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Collaborating to Innovate and Improve Patient-Centred Care at Hamilton Health Sciences

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Abstract

Although working in teams is common for most healthcare practitioners today, the Romanow Report (2002) directed our collective attention towards the need for effective interprofessional collaboration in primary healthcare settings. Subsequently, federal policy and funding agencies like CANARIE Inc. and the Office of Learning Technologies have focused efforts on promoting interprofessional practice using new technologies. Ideally, effective interprofessional collaboration leads to improvements in patient care – yet how do organizations assess where they are and need to go with respect to optimizing teamwork and collaborative practice to improve patient care? This was exactly the design challenge taken up by Hamilton Health Sciences (HHS) in a recent collaborative pilot project with the Institute of Knowledge Innovation and Technology (IKIT) at the Ontario Institute for Studies in Education of the University of Toronto. An interprofessional Task Force was struck to develop a new philosophy of patient care for HHS (Cunningham et al., in press; Russell et al. 2004). The main challenge was to shift teamwork from exclusive reliance on face-to-face meetings and use of one-way communications technologies (e.g., voice mail and e-mail) towards asynchronous collaboration in a communal database technology called Knowledge Forum®. Over the past 18 months, results of the project reveal that participation in Knowledge Forum® successfully supported interprofessional teamwork and collaboration; democratized the knowledge-creation process; reduced turnaround times for interprofessional teamwork; and provided an ideal environment for sharing multiple sources of evidence, including patient survey data to support the knowledge-creation process. New technologies that support interprofessional teams to produce public knowledge of value to the local and extended community (such as the new philosophy of patient-centred care that emerged in this project) are powerful mediums for hospital based teamwork.

BACKGROUND

Ideally, healthcare institutions engage in a continuous cycle of improvement: creating, evaluating and improving upon current best practices in patient care and service delivery. However, the conceptual work involved to extend beyond current best practice by creating new and innovative models of care is a challenge for teams charged with this work given time constraints and lack of human resources in healthcare generally. At Hamilton Health Sciences (HHS), the challenge to create a new philosophy of patient-centred care was further challenged by the time-distance problem imposed by the four hospital sites and shift-work, making it difficult for the entire team to meet face-to-face regularly to set and accomplish goals. The project reported on in this paper aimed to use a communal database technology called Knowledge Forum® as the primary work environment for an interprofessional team whose shared goal was to create a new philosophy of patient-centred care for Hamilton Health Sciences.

METHOD

Technology and Pedagogy

Knowledge Forum® is a second-generation computer supported learning environment (CSILE). It is a communal database technology that is accessed using a Web browser. Functions and features of the software support knowledge-building – a pedagogical model developed by Bereiter and Scardamalia (1993) to support collaborative learning, progressive problem solving, synthesis and innovation. The content of all Knowledge Forum® databases is entirely the construction of participant groups. Multimedia notes (e.g., text, audio, video, graphic) are entered into views, or communal workspaces. The purpose of collaboration in Knowledge Forum® is to build knowledge of use to the local and extended communities.

Unlike on-line discourse communities such as support groups or interest groups that learn by sharing knowledge, the sole purpose of collaboration in a Knowledge Forum® database is knowledge-building. Knowledge-building is distinguished from learning in that the former emphasizes the creation of new knowledge, while the latter emphasizes the internalization of knowledge. Communities and organizations dedicated to knowledge-building are committed to continual improvement and innovation that will benefit not just individual learners, but groups, networks and societies of learners and practitioners.

Project Goals

The goal of this project was to support the Patient-Centred Care Task Force at Hamilton Health Sciences (HHS) develop a new philosophy of patient-centred care that would underpin development of an interprofessional care delivery model. An interprofessional team of healthcare professionals collaborated over 14 months in an on-line communal database technology accessed over the Internet. At the end of the project, a new philosophy of patient-centred care was created with the potential to have impact on the over two million patients and families in southwestern Ontario served by HHS. In addition to using on-line technology for interprofessional teamwork and e-learning, data from over 600 patient and family surveys were inputted into the on-line environment and served as the foundation evidence for creation of a new philosophy of patient-centred care at HHS. The ability to include patient perspectives (data) in an active e-learning environment was a major innovation of this project.

