THE ROLE OF EPISTEMIC AGENCY AND KNOWLEDGE BUILDING DISCOURSE TO FOSTER INTERPROFESSIONAL PRACTICE IN A CANADIAN HOSPITAL.

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The goal of this paper is to demonstrate how knowledge building principles (Scardamalia, in press) were operationalized in a hospital setting, to support an interprofessional team engage in continuous learning and reflective practice (Schon, 1983, 1987). A complex of twelve principles (Scardamalia, 2002) underpin socio-cognitive activity in a Knowledge Building Community (KBC). A prototypic example of a KBC is a scientific research network. Ideally, knowledge building principles work in concert to create and improve upon what Popper (1972) called *objective knowledge* and that Bereiter (in press) calls *conceptual artifacts* -- ideas, concepts, theories and innovations. In the present context, however, the goal was to foster knowledge embedded in practice – the kind of knowledge that has been the focus of work on situated cognition (Lave & Wenger, 1991), reflective practice (Schön, 1983, 1987; Argyris & Schön, 1996) and transformative learning (Engeström, 1992, 1999). This paper highlights the role of two principles, epistemic agency and knowledge building discourse, in the design and evaluation of an activity geared at fostering interprofessional continuous learning and reflection, called Monthly Reports. Generally, epistemic agency was construed as the individual and collective responsibility for continuous professional development by engaging in inquiry with team members for the purpose of advancing individual and community knowledge. Knowledge building discourse was construed as evidence of any of the 12 principles-in-action, with specific attention to epistemic agency, improvable ideas, real ideas and authentic problems and embedded constructivist assessment. Participants (N=21) were encouraged to submit narrative accounts of their professional activity over a 16 month period to a virtual communal intentional learning environment (VCILE) called Knowledge Forum. In this virtual medium, the interprofessional team from nursing, research, bioethics, occupational therapy and physiotherapy read and commented on each other's notes. Results of quantitative and qualitative analyses indicate that Monthly Reports activity extended beyond best practices mandated by the Regulated Health Care Professions Act (1991) in Canada in three ways. First, a static activity of submitting documentation of learning activities was transformed into a dynamic opportunity for interprofessional progressive discourse about shared ideas, problems and theories of practice. Second, profession specific practices were transformed by situating continuous learning and reflective practice in an interprofessional communal context. Third, this study designed a method for using a virtual medium to enable an interprofessional team separated by time and distance, to connect, collaborate and construct knowledge asynchronously. Socio-cognitive and technological indicators of epistemic agency and knowledge building discourse are discussed. It is suggested future research consider temporality, 'promisingness' and activity theory perspectives in design of KBCs.

INTRODUCTION

The Knowledge Building Communities (KBC) model – making the process of expertise explicit

The Knowledge Building Communities (KBC) model developed by Bereiter and Scardamalia (1993) derives from an extensive body of research on the characteristics and cognitive processes of experts in multiple fields of practice. Research in the domain of expertise has largely focused on comparisons between novice and expert performers (e.g., chess players) or practitioners (e.g., medical professionals). Research indicates that when compared to novices, experts display characteristics of progressive problem solving, deep understanding of domain knowledge, and commitment to advancing the frontiers of knowledge for the betterment of society. Also, when compared to novices, experts display cognitive and metacognitive abilities such as pattern recognition, forward and backward reasoning, causal reasoning, problem assessment, and superior short-term and long-term memory (Patel, Arocha, & Kaufman, 1999).

The KBC model construes expertise as a characteristic of careers as opposed to individuals. The process of expertise is articulated by the knowledge building principles (Scardamalia, in press), conceptual artifacts or tools that guide activity in distributed networks of learners, practitioners and researchers. When operationalized, knowledge building principles offer a means by which members of the community may emulate expert behaviour regardless of individual or collective levels of ability. They are: *epistemic agency, knowledge building discourse, improvable ideas, community knowledge, real ideas and authentic problems, rise-above, idea diversity, symmetric knowledge advance, pervasive knowledge building, constructive uses of authoritative sources, embedded transformative assessment, democratizing knowledge, and continual improvement.* The KBC model extends beyond traditional models by treating expertise a process extant in distributed knowledge networks, not simply contained in the mind of the learner or practitioner. It is a model of knowledge creation directed at effecting cultural change by influencing the way we collectively think, learn and practice.

Conceptual artifacts (Bereiter, in press) take the form of new ideas, theories, and understandings that further the community's knowledge creation goal. In a hospital setting, conceptual artifacts in use take the form of best practice guidelines, policies and procedures, discoveries, diagnoses, and the like. Embedded in any community's conceptual artifacts are cultural and historical material or ideal precedents (Cole, 1996; Engeström, 1992). Activity in a KBC and VCILE is focused on continually improving upon conceptual artifacts by *rising-above* past performance or understanding. Participants drive progressive inquiry and knowledge creation by choosing *real ideas and authentic problems* of concern to their community, which may be a local hospital or international research network.

