts was apparent within the day 1 notes. Some of these misconceptions were only partially resolved by other students in the database. The facilitator had not attempted to resolve misconceptions. More active, scaffolding of discourse and mentorship role may be required of facilitators, especially in the first days. As previously stated some of these misconceptions may have been resolved later in the week; the database was not examined for change over time. Many relevant concepts were reinforced or partially reinforced, queried or expanded upon in other notes by other contributors. Only one relevant concept was misinterpreted.

**Discussion:** What is demonstrated by these results is the important way that student contributions archived in an E-Learning database can be analyzed for conceptions and misconceptions. These data provide a unique “in vivo” snapshot of students’ knowledge, beliefs and understanding. Analysis of students’ conceptions/misconceptions can be used to provide feedback for uniprofessional and interprofessional health sciences curricula development and E-Learning pedagogic development. Initial analysis of these data has demonstrated that much can be mined from this rich resource; E-Learning has been used as a pedagogic tool but it has been overlooked as a powerful “in-vivo” research tool.

It is recommended that this area of research be advanced to support feedback and help students overcome misconceptions in a safe environment. Further development of methods of analysis are needed to enable tracing by single concept or idea through a database and in-depth scoring and feedback on uniprofessional and interprofessional patient management plans. It is specifically recommended for further advancement of this and other E-Learning cases, that an interprofessional management plan be constructed by experts to be used as a guide for student online learning, facilitator feedback and evaluation of conceptions/misconceptions, as demonstrated herein.

**Conclusions:**

Three key points emerge from these data:

1. E-Learning is an effective way to promote relevant knowledge and understanding.
2. E-Learning provides unique “in vivo” analyses of students’ conceptions/misconceptions that can be used for virtual mentoring, E-Learning and face-to-face curriculum design/feedback.
3. E-Learning misconceptions need to be directly addressed by online facilitators, in a face-to-face synthesis session or by addition online reference materials.

**Rating Exemplar:**

**KF Note**

Author: iceman

Note #528

View: 1st Clinical Scenario-Mon.-GREEN TEAM

Creation Date: Mar 18 2002 (18:39:26)

**Treatment options**

We all seems to agree there are a few causes or his pain:

- 1) Tissue injury - acute, caused by the amputation or after and would best be managed via potent analgesics. (A.1-F, D.10)
- 2) Neuropathic pain - more of a chronic pain which requires more modalities to treat eg. tricyclics. (A.1-F, D.10)
- 3) Physiological undertones - best treated non-pharmacologically to ensure that pt. continues to function and has a positive outlook and is able to cope with everyday life. (A.1-F, D.10)

**\*It is imperative to determine the cause of his pain!** (A.2-F, D.10) Granted his pain will be treated but we must know the precise cause of the pain if we are to treat it effectively. The prescription for Tyl 3's would have addresses (1) (A.2, B.3, C.7) but unlikely to have adressed (2) or (3). (A.1-F, D.11)

**\*Scorer's explanation of misconception: "cause vs type – can't always determine cause which is a problem for people with chronic pain."**

## Analysis of Facilitator Contributions in Knowledge Forum and WebCT

Five pain experts participated in this study as facilitators for the student uni/multiprofessional small groups. Facilitators were trained for technical competency in WebCT and Knowledge Forum. Facilitators did not receive any training in managing small groups online; this was done to allow for the unbiased study of individual online facilitation styles. Facilitators were only told that a good approach was a learner-centred style similar to that used to facilitate face-to-face, small group, problem-based learning. Five unique facilitation styles emerged.

**Methods:** The Knowledge Forum Analytic Toolkit was used to create single user reports for each facilitator in Knowledge Forum. An overview of activity for the week and daily reports were used to determine type of activity, facilitation style and the effect on collaborative knowledge building. The WebCT tracking tools were used; the only data provided is read and post and hit cumulative totals.

### Participants:

Five facilitators from different health professional disciplines, but all pain experts participated in this study. Three facilitators participated in Knowledge Forum and two participated in WebCT. Facilitator 1, holds a UofT academic appointment, facilitated the Green and Blue multiprofessional teams. Facilitator 2, is a practitioner with a UofT academic appointment, facilitated the Red and White multiprofessional teams. Facilitator 5, is a practitioner with no academic appointment, was added on the first day of Pain Week to facilitate a newly registered group of medical students and one OT student. (The opportunity for same day sign up and training was provided because medical students had their holidays prior to Pain Week and interest was indicated).

Two facilitators participated in WebCT. Facilitator 4, is a practitioner with no academic appointment, who chose to use a different code name, Marla, facilitated the Green and Blue multiprofessional teams. Facilitator 3, holds a UofT academic appointment, facilitated the Red and White teams.

### Results:

#### Facilitation Overview of the Week

#### **Knowledge Forum Analytic Toolkit Results**

	<b># of Notes Created</b>	<b>% of Notes Linked</b>	<b># of Views Worked In</b>	<b>% of Notes Read</b>	<b># of Revisions</b>	<b># of Notes in Build-ons</b>
<b>Facilitator 1</b>	12	8	11/13	82	11	1/12
<b>Facilitator 2</b>	12	58	8/13	86	12	7/12
<b>Facilitator 5</b>	46	80	6/6	100	0	37/46

#### **WebCT Tracking Results**

	<b># of Notes Posted</b>	<b># of Notes Read</b>
<b>Facilitator 3</b>	7	324
<b>Fac. 4 - Marla</b>	40	153

**Description of Facilitators’ Knowledge Building Contributions:**

**Knowledge Forum Facilitators:**

<b>Facilitator 1</b>	<b>Characteristics of Discourse Contributions and Resultant Effects</b>
<b>Activity Level</b>	Minimal, 1 final note each day, late evening, summary note, many links, worked in all views, 83-100% of notes read.
<b>Facilitation Style</b>	High level summary, addressed to group, questions posed, positive feedback, no humour.
<b>Effect on discourse &amp; collaboration</b>	No stimulation of further discourse or collaboration. (Last note in each multiprofessional view. Questions: Does high level summary close down discourse? Lack of individual address? Evaluative tone?)

<b>Facilitator 2</b>	<b>Characteristics of Discourse Contributions and Resultant Effects</b>
<b>Activity Level</b>	Decreased over the week (Days 3 & 5 no contributions/Day 4=2notes), Days 1 & 2 50% linked and build-ons, 65-94% of notes read.
<b>Facilitation Style</b>	Days 1 & 2 collegial and responsive. Directly addressed content issues, posed probing questions, advanced discourse, positive feedback, no humour.
<b>Effect on discourse &amp; collaboration</b>	Stimulated further discourse and collaboration on Day 1 & 2. Some students’ referenced facilitator notes advancing knowledge building. (Reason for drop-out given as: “Lack of familiarity with pharmacological content”. Begs question: expert vs. non-expert tutors – difficult to answer in interprofessional context . Training required.)

<b>Facilitator 5</b>	<b>Characteristics of Discourse Contributions and Resultant Effects</b>
<b>Activity Level</b>	Very active, activity increased Day 1 to 4, very responsive mostly via build-ons, 75-80% linked, worked in all views, 100% of notes read.
<b>Facilitation Style</b>	Conversational, directive and responsive to individual and group concerns. Posed new issues, added references, asked for input, positive feedback, used humour.
<b>Effect on discourse &amp; collaboration</b>	<b>Stimulated discourse and collaboration.</b> Advanced new ideas and received feedback on process.

**WebCT Facilitators:**

<b>Facilitator 3</b>	<b>Characteristics of Discourse Contributions and Resultant Effects</b>
<b>Activity Level</b>	Very few comments contributed, but extraordinarily high # of notes read.
<b>Facilitation Style</b>	Non-responsive. (except for notable feedback on very specific occasions).
<b>Effect on discourse &amp; collaboration</b>	No effect on discourse and collaboration. One group commented on lack of facilitation (White team, Note #286).

