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Case study of Virtual Collaboration in Health Informatics Research

by

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Abstract

The purpose of this study was to explore how Health Informatics research collaboration among Trainees and Mentors in the CHPSTP was mediated by information and communication technologies. Using qualitative methods, a purposive sample of fifteen CHPSTP Trainees and Mentors who participated in the CHPSTP-Virtual Community were interviewed. Results of the study indicate that the CHPSTP has been considered a growing success and through the use of technology has enabled a national Health Informatics Community of Practice to develop, function and grow. As a consequence, Health Informatics researchers have enhanced opportunities to collaborate and increase their HI network, as well as increased research and training capacity.

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Dedication

This work is dedicated to Ana Maria Fuentealba Prado, my mother in law, my second mother. She taught me there's always a reason to smile and enjoy the gift of life. Her kindness, generosity, laughter, and amazing spirit are a source of inspiration for all who know her.

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CHAPTER 1: RESEARCH PROBLEM

1. 1 Introduction

There is an increasing appreciation of the important role that Health Informatics (HI) can play in an efficient and effective health system. This is reflected in the increasing demand for experts and training in design, use and evaluation of computer technology. As newer and more sophisticated health care applications constantly appear in the market, expert health technology assessment regarding their cost-benefit, impact, and effectiveness on the health care system and individual health outcomes becomes essential.

In Canada this challenge to assess effectiveness is compounded by a limited number of HI experts and researchers who are geographically dispersed. For this reason increased HI research capacity and graduate training have been identified as high priority needs (Covvey et al., 2001; School of Information Science University of Victoria, 2002; Health Informatics at the University of Waterloo, 2004).

As HI advances and the need for training of experts continues to grow, effective models to support professional development in this field become more critical. One proposed approach is the development of Communities of Practice (CoPs), a concept that involves groups of people learning together and deepening their knowledge and expertise by interacting on an ongoing basis (Wenger et al., 2002)

A recent example of efforts to address HI needs is the Canadian Institutes for Health Research (CIHR) Health Informatics PhD/Postdoc Strategic Training Program (CHPSTP) (Canadian Institutes for Health Research, 2004 a) (Appendix A). As a

component of the Strategic Training Initiative in Health Research launched by CIHR in the year 2002 (Canadian Institutes for Health Research, 2004 b), the CHPSTP aims to establish a collaborative HI graduate training program and CoP over a 6-year period. CIHR allocated $1.2 Million for development of the CHPSTP, of which 70% is expected to be spent on Trainees' salaries.

The CHPSTP has eight university team partners (universities of Calgary, Dalhousie, McGill, McMaster, Toronto, Sherbrooke, Victoria, and Waterloo) and focuses on Research Learning Experiences (RLEs) not obtainable from local programs. RLEs are offered to graduate students as part of their PhD/Postdoc training with the aim to provide intense and in-depth hands–on HI learning opportunities through interactions among multiple faculty, Trainees and stakeholders. These activities also theoretically support the development of a CoP which in this case is mediated by technology.

Pan-Canadian scientific collaboration and mentoring of Trainees such as that offered through the CHPSTP, may enable better use of the existing HI resources and expertise. It is expected to increase research capacity and training of experts, which is crucial to significantly advance the HI discipline. Use of information and communication technologies (ICTs) to support this process has not been explored.

1. 2 Rationale for the Study

HI is a specialized area and a review of the relevant literature revealed a lack of research studies examining virtual research collaboration and training in the area of HI. Similarly, little research has been done to understand the effect of ICTs on CoPs and whether CoPs can emerge and function as such in their presence. While there has been

much theory and discussion surrounding CoPs, little research exists as to how such CoPs are able to form, maintain and function when facilitated by ICTs. A question remains as to whether a research community is able to function as a CoP when mediated by technology, and provide benefits to its members.

1. 3 Study Purpose

The purpose of this study was to explore how HI research collaboration among Trainees and Mentors in the CHPSTP was mediated by information and communication technologies.

Specific objectives were to:

- Gain a better understanding of how technology was perceived to impact CHPSTP Virtual Community (CHPSTP-VC) participants' training and mentoring experience;
- Identify factors that may have enhanced and/or hindered virtual collaboration in HI research.

1. 4 Research Questions

The research questions for this study were:

- How does technology help or hinder CHPSTP-VC members to move from team to CoP?
- How does the context of CHPSTP-VC membership help or hinder members to move from team to CoP?

1. 5 Significance of the Study

The research study provided an opportunity to explore the development and outcomes of the CHPSTP-VC, and contribute to the overall evaluation of the CHPSTP initiative. The examination of technology mediated interactions between Trainees and Mentors participating in the CHPSTP-VC, contributed to understanding the impact a program of this nature had on the training and mentoring experience of its participants (i.e., exchanging information, sharing ideas, solving problems, collaborating on projects). A better understanding of the factors enhancing and/or hindering virtual collaboration in HI research can be used to inform similar training initiatives that provide better access to training of experts across distance, hopefully facilitating a significant advance of the discipline. The study also contributed to identifying concepts important in understanding how virtual communities of practice develop and grow.

CHAPTER 2: LITERATURE REVIEW

2. 1 An Overview of Health Informatics

In Canada, the use of ICTs in health care has been recognized as essential to a high quality health care system (Romanow, 2002) and considered one of the "four strong winds" driving change in health care today (Decter, 2000). According to Romanow (2002), advances in health technology have tremendous potential for changing the organization and delivery of health care services and improving health outcomes for Canadians.

No single definition of HI has been adopted, although there are areas of overlap in the many proposed definitions. Some authors have also used this term as an alternate for 'Medical Informatics' (e.g., Shortliffe & Perrault, 2001). Two examples of the variability include:

- "the scientific field that deals with biomedical information, data, and knowledge-their storage, retrieval and optimal use for problem-solving and decision-making" (Shortliffe & Perrault, 2001 p. 21); and
- "the discipline dedicated to the capture, storage, management, processing and communication of information in the health system" (Education Program for Health Informatics Professionals, 2003).

It is widely acknowledged that HI is crucial to the future of healthcare particularly since ICT applications enhance healthcare, and their costs have declined over the past decade. HI has the potential to improve the health system by reducing medical errors as well as improving the quality of medical care, thereby improving the health of individuals (Reducing Errors in Healthcare, 1990; Kohn et al., 1999; Leape, 2000; Technology to

play major role in reducing medical errors at hospitals, 2000; Musen, 2002). As a consequence, a number of HI graduate education programs, both campus and online based, have been made available to prospective students worldwide using different approaches for their development (Medical Informatics, 2004; Medical Informatics/Bioinformatics, 2004). Canada is no exception. Increased HI research capacity and graduate training have been identified as high priority needs (Covvey et al., 2001; School of Information Science University of Victoria, 2002; Health Informatics at the University of Waterloo, 2004) and efforts such as the CHPSTP, have been made to address them.

A review of the concepts involved in research collaboration and mentoring will provide a context for this study as well as help understand the dynamics of a collaborative research training program such as the CIHR HI PhD/Postdoc Strategic Training Program (CHPSTP).

2. 2 Research Collaboration

Several definitions of collaboration found in the literature focus on both organizations and individuals. Collaboration among organizations has been defined as "a mutually beneficial and well-defined relationship entered into by two or more organizations to achieve common goals" (Mattessich, 2001, p.16). Definitions of collaboration that focus on individuals include: "the process of shared creation: two or more individuals with complementary skills interacting to create a shared understanding that none had previously possessed or could have come to on their own" (Scharge, 1995, p.117); and, "human behaviour that facilitates the sharing of meaning and completion of

activities with respect to a mutually shared super-ordinate goal and which takes place in a particular social, or work, setting" (Iivonen & Sonnenwald, 2000, p.78). Hara et al. (2003) identified two common elements in a number of definitions of collaboration that focused both on organizations and individuals: working together for a common goal and sharing of knowledge.