Strategic Objectives

1. Design of a communal knowledge-building environment (e-learning environment) using Knowledge Forum®.
2. Generation of a new philosophy of patient-centred care by Task Force.
3. Design of strategies to incorporate patient-family feedback in design of new patient-centred care philosophy (via focus groups and surveys).
4. Development of an integrated Knowledge-building/Knowledge-management System.

Overview of Accomplishments

This project succeeded on three major fronts. First, the on-line environment successfully supported e-learning and knowledge-creation for the interprofessional team that comprised the Patient-Centred Care Task Force. Second, the project succeeded at integrating knowledge-management systems such as on-line dynamic reporting, automatic notification systems, e-mail repositories and on-line surveys directly in the e-learning on-line environment. The seamless integration of knowledge-management and knowledge-creation systems supported administrative functions, such as quarterly reporting, and conceptual work, such as the creation of a new philosophy of care for HHS. Finally, a unique methodology derived from market research (conjoint analysis) was used to interpret survey data and reduce turnaround times for knowledge-creation at HHS.

The e-learning environment created by the Task Force will continue to be used during the next phase of the project – the implementation phase. As well, three new e-learning projects in development are direct 'offshoots' of this project (#004). Specifically, future plans to use the model of e-learning and collaborative knowledge-building used in this project will be used in three new areas, including: 1. on-line support and expert knowledge repository for Lupus patients; 2. occupational therapy orientation and research environment; 3. project planning and research environment for a CIHR funded child/family research project.

Participants

Hamilton Health Sciences (HHS) is among Canada's largest teaching hospitals and provides the most comprehensive range of health services of any Ontario hospital. The Patient-Centred Care Philosophy (PCCP) Task Force (N=24), an interprofessional team from nursing, psychiatry, occupational therapy, physiotherapy, social work, organizational development, speech language pathology, child life therapy and dietetics will engage in e-learning and collaboration over the course of this project to develop a new model of patient-centred care for HHS.

The majority of participants (n=20) were between 30 and 50 years of age. Approximately one-third of all respondents have less than 10 years experience, one-third of all respondents have an average of 15 years experience, and one-third of all respondents have an average of 25 years experience. The dominant professional group in this sample is nursing. Other professional groups include organizational development, dietetics, psychology/psychiatry, physiotherapy, occupational therapy, IT education and social work.

The majority of participants (n=22) had an Internet connection at home and all participants (n=24) had an Internet connection at work used primarily for e-mail, education, general browsing and work-related activities. The majority of participants (n=14) reported being "somewhat skilled" using Internet- and Intranet-based technologies, six respondents reported being skilled and three reported being very skilled Internet users. Responses varied with respect to how much time respondents spend using the computer at work. The majority (n=15) report using the computer between 7 and 20 hours per week, while six participants reported using the computer more than 20 hours per week. About half of all participants reported spending less than two hours per week connected to either the Internet or Intranet. The majority of participants (N=18) reported having no previous experience with on-line collaboration, e-training or professional development using computer technologies.

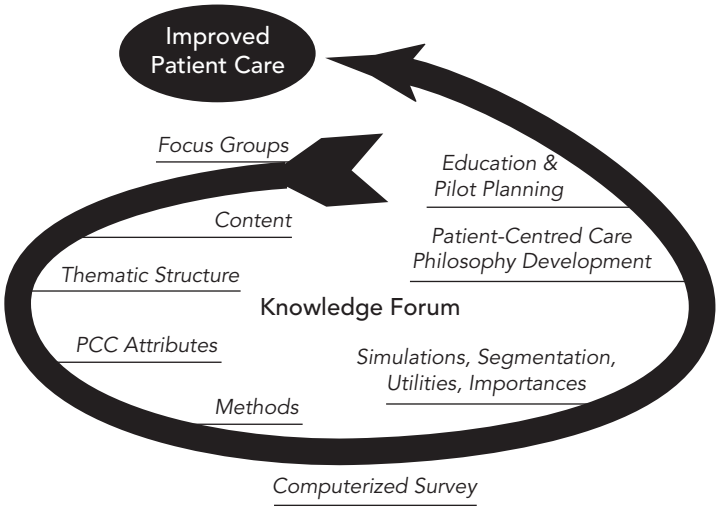
Institute for Knowledge Innovation and Technology (IKIT) conducts research, develops technology and helps build communities aimed at advancing beyond "best practice" in education, knowledge work and knowledge-creation. An international community from a variety of sectors is actively engaged in pooling intellectual resources and participating in projects. The IKIT research team (N=3) collaborated with HHS participants to develop best practice models of e-learning and on-line collaboration.