<b>Facilitator 4 - Marla</b>	<b>Characteristics of Discourse Contributions and Resultant Effects</b>
<b>Activity Level</b>	Extremely high level of activity, many individual and collective responses.
<b>Facilitation Style</b>	Collegial, in-depth, clinically-based, experiential feedback/from the “trenches”, multiple responses on individual issues, positive feedback, validated numerous students’ contributions, commented on professional discourse i.e. use of “residual limb” not “stump” (Red Team, Note 273), no humour.
<b>Effect on discourse &amp; collaboration</b>	<b>Highly stimulated discourse and collaboration.</b>

Inconsistent facilitator participation or decreased participation and minimal participation verging on “lurking” does not advance discourse, progressive problem solving, knowledge building or collaboration in ways that might be possible, as one would expect. Interestingly, the essentially self-facilitated groups accomplished the goals set out and did not seem to become overly discouraged or become negatively effected by the lack or decrease in facilitator participation. Team motivation and epistemic agency remained strong. Their collaborative knowledge building activity as indicated in previous analysis was very high. Thus, student self-facilitated E-Learning groups can be highly active, self-directed, motivated and collaborative. This researcher believes that even though the facilitators of these groups did not provide scaffolding to advance knowledge building, the strong pedagogic design of the clinical case, discussion issues and ideas at the centre did provide the necessary support for students.

By comparison however, the group discourse with the two highly active and responsive facilitators (Facilitator 4, known as Marla in WebCT and Facilitator 5 in Knowledge Forum) added value to the knowledge building process, by further stimulating discourse and collaboration. Thus facilitation can add value. This indicates that Facilitator training should be a required aspect for E-Learning participants.

Some interesting and unexpected findings emerge from these data, posing new questions for research in E-Learning facilitation. The effect of the high level summary notes posted late in the evening, at approximately eleven pm, by Facilitator 1, seems unusual. Often a high level summaries with positive feedback and new questions posed, generate progressive problem solving. In this case it had the reverse effect. The high level summaries closed down the discourse each evening. Perhaps the style was identified by students as teacher-centred or evaluative in tone. Usually high level summaries are initially modeled by teachers in an E-Learning database in the hopes that this pedagogic strategy will be followed by students.

The issue of facilitating interprofessional groups is particularly difficult since no one person will be a content expert in all domains. Therefore facilitator training should focus on group process for the “non-expert”. In this case study once the discourse became centred upon pharmacology one non-pharmacy expert dropped out and the other continued to successfully facilitate by contributing related clinical experiences. This issue needs to be addressed. In addition it should be noted that many misconceptions arise that facilitators can provide feedback on. This can be done in a facilitator training session based on an multi-expert developed interprofessional management plan. Facilitation online or face-to-face debriefing on patient management issues should be used to correct identified misconceptions in the discourse.

Further, in-depth investigation is needed to determine what constitutes effective E-Learning facilitation to advance collaborative knowledge building. Interesting analogies can be drawn from the Problem-based Learning literature on expert versus non-expert tutors and from other references, in this domain, such as Dr. Richard Tiberius’s book on “Small Group Teaching”. The body of research literature on facilitating online discourse is growing, although little research has been done specifically in facilitating knowledge building online. Further research is also necessary to determine how to best support self-facilitated knowledge building groups in E-Learning environments.

## DISCUSSION, CONCLUSIONS, NEXT ITERATION

Netscape: E-Case Study



The video player shows a man with glasses and a blue shirt speaking. The video player has a progress bar and control buttons (play, stop, previous, next, volume).

**Clinical Case Video Vignette 4**

**DATE: 9 Months Later**

**ADAM:** Good afternoon everyone. I see we have a good group today, present and online. The clinical case I want to discuss with you today is Frank Morris. I am concerned about Frank's chronic pain. I think Frank places tremendous demands on himself and has expressed frustration over his lack of progress, which he attributes to his chronic pain and his lack of restorative sleep. On Frank's last visit, I noted that Frank has excessive forward head posture and numerous trigger points in scalenes, trapezius, and anterior pectoral muscles. Tinel's sign over ulnar and median nerves was negative. Palpation of the stump did reveal some tenderness and provocation of the

## Discussion

Based on the results indicated in the Preliminary, Initial and Final IT & E-Learning Reports, we can conclude that the Interfaculty Pain Week Information Technology & E-Learning Project was successfully implemented and can successfully support undergraduate interprofessional health sciences education. It is therefore, recommended that the Information Technology (IT) & E-Learning components be further explored and expanded, through *full* integration, implementation and evaluation in future Pain Week curricula, other Interprofessional Education (IPE) and health sciences education initiatives. Key findings from this study answer many questions and raise new ones. Challenges for future research can be divided into three main areas: pain knowledge/beliefs related to curriculum development, online knowledge building pedagogy and interprofessional education for collaborative advancement.

In particular, this study identifies new ways and poses new questions about how to evaluate and make use of evaluations of interprofessional collaborative online discourse (identifying students' conceptions and misconceptions) for health sciences education curricula feedback and design. The significance of results herein demonstrated the unique way in which student self-constructed note contributions archived in an E-Learning database can be analyzed for conceptions and misconceptions. These data provide an "in vivo" snapshots of students' knowledge, beliefs and understandings. Analyses of students' conceptions/misconceptions can be used to provide feedback for uniprofessional and interprofessional health sciences curricula design and E-Learning pedagogic development. Initial analyses of these data has demonstrated that much can be mined from this rich resource; E-Learning has been used successfully as pedagogic tool, but it has yet to be explored as a powerful "in vivo" research tool.

Other questions arising from research herein focus on issues of online pedagogy, such as those concerning E-Learning facilitation. Are self-facilitated groups effective? What is the role of an expert online facilitator? Who should facilitate IPE? What are the best methods? And what are the barriers and implications of "just-in-time" student feedback? In this study five different styles of facilitator feedback were apparent. E-Learning facilitators were not trained in this study. It is apparent that E-Learning facilitator training is a necessity, even for subject matter expert

Use of Knowledge building socio/cognitive technical supports require further development to advance evidence-based discourse. Greater use of embedded hypertext links to evidence-based resources, such as My.library, is needed to enhance evidence-based interprofessional discourse. In addition multiple source simultaneous referencing of evidence is needed. Students like to reference multiple sources, e.g. my.library, other web-based resources and many of their colleagues E-Learning notes while constructing their own notes. Analogous to spreading books out on a desk, students have requested that an E-Learning environment have a feature for use of simultaneous multiple notes for multiple referencing. We believe use of this technical feature will affect socio/cognitive behaviour promoting evidence-based learning and deeper collaboratively constructed discourse. The only E-Learning environment that enables simultaneous multinote referencing is the latest version of Knowledge Forum software (KF4). Future use of KF4 is recommended to better support multi-source evidenced-based discourse for collaborative knowledge building. Future research may also address various combinations of synchronous e-based environments (e.g. MSN Chat or Videoconferencing) with asynchronous knowledge building environments as required by pedagogic design plan.



Students from different disciplines demonstrated varying levels of satisfaction levels with interprofessional education online. The question of how to make IPE more inclusive and not marginalize any group(s) continues to be central. This study found interesting variations in satisfaction ratings from different disciplines, Medicine being highest and Physical Therapy being lowest. Most surprisingly, case developers initially thought that a musculoskeletal Phantom Pain case would be of especially high interest to PT students. However, as interpreted by researchers, as the online discourse of pharmacological management became an increasingly important focus some students were marginalized. Overall it was found that E-Learning can successfully provide opportunities for interprofessional collaborative knowledge building. Depth of student contributions surpassed researcher expectations; epistemic agency and commitment to collaborative knowledge building extended well beyond the required minimum. 87% of students rated their E-Learning experience as Excellent (21%), Very Good (33%), Good (33%). This initial IPE E-Learning effort was extremely successful, but not equally successful across all disciplines; iterative design modifications to case narrative and knowledge building scaffolds are needed fully support inclusion of all learners.

In summary, both Knowledge Forum and WebCT were successfully used to support interprofessional education in a cost/effective manner. Cost for new multimedia E-Learning case creation is high in comparison to sustainability (modifying/using previously developed cases). Similarly training costs are currently high, but it is anticipated that training costs will decrease over the coming years as more participants become active and familiar with E-Learning. The Knowledge Building theoretical approach (Scardamalia and Bereiter, 2002) for online pedagogic design and evaluation was successfully used in this study to support E-Learning in both Knowledge Forum and WebCT. Advantages detailed in this study clarify the socio/cognitive dynamics related to the technical differences between KF and WebCT environments. Of particular advantage, are the strong technical features (e.g. linking, referencing, revising) found in Knowledge Forum (not found in WebCT) to support socio/cognitive advancement for collaborative knowledge building. In addition, the powerful embedded tools for multiple analyses in the Knowledge Forum Analytic Toolkit (lacking in WebCT) have provided extremely useful for in-depth analysis of knowledge building effectiveness. Benefits to knowledge building in KF were demonstrated and it is anticipated that with longer and deeper use, these benefits would become magnified.