Collaboration in research is a critical element of scientific inquiry that allows researchers to benefit from sharing resources and knowledge to address complex research problems, activity often not possible through individual scientific work. A number of authors have explored a wide spectrum of topics regarding research collaboration that have been well documented in the literature. For example, Miller (1994) proposed a six–stage process for creating collaborative research relationships (acceptance/validation, shared expectations, declaring group process, action consensus, shared common space and sustained common action), as well as essential ingredients for research collaboration success. Hara et al. (2003) developed a framework that identified forms of collaboration that emerged among scientists (e.g., complementary and integrative collaboration) and associated factors, which influenced collaboration including personal compatibility, work connections, incentives and infrastructure. Communication is also an important aspect of research collaboration (Cole, 1973, p.16):

> *"Scientific advance is dependent on the efficient communication of ideas. The communication system then is the nervous system of science, the system that receives and transmits stimuli to its various parts."*

Research collaboration is common among participants separated by temporal, geographical, organizational, disciplinary and cultural boundaries (Schleyer, 2001) and thus, researchers are continuously searching for tools to facilitate its success. Over the

past decade, the rapid development of ICTs has made new ways of communication possible, and which have become progressively more important to scientific work (e.g., fast communication via e-mail; computer conferencing in real time, and asynchronous online discussion, among many others). Research scientists have increasingly incorporated computer mediated communication (CMC) technologies into their work practices, as these have the potential to enhance collaboration, as well as support more efficient and inclusive types of interactions (e.g., younger scientists and those at less prestigious institutions are better able to actively participate in scientific work) (Walsh, 1996).

A collaboratory can be defined as an "Information Technology infrastructure that supports cooperation among individuals, groups, or organizations in pursuit of a shared goal by facilitating interaction, communication, and knowledge sharing" (Schleyer, 2001, p.1508). The use of ICTs (i.e., Internet, web-based collaborative spaces, web-based conferencing, etc.) among collaboratories is expanding, offering a number of advantages including anytime, anywhere access; collaborative tools that cross time and space; and distribution of information in a digital format, which eliminates the historical challenge of version control, as updated information can be rapidly communicated (Korner, 2003).

The increasing use of ICTs for collaboration has led to a number of studies exploring topics such as CMC, virtual team interactions, e-collaboration and virtual team effectiveness, primarily in the fields of business, management and education. As might be expected with any new approach, the reviews are mixed, although innovators and investors tend to stress the positive, and are less likely to report unsuccessful attempts

and risks associated with use of the technology to collaborate and communicate (Galinsky & Schopler, 1997).

A need for further study in research collaboration that involves the use of technology has been identified. Few evaluations of scientific collaboratories exist and therefore fundamental questions regarding their potential have yet to be answered (Sonnenwald, Sonnenwald, Whitton & Maglaughlin, 2002). For example, they have significant potential to facilitate cooperative research, but should be evaluated carefully to determine best practices (Schleyer, 2001); there is a need for empirical research on scientists' uses of CMC technologies including information from researchers in a broad variety of fields, as they have fundamental differences and therefore their outcomes may be expected to differ (Walsh et al., 2000); only few studies touch upon group knowledge production when using CMC (Kruempel, 2000), an essential component of collaborative research work. As a consequence, it seems important to explore and evaluate innovative forms of communication that may assist research collaboration.

2. 3 Research Mentoring

Mentoring is a personal relationship in which a more experienced individual acts as a guide, role model, teacher, and sponsor of a less experienced protégé (Johnson & Nelson, 1999). A mentor provides the protégé with knowledge, advice, challenge, counsel, and support in the protégé's pursuit of becoming a full member of a particular profession.

Mentoring associated with professional graduate education involves a number of activities from which the trainee may benefit. These include assistance with research

grant writing, research supervision, manuscript writing, and occasionally work opportunities. In return, the relationship is also likely to benefit the mentor's professional activity and growth by means of assistance with own projects, greater productivity, increased professional visibility via the network of protégés, networking as protégés advance and increased power (Johnson & Nelson, 1999). Research mentors and their protégées are likely to build strong research ties as they work together. A study that explored students' views of mentors in a graduate training program reported that most students entered into such relationships as a result of seeking out a faculty member who had similar interests; they argued that a true mentor could not be "assigned" to a student (Cronan-Hillix et al., 1986).

The shortage of researchers and experts in the area of HI, that is, potential mentors, has important implications for prospective trainees in this field. Unless they enroll in a program involving mentors with areas of expertise diverse enough to cover a number of HI topics, prospective trainees may have fewer opportunities for close research ties with mentors. As a consequence, a detailed look at novel forms of mentoring that could help address the issue of shortage of potential mentors in the field of HI is needed.

Lateral mentoring, a relatively new form of mentoring, has been identified in the context of a community of practice. Lateral mentoring occurs when groups of people with a common interest come together by choice. All members possess varying degrees of skills, abilities, and talents and work together toward significant shared goals, which give all community members access to the group's body of knowledge. A lateral mentoring community supports all of its members. The power of the group is acknowledged and the

expertise of all members evolves because of the spirit of shared knowledge (Polin et al., 2001). A review of CoP literature will provide a context to better understand this new concept of mentoring.

2. 4 Communities of Practice: An Approach to Support Professional Development and Training in Health Informatics Research

The field of HI continues to advance and with it a growing need for training of experts in the area, as well, as increased research capacity. Therefore, effective models to support professional development and research collaboration in the field of HI become essential.

A number of models of collaborative research and learning are found in the literature; for example, learning organizations (Senge, 1990), action research (Calhoun , 1994), professional development schools (Book, 2004) and CoPs (Lave & Wenger, 1998). These models differ in their scope including who participates and whether the goal is short term and local or long term and public. However, they have in common the emphasis on increased interactive dialogue among professionals about professional knowledge and practice. Ongoing reflection and inquiry are core practices in each model, as it is the notion that by improving what and how they learn, participants create positive outcomes that extend beyond their own learning (Wesley & Buysse, 2001).

In the next section, CoPs as a model of collaborative inquiry and knowledge management will be discussed. This model was used to build the theoretical framework that guided data collection and analysis in this study, as it was deemed most appropriate to answer the research questions (Appendix B).

For many years people have come together informally to share their passions and interest in specific topics in a variety of ways. Whether within a personal or professional context, they bond through sharing and learning. Wenger and Snyder (2000) differentiated Communities of Practice, formal work groups, teams, and informal networks. They identified distinctive characteristics for each of them including the purpose guiding their gathering, who constituted them, what held them together, and for how long (Table 1).

Table 1: Comparison between Communities of Practice and Other Groups. (Wenger et al., 2002, p. 42)

	Purpose?	Who?	Held Together by?	How long?
Communities of practice	To develop members' capabilities; to build and exchange knowledge	Members who select themselves	Passion, commitment, and identification with the group's expertise	As long as there is an interest in maintaining the group
Formal work group	To deliver a product or service	Everyone who reports to the group's manager	Job requirements and common goals	Until the next reorganization
Project team	To accomplish a task	Employees assigned by senior management	The project's milestones and goals	Until the project has been completed
Informal network	To collect and pass on business information	Friends and business acquaintances	Mutual needs	As long as people have a reason to connect

A CoP is a type of informal learning environment that presents a forum for people to share information, insight and advice, and manage knowledge. CoPs have existed in workplace settings for centuries (Wenger et al., 2002), and yet have just recently become recognized as viable organizational learning and problem-solving environments (Allen et al., 2003).

A CoP is defined as a "persistent, sustained social network of individuals who share and develop an overlapping knowledge base, set of beliefs, values, history and

experiences focused on a common practice and/or mutual enterprise" (Barab et al., 2003, p. 237); or as a "group of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis" (Wenger et al., 2002, p.4).

CoPs are composed of members with diverse expertise and experience who transcend organizational, disciplinary, and geographic boundaries. Their main goal is to engage in systematic, collaborative discourse reflection and inquiry for the purpose of improving professional development and practice as well as contributing to the field at large (Lave & Wenger, 1998). They spend time together and share information, insight and advice; help each other solve problems; discuss their situations, aspirations and needs; ponder common issues, explore ideas, and act as sounding boards. They become informally bound by the value they find in learning together (Wenger et al., 2002).