Putting knowledge building principles to work in a hospital setting

This study is the first attempt to operationalize knowledge building principles in a health care practice setting. Ideally, knowledge building principles operate in concert to encourage groups of students or employees to function at the edges of competency and extend beyond best practices (Scardamalia, in press). The notion of *beyond best practice* is more common in scientific research communities where discovery and innovation are expected socio-cognitive and cultural-historical activities. However, in traditional learning environments such as hospitals, achieving and sustaining competency often *is* best practice. For example, in a review of some of the regulated health care professions web sites in Canada, I found no evidence of colleges linking exceptional or expert practice to certification or re-certification. Rather, of those sites reviewed (College of Occupational Therapists, College of Nurses, Royal College of Physicians and

Surgeons, College of Psychologists), continuous learning and reflective practice, concepts put forth by Schön (1983, 1987) to encourage continuous professional development, were linked directly to maintenance of competency. A closer approximation to the KBC model is Frankford's (2000) model "institutions of reflection", yet in its current version, is directed at the medical profession only. In this study, however, our collective goal was to design opportunities for participants to live at the edges of *interprofessional competency* by putting knowledge building principles to work.

Designing for knowledge building – cultural-historical and socio-cognitive influences

The challenge and promise of the design phase includes tying opportunities for transformation to real ideas and authentic problems of practice. This requires deep understanding cultural-historical and socio-cognitive facilitators and impediments to knowledge building. In this hospital context, the main cultural-historical considerations influencing operationalization of knowledge building principles were hierarchical organization and division of labour. The KBC model challenges us to *democratize* the process of knowledge creation by shifting responsibility from an elite few (e.g., managers, administrators, researchers, etc.) to a distributed network of participants. Yet, hospital management structures embody classical organizational theoretical principles established in the early 20th century by Frederick W. Taylor and proponents. The principles of unity of command and direction were two of a set of twelve principles that provided prescriptions for the management of authority relationships within organizations, advocating for singularity in the employee-supervisor relationships and hierarchical problem solving and decision making (Shafritz & Ott, 1996).

Arguably, organizations today have more fluid and flexible management and reporting structures than those of the early 20th century, yet present day manifestations of Taylorism in this hospital context included program management (silo governance) and tendency towards profession specific practice and learning. In our favour, the hospital in this study is in the beginning stages of implementing an interprofessional care delivery model (Barr, Hammick, Koppel, & Reeves, 1999) that cuts across programs and services and encourages professionals to engage in collaborative problem solving in service of the patient, family and extended community. In fact, some participants in this study designed the model of interprofessional care and are responsible for the 'roll out' across programs and professional groups hospital-wide. Initiating an interprofessional knowledge building initiative then was facilitated in part by participants' goal to embed interprofessional practice more broadly within organizational culture. The design challenge, however, was to engage this particular group in inquiry focused on *real ideas and authentic problems* in their collective practices. Finally, design of knowledge building in this context depended upon particpation in a VCILE, which required some computer literacy. However, the group of participants in the current study had limited to moderate computer literacy skills and preferred face-to-face or verbal interaction over written discourse or computer mediated communication.

Real Idea and Authentic Problem – fostering continuous learning and reflective practice

The real idea and authentic problem of practice chosen by participants was how to meet the continuous learning and reflective practice standards mandated by the Regulated Health Care Professions Act (1993). Each professional college's Quality Assurance (QA) program establishes guidelines for their individual memberships that are tied to certification and re-certification. There is great variability between the colleges in how QA programs are implemented, with some choosing random audit approaches (e.g., College of Nurses of Ontario), while others require members log on to a database and 'earn' credits towards re-certification (Royal College of

Physicians and Surgeons of Canada). However, in their current form, it is not clear how these initiatives actually foster learning and reflective practices at the workplace.

The goal of participants in this study was to embed continuous learning and reflection in their professional practices at work. However, the hospital has five different sites and participants from different locations had rare opportunities for collaboration about shared problems of interprofessional practice, unless engaged in project work such as task force activity. The potential to connect this diverse group of participants via a virtual medium called Knowledge Forum was seen as promising, as reflected in the note below, despite previously mentioned cultural-historical and socio-cognitive impediments:

> One of the main things that I find so alluring about Knowledge Forum is the concept of "community " in activities of building and sharing knowledge. It is not dependent upon a level of expertise, sophistication or professional savvy -- but rather an ability and willingness to reflect, share and add to knowledge for a common good or benefit. This approach fits with a broad range of health care provider's goals in our system – and, in the future, we *dream* it will include patient and family participation (*Clinical Nurse Specialist*)

METHOD

Analytic Framework

Activity system models have been used in diverse contexts to explicate complex cultural-historical, psychosocial, and socio-cognitive phenomena (Cole & Engestrom, 1993). The model below derives from Engeström's (1999) expansive learning model. From design and implementation perspectives, desired outcomes in this study were considered evidence of knowledge building principles-in-action.