Overall epistemic or knowledge building agency in regard to student participation surpassed researcher expectations. Activity in both databases, especially the extra-ordinarily high read/write ratios testify to this fact. Strong collaborative knowledge building and depth of contributions were evident in both WebCT and KF databases, e.g. development of Doctor's patient management plans and reflection on interprofessional plans. Overall discourse in both databases exemplified high levels of uni/interprofessional knowledge exchange and shared understanding. The discourse in both databases, is therefore, classified as shallow constructivist knowledge building discourse. The challenge is now to go beyond knowledge sharing, to refining interprofessional knowledge and moving toward knowledge transformation and innovation to advance best practices.

## **Conclusions**

In conclusion, collaborative knowledge building in Knowledge Forum and WebCT successfully supported the face-to-face Pain Week curriculum, by promoting most current pain knowledge and by enhancing interprofessional understanding, in a cost efficient and educationally effective manner. The future challenge of interprofessional knowledge building is to go *beyond* shared knowledge and understanding of current best practices, by working with idea diversity, the similarities and the contrasts, “to spark and sustain knowledge advancements” (Scardamalia, 2002). Working toward interprofessional knowledge transformation and innovation beginning in undergraduate health sciences education, sustained throughout professional practice, are goals currently aspired to, and best supported by knowledge building in Knowledge Forum.

### **Next Iteration of the Interprofessional E-Learning Research Project**

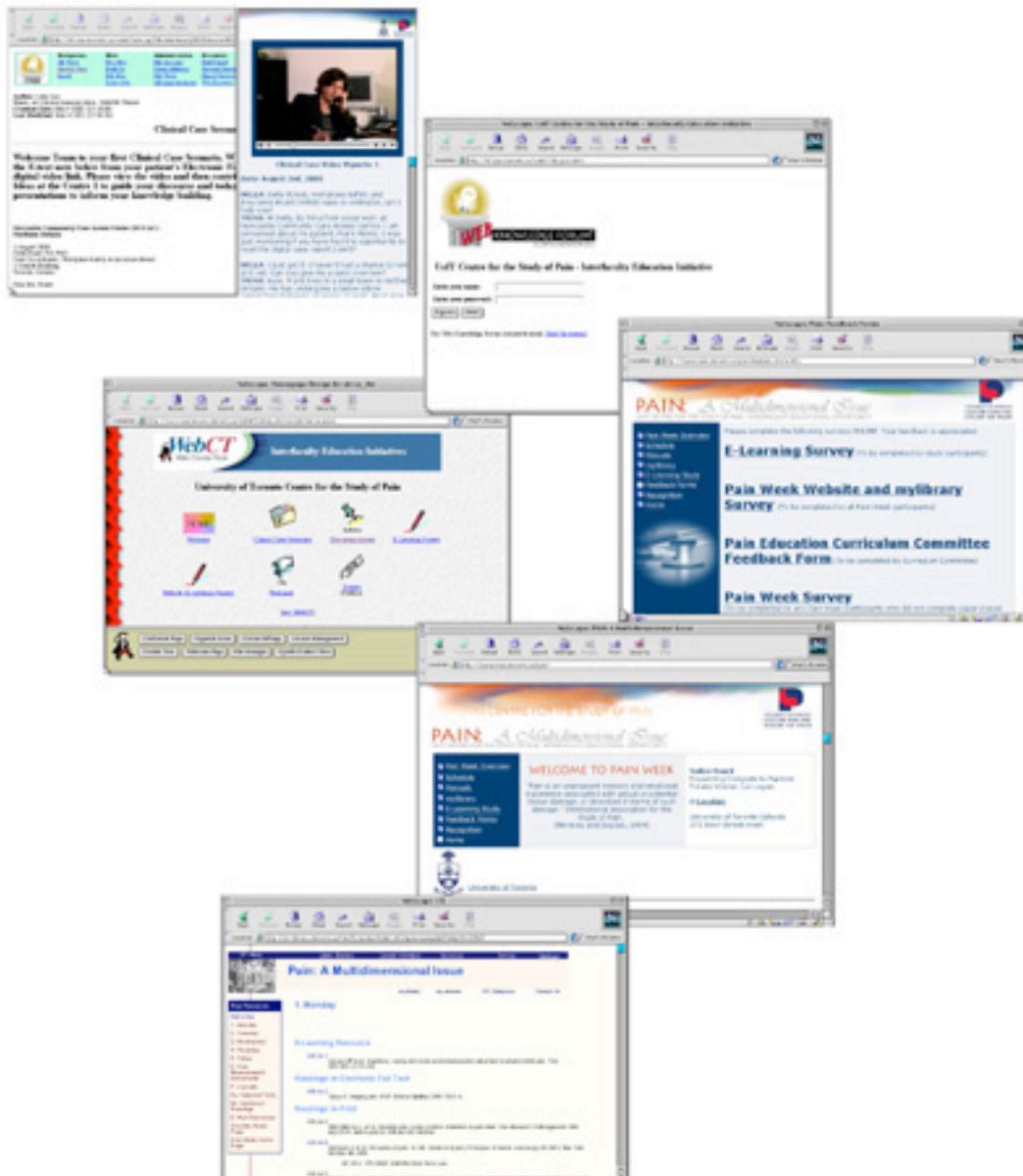
The next iteration of this research initiative is currently being planned. A similar collaborative knowledge building study, using the most recent version of Knowledge Forum and modified Phantom Pain clinical case scenarios, will be offered to experts across various disciplines, for CE credit during Pain Week Facilitator training, in February 2003. The objectives and outcomes are similar to those for the students; participation is aimed at two main outcomes: achievement of most current pain knowledge and enhanced interprofessional expertise. It is anticipated that the expert interprofessional online teams will develop “model” interprofessional management plans to be used for reference and feedback in future implementations of this E-Learning Phantom Pain case to advance interprofessional health sciences education.

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## Appendix



## Appendix 1

**SUMMARY OF STUDENTS' COMMENTS FROM E-LEARNING SURVEY****Categories of Comments**

1. Opportunity for interdisciplinary discourse  
(e.g. enhanced understanding of roles & knowledge perspectives)
2. Metacognitive benefits  
(e.g. clarification, justification, reflection, synthesis, depth and feedback on ideas; like PBL “makes knowledge more retainable and memorable”)
3. Evidence-based discourse  
(e.g. enhance software design with multiple windows, designate time to research, read, reflect & respond)
4. Time  
(e.g. more than 1hr/day, recommended 1.5 –2.5 hr/day; specific post times difficult-some prefer asynchronous with unspecified times, others recommend inclusion of synchronous chat)
5. Facilitator input  
(e.g. more expert feedback, patient information)
6. Pedagogic interactions  
(e.g. resentment of early in depth note contributions (limits others), repetition of ideas)
7. Pedagogic design  
(e.g. objectives of the assignments unclear; 2<sup>nd</sup> management plan not necessary; establish relevancy to dental students)
8. Computer access & updatedness  
(e.g. MSB lab noisy, no multimedia players on Gerstein computers, late night access few do not have home computer)

**Selected Sample Positive Comments:**

Comments: I believe this was a very fascinating experience that I personally always wanted to happen. As a medical student, we regularly participate in small discussion groups like this as PBL or seminar groups and those could easily be replaced or supplemented by such an E-learning method. Although in general I enjoyed the whole experience, I believe there is room for improvement and so I have a few suggestions: 1) Since we are using the electronic medium, there is more opportunity for using multimedia tools such as animations, graphs, illustrations and pictures, which should be used to the fullest extent possible. 2) There is an absolute need for the presence of a facilitator in the discussion group to guide the direction of discussion. 3) The goals and objectives should be more clearly and narrowly refined. 4) There is no need for including a 40-page document as a reading material for case of a day such as on Friday. 5) It would be fantastic if there were a few-page summary of the related material and content of the relevant information for each day. For example, if there was a summary of the lecture material. At the end I want to thank you those who spend a lot of time developing this system and I really enjoyed and learned from it.

Comments: I loved this experience. It helped to put the lecture material into context and allowed me to clarify difficult concepts with an expert (the facilitator). What's good about the facilitators is

that they don't give the answers away but rather asked probing questions and directed me to go and find the answers ourselves. This interactive way of learning, much like during PBL, makes the knowledge much more retainable and meaningful than spoonfeeding. I also liked the idea that during E-learning, I'm given enough time to think and reflect and do readings before I need to respond to the questions asked by colleagues and facilitators. Excellent initiative. I would definitely recommend it to my colleagues! Thank you for having me participate. I surely learned much more about pain.