CoPs may emerge and be populated under diverse situations by people with various levels of expertise. Their characteristics vary greatly, based on the needs of the members and the organization(s) within which they are located. They can be small or big; long or short lived; collocated or distributed; homogeneous or heterogeneous; inside and across boundaries; spontaneous or intentional; and unrecognized or institutionalized. Regardless of the form they take, they all share a basic structure including three core characteristics: a domain of knowledge, a community of people who care about this domain, and a shared practice (Wenger et al., 2002):

1) **The Domain** – A CoP focuses on a domain of interest; membership therefore implies a minimum level of knowledge of that domain;

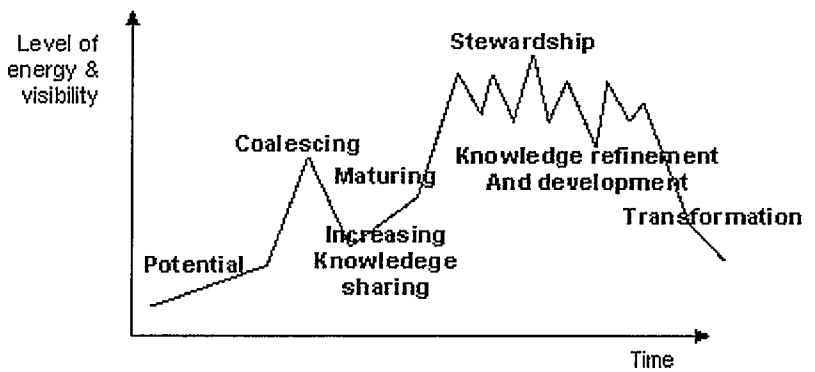
2) **The Community** – In pursuing their interest in a domain, members engage in joint activities and discussions, help each other, and share information; and

3) **The Practice** – Members of a CoP develop a shared repertoire of resources, including experiences, stories, tools, ways of addressing recurring problems – in short, a shared practice.

In addition, Barab and Duffy (2000) suggested four other characteristics: shared knowledge, values and beliefs; overlapping histories among members; mutual interdependence; and mechanisms for reproduction. The community is regenerated as newcomers join the group and old-timers leave. The newcomers have access to the old-timers and learn from them. Barab et al. (2001) suggested that CoPs characteristics also include opportunities for interaction and participation; meaningful relationships; and respect for diverse perspectives and minority views.

As most communities, CoPs go through a natural cycle of birth, growth, and death. Wenger et al. (2002) identified five stages of CoP development (Figure 1):

Figure 1: Five Stages of Community Development (Wenger at al., 2002, p.69)



1) **Potential:** the CoP focuses on defining the scope of their domain; finding people who already network on the topic and helping them to imagine how increased networking and knowledge sharing could be valuable; and identifying common knowledge needs.

2) **Coalescing:** the CoP focuses on establishing the value of sharing knowledge about that domain; developing relationships and sufficient trust to discuss practice problems; and discovering specifically what knowledge should be shared and how.

3) **Maturing:** the CoP focuses on defining its role and relationships to other domains; and managing the boundary of the community which is no longer just a network of professional friends; organizing the community's knowledge and taking stewardship seriously. During this stage, increasing knowledge sharing is observed within the CoP.

4) **Stewardship:** the CoP focuses on maintaining relevance of the domain and finding a voice; keeping the tone and intellectual focus of the community lively and engaging; and keeping the community on the cutting edge. During this stage, knowledge is refined and developed by the CoP members.

5) **Transformation:** at this stage the community may fade away or officially close. This may also mean that the community has become redundant, or that this stage brings about the beginning of a new community. Other possibilities include merging with other communities or becoming institutionalized as a formal unit.

Learning within CoPs has been the focus of several researchers' work and is intimately related to Social Learning Theory. Initial ideas of Social Learning Theory are attributed to the work of Bandura in the late 1970's who emphasized the importance of observing and modeling the behaviors, attitudes and emotional reactions of others (Bandura, 1977). He believed that "most human behavior is learned observationally

through modeling: from observing others, one forms an idea of how new behaviors are performed, and on later occasions this coded information serves as a guide for action" (p.22). The approach taken by Lave and Wenger (1991) and elaborated in more detail by Wenger (1998) views learning as 'situated' in an intrinsically social activity. Their social theory of learning begins from a set of assumptions about human beings and the nature of knowledge in which learning is not necessarily the result of teaching. Learning is not separated from the rest of our activities, but rather, part of our lived experience of participating in the world (Wenger, 1998). Learning is a social process that involves building connections which are between what is being learned and what is important to the learner; between what is being learned and those situations in which it is applied; and between the learner and other learners with similar goals (Barab et al., 2003).

In a CoP context, learning may be distributed among many participants within the community in which people with diverse degrees of expertise (i.e., experts, novices and those in between) are transformed through their own actions and those of other participants (Hanks, 1991). Researchers are no longer perceived as experts and "knowledge generators" with practitioners considered as novices and "knowledge translators" (Palincsar, Manguson & Marano, 1998). Rather, teaching and learning are viewed as bidirectional because both groups contribute equally to the professional community's knowledge base (Buysse et al., 2003).

The CoP model specifies that the opportunity to engage in practice with others as well as social interactions that involve whole persons, not simply individual minds, is critical to the learning process (Barab & Duffy, 2000). Wenger (1998, p.4) stated:

> *The primary focus of this theory [CoPs] is on learning as social participation. Participation here refers not just to local*

> *events of engagement in certain activities with certain people, but to a more encompassing process of being active participants in the practices of social communities...Such participation shapes not only what we do, but also who we are and how we interpret what we do.*

This model also involves sustained relations over time among community members and contexts in which they function and among more and less experienced colleagues (Moore, 2002).

Lave and Wenger (1991) created a CoP framework as an approach to conceptualize learning and suggested that this approach could also be used to consider new methods of knowledge generation and dissemination in practice fields. They specifically emphasized the social aspect of learning as intimately tied to social practice. They believe that learning occurs via legitimate peripheral participation, that is, learners begin as peripheral participants of a CoP; they work with others to perform their duties and solve problems; and over time move closer to full, legitimate participation as they gain knowledge, learn the community's customs and rituals, and adopt a view of themselves as members of the community. Wenger at al. (2002) identified four levels of participation among groups of CoPs (Figure 2):

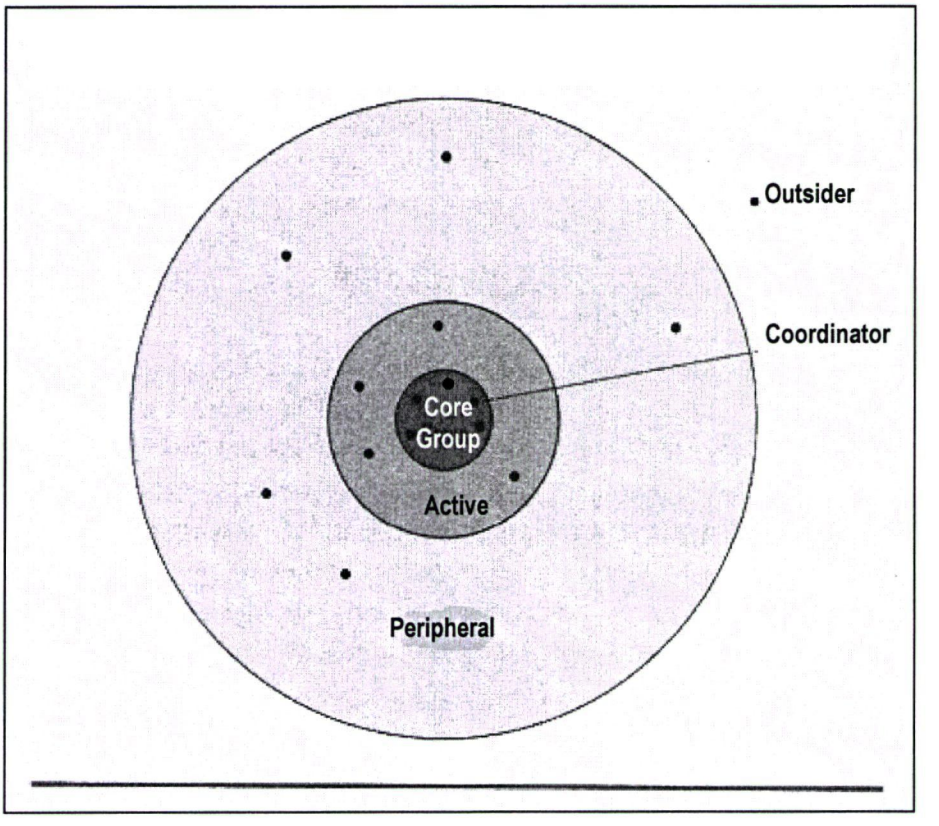
1) **Core group**: small group of people who actively participate in discussions, even debates in the public community forum; constitutes approximately 10-15% of the community