HEALTH CARE KNOWLEDGE BUILDING COMMUNITY (KBC)
ACTIVITY SYSTEM
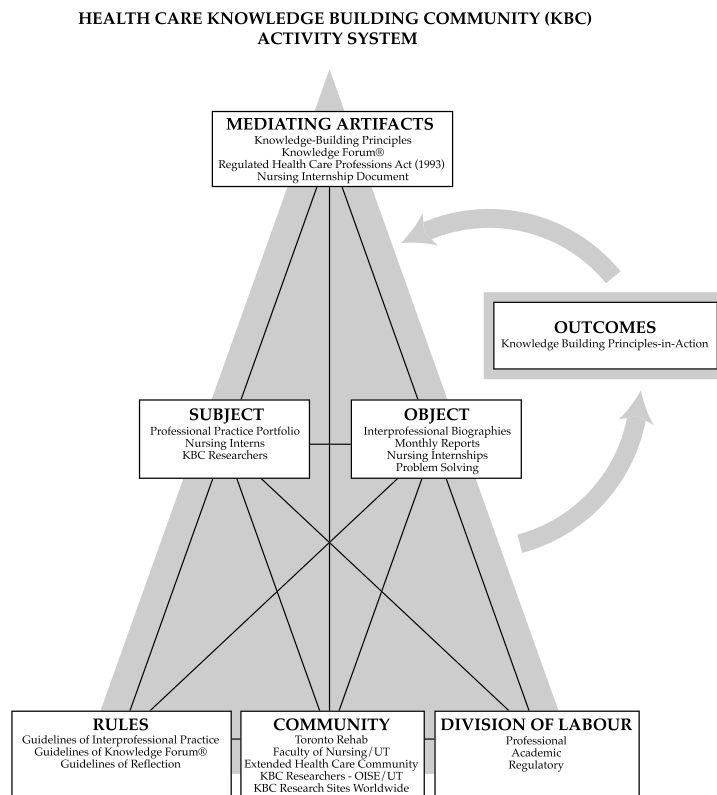
Knowledge building principles-in-action – Monthly Reports

Monthly Reports were semi-structured activities in which participants were encouraged to contribute notes to a VCILE database each month over a 16 month period regarding their professional activities, problems of practice and learning goals and objectives, ideas, theories and so on. As well, they were encouraged to read and comment on notes written by their colleagues. The purpose of Monthly Reports was defined in a note in all views, and was refined over time. However, the core principles guiding Monthly Reports activities as articulated in all purpose statements were epistemic agency and knowledge building discourse. Generally, epistemic agency was construed as the individual and collective responsibility for continuous professional development via purposeful and progressive discourse with team members for the purpose of advancing knowledge about health care practice and delivery.   Knowledge building discourse was construed as evidence of any of the 12 principles-in-action, with specific attention to epistemic agency, improvable ideas, real ideas and authentic problems and embedded constructivist assessment (see graphic below).

According to Scardamalia (in press), the following socio-cognitive and technological dynamics describe these principles.

> *Epistemic Agency*
> *Socio-cognitive dynamics***:** Participants set forth their ideas and negotiate a fit between personal ideas and ideas of others, using contrasts to spark and sustain knowledge advancement rather than depending on others to chart that course for them. They deal with problems of goals; motivation, evaluation, and long-range planning that are normally left to teachers or managers.
> *Technological dynamics***:** Knowledge Forum provides support for theory construction and refinement and for viewing ideas in the context of related but different ideas. Scaffolds for high-level knowledge processes are reflected in the use and variety of epistemological terms (e.g., conjecture, wonder, hypothesize, and so forth), and in the corresponding growth in conceptual content.
>
> ***Knowledge Building Discourse***
> *Socio-cognitive dynamics:* The discourse of knowledge building communities 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.
> *Technological dynamics:* Knowledge Forum supports rich intertextual and inter-team notes and views and emergent rather than predetermined goals and workspaces. Revision, reference, and annotation further encourage participants to identify shared problems and gaps in understanding and to advance understanding beyond the level of the most knowledgeable individual.

However, participants in this study were at the beginning stages of working with knowledge principles and VCILE database technology. Progress towards an ideal – knowledge building principles-in-action – was the high level desired outcome. However, temporal analysis needed to take into account knowledge building principles-in-action at both minimum and ideal outcome levels. Initially, knowledge building was construed at a more general level than articulated by Scardamalia (in press) as reflected in the graphic below. Specifically, it was construed as the interaction of epistemic agency, real ideas and authentic problems, embedded contructivist assessment, and improvable ideas operationalized by participants through discourse. The goal of

analysis is to characterize how knowledge building principles were used to foster continuous learning and reflection by participants.

Participants
Members (N=21) of the Professional Practice Portfolio at the Toronto Rehabilitation Institute (Toronto Rehab) participated in this research. Participants came from four of the five hospital sites. This interprofessional team included clinical nurse specialists (N=10), clinical nurse educators (N=4), manager (N=1), bioethicisist (N=1), researcher (N =1), occupational therapists (N=2), physiotherapists (N=2) and interns (N=2). All were females. All participants were university graduates, holding Bachelor (N=7), Master (N=13) and Doctorate (N=1) degrees in the health and social sciences. The primary roles fulfilled by members of the portfolio were clinical consultation and education.

Setting
Toronto Rehab is a regional rehabilitation and complex continuing care hospital in Ontario that comprises five sites and six specialty clinical inpatient and outpatient programs including: cardiac and secondary prevention, complex continuing care, geriatrics, musculoskeletal, neurorehabilitation, and spinal cord.

Duration
Results reported in this paper derive from an ongoing collaborative research initiative over the past 2 years. A 16-month period (February to May 2000) was selected for quantitative analysis of knowledge building indicators and patterns of activity in the VCILE database. For qualitative analysis of discourse in the VCILE, a sample of notes was selected over 16 months (one month per quarter). This study began in February 2000, is still in progress.