Comments: First of all this was a very good learning experience, it made pain week much better, more relevant and helped me learn more about clinical application of pain knowledge. I found it a bit difficult to post a note before 5 pm every day... we had scheduled class time in the afternoons, and also a research project to finish, and I did find my learning experience was reduced by coming to the group discussion late, after many contributions had already been made.... the real benefit is in being forced to sit down and figure out the answer to the questions posed, and if three people have already done that (and we had some very good responses in our group), it's nice to learn from them but not so useful as doing it your self. Also, I know there were several times when I wanted more information about the case, I wonder if there would be an interactive way to access more info about the case (ie a better description of Frank's pain). Finally, yes, think a facilitator could contribute -- it's great to have student participation. But there comes a time when the blind are leading the blind, (so to speak) and someone who really knows something would be useful. I found the facilitator in our small group sessions (Wed and Thurs am) was very good at this.

Comments: Interdisciplinary learning is so vital and e-learning helped to facilitate that type of learning that doesn't take place very often in our own curriculums.

Comments: ...It definitely takes longer than one hour to take part in meaningful discussions. Having a e-learning program like this through the year for all health professions would be an excellent opportunity to learn!

Comments: I commute a large distance every day and e-learning is fabulous for me. This experience helped to solidify the concepts covered in the seminars. I would recommend that this type of learning be integrated into all courses. I found that my group did not very often respond directly to a posting unless asked. This hindered the collaborative aspect of the experience. One reason for this I suspect is the length of each posting. Everyone had so much to say that if everyone responded to every comment it would have gone on forever. In terms of facilitators I think that more of a presence would have been useful. I felt that at times they could have picked out the salient parts of different postings for further discussion. This would have encouraged feedback on people's posts and encouraged further discussion in the right direction. Real time discussions would be useful I think with an opportunity to post messages on your own time afterwards. I found the experience very time consuming. Much more so that the 1 hour a day originally estimated. I would usually post twice and spend at least 45 minutes composing each post. Additionally I had to do extra reading for approx. one hour to cover the needed material. The "ideas at the centre" were a good idea, but I found that my group didn't always allow them to guide our discourse. The video vignettes were a nice added feature of the experience. I found the patient interview and assessment particularly useful and the others less so especially the last one. My last comment is that I found the multidisciplinary aspect

difficult. Everyone was trying to be so comprehensive that the individual perspectives were not always clear. Overall though a worthwhile experience.

**Selected Sample Negative Comments:**

Comments:    ...I was sick of "pain" conversation by the end of the day. I also don't like the feeling of wandering around in the dark with a group of people -- I'm just as good at that by myself. And if I am going to do a bunch of research, I might as well do it for myself anyways, b/c that is how we learn. Anyways, not my cup of tea, but hopefully other people found it more useful. -



## Appendix 2

**PAIN WEEK IT COMPONENTS: WEBSITE & MY.LIBRARY  
SUMMARY OF SURVEY RESULTS**

**Background:** The Pain Week IT components, defined as the Pain Week Website and linked My.library resource, were made available to all students (n=540), faculty and others on the World Wide Web at the URL <http://icarus.med.utoronto.ca/pain/index.htm>. However, few participants (n=47) responded to the online questionnaire (<http://icarus.med.utoronto.ca/pain/evaluation2.html>). Online responses were transferred to an Excel file which in turn was used to calculate descriptive statistics in SPSS. Please see Initial Report for detailed results.

Results: Students accessed the Pain Week Website (Yes/Sometimes) from home (74.5%), from the Education Innovation Lab in the Medical Sciences Building (74.4%), from the Gerstein Library (34.0%) and from various faculty/department computers (34.0%). 85.1% of students have home access to a computer and 59.6% use a high speed cable or telephone Internet connection.

**Results:** In summary, the Pain Week Website was well received. A 5 point Likert scale ranging from strongly agree to strongly disagree was used to determine students' attitudes and opinions on Website design, content and overall rating. The summary statistics herein will be reported by combined categories of strongly agree/agree.

Design & Content

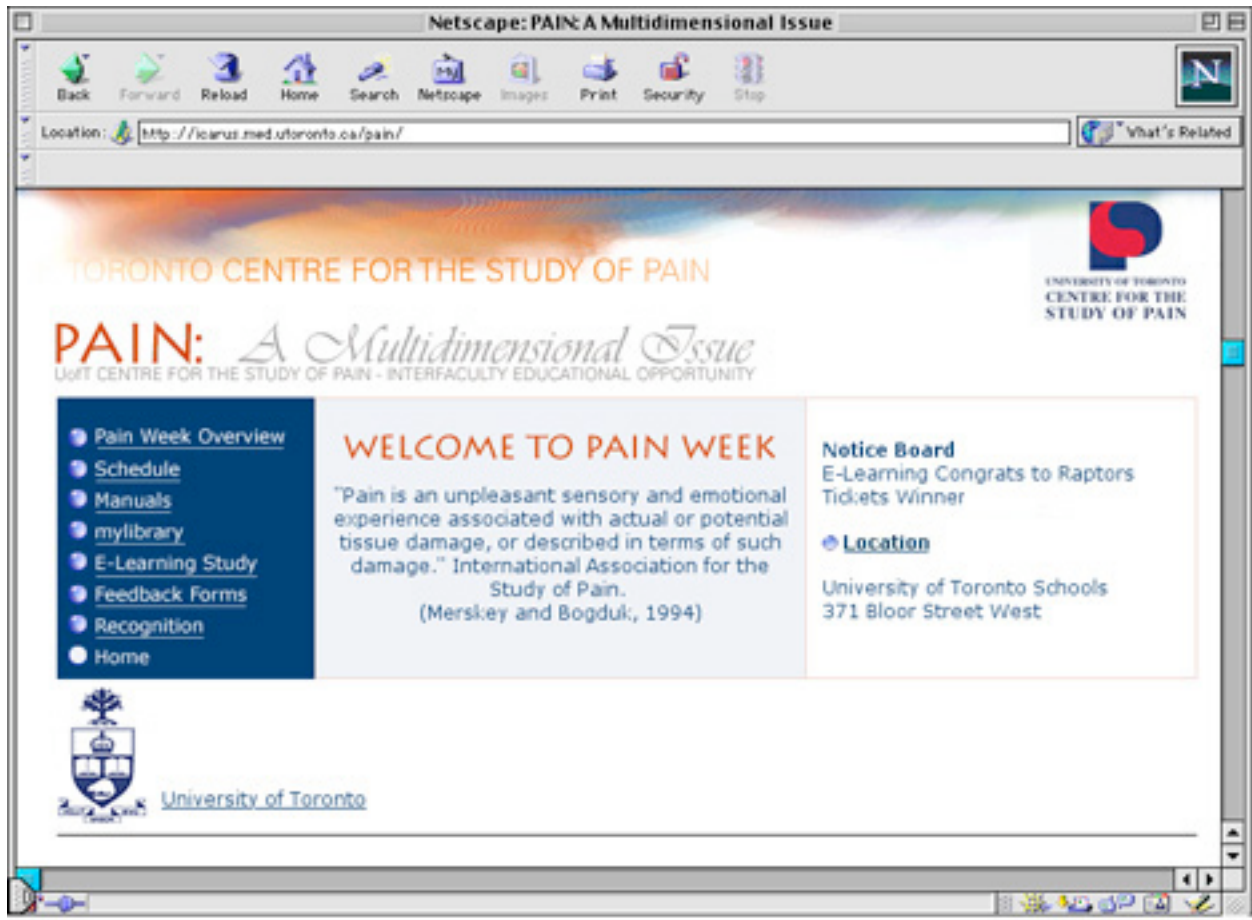
87.3% of students indicated the Pain Week Website was easily accessible, 85.1% indicated it was easy to use, 87.3% indicated it was well organized, 80.8% indicated it was aesthetically pleasing and 63.8% indicated it was functional. The low functionality rating is likely due to the problems students encountered trying to download the large Powerpoint files. The original intent was only to view ppts online. Feedback on content of each Pain Week webpage was similarly high. In addition, use of online feedback forms was well received; 72.4% of students indicated they were convenient. Attitude and opinion results about the My.library resource were somewhat lower, indicating a need to better integrate online references. 63.8% of students indicated My.library was well organized and 55.1% of students indicated My.library reference pages were informative.