Iterative Design

An iterative design methodology was used to guide project goals and collaborative teamwork and generation of a new philosophy of patient-centred care and is consistent with design research methodologies generally used in knowledge-building communities across sectors (Brown 1992; Collins 1999; Collins et al. 2004).

Figure 1 illustrates the Iterative Design framework for generation of the patient-centred care philosophy at Hamilton Health Sciences. All stages of iterative design were captured in the e-learning environment Knowledge Forum®. Views (or communal workspaces) were created to support the PCC Task Force and engage in on-line collaboration and knowledge-work. Views mapped on to stages in the process described in Figure 1 and developed by Dr. Chuck Cunningham, Hamilton Health Sciences, Laidlaw Chair for Patient-Centred Care (graphic by Susana LaRosa, IKIT).

Figure 1



RESULTS

Database Overview

To review, the following direct outcomes were achieved:

1. Development of effective and productive e-learning communal database (59 views or communal workspaces and 902 notes related to creation of a new philosophy of care).
2. Development of effective continuous evaluation methodology to assess knowledge-building indicators and interprofessional collaboration.
3. Development of on-line survey methodology (pre- and post-questionnaires).
4. Development of new philosophy of patient-centred care.
5. Development of integrated e-tutorials and knowledge-management systems into e-learning environment.
6. Development of innovative iterative design methodology to include multiple sources of patient evidence including focus groups, conjoint analysis and surveys (see Figure 1).
7. Development of virtual meeting methodology, Virtual Tour and Patient-Centred Care educational and Public Relations' resources including poster, Educational Video.
8. Development of future designs to foster e-learning in three new contexts: Lupus Patient Support Pilot Project developed by Anne Matheson, Project Coordinator/ Patient Representative at HHS to use on-line broadband technology to support Lupus Patients in Canada); orientation and research environment for Occupational Therapy at HHS (Jennifer Henderson, Chief Occupational Therapy); and patient/family research database (C. Cunningham, Laidlaw Chair in Patient-Centred Care). Development of effective and productive e-learning communal database (59 views or communal workspaces and 902 notes related to creation of a new philosophy of care).

Self-Report Participant Satisfaction Survey

The following results are the e-learning outcomes that were identified by participants (N=12) resulting from the use of the collaborative knowledge building technology, Knowledge Forum®.

- 73% of participants reported the technology reduced the number and frequency of face-to-face meetings
- 73% of participants reported the technology supported/encouraged participation by Task Force members
- 64% of participants reported technology helped to keep Task Force's work on schedule
- 100% of participants reported their knowledge and expertise using technology increased as a direct result of using the technology
- 45% of participants reported their knowledge of professional practice issues increased
- 73% of participants reported an improvement in inter-professional communication
- 91% of participants reported Knowledge Forum® facilitated access to resources (documents and ideas)
- 55% of participants reported Knowledge Forum® supported individual learning
- 64% of participants reported Knowledge Forum® supported team learning

- 36% of participants reported Knowledge Forum® supported their professional practice
- 82% of participants reported Knowledge Forum® assisted in the development of the emergent patient-centred care philosophy
- 45% of participants reported Knowledge Forum® supported productive work between HHS Task Force and IKIT researchers
- 64% of participants reported Knowledge Forum® helped to develop new or more productive relationships with peers and colleagues
- 64% of participants reported Knowledge Forum® supported shared responsibility for project completion by participants
- 64% of participants reported IKIT researchers provided timely responses to questions and concerns