2) **Active group:** level outside the core group whose members attend meetings regularly and participate occasionally in the community forums, but without the regularity or intensity of the core group; constitutes approximately 15-20 % of the community;

3) **Peripheral Group:** level outside the active group whose members rarely participate. Instead, they keep to the sidelines watching the interaction of the core and active members; constitutes approximately 65-75% of the community; and

4) **Outsider Group:** level outside all the other groups composed by people who are not members but yet have an interest in the community. It includes customers, suppliers and "intellectual neighbors."

Figure 2: Degrees of Community Participation (Wenger et al., 2002, p.57)



Legitimate peripheral participation conceptualizes novices at the periphery and experts at the center of a CoP (Gherardi & Nicolini, 2000; Wenger, 1998). In CoPs,

peripheral roles play an important part by developing and using skills that require collaboration and mixing different types of expertise (Johnson, 2001), which Bielaczyc and Collins (1999) believe cannot be learned in traditional education environments.

Buysse et al. (2003) identified two central tenets of the CoP framework and the theories that underpin them: first, knowledge is situated in experience (underpinning theory: situated learning), and second, experience is understood through critical reflection with others who share this experience (underpinning theory: reflexive practice). The application of new knowledge, not the retention of it, is the benchmark for evaluating the effectiveness of a CoP (Lave & Wenger, 1998). In a CoP framework, new knowledge generated through collaborative reflection, observation, and systematic inquiry would be used, not only to extend professionals' understanding and command of their own situations, but also to advance the knowledge base for the field as a whole (Buysse et al., 2003).

Originally, CoPs typically involved people who shared geographical boundaries. As a result, the largest body of literature regarding research of CoPs has addressed conventional CoPs assuming physical proximity and face-to-face interaction between members. However, in today's world, companies have offices in different cities and countries; rural-based healthcare practitioners have few rural colleagues with whom to share best practices; and self employed individuals work at home and miss the collegiality of co-workers. These are only a few examples of situations in which face-to-face interactions present a challenge. New networking technologies have provided an opportunity to bridge geographic and time boundaries faced by today's practitioners and made it possible to expand the geographical scope of CoPs. A number of different

technologies have been used to support them including, asynchronous discussion boards and chat (e.g., Blackboard Learning System™, Moodle, and MSN Messenger); synchronous discussion software (e.g., CentraOne® and Elluminate); and websites. Technology can support CoPs in a variety of ways such as connecting groups who otherwise would be unable to meet face-to-face; connecting group members between face-to-face meetings; providing an additional communication forum for groups that meet regularly face-to-face; and providing a way to share documents related to the developing practice.

As organizations expand and new technologies become more affordable, CoPs have also expanded to include distributed members who rarely, if ever, engage in face-to-face communication. These technology-enabled CoPs are commonly called virtual CoPs, and have been defined as "physically distributed groups of individuals who participate in activities, share knowledge and expertise, and function as an interdependent network over an extended period of time, using various technological means to communicate with one another, with the shared goal of furthering their practice or doing their work better" (Allen et al., 2003, p.7).

For some researchers the term Virtual Community is not a synonym of virtual CoP. Henri and Pudelko (2003) identified four different types of virtual communities: the Community of Interest, the Goal-oriented Community of Interest, the Learners Community and the Community of Practice. They believe a virtual CoP develops among people who are already part of a given geographically based CoP. For a face-to-face CoP of professionals, involvement in a virtual CoP helps them make practice explicit-both improving and transforming it. For the organization, it helps to integrate new members

and maintain the common know-how essential for efficient professional practice. Daniel et al. (2002) also differentiated CoPs from other virtual communities such as a Communities of Learners, which he defined as groups of people who gather in cyberspace with the intention of pursuing learning goals. Alternately, he referred to virtual CoPs as "Distributed CoPs" and defined them as groups of geographically distributed individuals who are informally bound together by shared expertise and interests of work.

Virtual CoPs present many advantages to their members' learning. They integrate two diverse knowledge management strategies: technology focused repositories and human-centered conventional CoPs (Hansen et al., 1999). CoPs' members can proactively pull knowledge from the repository created by the collective contributions of all community members, as well as efficiently access and interact with knowledgeable community members (Zang & Watts, 2004). According to Allen et al. (2003, p.46),

> *Virtual CoPs are effective informal learning environments because they situate learning in the workplace, provide just-in-time learning and content-specific solutions to problems, and capitalize on employee interaction. They overcome the limits of formal training, satisfy critical conditions for learning, and help employees learn and solve problems so that they can perform better on the job by providing the necessary interaction and perspectives to increase their skills and knowledge.*

The CoP model offers a new approach to professional development in which professional development is not something people receive, but rather something in which they participate as part of their everyday activities (Moore, 2002). In a research context, this model offers the potential for researchers to co-construct knowledge together with practitioners. CoPs represent an ongoing enterprise that invites both groups to share,

build upon, and transform what they know about effective practices (Buysse et al., 2003). With the support of technology, there is tremendous potential of the CoP framework to further HI research and mentoring via virtual CoPs.

Research on virtual communities has been approached from several perspectives. From a social perspective studies have examined the relationships and the social values conveyed by the notion of community. Some authors question whether communities can exist in a virtual mode (Weinreich, 1997) while others believe virtual life is an established fact (Levy, 2000). From an educational perspective, some researchers have questioned the validity of the notion of a Virtual Community (Huang & Chen, 2002) while others have investigated its pedagogical potential and implementation (Trentin, 2001). Despite their practical significance, there is still a limited theoretical understanding of virtual CoPs. The different definitions of virtual communities, research approaches, discrepancies and inconsistencies in virtual CoPs' research results suggest the need for further research to better understand virtual CoPs characteristics and dynamics.

Research on applications of CoP theory exists in apprenticeship contexts (Leave & Wenger, 1991); in business contexts regarding the value of CoPs in knowledge management (Wenger et al., 2002); and in education contexts regarding teacher training and professional development (Barab et al., 2002). However, little research had been done in the field of HI and thus, further inquiry is required to move in this direction.

CHAPTER 3: RESEARCH DESIGN AND METHODS

3. 1 Research Design

This study explored how HI research collaboration among Trainees and Mentors in the CHPSTP was mediated by ICTs, focusing on participants' perspectives. The qualitative research method chosen for this study was appropriate for the exploratory nature of the study and well suited to answer the research questions.

Qualitative research inquiry contributes to understanding the particular context within which the participants act, and the influence that this context has on their actions (Maxwell, 1996; Fridlund, 1997). Given any person, group, or locus for interaction, it is a means for describing and attempting to understand the observed regularities in what people do, or in what they report as their experience (Miles & Huberman, 1994). Qualitative research also plays an important role in clarifying the values, language, and meanings attributed to people who play different roles in organizations and communities. It allows people to speak in their own voice, rather that conforming to categories and terms imposed on them by others (Sofaer, 1999).