Training
a) Formal in lab computer and pedagogical training (2 days at onset of study)
b) Weekly small group consultation sessions (3 months during implementation phase)
c) Individual and small group consultation (ongoing throughout study)
d) Telephone and virtual technical support (ongoing throughout study)
d) Knowledge Building/Knowledge Forum Annual Summer Institute

Technology
In addition to knowledge building principles acting as tools to mediate interaction in a distributed network of learners, they too are embedded in a software program called Knowledge Forum, used in all KBCs. Knowledge Forum is a virtual communal intentional learning environment (VCILE). The functions and features of the database software support collaboration and expert learning. Views in the database are communal work-spaces in which participants contribute notes (narrative text or multimedia objects) to solve problems, deepen understanding and *rise-above* individual and collective understanding to create new conceptual artifacts (Bereiter, in press). Scaffolds are within-note cognitive and metacognitive tools that are designed and selected by users. Similarly, users select which key words are significant in their text and add them to the communal key word repository. All functions and features in the VCILE support intentional and purposeful knowledge activity such as reflection, complex problem solving, progressive inquiry, synthesis, and innovation. Knowledge Forum® is the most thoroughly researched on-line learning environment that is commercially available. This communal database technology may be accessed using a web browser (e.g., Internet Explorer, Netscape Navigator) or using the Knowledge Forum® Client (Windows or Macintosh). The Server runs on Linux, Windows and Macintosh OSes. Participants in this study used client version 3.2. The content of any VCILE is entirely the creation of participants. Over the period of investigation, participants wrote and contributed approximately 1,500 notes; and created 74 views or communal workspaces in the VCILE constructed by participants in this study.

RESULTS & DISCUSSION

Table 1 – Sociocognitive and technological indicators of epistemic agency and knowledge building discourse principles-in-action at two levels of analyses.

Level of Analysis	1. Sociocognitive Indicators	2. Technological Indicators
Within Note	√Refinement of collective purpose √Discourse –- from tasks to ideas	√Scaffold design √Keywords, titles, scaffold supports
Within View	√Interprofessional patterns of discourse activity √Collective inquiry & emergent views	√Notes created, read, modified, built-on √Titles of views

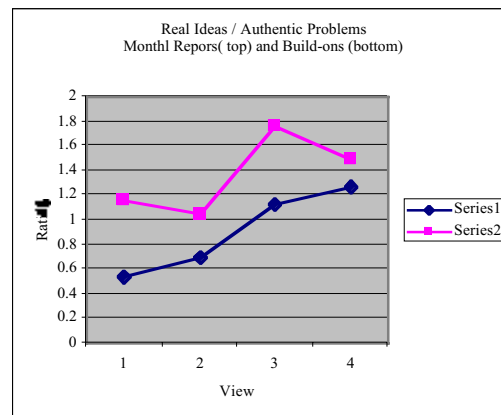## 1. Sociocognitive indicators

1.0. Within note analysis

1.1.a. Refinement of collective purpose over time
Knowledge building is intentional learning and collaboration for the purpose of advancing individual and community knowledge. Purpose statements in Monthly Reports views appeared for the first 2 months of the study, but did not reappear until 3 months later (July 2000).   At that time, a new purpose statement was generated to reflect movement towards conceptual understanding of pedagogical model, and away from technical training. In August 2000,
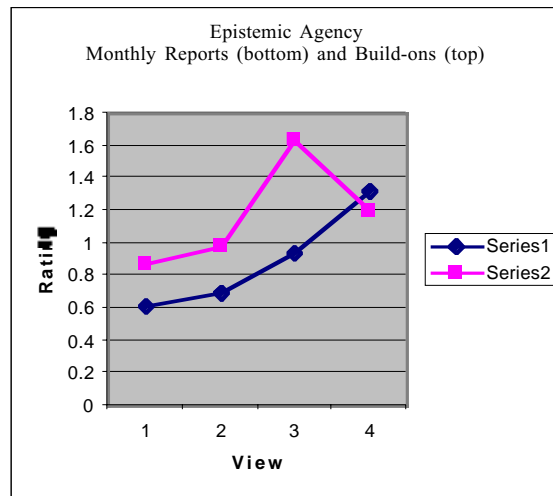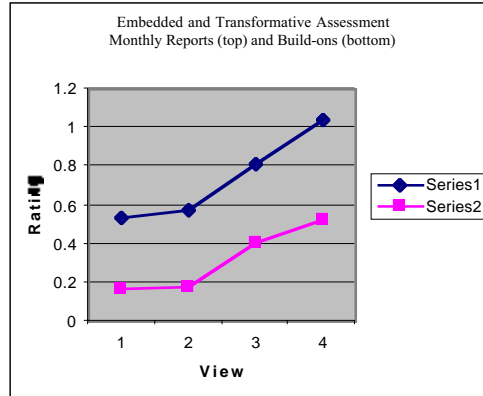
knowledge building principles themselves were redefined, moving away from core concepts with embedded principles to a set of 12 principles only. Conceptual artifacts relating to the new set of principles were not introduced to the VCILE until October 2000. Then, a view called knowledge building principles was created and all of Scardamalia's (2000) notes published in the Knowledge Society Network database were copied into the hospital database. As well, a scaffold with this set of principles was created and integrated into discourse in Monthly Reports views November 2000. Discourse among participants continues to focus on integration of not only knowledge building principles into practice, but other best practice theories in health care.