Integrated Knowledge-Management Systems

1. Purposeful Welcome/Orientation Page directed participants to ongoing work in progress including both administrative and conceptual working views (communal work spaces in Knowledge Forum® technology).
2. On-line Knowledge Forum® Tutorials were integrated into the e-learning environment. These technical training resources proved essential during the start-up phase (Q1 2003) due to restrictions imposed by SARS.
3. E-mail repositories were built into Knowledge Forum® so that all e-mail could be routed directly to the e-learning environment to facilitate knowledge sharing/transfer.
4. Program written to generate a Dynamic Quarterly Report from the e-learning environment to CANARIE project Web site. All coded deliverables in the Statement of Work (SoW) were inputted into Knowledge Forum® as notes. Participants responsible for reporting on progress updated those notes in the deliverable series/views (e.g., 1100 Iterative Design; 1200 Implementation; 1300 Evaluation; 1400 Project Management) and updated notes quarterly. These notes were fed directly to the project Web site and the quarterly report was dynamically generated. The seamless integration of administrative and knowledge-management activities in the active e-learning environment improved turnaround times for collaborative report generation.
5. Automatic notification – participants were automatically notified by e-mail of new notes contributed to their Knowledge Forum® database intermittently throughout the life cycle of the project. The Notification feature built into Knowledge Forum® was not operational until the later stages of the project. The potential to use this feature was not exploited fully since the tool was in the development stages during the life cycle of this project. However, we did pilot the feature towards the end of the project and it was well received by participants. It has the potential to be a powerful project and knowledge-management tool in future designs as it serves to manage information overload.
6. On-line pre-and post-evaluation surveys – all participants received an e-mail with a URL to the on-line survey, the results of which were routed to private views in the e-learning environment, Knowledge Forum®. This significantly reduced time required for data collection and analysis by researchers. By having all data easily accessible in a communal space more than one person could conduct analysis and

use emergent data to compare self-reports to actual performance within the e-learning environment. The ease of on-line survey administration also significantly reduced turnaround times for questionnaire completion – the majority of respondent surveys were submitted within a two-week period.

Interprofessional Knowledge-Building Outcomes

Several new analyses were created for this project to assess interprofessional collaboration. Among them, was a customizable relative participation analysis. The participation score for an author is the mean of the author's relative participation levels on selected measures. Measures for this analysis included standard knowledge-building activities such as number of notes created, linked, read and so on, and also included the number of words used, the number of distinct words used and the number of words/notes. Table 1 shows the mean participation scores for each group: Steering Committee (subcommittee of Task Force), IKIT and Task Force.

Table 1: Mean Relative Participation Scores

	Steering Committee	IKIT	Task Force
Mean	45.5	65.6	35.2
Standard Deviation	32.48	46.38	29.1
Median	37	97	27
Evenness	0.8022	0.6308	0.8824

The analysis in Table 1 shows that, although IKIT did achieve a higher participation score than the other groups, the evenness score was lower suggesting that IKIT participants contributed in more varied ways than did the other groups (e.g., IKIT researchers M. Lamon and B. Melnick contributed many analytic toolkit results and tutorial notes that inflated the "notes contributed" score relative to HHS Steering Committee and Task Force opportunity to "contribute notes"). With respect to HHS Steering Committee and Task Force participation, however, results indicate active levels of on-line collaboration.

Table 2: Database Thread Analyses

Size of build-on trees participated in:	
Small (2-5 notes)	68
Medium (6-20 notes)	17
Large (21-40 notes)	0
Very Large (over 40 notes)	0
(The largest tree participated in has 19 notes.)	