Overall Ratings

72.5% of students indicated that the Pain Week Website was an important resource. 31.9% of students indicated that My.library was an important resource.

**Recommendations**

- *Provide printouts to students of Powerpoints used in presentations.*
- *Integrate and reference in Pain Week presentations, manuals, and e-learning component by using hypertext links and URLs to direct students to important evidence-based resources online.*



Appendix 3

**TRACING STUDENTS' CONCEPTIONS / MISCONCEPTIONS IN AN E-LEARNING DATABASE: CODING**

**A. Frequency of Relevant or Misleading Concept(s)**

- |  |         |
|--|---------|
| 1. Relevant knowledge/concept(s) in comment(s)         | 34F     |
| - [stated as <i>hypothesis</i> (H) or <i>fact</i> (F)] | 9H      |
| <b>Proceed to score with D</b>                         |         |
| 2.a. Misleading knowledge/concept(s) in comment(s)     | 11F     |
| - [stated as <i>hypothesis</i> (H) or <i>fact</i> (F)] | 3H, 1H* |
| <b>Proceed to score with B &amp; C</b>                 |         |
| 2.b. Knowledge gap(s) demonstrated in comment(s)       | 1#      |
| <b>Proceed to score with B &amp; C</b>                 |         |

**B. Enquiry about Misconceptions &/or Knowledge Gaps**

- |   |                            |
|---|----------------------------|
| 3. No awareness of misconception stated in comment(s)   | B.3=4, B.3(a)=1, B.3.(b)=2 |
| <i>(Please score as [3.a.] for incorrect statement of fact or as [3.b.] for knowledge gap)</i>  |                            |
| 4. Awareness of misconception stated in comment(s)  |                            |
| C. [stated <i>explicitly</i> (E) (e.g. I do not know. I do not understand) or <i>implicitly</i> (I)] (e.g. I think..., I believe...)                                      | 1*                         |
| D. [formulated into a <i>problem of enquiry</i> (P) or <i>question</i> ]  |                            |
| 5. Awareness of knowledge gap stated in comment(s)  | 1#                         |
| • [stated <i>explicitly</i> (E) (e.g. I need to know..., I do not understand...)] or <i>implicitly</i> (I)] (nb: this category may not be needed – if used please define) |                            |
| • [formulated into a <i>problem of enquiry</i> (P) or <i>question</i> ]   |                            |

• **Responses to Misconceptions**

*The misconception was:*

- |  |     |
|--|-----|
| 6. Reinforced by other contributors  | 1   |
| 7. Not addressed further   | 1   |
| 8. Partially resolved  |     |
| • [by <i>other</i> contributions (O), by <i>self</i> (S), by <i>facilitator</i> (L)] | O=3 |
| • [+ or - ]  | S=1 |
| 9. Resolved  | O=1 |
| • [by <i>other</i> contributions (O), by <i>self</i> (S), by <i>facilitator</i> (L)] |     |

• **Responses to Relevant Concepts**

*The concept was:*

- |  |                              |
|--|------------------------------|
| 10. Reinforced by other contributors                                     | 9                            |
| 11. Not addressed further  | 4                            |
| 12. Partially reinforced, queried or expanded                            |                              |
| • [by <i>other</i> contributions (O), by <i>facilitator</i> (L)]         | D.12=3, D.12-O+=15, D.12.L=2 |
| • [+ or - ]  |                              |
| 13. Reinforced by evidence from reference(s) – NOT SCORED – SCORED in KF |                              |
| 14. Misinterpreted   | 1                            |

## Appendix 4

**Pain Week March 18-22, 2002**

**INFORMATION TECHNOLOGY & E-LEARNING RESEARCH BUDGET Final Report**  
**Submitted by Prof. Leila Lax (April 8, 2002)**

E-learning senior research scientist (Prof. Leila Lax)	\$ 5,000.00
E-learning research assistant (Teddy Cameron-medical animation)	2,000.00
E-curriculum Standardized Patient case digital videotaping	1,836.00
Standardized Patient digital video edit	900.00
E-curriculum & clinical case design (in-kind contribution UTCSP members)	
Website design, Power Points & Streaming Video of Presentations and Online Evaluation (in-kind contribution from Faculty of Medicine Educational Computing/Dr. Lawrence Spero)	
My.library – digital references and resources in Pain Week Website (in-kind contribution from UofT Libraries/Dr. Joan Leishman)	
WebCT research use, database hosting, and training (in-kind contribution Resource Centre for Academic Technology/Jay Moonah)	
Web Knowledge Forum research use and database hosting (OISE/UT/Dr. Marlene Scardamalia)	500.00
<b>TOTAL</b>	<b>\$10,236.00</b>

**E-Learning Study Student & Facilitator Participation Rewards**, The University of Toronto Centre for the Study of Pain, Dr. Michael Salter (Original commitment \$ 5,000.00)

**Itemized expenses**

UofT Bookstore gift certificates (73)	\$3,650.00
Multimedia Earphones (70)	349.00
Facilitator framed certificates (5)	47.03
<b>TOTAL</b>	<b>\$4,046.60</b>

Appendix 5

**EXEMPLARS FROM KNOWLEDGE BUILDING ANALYSIS**

**Green Team**

**Exemplary Notes**

Category	Knowledge Forum		WebCT		KF	WebCT
	Day 1	Day 4	Day 1	Day 4	Numbers	
<b>Knowledge Building Discourse</b>	24/24 note = 48 points  (kn sharing)	8/8 notes (+1) = 16 points  (kn sharing)	26/31 notes = 52 points  (kn sharing)	16/17 notes = 32 points  (kn sharing)	<b>Day1: #498, 502, 513, 547, 528, 531, 532, 552, 555</b>	<b>Day1: #155, 192, 197, 199, 200, 203, 205,</b>
<b>Constructive Use of Authoritative Sources</b>	4/24 notes = 7 points	3/9 notes = 6 points	6/31 notes = 11 points	10/17 notes = 18 points	<b>Day1: #498, (Appendix 5)</b>	<b>Day1: #155, 192 (Appendix 6)</b>

**KNOWLEDGE FORUM EXEMPLARS – DAY 1**

EXEMPLARS OF KNOWLEDGE BUILDING DISCOURSE (exemplifying principles of epistemic agency, idea diversity and collective responsibility/community knowledge)

EXEMPLARS OF CONSTRUCTIVE USE OF AUTHORITATIVE SOURCES (evidence-based discourse) designated by asterisk\* and bold text.

**KF Note #498\***

Author: sibbs

Note #498

View: 1st Clinical Scenario-Mon.-GREEN TEAM

Creation Date: Mar 18 2002 (16:02:52)

Last Modified: Mar 18 2002 (16:06:13)

Keywords: biopsychosocial model, phantom pain

Builds On: Pain Interference

**Pain control**

**I thought I would take what you wrote and stick it in the format presented in the article for us to read**

**The article given categorizes the psychological aspect of pain into several social spheres:**

**cognition**

**copng strategies**

**social environmental variables**

## Cognition

It sounds like Mr Morris cannot stand the pain - ie. is catastrophizing the incident (especially since it was not expected)! Therefore, he is likely to feel more severe pain and be more psychologically distressed. Apparently, the article isolates this as an independent cause of depression (Mr Morris has symptoms of depression)

Also, since he is only reducing his pain score by two points, there is a good chance he is feeling like he cannot control his pain. Apparently, people who endorse higher levels of perceived control also report less pain interference with daily functioning

## Coping

Sounds like Mr Morris is diverting more attention to the pain rather than less, and this is affecting his daily function (no longer feels like taking care of himself).

It sounds like Mr Morris is very stressful and the many questions he and his wife face are affecting his mood and his desire to recover.

## Social/Environmental Factors

Incentives to remain ill - like the barrage of health care workers may not provide incentives for him to recover...I am not sure how much of a role this plays...

## References:

spiral (2002). Pain Interference. Toronto, Ontario, Canada: Interfaculty Education Initiative on Pain, Web Knowledge Forum.

## Notes that refer to this note:

iceman (2002). Ineffective pain control. Toronto, Ontario, Canada: Interfaculty Education Initiative on Pain, Web Knowledge Forum.

sonic (2002). Control. Toronto, Ontario, Canada: Interfaculty Education Initiative on Pain, Web Knowledge Forum.