Within qualitative methods, a case study design was chosen for this research. A case study is "an exploration of a *bounded system* or a case (or multiple cases) over time through detailed, in depth data collection involving multiple sources of information rich in context" (Creswell, 1998, p.61). A case study typically contains an operational framework and specifies theoretical propositions to help identify the relevant information to be collected about the case(s) (Yin, 1994). According to Yin (1994, p. 15), "case studies have a distinctive place in evaluation research". He identified at least five different applications including to: explain the causal links in real-life interventions that

are too complex for the survey or experimental strategies; describe an intervention and the real-life context in which it occurred; illustrate certain topics within an evaluation in a descriptive mode; explore those situations in which the intervention being evaluated has no clear, single set of outcomes; and perform a "meta-evaluation", that is, a study of an evaluation study. This study is a component of a larger evaluation of the CHPSTP overall. Therefore, case study design was considered appropriate to answer the research questions and meet the study goals.

This research focused on a single case, the Virtual Community, developed as part of a CIHR strategic training grant. It had multiple units of analysis both at the individual level and at the group level.

3. 2 Operational Definitions

The following are operational definitions of key terms used throughout the study:

Asynchronous Discussion - Communication that doesn't require all the parties involved to be present and available at the same time. Examples of this include e-mail, text messaging over cell phones, and discussion boards which allow conversations to evolve and community to develop over a period of time.

CHPSTP-Virtual Community - Community of CHPSTP Trainees and Mentors that uses technology to exchange information, share ideas, solve problems and collaborate on projects in the area of HI.

Community of Practice - A group of people who share an interest in a domain of human endeavor and engage in a process of collaborative learning that creates bonds among them.

Mentors - Accomplished researchers with diverse expertise and experience in HI and related areas participating in the CHPSTP. Among Mentors are Faculty members of the CHPSTP and researchers that supervise Trainees in their doctoral/post-doctoral research.

Synchronous Discussion - Direct communication, where all parties involved are present at the same time. Examples include a telephone conversation, a clinical meeting, a chat room event and instant messaging using internet technologies.

The Researcher - Graduate student submitting the dissertation.

Trainees - Researchers at the PhD or Postdoctoral level enrolled in the CHPSTP, participating in the HI Virtual Community.

Training and Mentoring Skills - exchange of information, sharing of ideas, problem solving, and collaboration in HI projects.

3. 3 Study Population and Sample

Purposeful sampling method was used to select the study participants from the population of CHPSTP Trainees and Mentors (Quinn, 1999; Rice & Ezzy, 1999). The purpose guiding sample selection of data sources in the study was to select a sample of Trainees and Mentors that:

- Represented more than one post-secondary institution taking part in the CHPSTP
- Actively participated in the CHPSTP-VC

Due to financial and time constraints, this study was limited to 15 participants.

3. 4 Study Location and Access to the Research Setting

The study took place in the virtual spaces used by the CHPSTP-VC, which included CentraOne® (synchronous online communications software) and Blackboard Learning System™ (Blackboard) (asynchronous online communication and collaboration software). Telephone interviews were conducted by long distance.

Consent to access the research setting and the information stored in both CentraOne® and Blackboard , i.e. CHPSTP-VC members' postings, access to attendance records and playback of guest lectures was obtained verbally from the CHPSTP-VC participants, and written from the CHPSTP Principal Investigator Dr. Francis Lau, University of Victoria (Appendix C).

3. 5 Data Collection Methods

A conceptual framework derived from the literature review (Barab & Duffy, 2000; Barab et al., 2001) of CoP characteristics was developed to guide the data collection and analysis (Appendix B). This framework was used to develop interview questions and identify 5-6 broad initial coding categories prior to data collection (Creswell, 1998). To help conceptualize the different stages of the research process and how they interrelate, a diagram of research methods was developed (Appendix D).

This study used multiple sources of data including (Appendix E):

- **Semi-structured one-on-one phone interviews** using an interview guide (Appendix F) derived from the conceptual framework. The purpose of doing in-depth interviews was to explore the complex nature of meaning which could not be achieved through a questionnaire (Rice & Ezzy, 1999). Interviews were used to

collect data on Trainees' and Mentors' perspectives of their experience participating in the CHPSTP-VC. One interview was held with each study participant. All interviews were held in the month of June, 2005;

- **Documentary evidence of the CHPSTP-VC** was retrieved from participants' postings in Blackboard discussion boards. The data included interactions occurring within the CHPSTP-VC, degree of participation, and collaboration of its members;
- **Researcher's personal journal** - These data were collected throughout the study and included the researcher's notes of her experience in the project (e.g., observations, feelings and comments from the interviews, documentary evidence and playback of guest lectures in CentraOne®); and
- **Playback of guest lectures in CentraOne®**– data on attendance and discussion of the CHPSTP-VC generated during all the virtual lectures in CentraOne® were collected. The four CentraOne® sessions held by the VC were reviewed. The sessions were held in October 21, 2003; November 20, 2003; January 14, 2004; and March 25, 2004; and reviewed in July and August of 2004.

3. 6 Data Collection, Management and Analysis

All the study participants identified through purposeful sampling agreed to participate in the study and provided informed consent prior to the telephone interviews (Appendix G). A total of 15 telephone interviews, one with each study participant, were conducted during the month of June, 2004 using the semi-structured guide developed for this purpose (Appendix F). All the interviews were held on the scheduled date and time, surrounded by a respectful and friendly atmosphere.

Data analyses occurred continuously throughout the study. Topics identified early in the study helped construct new questions for further interviews. The initial version of the interview guide was adapted to include subsequent questions relevant to participants' experience with the CHPSTP. At times participants discussed issues that were relevant to them and not necessarily included in the interview guide.

All interviews were tape-recorded with permission of the informant, and transcribed verbatim to facilitate thematic analysis. The interviewer reviewed all transcripts to ensure they were complete and accurate prior to being included in the analysis. Data from documentary evidence and the researcher's journal were typed and saved as text files for coding and analysis. Data obtained from playback of CentraOne® CHPSTP-VC sessions was coded using a template.

QSR NVivo 2.0®, a qualitative analysis software package, was used to facilitate data management and analysis. A preliminary read-through of the transcripts enabled the researcher to obtain a sense of the overall data (Creswell, 1998). Initially, data were coded descriptively in order to store what was known about the data items to facilitate researcher retrieving the information (i.e., date, place of the interview, participant interviewed) (Morse & Richards, 2002).

The initial broad categories identified from the conceptual framework were used as a starting point for coding the data. Initial interviews and documentary evidence then served as a guide for development of new categories, sub-categories and emergent themes (Creswell, 1998). Throughout the data analysis, the proposed conceptual framework was being constantly reviewed as part of an iterative process. The researcher looked for patterns and a correspondence between two or more categories within the

themes. These patterns and correspondence were confirmed and disconfirmed throughout the analysis. Finally, the researcher developed generalizations about the case in terms of the patterns identified (Creswell, 1998).

3. 7 Rigor

A study is rigorously conducted if it has sound reasoning and argument, the choice of methods are appropriate to the research problem, it offers clear documentation of methodological and analytic decisions, and honestly reports the role of the researcher in the research (Rice & Ezzy D, 1999).

The measures of scientific credibility in quantitative research are well known: internal validity, external validity, reliability and objectivity. Methods for verification of qualitative research are equally important. To establish *trustworthiness* of a study, Lincoln and Guba (1985) use the terms *credibility*, *transferability*, *dependability,* and *confirmability*. Credibility is the criterion with which to judge whether the respondents' reality is similar to the reconstructions of reality attributed to them. Transferability is the extent to which findings can be applied to other groups. Dependability is concerned with stability of the data overtime. Confirmability is the ability to trace findings back to the data. Creswell (1998) suggests at least two of eight methods for verification be used in any qualitative research study, including prolonged engagement and persistent observation; triangulation; peer review or debriefing; negative case analysis; clarifying researcher bias; member checks; and rich, thick description.

In this study, four of the eight methods for verification proposed by Creswell were used; triangulation; peer review or debriefing; clarification of researcher's biases; and rich, thick description.