Knowledge-building discourse means that there is a continuous improvement of ideas. One measure of improvable ideas in educational settings is large threaded discourse trees containing over 20 notes per thread. Table 2 indicates that most threaded discourses were small, containing between two and five notes. However, these results are consistent with performances in other occupational healthcare settings (Russell

and Perris 2003; Russell et al. 2000) that are using Knowledge Forum® for project-based collaboration and learning. Results here reflect the time-sensitive nature of project teamwork in hospital settings and the goal-oriented (versus exploratory) nature of this work.

INTERPROFESSIONAL DISCOURSE

An original goal for this project was to develop an interprofessional practice model. This goal was amended three months after the project started for two reasons. First, SARS delayed training and project development. Second, the need to develop a "philosophy of patient-centred care" that would underpin development of an interprofessional care-delivery model was determined to be the priority. For that reason, the goal shifted from development of an interprofessional care-delivery model, to creation of a new philosophy of patient-centred care. However, interprofessional discourse and collaboration between Task Force, Steering Committee and IKIT was still of interest in the context of designing and evaluating strategies and processes to foster interprofessional teamwork (the mandate of the CANARIE/OLT fund). In particular, we were interested in discourse patterns between these groups to examine the extent that all are central contributors to the shared goals of the community. We conducted analyses of group interactions in terms of reading and linking within a group and between groups for the Steering Committee, the Task Force and the IKIT team.

Figure 2 shows the percentage of notes read relative to the number of notes available to be read; as an example, the percentage of notes that authors in the Steering Committee read, on average, that were written by the Task Force. For reading within one's own group, one's own notes are not included. Interestingly the Steering Committee read many more of the Task Force's notes than their own notes, but there does not seem to be any difference for the Task Force in terms of reading their own group's notes and the Steering Committee's notes. Results indicate average to above average readership and collaboration within and between groups.