## **KF Note #502 - Linked**

Author: iceman

Note #502

View: 1st Clinical Scenario-Mon.-GREEN TEAM

Creation Date: Mar 18 2002 (16:25:32)

Builds On: Pain control

### **Ineffective pain control**

It seems that the primary care personnel have thus far ignored the pain Mr Morris is experiencing. It is affecting him cognitively, physically as well as socially. What is not evident though is the severity and cause of the pain. He has just lost an arm. Is most of his pain and discomfort arising from his fear of social consequences, i.e unable to support his family be a "good" father or husband. These feelings for one reason or another may exacerbate the pain experience. Is his pain really a phantom phenomenon or is it arising from actual tissue damage caused by the surgical procedure he just underwent? One required a thorough investigation of the sources of pain to determine the appropriate course of treatment. The simple prescription of Tylenol 3's was obviously inadequate in dealing with Mr. Morris's problems. As for incentives to remain ill, from a completely cynical perspective, perhaps he is seeking further ledigation and compensation thus feeling that he need make his problems seem worse then they are?

#### References:

sibbs (2002). Pain control. Toronto, Ontario, Canada: Interfaculty Education Initiative on Pain, Web Knowledge Forum.

#### Notes that refer to this note:

redcity (2002). Untitled. Toronto, Ontario, Canada: Interfaculty Education Initiative on Pain, Web Knowledge Forum.

sonic (2002). malingering. Toronto, Ontario, Canada: Interfaculty Education Initiative on Pain, Web Knowledge Forum.

Facilitator1 (2002). Comments on discussion issues. Toronto, Ontario, Canada: Interfaculty Education Initiative on Pain, Web Knowledge Forum.

#### **KF Note #513**

Author: sparkle

Note #513

View: 1st Clinical Scenario-Mon.-GREEN TEAM

Creation Date: Mar 18 2002 (16:50:08)

### **Psychosocial factors/OT involvement**

Unless I missed it..no one introduced their discipline at the beginning of their notes..so I guess I'll introduce myself - I'm the OT on the team (unless we have two!). I would have to agree with the previous notes (as well as what we learned today) that pain is definitely both emotional and physical. Della needs to consider the biopsychosocial factors when conducting an intake interview with Frank - there needs to be a comprehensive pain assessment, complete with

information on previous illnesses, accidents, incidences of major 'pain' experiences, and even possibly delving in to how Frank has reacted to pain all his life prior to the accident. As well, it has only been 4 weeks post-injury and Frank could be at risk for depressive symptoms (e.g. lack of interest in self care, adverse impact on self esteem and family dynamics) - so this must be assessed for as well. In terms of not participating in OT, Frank needs to be engaged in collaborative goal setting in his treatment - what things are important to him and having the team facilitate achievement of those goals - the OT could increase his feelings of self-efficacy by providing the 'just-right' challenge - breaking down previously-easy activities into smaller tasks and allowing him to succeed in each component task before trying to tackle the bigger activity (e.g. succeed in picking out a shirt, pulling it on with one arm, buttoning it, all before he integrates these tasks into the one big activity of upper extremity dressing). This would certainly help with his concentration (alongside proper pain management), and will help bolster his self esteem.

Notes that refer to this note:

sonic (2002). Thank you for the OT perspective. Toronto, Ontario, Canada: Interfaculty Education Initiative on Pain, Web Knowledge Forum.

**KF Note #547 - Linked**

Author: sonic

Note #547

View: 1st Clinical Scenario-Mon.-GREEN TEAM  
Creation Date: Mar 18 2002 (21:08:46)  
Builds On: Psychosocial factors/OT involvement

**Thank you for the OT perspective**

Sparkle,

Thanks that was a great description of the role of OT! It was very helpful.

References:

sparkle (2002). Psychosocial factors/OT involvement. Toronto, Ontario, Canada: Interfaculty Education Initiative on Pain, Web Knowledge Forum.

**KF Note #528\***

Author: iceman

Note #528

View: 1st Clinical Scenario-Mon.-GREEN TEAM  
Creation Date: Mar 18 2002 (18:39:26)

**Treatment options**

We all seems to agree there are a few causes or his pain:



- 1) Tissue injury - acute, caused by the amputation or after and would best be managed via potent analgesics.
- 2) Neuropathic pain - more of a chronic pain which requires more modalities to treat eg. tricyclics.
- 3) Psychological undertones - best treated non-pharmacologically to ensure that pt. continues to function and has a positive outlook and is able to cope with everyday life.

It is imperative to determine the cause of his pain! Granted his pain will be treated but we must know the precise cause of hte pain if we are to treat it effectively. The prescription for Tyl 3's would have addresses (1) but unlikely to have adressed (2) or (3).

**KF Note #531**

Author: island

Note #531

View: 1st Clinical Scenario-Mon.-GREEN TEAM

Creation Date: Mar 18 2002 (19:00:37)

**Drug Concerns...more info needed**

Hi People:

Here's a note from your friendly e-neighbourhood pharmacy student.

I noticed while reading the letter that one of the reasons Mr. Morris' pain is not under control is that he is actually hesitant to take the acet. w/ codeine. One of the first things that I'd do would be to try and figure out what is underlying this hesitancy.

We need to determine:

1. Is it his concern about the side effects of the medication? (i.e. nausea/constipation) If this is so, does he realize that the side effects are treatable?
2. Is it for a social reason? Is it due to pride or a family tradition of avoiding medication unless it is urgently necessary? (I say this because I know my family is like this.)
3. Is he concerned about becoming dependant on the medication?
4. Does he think that the pain is unavoidable? Would he rather deal with the pain than be incapacitated by its treatment?

Once we have dealt with the underlying cause of his hesitancy, we can then address the choice of therapy itself. It is clear that 30mg of codeine q4-6 is not appropriately reducing his pain.

It is necessary to determine whether or not the pain is nociceptive or neurogenic in nature. Then, according to what is found a new agent can be chosen, likely a more potent analgesic. However, that choice has to be made with the input of the patient, taking into account the answers to the questions above.

Comments anyone?

Notes that refer to this note:

iceman (2002). Geronimo!!. Toronto, Ontario, Canada: Interfaculty Education Initiative on Pain, Web Knowledge Forum.

### **KF Note #532 - Linked**

Author: iceman

Note #532

View: 1st Clinical Scenario-Mon.-GREEN TEAM

Creation Date: Mar 18 2002 (19:08:14)

Builds On: Drug Concerns...more info needed

### **Geronimo!!**

I agree with out pharmacy prodigy. We need to determine the source, quality and nature of the pain before offering adequate pharmacological options. We can deal with the physiological side affects by offering other drugs. It is more prodent to find out any phsycolgical or behavioural problems as outlined above.

We all agree then that the cause of the pain is the most important part of treating it. We can't treat pain if we know not whence it comes from!

References:

island (2002). Drug Concerns...more info needed. Toronto, Ontario, Canada: Interfaculty Education Initiative on Pain, Web Knowledge Forum.

### **KF Note #552**

Author: sonic

Note #552

View: 1st Clinical Scenario-Mon.-GREEN TEAM

Creation Date: Mar 18 2002 (21:23:22)

### **Other treatment options**

Thank you to Sparkle and Island for the introdcutions. Knowing the perspective from which everyone is looking at the problem is helpful.

I am one of the 2nd year medical students.

We have been taking a lot about the pharmacological treatment of pain. Usually medication is first line. There are however other options. For example TENS - transcutaneous electrical nerve stimulation, or local nerve blocks. Also we should keep in mind a role for complementary and alternative medicine. Acupuncture fits very nicely with the gate theory of pain.

Notes that refer to this note:  
sparkle (2002). Treatment possibilities. Toronto, Ontario, Canada: Interfaculty Education Initiative on Pain, Web Knowledge Forum.

**Note #555 - Linked**

Author: sparkle

Note #555

View: 1st Clinical Scenario-Mon.-GREEN TEAM  
Creation Date: Mar 18 2002 (21:51:13)  
Keywords: assessment, holistic, patient education  
Builds On: Other treatment options

**Treatment possibilities**

Island...I think you did a great job at describing how we need to determine the reasons for his pain and difficulties with his medication...Sonic - I'm glad to see we're on the same page here - we must consider the psychosocial aspects of Frank's life in order to gain a holistic view of his perception of pain...sonic - we definitely cannot dismiss alternative and complementary therapies - the key is to strike a balance between all available treatments - the first step is to have an interdisciplinary team assessment or some type of comprehensive assessment that shows us his current status..then ask him what his goals are..once we know his goals, compliance with treatment is that much easier because he is intrinsically motivated and the treatment is meaningful to him....as well we all forgot about Frank's family - we need to have an education session with him, his wife and daughters (since they are 12) and discuss how one adjusts to an amputation/traumatic injury - this way the family isn't left in the dark and no resentment is created between each other..instead Frank's family will ideally become a foundation of support and understanding..