1.1.b. Discourse analysis – competency as point of departure and movement from tasks to ideas

Qualitative analysis of narrative content of notes (N=125) contained in 4 Monthly Reports views (Feb 2000, Jul 2000, Dec 2000, and May 2001) were performed using a scoring protocol designed by this author for assessment of real ideas and authentic problems, embedded transformative assessment and epistemic agency. Two independent raters rated the content of all notes using a 3-point scale (0=no evidence; 1=some evidence; 2=clear evidence) for evidence of knowledge building principles-in-action. High inter-rater reliabilities (Spearman-Brown) were achieved for all three principles (epistemic agency = .82; real ideas and authentic problems = .81; embedded transformative assessment = .77). Graphs 1, 2, and 3 below illustrate progress over time from very little evidence of principles-in-action as assessed by this measure, to moderate evidence of principles-in-action. Embedded transformative assessment (Graph 1) and real ideas and authentic problems (Graph 2) principles were similar. Rating for both principles increased over time, with build-on notes being rated lower than Monthly Report source notes. In contrast, epistemic agency (Graph 3) ratings were higher for build-on notes than for Monthly Report source notes.

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Embedded and Transformative Assessment
Monthly Reports (top) and Build-ons (bottom)

Epistemic Agency
Monthly Reports (bottom) and Build-ons (top)

Graph 1 – ratings ranged from no evidence, to idea/problem identification, to elaboration of ideas/problems.

Graph 2 – ratings ranged from meeting expectations, to self –assessment leading to generation of practice goals, to use of interprofessional network, extended community and external benchmarks to extend beyond best practice.

Graph 3 – ratings ranged from focus on tasks and activity reports (any note contributed), to reference to one's own professional theories and practices (my theory, my mind, my practice), to reference to interprofessional ideas/problems, theories, ideas, plans, models, innovations, etc.

The rating protocol was intentionally designed to take competency as the point of departure; therefore any evidence of competent practice was not seen as evidence of knowledge building principles in action. Rather, credit was given to notes higher order socio-cognitive abilities. However, movement from task focused centered notes to idea and problems centered notes over time, as well as increases in principle ratings over time is suggestive of working more deeply to integrate knowledge building principles into practice. Finally, the overall lower ratings of epistemic agency relative to the other two principles are worthy of further consideration. It is possible that epistemic intent (focus on learning or advancing knowledge) may be combined with indices of agency as evaluated by participation (intention to contribute, read, etc.).

What follows are examples of notes that received higher ratings on all principles as they generally address issues of concern to practitioners, but the relevance to community is explicit, and ideas are improved or understanding is deepened.

> *Nurse Educator (25+ years experience) – on collective epistemic agency*
> *I need to understand* - How to get/help nurses to see our role as more than helpers in situations where someone else is telling us what to do. Patient Centered Care extols the role of nursing as one that listens to the patients, contributes to the interprofessional plan and delivery of care that supports the patients values and perspectives and advocates for the patient in team situations. How can anyone do that when they're not even "in the room"?
> *My theory* - Compliant, compassionate females of "a certain generation" (that would be mine) self selected into the profession, and were rewarded through the medical model for being really good handmaidens to the physicians. Do what you're told, keep your eyes open, don't question authority, and for heaven sake don't take any initiative. There are lots of nurses of my generation still around.
>
> *Graduate Nursing Student – on epistemic agency and community knowledge*
> I don't have any answers about how to change the system of education (from knowledge telling to knowledge building). Is the onus on leadership/teachers to change, to introduce a community of learners to a different way of learning and sharing ideas? Somehow, I think that there is so much room for improvement, however, what may be useful is engaging in some discussion with my peers about my thoughts, after all that's how knowledge building occurs.
>
> Jane's *annotation* to my thoughts above provides me with a new perspective hence the *scaffold* "new information". The *idea* of "seizing the moment" is so important in encouraging reflective practice. Since most people don't think very

procedurally or of the process behind the content. It makes sense that the key thing to do would be to question and discuss *ideas* when the timing is right. I think that seizing the moment and timing are related *concepts* because in order to motivate others to become aware and to think *innovatively*, we need to have people who are passionate about their work, people who seize the moment to *discuss* problems, challenges, and triumphs. A community for sharing knowledge may be fostered if a nurse (or any health care professional) takes full advantage of significant moments by discussing *meaningful* issues (October, 2000).

Graduate Nursing Student – epistemic agency as a professional responsibility
I see that diffusing changes to the bedside practitioner is challenging. Well, no wonder, given that in the system of education, one develops early on a "comfort zone", a way of meeting course objectives never stopping to reflect on the process one is engaged in. My perceptions of how things "ought" to be may be naive. I can think of three instances over the past two weeks where I've been told by colleagues, "yes, but, this is the real world". The discussions were about differing situations, but in every instance my views were perceived as unrealistic. Does this reflect an apathetic attitude or is it reality that certain things must remain unchanged? My overall opinion is that engaging in knowledge building is challenging for the process requires a lot of thinking and reflection; it requires time; and it requires one to be confident enough to take on ownership of ideas. I struggled with this. I wondered… "Do I have the right to comment?" because in my education so far, the writing has been more reflective of supporting or refuting other's ideas (using literature); instead of, creating my own (December, 2000).