- **Triangulation** - involves searching for the convergence of the information coming from the different sources used in the study (Stake, 1995). Studies that use only one method are more vulnerable to errors linked to that particular method (e.g., loaded interview question, biased or untrue responses) than are studies that use multiple methods. Triangulation contributes to verification and validation of qualitative analysis (Quinn, 1999). In this study, the information obtained from the interviews was triangulated with data obtained from other data sources such as documentary evidence and researcher's personal journal.
- **Peer review or debriefing** – provides an external check of the research process; in this study the researcher met with the thesis supervisor on a regular basis to discuss the data analysis.
- **Clarification of the researcher's biases** - Bracketing is a technique commonly used to assist qualitative researchers to gain awareness of their own feelings and perceptions to minimize personal biases during the development of the analytical framework and data analysis process (Miles & Huberman, 1994).

It is important to highlight that the researcher in this study is the former project manager of the CHPSTP. However, her duties as the project manager were finished, and she had no work-related liaisons with any of the study participants at the time the study was conducted. As opposed to being a limitation, it could be argued that this previous knowledge of the study participants strengthened the researcher's role. Participants were

more open during the interviews as a consequence of knowing the researcher and having a trust relationship. Prior to data collection, the researcher wrote notes attempting to record and bracket her own assumptions and biases. This helped the researcher be more aware of personal beliefs, values and expectations of this research project. The researcher also kept a journal throughout the data collection process to record her personal feelings and thoughts in order to facilitate reflexivity throughout the data analysis.

- **Rich, thick description** – allows the reader to make decisions regarding transferability; the researcher in this study described in detail the participants and setting under study to facilitate the reader's determination if the findings could be transferred.

3. 8 Ethical Considerations

The project was submitted to the University of Calgary/Calgary Health Region Conjoint Health Ethics Review Board for review and ethical approval in April, 2004. Ethical approval was received in May, 2004 (Appendix H).

A narrative including an outline of the proposed research was read to the study participants over the phone (Appendix G). They were asked if they had questions regarding the research and whether they agreed to participate before the interviews took place.

The data collected throughout the study were stored in a computer at the Health Telematics Unit, University of Calgary, with restricted access to the researcher and her supervisor. All the data will be kept at the University of Calgary for seven years and destroyed after this time period. All interview tapes were destroyed after the data were transcribed and transcriptions were reviewed by the researcher.

CHAPTER 4: RESULTS

4.1 Description of the Sample

Fifteen CHPSTP-VC participants were interviewed for this study, which represented the eight universities involved in the CHPSTP. These included the Universities of Calgary, Dalhousie, McGill, McMaster, Toronto, Sherbrooke, Victoria, and Waterloo. In this sample, each university was represented by one CHPSTP Mentor and one Trainee. The only exception was the University of Calgary which was represented exclusively by one Mentor because at the time the study was conducted no Trainees from this university were enrolled in the program.

The sample was composed of highly educated researchers and professionals. At the time they were interviewed, Mentors were holding academic and research positions at the Universities they represented while Trainees were pursuing training in Health Informatics (HI) at the doctoral or post-doctoral level. Both Mentors and Trainees had a variety of backgrounds. Mentors within the sample included two physicians, one nurse, one psychologist, one statistician, and three computer scientists. Trainees included two physicians, two nurses, one occupational therapist, one computer scientist and one health informatician.

All the telephone interviews were held in a respectful and friendly atmosphere. Study participants were very cooperative and openly discussed their experience in the CPSTP-VC with the researcher. They seemed particularly interested in the study and tried to accommodate their busy schedules to participate in the interviews.

Data obtained from the interviews was contrasted with the data obtained from the documentary evidence of the CHPSTP, the playback of the CentraOne® sessions, and the researcher's personal journal to achieve triangulation.

The italicized quotes used throughout the results chapter were taken from the verbatim transcriptions of the study participants' interviews. They represent participants' own words in discussing their thoughts and perspectives on the issues discussed during interviews with the researcher. They were used to illustrate specific issues the study participants felt strongly about and that are relevant to the results presented in this chapter.

4.2 Introduction to Themes

The interview questions were based on themes identified in the conceptual framework. The data were naturally organized around these themes including CHPSTP-Virtual Community, Characteristics of a Community of Practice in the CHPSTP-VC, and the Role of Technology. The data analysis also revealed one emergent theme, CHPSTP Overall (Table 2). Categories, sub-categories and topics were identified within each of the themes, some of which overlapped with each other and the emergent theme. Initial themes are presented in sections 4.3 to 4.5; the emergent theme in section 4.6.

Table 2: List of Themes and Their Correspondent Categories, Sub-categories and Topics

Themes	Categories	Sub-Categories	Topics
4.3.CHPSTP-Virtual Community			
	4.3.1. Personal Expectations		
	4.3.2. Building Community and Trust		
	4.3.3. Participation		
		Preparation for Participation	
		Level of Participation	
			According to Roles
			Role of Time Availability
			Virtual Setting Vs. Face-to-face Setting
			Research Interest and Expertise
		Suggestions for Improvement	
	4.3.4. Contribution of the CHPSTP to the Field of Health Informatics		
		Building a Health Informatics Research Network	
		Increasing Health Informatics Research and Training Capacity	
	4.3.5. Outcomes		
4.4. Characteristics of a Community of Practice in the CHPSTP-Virtual Community			
	4.4.1. Shared Passion/Practice		
	4.4.2. Value of Expertise		
	4.4.3. Support from CHPSTP-Virtual Community Members		
	4.4.4. Sharing within the CHPSTP-Virtual Community		
	4.4.5. Mechanisms for Reproduction		
4.5. Role of Technology in the CHPSTP-VC			
	4.5.1. Technology Overall		
		Advantages	
		Disadvantages	
		Technology as a Tool to Communicate and Collaborate	
		Technical Support	
	4.5.2. Use of CentraOne® Technology		
		Advantages	
		Disadvantages	
	4.5.3. Use of Blackboard Technology		
		Advantages	
		Disadvantages	
4.6. The CHPSTP-Overall			
	4.6.1 Sustainability		
	4.6.2. Roles of CHPSTP Members		
		Principal Investigator	
		Program Director	
		Program Manager	

Mentors

Trainees

4.6.3. Collaboration

Opportunities

Facilitators

Obstacles

Face-to-face vs. Virtual Collaboration

4.6.4. Leadership and Management

4.6.5. Areas for Improvement and Suggestions for Future Development

4.6.4. Health Informatics Overall

4.3 CHPSTP-Virtual Community

This theme presents specific findings relevant to the CHPSTP-VC. Five categories will be explored in more detail, including: Personal Expectations, Building Community and Trust, Participation, Contribution of the CHPSTP-VC to the Field of HI, and CHPSTP-Virtual Community Outcomes.

4.3.1 Personal Expectations

Most Mentors in the study expected the CHPSTP-VC would enable them to work together without having to travel. They also had specific expectations regarding the tangible outcomes of their collaborative work within the CHPSTP-VC, for example, research manuscripts, grant applications, conference presentations, etc. A few others were skeptical as to how the interactions would occur, in terms of how successful research collaboration would be conducted when using a web-based tool. However, they appreciated the fact that the CHPSTP-VC was at a very early stage. They didn't expect to see results right away and appeared confident that in the long run the CHPSTP-VC would pay dividends.

> *... with the Virtual Community I think we are primarily at the community building level. But things will inevitably come out of it...*
> *(Participant 02)*

One Mentor was skeptical about the quality of discussion and classroom environment they would be able to build during virtual seminars, and therefore, had low expectations for the CHPST-VC. For this participant, small group seminars (e.g., 15 to 20 Trainees) were a perfect size for a good face-to-face graduate level discussion, and physical presence in the classroom was always better than virtual. However, after

participating in the CHPSTP-VC he thought the virtual classroom performed much better than he had expected.

In contrast, another Mentor expected to collaborate with other HI researchers in Canada to further the integration of the computer into medicine so that physicians could use it as a tool to better manage patients and update knowledge. This participant expected this to be the ultimate outcome of the collaborative work of the VC.

One Trainee didn't have any expectations regarding the CHPSTP-VC, but was curious what participation would be like. Other Trainees didn't have very high expectations, but after participating were positively impressed by the results.