References:  
sonic (2002). Other treatment options. Toronto, Ontario, Canada: Interfaculty Education Initiative on Pain, Web Knowledge Forum.

## Appendix 6

**WEBCT EXEMPLARS – DAY 1**

EXEMPLARS OF KNOWLEDGE BUILDING DISCOURSE (exemplifying principles of epistemic agency, idea diversity and collective responsibility/community knowledge)

EXEMPLARS OF CONSTRUCTIVE USE OF AUTHORITATIVE SOURCES (evidence-based discourse) designated by asterisk\* and bold text.

**WebCT Note #155\***

Message No. 155: [Branch from no. 62] posted by multipain (multipain) on Mon, Mar. 18, 2002, 16:44

**Subject: Re: Discussion Issues 1 Green Team**

Hi, I'm a second year nursing student. Here are my thoughts.

1.) Considering the impact of pain on Frank as a person, he fears never being able to work again, fears being faced with unachievable expectations from the WSIB, and fears never being able to coach another soccer league or continue as a former community center leader. In his own words, "those days are over".

**And, according to Jensen, M. P. et. al.'s "Cognitions, coping and social environment predict adjustment to phantom limb pain," the three psychosocial factors of cognitions (thoughts, beliefs, appraisals), coping responses, and social environmental variables are emphasized in the adjustment to pain.** In terms of cognition, Frank's fears predominate. His pain rating is between 7 and 9. And, his uncomfortable self image as he hides his arm under his coat may affect his pain experience. He also finds it difficult to concentrate. In terms of coping, he is finding it difficult to participate and reluctant to stay at his OT rehab appointments. He attends daily nursing appointments, yet his self-care interest have been declining. Finally, in terms of social environmental factors, his wife provides great social support although he relies heavily on her for his ADLs. (Increased social support is consistent with lower pain levels and depressed mood.) However, Frank's reduced activity level may have a negative impact on his pain.

2.) More information regarding Frank's coping strategies

may be useful. For example, what helps and/or makes his pain worse. What past experiences with pain in him and/or his family he has had. And what coping strategies he/they previously used. Also, information into his perception on pain and management re: why the fear of taking Tylenol #3's regularly, may be useful. In terms of social support, it would be best to ask him personally for his own perceived level of social support. Similarly, it would also be useful to know how he personally experiences pain, whether or not he is feeling depressed and if he is getting enough sleep and rest or not, and how it is affecting his daily life. Finally, inquiring into the quality, location, and frequency/timing of the pain is also important alongside his rating of 7 to 9 out of 10.

The pain experience is also better understood via the underlying physiological mechanism of phantom limb pain. Consequently, following Frank's severe and persistent injury, alteration in the biochemical properties and resulting hyperexcitability of dorsal horn neurons may have lead to spontaneous pain and decrease in the threshold of pain. With peripheral sensitization, repetitive C fiber firing and consequent opening of NMDA-type glutamate gated postsynaptic ion channels, wind-up may have occurred producing a long-term change in the dorsal horn neurons. Centrally sensitized, secondary afferents would send action potentials up the spinothalamic tract to corresponding brain regions leading to a persistent sensation of pain appearing to originate from his amputated arm.

So accordingly, Frank's experience of chronic pain (in acute pain, the mechanism would be the same without the long-term change to the CNS) is real and can be explored through the multidimensional aspects of pain.

By multipain.

[Prev Thread] [Next Thread] [Prev in Thread] [Next in Thread]

#### **WebCT Note #192\***

Message No. 192: posted by bdyland (bdylan) on Mon, Mar. 18, 2002, 19:47

**Subject: hello, morphine and other issues**

Hello I'm an OT4 medical student as well. I agree with everything that has been written thus far, and would like a better description of the pain (onset, duration...) Like

jllb, I question why there was a switch from the morphine to an NSAID, especially if Frank has fear's regarding the Tylenol 3. did he have a negative experience in the past with T3's? If the morphine worked in the hospital, it should be prescribed as an outpatient. **There are misconceptions of it's addictive nature, however, psychological dependence is uncommon (< .1%, in "misbleiefs about pain management" tuesday's readings).** People with previous addictions are more susceptible, so this should be explored if he does return to morphine.

Regarding psycho-social issues, it seems that Frank is blaming himself in ways for the accident, questioning choice of volunteering to work that particular shift the night of the accident. It is a common phenomenon amongst those experiencing losses (ie. death, family members of individuals who commit suicide,..). He must be reassured, that it is not his fault. Frank also seems to be defering to his wife to answer questions and should be encouraged to speak on his own. perhaps he could speak to the Health care profesional on his own. I agree, that he must be encouraged that his stature in the community has not changed and he can continue to coach and do other things. Finally, I agree with the multipain and others who suggest determining other factors ie pain such as past experiences, ect. We must also determine cultural factors, including religious background and ethnicity.

Finally, several people have alluded to depression, we must further explore that issue asking about mood, interest, sleep, appetite, energy, suicide, guilt, psychomotor slowing and concentration. We should then explore management of depression via CBT or meds if necessary.

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### **WebCT Note #197**

Message No. 197: posted by fred (fred) on Mon, Mar. 18, 2002, 20:06

#### **Subject: introduction and thoughts**

Hi, everyone! "Fred" from pharmacy here. I agree that Frank's pain interferes with activities of daily living and substantially decreases his quality of life. This also places stress on his family. I'd like to know the dosing schedule of the morphine. How is he taking the Tylenol? Tylenol 3 is usually given 1-2 tablets every 4 hours as

required. We heard today that patients may trust health care providers to give the best pain relief. Patients may also prefer to suffer quietly rather than complain. How severe was the pain Frank experienced while in hospital? Does the attention and monitoring he received there make a difference in his experience of pain? Frank may also be among the subset of patients who are resistant to codeine. Has he taken any drugs which induce the liver P450 enzymes that metabolize Tylenol? Does he have drug or food allergies that would preclude using a different analgesic? My guess is that Frank has heard about acetaminophen liver toxicity and that's why he doesn't want to take Tylenol. Liver toxicity is usually seen in chronic alcoholics who take Tylenol overdoses. (Information about social history, drug history, and medical conditions would be helpful in deciding on drug therapy.) Even so, the reports of liver toxicity are relatively rare (CPS 2001). If Frank is stopping himself from using a potentially effective drug, then he should be educated about the actual risks. Has someone sat down with him and talked about the benefit:risk ratio for Tylenol use? Tylenol has analgesic and antipyretic effects thought to be due to inhibition of prostaglandin synthase (the same mechanism as for ASA and related drugs). Tylenol also seems to increase pain threshold and is equipotent to ASA in terms of analgesic and antipyretic properties. Other choices for the treatment of acute pain include ASA, ibuprofen (Advil), and naproxen. NSAIDs are for minor to moderate pain, while the opioids are for moderate to severe pain. Codeine can be constipating and should be given with stool softeners like Colace 100-200 mg/day and/or bulk-forming laxatives like Metamucil 4.5-20 g (taken with increased fluids). That's a lot to read, but it should be a start!

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### **WebCT Note #199**

Message No. 199: [Branch from no. 181] posted by black (black) on Mon, Mar. 18, 2002, 20:41

**Subject: Re: hello**

In terms of pain killers, we could try a slow release narcotic patch. What if we try ibuprofen and codeine?

With pain killer prescription, maybe we should slowly adjust up to the level he is comfortable with. For instance, if tylenol 3 doesn't work. Go up a notch and

try percocet. Jumping to morphine without trying the "in between" may not be the best way to go.

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**WebCT Note #200**

Message No. 200: [Branch from no. 192] posted by black (black) on Mon, Mar. 18, 2002, 20:43

**Subject: Re: hello, morphine and other issues**

Correct me if I'm wrong but T3 doesn't have any NSAIDs in them....

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**WebCT Note #203**

Message No. 203: [Branch from no. 193] posted by black (black) on Mon, Mar. 18, 2002, 20:51

**Subject: Re: What Della should know**

I also wonder if Franks lesser frequency of cleaning his wound has affected his pain.