Nurse (25+ years experience) – knowledge building discourse
I need to understand
My problem of understanding is how do we move our practice from the mire of all the task issues that present themselves daily to getting nurses to think of nursing as a deeper relationship that involves progressive problem solving free of judgmental bias. Knowledge building then challenges that pedagogical model which was the "teacher as expert". Knowledge building requires sharing knowledge with more than one person and challenges the model of learning separately and shifts it to the community. It focuses on communal rather than individual learning and this is very different than what we learned ourselves as students. So as teachers in the organization, the knowledge building approach invites feedback and new thinking; teaching becomes dynamic in the sense that everybody is learning - not just laying out of information - it's dynamic learning on all fronts - so that teacher learns too (October, 2001).

1.1. Within view analysis

1.2.b. Emergent views
Perhaps the most interesting story here is the emergence of new views in the VCILE. Progressive inquiry in Monthly Report views (N=16) led to creation of Emergent Views (N=36). The first quarter, purpose statement were found in 50% of the new views created and of those 8 views, 50% were dedicated to tasks and 50% to solving complex problems. Further analysis will

investigate the life span of views to determine success and failure of design strategies. The theory guiding this analysis is that task focused views with no purpose statement lacked intention; and it is difficult to garner epistemic interest in tasks. However, of the views that lived on and served multiple purposes or in which iterations of problem solving were observed, the goal of deep understanding was explicit and clearly negotiated among interprofessional collaborators. If problem solving views have greater longevity an d usefulness in the VCILE, a strong argument for using knowledge building pedagogy, technology and methodology at the workplace could be made.

Finally, within view content analysis will investigate problem solving that lead to improvement of best practice. Preliminary results indicate two views in particular succeeded at moving beyond best practice. First, Evaluation of best practice guidelines for assessment and treatment of chronic non -cancer pain (Pain CPG view) used both Pain CPG scaffold and Kitson Model scaffold to assess efficacy of guidelines and on-line data collection. Also*, Ethical Concerns in Therapeutic Boundaries* view was an attempt to integrate research into practice to move beyond best practice. These views were the first attempts to collect and integrate best practice literature using knowledge building principles and a VCILE to solve clinical problems at Toronto Rehab. The *Academic Practice* view is the final view created during the period of investigation and it seeks to develop a model that incorporates knowledge building principles into interprofessional practice, clearly evidence of success of this research. Further analysis will investigate emergence of problem solving views of increasing complexity; and, how discourse within and between views shifted from focus on tasks to ideas and complex problems.

2.   *Technological indicators of epistemic agency and knowledge building discourse principles-in-action*

2.1. *Within note analysis*

2.1.a.. *Interprofessional patters of discourse activity – interprofessional interaction with conceptual artifacts*

Interprofessinal interactivity with conceptual artififacts
Notes Created, Built-on, Modified and Read
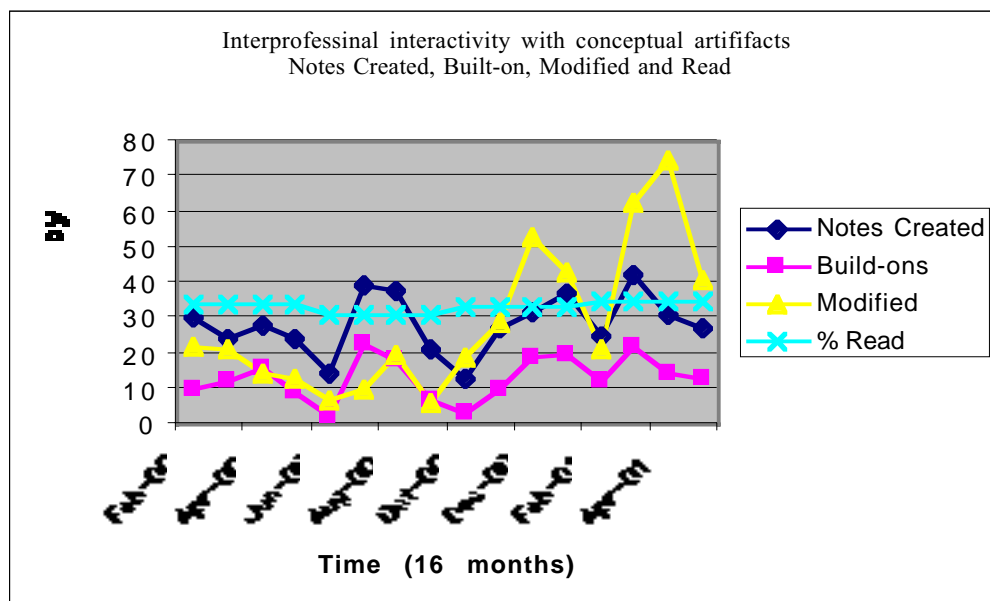
Graph 4 above illustrates interprofessional interaction with conceptual artifacts embedded in the VCILE technology. Frequency scores for all data is presented with the exception of notes read which is presented as a percentage. At the collective level of analysis, the group of participants seems actively engaged in contributing notes and build-ons. Approximately, 50% of all activity is in the form of build-on notes, representing interprofessional discourse. However, both readership and modifications seem quite low. On average, only 30 to 35% of notes are being read, and notes are being modified less than twice (Table 2).