> *...It's been pretty good. I would say that the Virtual Community wasn't exactly as what I thought, as I anticipated it might be, it's actually better...*
>
> *(Participant 07)*

4.3.2 Building Community and Trust

Building a sense of community was seen as a crucial step prior to collaborating in the CHPSTP-VC. Most of the Mentors knew each other from previous collaboration experiences or research meetings. This was considered an advantage as it was viewed as a key component in the community building process and a preamble to successful virtual collaboration. It also helped them build trust and strengthen the sense of community.

> *...but again, in that case I'd met I think I'd met every single faculty member who participated in those and so I was very comfortable using the web-conferencing and voice over IP for those.....mainly because I'd met these people and I felt I knew them and I felt comfortable with that...*
>
> *(Participant 13)*

> *...I think that trust is very important in any community, in any social interaction. You know we approach our interactions with people based on sort of trust. And if we don't have that trust already established, we don't have that already there, then what I am going to say is not*

> *gonna be listened to. So why would I put myself in a vulnerable position? I think trust has to be built on already existing relationships...*
>
> *(Participant 15)*

They saw value in getting to know each other and investing time in developing relationships. Open discussions with other CHPSTP-Virtual Community members were considered a way to strengthen relationships among members. One of the Trainees thought this type of exercise would facilitate building relationships beyond just research, (e.g., friendship):

> *...and you know that people are working in the same areas and you know more about them and you become friends. More than just research...*
>
> *(Participant 04)*

The group agreed that the CHPSTP-VC was primarily at the community building level and acknowledged that in any group effort it takes time to initiate collaboration. One of the Mentors acted as the CHPSTP director for the first two years. She believed she didn't spend enough time getting people engaged (i.e. building community) during the first year, and as a consequence, a low activity was observed in the VC during that year. This improved during the second year, after building community efforts such as a face-to-face workshop were carried out. Some study participants agreed with the lack of engagement during the first year.

> *...The first year I don't think it was very successful. People didn't know what to do. There wasn't a lot of commitment, I guess, to actually participating. And it really began to take off more in the second year. And I think partially because we met at UVIC.....and I think that really, that really, gave some impetus to move forward with the Virtual Community...*
>
> *(Participant 11)*

This example illustrates the general feeling of the study participants that building a sense of community and trust takes time, requires effort, and is facilitated by face-to-face encounters.

4.3.3 Participation

Three main sub-categories emerged from the category Participation in the CHPSTP-Virtual Community: preparation for participation and discussion in the VC; level of participation of Mentors and Trainees in Virtual Community activities; and suggestions to improve participation.

The VC was organized as a set of two-week discussion periods each focusing on a different topic in HI research. Each discussion period started with a 1.5 hour synchronous virtual guest lecture using online CentraOne® software. This was relevant to the topic selected for that period, followed by asynchronous discussion in Blackboard. The asynchronous discussion took place in "Discussion Boards" set up for this purpose inside the Blackboard virtual space. Prior to the virtual lectures, the discussion leader for this period determined the learning objectives, discussion questions, and suggested readings to prepare for the lecture and subsequent discussion. These materials were posted in Blackboard and also e-mailed to the VC members. Prior to the beginning of each discussion period, Mentors and Trainees in the program were asked to prepare by reading these materials.

Preparation for Participation

Perceptions of the importance of preparing for the discussion prior to its commencement and the burden this implied varied among Mentors and Trainees. From the Mentors' perspective a well prepared audience was considered valuable and directly

resulted in rich discussion, as well as generating interesting questions and active debate. Distributing the lecture material in advance was considered a concrete way to provide content to the VC members as well as something they could take away and refer to in their daily work. Mentors believed any graduate program at the doctorate level implies reading relevant material and therefore did not think of it as a burden, but rather as a common practice within graduate programs that would benefit Trainees.

Some Trainees believed they were already loaded with reading materials in their required courses and graduate activities at their home universities, and at times thought preparing for the virtual lectures was an additional burden to their already busy schedules.

> *...at this time I just couldn't have the time or energy to read more. I was already reading (patient notes) 340 pages a week. My mind was like mushing I couldn't have read any more. I had to choose what was important for me...*
>
> *(Participant 15)*

However, most of them did prepare for the lectures and discussions as they thought it was beneficial for their training and helped them get started exploring some of the HI research areas. Their preparation was influenced by the material being relevant and readily available. Some Trainees revealed they had become somewhat selective of the material they would choose to read for the VC discussions, which was influenced by their doctoral research topic.

> *...hum I guess didn't have much...will or interest to attending or reading stuff that I knew would not be my area...*
>
> *(Participant 10)*

> *...I took out the reading I was interested in.....I read very selected ones...*
>
> *(Participant 15)*

They appreciated the convenience of getting suggested materials in certain areas they were not familiar with, although a few Trainees found some of the readings quite challenging as they used a lot of technical jargon they weren't familiar with.

> *...I liked to know um...especially if it's an area that I am not familiar with, then I didn't have to go out and look for articles and information... that was available to me, and the most appropriate ones. So I could read through it and I would have much more, I guess relevant or maybe knowledgeable questions..... that I had a little bit of something to start with...*
>
> *(Participant 11)*

Most Trainees valued having access to the PowerPoint presentations prior to the guest lectures as it gave them a general idea of what would be covered during the lectures.

> *...And then I appreciated the slides so I could review them and kinda see how the information kind of um...add to the slides and the discussion. And then with the discussion if I had concerns or question and if it wasn't answered in the um...the presentation, then I could ask that. I appreciated that. I liked to prepare ahead of time...*
>
> *(Participant 11)*

Some Trainees who read all the suggested articles prior to each virtual lecture commented that it seemed the guest lecturers had not always read these materials themselves. They were frustrated by the fact that they had spent a lot of time reading papers that were never actually referred to during the virtual lectures.

Level of Participation

While all the Mentors and Trainees contributed to the CHPST-VC, their level of participation and engagement varied. They discussed extensively their motivations to participate, reasons for not participating, and whether they felt more or less comfortable participating in the asynchronous discussions in Blackboard or synchronous discussions in CentraOne®.

The Participants' contexts determined their level of participation in the CHPSTP and emerged throughout this section in regards to their roles in the program. This included amount of time they had to commit, level of comfort in a virtual setting, research interest, area of expertise, and for Trainees the degree of advancement in their graduate studies. Some of these topics also influenced their preferences for participating in synchronous discussion in CentraOne® rather than asynchronous discussion in Blackboard within the Virtual Community.

According to Roles

Mentors who committed to play a leadership role in the CHPSTP such as the Principal Investigator (PI) or the Program Director (PD) participated more in the VC activities than those who played more of a secondary role in the program.
Overall, Trainees participated more in the CHPSTP-VC activities than Mentors. In general, they felt they had an urgent need to learn from more experienced CHPSTP participants, and therefore were highly motivated to become involved in VC activities.

Role of Time Availability/Synchronous vs. Asynchronous Discussions

Most Mentors acknowledged having participated mostly in the virtual lectures in CentraOne® and very little or nothing in asynchronous discussions in Blackboard that followed the virtual lectures. The primary reason given for this was time constraints. Given their busy schedules, it was difficult for them to make time to attend all the lectures and therefore, they tried to choose the ones they could gain the most from. Both Mentors and Trainees agreed that it was easier for them to attend the virtual lectures and meetings in CentraOne® than to participate in the asynchronous discussions in

Blackboard. This was due to the fact that the sessions were planned in advance and had a pre-set date and time that could be marked in their calendars.

> *...Well for the, for the lectures it was very easy, because it's time sensitive and you know somebody's speaking Tuesday at three O'clock, you put that in your calendar and you make time for that...*
>
> *(Participant 12)*

Discussion in Blackboard required finding the time to log on, writing and editing ideas, waiting for someone to respond and then responding back.

Trainees that participated in asynchronous discussions expressed their frustration for lack of participation of other CHPSTP members. They thought they needed the other participants' input to enrich their learning experience and therefore made the CHPSTP-VC activities a priority.