Can someone out there update me on the "normal" post op signs of an amputation? Is it normal to have drainage? Is it pus coming out? If this is a complication from not cleansing the wound, is it a possibility that there is an infection? Should we consider antibiotics?

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**WebCT Note #205**

Message No. 205: [Branch from no. 197] posted by black (black) on Mon, Mar. 18, 2002, 20:55

**Subject: Re: introduction and thoughts**

I also think that Frank may not be taking adequate therapeutic doses of T3...

we need him to take close to 1000mg of acetamin and around 60mg of cd...

what would be the best way of getting this? 3 T2's or 2 T3's plus a regular T?



Appendix 7

**UNIPROFESSIONAL COLLABORATIVE PAIN MANAGEMENT PLAN**  
**SAMPLE KNOWLEDGE FORUM NOTE – DAY 3**

**KF DOCTORS PLAN**

**Author: shadow**

**Note #700**

**View: 3rd Clinical Scenario-Wed.- Doctors**

**Creation Date: Mar 20 2002 (19:43:23)**

**Last Modified: Mar 20 2002 (19:51:41)**

**SUMMARY: goals and management**

Frank's goals and what's interfering with them:

-ADLs/IADLs: becoming functionally independent. At this point Frank is not very compliant with his rehabilitation regimen because of pain which interferes with his ability to do things and to concentrate.

-Complete wound healing. His care of the operative site is also affected by his pain.

-Getting and learning to use a prosthesis. He expresses worry about not being able to do it, also associated with pain.

-Being comfortable with his self-image, relieve the feelings of guilt, alleviate his worries towards his family.

-Ongoing support at home.

-Getting back to some things he used to do: coach the girls soccer team, becoming active in the community.

-Future employment: being able to meet WSIB expectations.

-Adequate pain control. This is presently hindered by his fear of addiction and side effects.

Management plan:

**PAIN**

-This is a modifiable factor which is having a tremendous impact of the patient. The goal here would be to get the pain down to a level that allows Frank to get on with his life.

-First get a detailed assessment of the experience of pain using the McGill Pain Questionnaire or the Brief Pain Inventory (which are 2 valid and reliable tools) to define his pain more clearly and measure a baseline against which the effectiveness of the management can be compared. It would be important to get Frank's personal accounts of his pain (not influenced by his wife). The assessment of pain will also allow identification of whether there is neuropathic pain only or in combination with nociceptive pain. Repeating the assessment throughout the management will allow us to follow the progression of his pain.

-Second is the treatment:

\*Pharmacotherapy: before any Tx is started it will be necessary to educate Frank on the use of opioids for the treatment of pain and addiction. For phantom pain, it has been suggested that amitriptyline to treat the neuropathic pain and Percacet for break-through pains is a treatment of choice.

\*Other modalities: TENS has been found to be useful with phantom pains. Relaxation techniques for stump muscles and biofeedback with a physiotherapist will be useful.

-Third is to monitor Frank's progress regularly. This can be done by asking him to come to the clinic once a week at the beginning for assessment and then adjust the frequency of visits depending on how the pain changes.

#### OCCUPATIONAL THERAPY / PHYSICAL THERAPY

Rehabilitation should be continued with one-handed techniques on dominant side, hand dominance transference training. This should be followed as quickly as possible with fitting of a prosthesis and teaching him how to use it. In the meantime, he should be evaluated for his need for assistive devices at home to make his life easier while he builds skills for independent living.

#### WORKING ARRANGEMENTS

Referral to an occupational health doctor would be recommended so that a plan can be worked out in collaboration with the WSIB and/or his employer for Frank's return to employment (when he is ready). This plan should be developed with reasonable expectations to ensure a good reinsertion in the workplace.

#### COUNSELLING

It is important to deal with Frank's issues with his self-image and his feelings of guilt and helplessness. This can be done through a psychiatrist, a social worker or a clergyperson. Dealing with these issues will open the door to getting Frank back to accept and overcome his handicap and return to what he used to do in the community as well as coaching.

#### PROGRESS

It has been suggested that one of the health professionals responsible for Frank's care should take on a more central role in his care. This person would be responsible for following Frank's overall progress and relay relevant information to appropriate persons when it is needed. This person would also be receiving update and feedback form all of those involved in Frank's care.

#### FRANK AS A PERSON (NOT AN ILLNESS)

Once the management plan has been elaborated, it would be important to discuss it with Frank (in "doses" that he is able to tolerate) and get his input on whether this suits his needs and determine how fast he would like to go with it. It would also be useful to get his family involved in this plan to increase the chance of good compliance, and promote his relief from pain through a supportive environment.

Notes that refer to this note:

hedgehog (2002). Big thanks. Toronto, Ontario, Canada: Interfaculty Education Initiative on Pain, Web Knowledge Forum.

Facilitator5 (2002). Untitled. Toronto, Ontario, Canada: Interfaculty Education Initiative on Pain, Web Knowledge Forum.

**UNIPROFESSIONAL COLLABORATIVE PAIN MANAGEMENT PLAN**  
**SAMPLE WEBCT NOTE – DAY 3**

**WebCT DOCTORS PLAN**

**Message No. 312: posted by seven (seven) on Wed, Mar. 20, 2002, 18:44**

**Subject: ASSESSMENT & MANAGEMENT OF POST-TRAUMATIC PAIN**

I have elected myself to provide the summary note (a compilation of all ideas contributed). I think that everybody has contributed quite a bit, and feel free to add more, or change anything that i include in this summary:

"1. According to the clinical information provided, what are the patient's goals? What are the pain problems interfering with these goals? What factors contribute to these pain problems? 2. How would you manage Frank's pain problems? Create a management plan. "

**GOALS AND MANAGEMENT:**

a)for frank to function independently - Frank will need some re-learning of some of the basic activities of daily living - work with his OT to plan activities that will most easily teach him how to do daily tasks using his amputated limb and functional hand - start getting used to the idea of a prosthetic

b)to control his pain - reduce pain to more tolerable levels (tylenol 3's aren't working well, in the hospital morphine worked well) - Frank does seem to have more than one pain: he has allodynia when you touch the end of this limb and he is also experiencing phantom limb pain. - phantom limb pain is neuropathic and there is no clear choice of treatment to alleviate this pain in the literature so it is not obvious how to approach treatment of the pain - His pain being 7-9/10 is considered severe enough by the "Three-Step Analgesic Ladder of the WHO" to treat with "stage 3" opioids(morphine, oxycodone, hydromorphone or fentanyl). an initial try with morphine for the pain, with proper education regarding possible side effects, risks of addiction, etc. - try non-pharma treatments like heat, desensitization of the residual limb (applying stimulation to the residual limb to desensitize the nerves), acupuncture, etc. - He may benefit by keeping

his limb warm and dry - neurologist is currently prescribing a TCA and another narcotic - patient education regarding limb pain

c) to facilitate other vocational and extra-curricular activities - to re-establish his self-identity/role in terms of employment and community interests (eg. coaching soccer) - get back to work in some capacity either at the butcher shop or adapting tasks for other jobs

d) to address issues around how the rest of his body/mind is functioning - stabilize his emotional state - concerns with body image - fears that he won't be able to work, fears of WSIB expectations - find out how the WSIB works and what kind of expectations they have for recent amputees in terms of getting back to work - psychological components that we must address: is he reliving the accident and reliving the trauma over and over again during the day (PTSD)? - assess for signs of anxiety and/or depression - suggest Frank speak to a psychiatrist to assess his mental state wrt his mood, problems with body image, and issues of control over his care - investigate what's preventing him from sleeping: pain, worry, depression, other? - measure how Frank is doing by watching his behaviour in our office, by asking him if he notices an improvement or not, by asking his family if they notice any change (positive or negative). - Frank needs to develop a more positive self body image - refer and educate regarding rehab as needed. refer either to hospital (e.g. Sunnybrook Centre for Independent Living for those with prostheses) or community services (e.g. prosthetic clinic), St. John's rehab etc.

e) to assess his family/financial supports - his wife Connie has taken a leave of absence from work and he is obviously not working - the pressures on his wife and twin daughters - how long can they afford this situation? - if ADL's are impaired, look into homecare or CCAC's - what kind of government financial support Frank and his family could receive while he isn't working

f) other medical management - include investigations to make sure the wound has healed properly, and continuing to clean and take care of it - frequent followup visits to get feedback from Frank to monitor if we're on the right track

i tried to summarize, but there were so many good ideas :) 7

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