Figure 2: Percentage of Notes Read Between and Within Groups

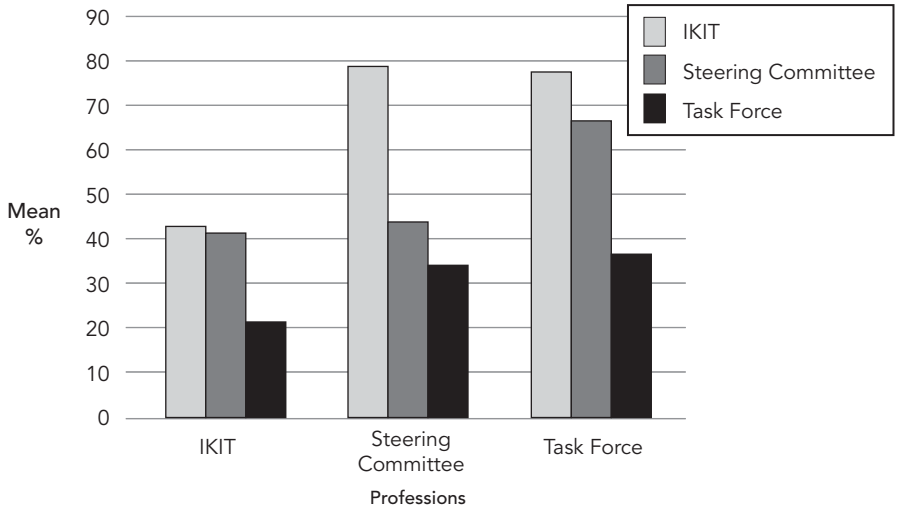


Figure 3: Percentage of Notes Linked Between and Within Groups

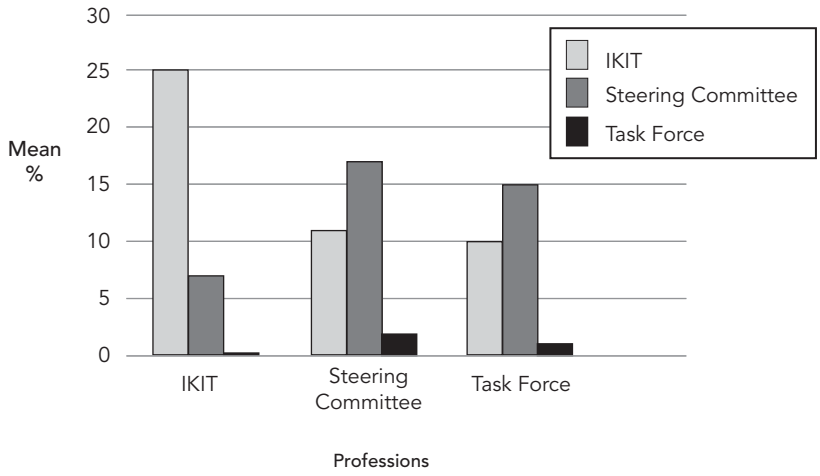


Figure 3 presents percentage scores for interactions in the database between groups. A score of 100, for example, suggests that every opportunity for linking (build-ons, annotations, referencing) was realized. Authors may link to the same note more than once, and so the relative score can actually exceed 100, and a score of 100 does not necessarily mean that every available note was actually linked to. As can be seen, the Task Force rarely linked to either their own or other group's work. In traditional hospital-based Task Forces, the Steering Committee seemed to 'drive' the work processes and these results mirror that phenomenon.

One hypothesis to interpret the lack of distributed knowledge work between the Steering Committee and Task Force was 'role ambiguity.' A number of Task Force members reported not being clear about expectations. Interestingly, however, one positive indicator of the democratization of knowledge work over the course of the project was the inclusion of more members on the Steering Committee, including the administrative assistant/project co-coordinator. The issue of goal setting and intentional participation in on-line knowledge-building communities was an ongoing issue discussed by the Steering Committee at their weekly teleconferences. Design strategies for the next iteration designs (implementation phase) include strategies to negotiate roles and responsibilities among all members of the on-line community. Throughout the duration of this project, the Steering Committee enlisted the participation of team members in ongoing work inside and outside the database. The responsibility for knowledge work shifted throughout the course of the project to as sub-committees emerged. Not all Task Force participants used Knowledge Forum® as their primary medium for collaboration while the Steering Committee consistently used Knowledge Forum®. Face-to-face meetings and e-mail exchange augmented knowledge work inside and outside the database.

The analyses presented above give a rough idea of database activity, but do not address specific critical episodes in a knowledge-building community aimed at solving real problems. The following analyses present that work.

Types of Participation and Tasks

One principle for knowledge-building communities is a focus on real ideas and authentic problems (Scardamalia 2002). The main goal for this project was to develop a patient-centred care philosophy – an authentic problem for HHS. Achieving the patient-centred care philosophy entailed several sub-goals. In this section, we examined conceptual views where sub-goals were realized to understand participation. We identified five distinct sub-goals:

1. Introduction to e-learning (Views: Knowledge Forum® Tutorial, Help/FAQ; Interprofessional biographies, Interprofessional Practice Model Development);
2. Design of a focus group methodology and results from patient focus groups (View: Focus Group Methodology);
3. Design of a survey based on focus group concerns (Views: Draft 1: Emerging Patient Care Themes, Draft 2: Emerging Patient CARE Themes, Draft three: Emerging Themes, Emerging Themes - Draft 4);
4. Implementation of the survey and analyses of survey results (Views: Entries re: Attributes and Attribute Levels, SURVEY METHODOLOGY-Working out the details, Survey Results);
5. Construction of e-learning and healthcare educational products (Views: CANARIE Conference Vancouver, Education Planning, Patient-Centred Care Philosophy Development Jan 04, and Video Production).

We reviewed levels of participation by the Steering Committee, the Task Force and IKIT in each phase. The Steering Committee was the core group concerned with developing the philosophy for Hamilton Health Sciences. Some members of the Task Force were active members in the community. These participants both read others' notes and contributed their own ideas. There were also legitimate peripheral participants (LPP) meaning that they followed the dialogue in the database reading more than 20% of notes but not contributing their ideas or building onto others' ideas. Wenger et al. (2002) have identified this type of participation as an acquisition phase where newcomers learn from active members. Finally, there were those who read less than 20% of notes that we labeled as no meaningful participation (NMP). Table 3 shows the number and types of participants for each phase.