Table 2 – Interprofessional interactivity with conceptual artifacts re-examined

Quarterly Analysis	Notes Created	% Read	Avg Modified	% Build-ons
Q1 (Feb00-May00)	106	34%	1.5	44%
Q2 (Jun00-Sept00)	112	31%	2.6	45%
Q3 (Oct00-Jan01)	109	33%	0.8	48%
Q4 (Feb01-May01)	125	35%	0.9	49%

Table 3 - Use of Scaffold Supports in Monthly Report Views – From Activity Structures to Knowledge Transforming Tools

Monthly Reports	Activity Supports	Cognitive Supports	Metacognitive Supports	Total Supports
Feb 2000	40 (91%)	2 (4.5%)	2 (4.5%)	44
Jul 2000	38 (79%)	8 (17%)	2 (4%)	48
Dec 2000	12 (44%)	14 (52%)	1 (4%)	27
May 2001	29 (56%)	21 (40%)	2 (4%)	52
Nov 2001	14 (33%)	19 (45%)	9 (21%)	42
Total	133 (63%)	64 (30%)	16 (7%)	213

Monthly Reports	Information and Knowledge Sharing/Transfer Supports	Knowledge Transforming Discourse Supports
Feb 2000	91%	9%
Jul 2000	79%	21%
Dec 2000	44%	56%
May 2001	56%	44%
Nov 2001	33%	66%

Actual Scaffold Supports Used during 5 Monthly Reports

Activity Supports	Cognitive Supports	Metacognitive Supports
Significant Issues/Activities	Research and Outcome Measures; Outcomes	Reflections
Accomplishments	I need to understand	What I've learned
Education	We need to understand	What we've learned - education
Clinical Education	New Information	Research Potential
Education Attended	Putting our Knowledge together – evidence, peer feedback, etc.	Problems of Understanding
Presentations Given	My theory	
Committees and Task Forces	Opinion	
University of Toronto	Epistemic Agency	
Program Specific	Knowledge Transforming Discourse	
Profession Specific	Community Knowledge	
Hospital Specific	Efficient Interprofessional Team	

	Work	
Program Planning	Kitson's Model (8 supports of a research method)	
Presentations Given		
Other		

SUMMARY

This paper attempted to characterize how knowledge building principles were put to work to support interprofessional practice in a hospital setting. The goal of analyses was to demonstrate design and evaluation of knowledge-building principles-in-action to foster continuous learning and reflection. Overall, preliminary results are suggestive of progress towards integrating the principles at deeper levels of practice as observed by increasing complexity of discourse within notes and views in the VCILE. This kind of research promises to advance practice in traditional organizations such as hospitals by cultivating a disposition for knowledge building (Bereiter, 1995).

When we began this research, participants were submitting hand written activity report forms to the Vice President of Professional Practice. The responsibility to share knowledge, make connections between people and generate ideas was driven from the top, down. Monthly Reports activity in this study were successful at democratizing this process, by placing responsibility on all participants to drive their own learn, inquiry, practice and assume responsibility to contribute to the community's knowledge.

Results of quantitative and qualitative analyses indicate that Monthly Reports activity extended beyond best practices mandated by the Regulated Health Care Professions Act (1991) in Canada in three ways. First, a static activity of submitting documentation of learning activities was transformed into a dynamic opportunity for interprofessional progressive discourse about shared ideas, problems and theories of practice. Second, profession specific practices were transformed by situating continuous learning and reflective practice in an interprofessional communal context. Third, this study designed a method for using a virtual medium to enable an interprofessional team separated by time and distance, to connect, collaborate and construct knowledge asynchronously.

Future research in this area would do well to capitalize on how knowledge building principles-in-action promises to solve practical problems in work place settings. For example, knowledge in the VCILE is preserved in the form of notes and views. Views are 'living' workspaces with potential to revisited and reworked for multiple purposes. Wenger's (1998) concept of learning as duality between participation and interaction with reified objects, or conceptual artifacts (e.g, notes and views), is a useful framework for further analysis, and application. How might historical records in this VCILE solve real world problems facing health care (e.g., recruitment retention issue, orientation platform, etc.)? From an activity theory perspective, conceptual artifacts in a VCILE may serve as objects of inquiry for the community, outcomes of collective activity, or mediational tools. Attunement to recognizing the promise extant in virtual knowledge networks is of primary importance in the knowledge society.