Table 3: Numbers of Participants for Each Phase in the Project

Steering Committee (N=4)					
Types of Participation	Introduction	Focus Group	Survey Design	Survey Results	Products
Active	4	4	3	3	4
LPP	0	0	1	0	0
NMP	0	0	0	1	1
Task Force (N=18)					
	Introduction	Focus Group	Survey Design	Survey Results	Products
Active	17	4	10	7	8
LPP	2	7	4	2	2
NMP	1	8	5	4	4
IKIT (N=3)					
Active	3	1	0	2	3
LPP	0	2	3	1	0
NMP	0	0	0	0	0

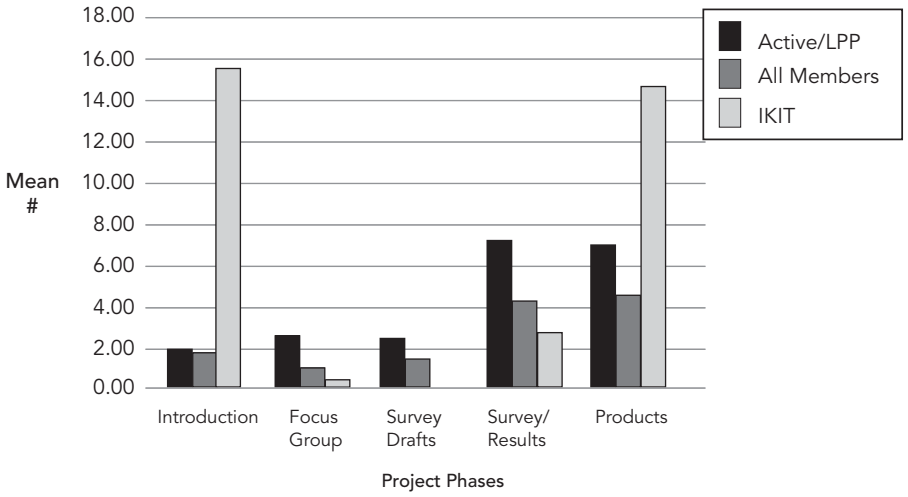
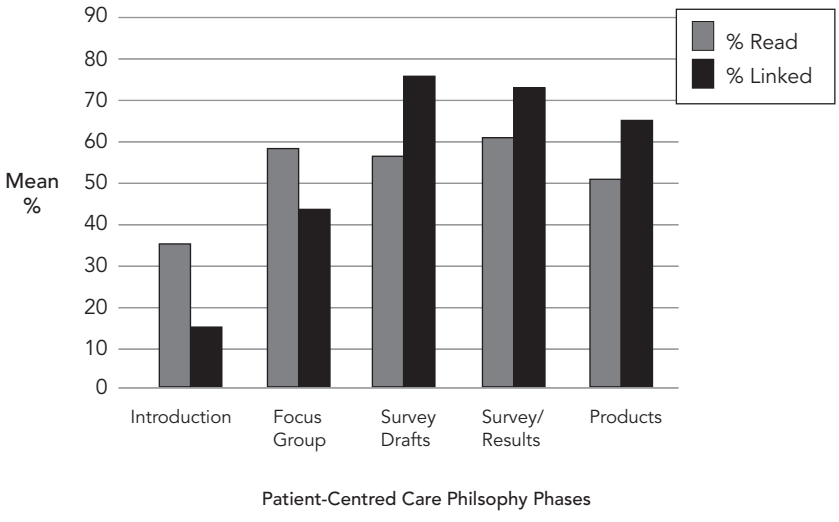


Figure 4: Mean Number of Notes Contributed in Each Phase Active/LPP Members, All Members and IKIT

Figure 4 shows that contributions increased dramatically for the last two phases of the project (Q3 2003 and Q4 2004) for all participants. People were very engaged in constructing the themes and attributes for the conjoint survey and understanding what the surveys revealed about patient-centred care. At one Task Force meeting when survey results were presented, participants were surprised that results indicated that healthcare teamwork was very important for patients. Many had expected that individual respect would be the most valued preference. Participants were also very involved in creating the patient-centred care philosophy and the educational video. In the introductory phase, several participants (11 Task Force and one Steering Committee member) contributed only their autobiography. IKIT contributed many notes in the Introductory Phase because tutorial notes are notes in the Help view are

Figure 5: Percentages of Reading and Linking for Each Project Phase for Active Members Only



included. Few people contributed in the focus group phase – primarily the steering committee and those Task Force members involved in conducting patient focus groups.

As shown in Figure 5, there was less reading in the Introduction phase relative to other phases of the project. As a reminder, four views were analyzed during the Introduction phase: Interprofessional Biographies, Interprofessional Practice Model Development, Knowledge Forum® Tutorials and Help FAQ. The two views directly related to ongoing work, namely Interprofessional Biographies (64% of notes read) and Interprofessional Practice Model development (55% of notes read) were read significantly more than Knowledge Forum® Tutorials (35% of notes read) and Help FAQ (36% of notes read) views. The view that received the highest percentage of readership during the introductory period was Interprofessional Biographies, as expected, since all participants were instructed to write a note about their professional experience and learning/contribution expectations for the project. Both the Help FAQ and KF Tutorial views were background resource views for participants – in other words, the participants visited these views only if they required technical help. We consider the readership results positive outcomes of this project and supportive of the design strategy to integrate technical knowledge management systems in on-line learning environments. The on-line introductory period of this project (Q2) occurred just as Ontario hospitals instituted "SARS alert" protocols. This prevented the IKIT research team from providing face-to-face technical instruction. The on-line tutorials as well as tele-conferencing and in-house instruction provided by the HHS project coordinator were implemented to address the training barrier imposed by SARS. As well, all face-to-face Task Force meetings were cancelled during the months of March, April, May and June. Therefore, goal setting and role ambiguity were natural outcomes for Task Force members during this period (as reported in Q2 Quarterly report). Activity increased overall in the last three quarters as teamwork goals emerged around generating the patient-centred care philosophy.

DISCUSSION

Taken together, results from both survey and analysis of interprofessional discourse indicate that participants made use of their Knowledge Forum® database as a place to collaborate, communicate, learn and co-create new knowledge. Over time, collaborative goals emerged from interprofessional discourse and collective roles and responsibilities were negotiated among participants. The production of a new philosophy of patient-centred care was the overarching collective goal – and that was achieved by the end of this project. Finally, we consider the results presented positive evidence of using computer technology to support teamwork and interprofessional collaboration in a practice setting.

Lessons learned in this project included considering the technological sophistication of users and contextual and socio-cultural impediments to knowledge creation within organizations. For example, structural barriers that affected design strategies for interprofessional collaboration in occupational samples in healthcare included firewall and privacy legislation affecting hospitals (PIPEDA); ethical consent to participation and confidentiality protection of employees covered under Quality Assurance guidelines of hospitals; ethical concerns related to use of patient data in electronic forum.

This collaborative e-learning method was intended to shift interprofessional practice from the usual one-way and two-way communications (voice mail, e-mail, face-to-face) to communal knowledge-building. Since the philosophy of patient-centred care is to transform the approach to care and achieve sustainability in a meaningful way, it is essential to democratize the process so that all members of the implementation team share collective responsibility to improve patient care. Putting the knowledge building principles to work in this way is a significant social design innovation at HHS that models collaboration, teamwork and accessibility – all critical elements in that patients themselves have identified as important to their care.

Pilot units at HHS have been selected to design and implement a specific plan to improve practice in their units. The PCCP Task Force will lead the groundwork and implementation of an interprofessional practice model based on our patient-centred care philosophy at HHS over the next 18 months. Its success will be measured and evaluated through follow-up patient/family and staff surveys.

We anticipate the further facilitation of the e-learning communal technology (Knowledge Forum®) to carry over into other aspects of our clinical practice in order to advance beyond "best practices" in our future knowledge work. IQ

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