In sum, I suggest future research concerning design and implementation of knowledge building principles-in-action consider the following:
1. *Temporality – knowledge building as progress towards an ideal*
2. *Promisingness – recognition of possibilities with potential – in pursuit of the ideal scenario*
3. *Activity - Theory - Iterative Design – continual improvement*

CONCLUSION

In conclusion, I end this paper with a promising quote by one participant entitled:

The Gifts of Knowledge Building Pedagogy and Knowledge Forum

In this note I use the term "gifts" to reflect the unexpected learning that took place with me. I had planned objectives along with activities that would reflect that I had met these, however along the way were some additional "gifts"

The first gift (deepened understanding of interprofessional team)
Even though I did not spend a day with any of the portfolio members, I was able to discern, for myself, the various roles of the CNS, NP, PT, OT et cetera through reading individual members' monthly report notes. Not only did I gain an understanding of the projects people are working with, but I also gained insight into peoples' thoughts, rationales, and dilemmas, as well as their questions, feelings, criticisms, and analyses relevant to each months agenda. I think that if I had gone and spent a day 'shadowing' any of these people, it is not likely that I would have known their thoughts about what was happening. Yet, through reading people's reflective practice pieces, I have an interaction analysis of sorts. Reflections were evident in biographies, monthly reports and learning portfolios. Interestingly, differing personalities also peak through all of the words and each note does reflect aspects of the individual including one's philosophy, main interests, problem solving techniques, and all sorts of skills.

The Second "gift" (principles of knowledge building)
The guiding principles of knowledge building (Scardamalia, 2000) put into my view, are really meaningful to me, because it is new information about education. The principles make sense to me. I wonder if our education system could ever entertain such ideas? It seems like only a small number of people are involved with writing and theorizing, and publishing, but with a knowledge community, all nurses, from the bedside to the management offices (and everywhere in between!) can engage in meaningful discourse in order to expand the few who now take on the task of knowledge building in our profession. Maybe someone is now saying to me "yes, but this is the real world"!! (see my reflection on how we teach people to teach). Graduate Nursing Student, December 2000.

REFERENCES

Barr, H., Hammick, M., Koppel, I., & Reeves, S. (1999). Evaluating interprofessional education: Two systematic reviews for health and social care. *British Educational Research Journal, 25*(4), 533-544.

Benner, P. (1984). *From novice to expert: Excellence and power in clinical nursing practice.* Menlo Park, CA: Addison-Wesley Publishing Company.

Bereiter, C. (1995). A dispositional view of transfer. In A. Mckeough & J. Lupart & A. Marini (Eds.), *Teaching for transfer: Fostering generalization* (pp. 21-34). Mahwah, NJ: LEA.

Bereiter, C. (in press). *Education and mind in the knowledge age.*

Bereiter, C., & Scardamalia, M. (1993). *Surpassing ourselves: An inquiry into the nature and implications of expertise.* Chicago, IL: Open Court.

Campbell, H., Russell, A., Scardamalia, M., & Bereiter, C. (2000 to 2002). *Fostering interprofessional practice in rehabilitation and complex continuing care through collaboration and virtual learning.* Ottawa: Office of Learning Technologies, HRDC, Project #99574.

Cole, M., & Engestrom, Y. (1993). A cultural-historical approach to distributed cognition. In G. Salomon (Ed.), *Distributed Cognitions: Psychological and Educational Considerations* (paperback 1997 ed., pp. 1 - 46). Cambridge, UK: Cambridge Universtiy Press.

Dreyfus, H., & Dreyfus, S. (1980). *Mind over machine.* New York: MacMillan, The Free Press.

Engestrom, Y. (1999). *Expansive learning at work: Toward an activity-theoretical reconceptualization.* Paper presented at the CLWR 7th Annual International Conference on Post-compulsory Education and Training.

Engestrom, Y., Miettinen, R., Punamaki, R.-L., & (Eds). (1999). *Perspectives on activity theory.* Cambridge, UK: Cambridge University Press.

Frankford, D. M., Patterson, M. A., & Konrad, T. R. (2000). Transforming practice organizations to foster lifelong learning and commitment to medical professionalism. *Academic Medicine, 75*(7), 708-717.

Patel, V. L., Arocha, J. F., & Kaufman, D. R. (1999). Expertise and tacit knowledge in medicine. In R. J. Sternberg & J. A. Horvath (Eds.), *Tacit knowledge in professional practice: Researcher and practitioner perspectives* (pp. 75-99). Mahwah, NJ: Lawrence Erlbaum Associates.

Polanyi, M. (1983). *The tacit dimension.* Gloucester, MA: Peter Smith.

Popper, K. R. (1972). *Objective knowledge: An evolutionary approach.* Oxford: Clarendon Press.

Ratner, C. (2000). Agency and culture. *Journal for The Theory of Social Behavior, 30*, 413-434.

Scardamalia, M. (in press). Collective cognitive responsibility. In B. Jones (Ed.), *Liberal education in the knowledge age.* Chicago: Open Court.

Schon, D. A. (1983). *The reflective practitioner: How professionals think in action* (paperback ed.). USA: Basic Books.

Schon, D. A. (1987). *Educating the reflective practitioner: Toward a new design for teaching and learning in the professions.* San Francisco, CA: Jossey-Bass Inc., Publishers.

Shafritz, J. M., & Ott, J. S. (1996). *Classics of organization theory* (Fourth Edition ed.). Fort Worth: Harcourt Brace College Publishers

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes.* Cambridge, MA: Harvard University Press.

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity.* Cambridge, UK: Cambridge University Press.