> *...What I discovered around this program was that the experience that you take out from this program is what you do about it. So if you don't do nothing, then you will get nothing. So if you get involved and if you ask question, if you participate then you will get more than if you just stand there and watch the train rolling...*
>
> *(Participant 14)*

> *...It's nice to have feedback. I don't think it has to be from a faculty member. But I think if you are gonna send information or you are responding to a question, or issue or concern or whatever, I think, you know, it's kind of ...for me in terms of learning it's not useful to send something out there and not have a response to that....if you are gonna show up online..., not just to learn but also to give something back...I think that's important. It has to be a reciprocal relationship. It can't be a one-way relationship...*
>
> *(Participant 11)*

> *...I think that it's fun that if you invest some time into something...that the persons that committed to it participate a lot...*
>
> *(Participant 14)*

They were also disappointed with the poor quality of the messages posted. They expected a good discussion flow, rich in both quantity and content that made the effort and time spent accessing the Blackboard discussion boards worthwhile.

> *...I think I had anticipated more of ...more of discussion in terms of back and forth messages. There were..... I think people mostly limited it to one message, and they felt like they were done. I would have hoped to have had more discussion through messages. And a little bit of that was happening. But I had hoped for more of that. Back and forth text discussion....and a lot of that was just time, I am sure, time commitment. It's easier to talk than to write things down...*
>
> *(Participant 11)*

> *...Few of the people were trying you know, to make a discussion really. Because there were only one or two posting per person. And the amount of discussion, since everybody has to post something, well the amount of discussion was quite large to read. But uh...few comments were interesting....so few of them build them into threads, which were interesting...*
>
> *(Participant 14)*

One Trainee thought the level of participation in the asynchronous Blackboard discussion was pretty good in the beginning but rapidly lost momentum, having a negative impact on Trainees' motivation.

> *...If you are not getting the traffic, you are not getting the posting, then it really is not something that people are going to come back to I guess...*
>
> *(Participant 07)*

Most participants believed that the low level of participation in the VC was more due to lack of commitment than time constraints. They thought time was an issue for everyone and no one had free time. However, they had to make the choice as where to spend the time.

> *...I think there is always the time issue. But I think it's more commitment than just time because usually when people see something valuable they will make the time...*
>
> *(Participant 05)*

Virtual Setting vs. a Face-to-face Setting

Most of the Trainees believed their level of participation in both synchronous and asynchronous discussion wasn't different than what it would have been if they were participating face-to-face. However, some Trainees who described themselves as shy reported they participated more in the asynchronous virtual environment provided by Blackboard than they would have in a face-to-face setting. They said they felt more comfortable in this asynchronous environment because it allowed them more time for reflecting and editing their thoughts and responses prior to sharing them with the other VC members.

Research Interest and Expertise

Trainees and Mentors believed that personal research interest and area of expertise played an important role in the CHPSTP-VC members' participation behavior. If the topic being discussed was related to their research area of interest or expertise they felt more motivated to participate in the VC activities.

Some of the Trainees acknowledged that while they had not actively participated, they monitored some of the threads for their own learning. They said they didn't feel comfortable posting their comments around topics they didn't know much about and therefore just followed the discussion without getting involved. This was also true for one of the Mentors who acknowledged following the discussion and only participating in it when the issue under discussion was relevant to his particular interests.

One of the Trainees said in the beginning he had attended most of the virtual lectures as he wasn't clear about his research interests. Later in the program when his

research idea became clear, he started being more selective of the guest lectures and discussion boards he would participate in, selecting those that matched his interest area.

Suggestions to Improve Participation

Trainees and Mentors felt strongly that participating in the Virtual Community was important and thought they should find ways of increasing it. This was also reflected in the Mentors' monthly meetings in CentraOne® to discuss organizational issues related to the program, in which participation was always included on the agenda and considered an important issue to be addressed.

Mentors in general felt they needed to find ways to get Trainees and other Mentors more involved and engaged in the VC.

> *...I think we are still struggling with how to get people participate...Not sure by now what to do different yet, but I think we should critically look at what we do now to see what is the way to improve it...*
>
> *(Participant 05)*

They thought perhaps they needed more structure in terms of enforced participation and clarification of expectations regarding their degree of involvement in the CHPSTP-VC activities. They believed that strong leadership and direction was needed when people have busy schedules. Therefore, having someone remind them what was expected from them and when, was viewed as an efficient way to keep CHPSTP-VC participants focused.

> *...I don't know... Maybe more structured, be more direction, in terms of forced direction. People are very free to come in any time. It's too loose in my view. I know there is a reason for that but I think to make it more structured not only for the Trainees but also for the people involved....So be more ...make sure that everything is going the way that it should be going...*

> *...And which means sometimes becoming a pain but I think that it's needed to be stronger in terms of requiring people to do things. Not just out of good will...*
>
> *(Participant 08)*

> *...I would almost like to say that, you know, that we need to be a little bit more stringent about people actually participating, and not leave it up to you can if you want. That's part of receiving funding and continuing on with funding in the future...I'd almost like to say that people are required to participate for a period of time, and after that become voluntary. But you do need to give it a try. You are required to participate twice a month. We sort of, I hate to say, force people, but really strongly encourage people to become part of the community...If you want to receive funding you need to become part of the discussion...*
>
> *(Participant 12)*

As an alternative to a more structured format that imposed participation, some Mentors believed that at the graduate level Trainees should be independent learners and leaders of their own education. Therefore, their role was basically to identify opportunities for Trainees to get involved and facilitate their participation, but it was up to the Trainees to take advantage of those opportunities. They thought they could structure the VC in a way that was appealing for Trainees as well as made participation in the planned activities feasible.

> *...I would do whatever I could to keep the students actually engaged. I think it's almost, I mean the faculty is there to help but this is a post-graduate level training program. I see very much....., even we have the same thing at undergraduate, but very much more in the post-graduate level students are in the driver's seat for their own education. So you know our job is to provide as many as resources and opportunities as we can...*
>
> *(Participant 03)*

Some Trainees suggested a good way to increase participation would be to clarify expectations regarding minimum level of participation as well as time commitment as soon as they joined the CHPSTP.

> *...would have very clear expectations of ...of those who are participating, that they would have to be a certain, you know, kind of certain standard of ...I don't know how you can standardize participation, but there has to be a certain expectation that you know, below this is inadequate. And then you know, you have to be involved for this amount of time, or maybe have different levels of involvement. If you are there just to listen and to hear, then you know kind of ...yourself that way, or that's all you want out of it. So that people aren't expecting that you know with all these people online, all these people who saying they are part of the Virtual Community but you know some only show up then for the conference, but you don't see them any other time through the year, or you don't hear from them. So just to clarify what the expectations are. If you are to be involved and this is what is expected of you...*
>
> *(Participant 11)*

4.3.4 Contribution of the CHPSTP-Virtual Community to the Field of Health Informatics

Overall, study participants thought the CHPSTP-VC was a very positive initiative and experience. They identified specific contributions of the Virtual Community to the field of HI around two main sub-categories: Building a Health Informatics Research Network and Increasing HI Research and Training Capacity.

Building a Health Informatics Research Network

Study participants thought the Virtual Community was instrumental in helping them build a National HI research network that allowed them to share resources, knowledge and expertise. They thought one of the most important things they gained from the CHPSTP-VC was the opportunity to meet, collaborate with, and learn from other HI researchers that they probably would not have met if it wasn't for the VC.

> *...I have really enjoyed it. I think it's an opportunity for people who wouldn't normally have chance to meet because of the geographic limitation to actually meet...And then I have just been amazed of some of the people that I've met...*
>
> *(Participant 11)*

> *...I think the [Training] experience becomes richer because the people who are trained in this area are sort of somewhat few and far between...*
>
> *(Participant 11)*

Mentors valued the opportunity to showcase their research and areas of expertise at the national level via the CHPSTP-VC. This was also valued by the Trainees who felt that they had gained exposure to HI experts and their interesting research work, which was unknown to them before joining the CHPSTP-VC. They felt they learned a lot by addressing questions about their own research topics as well as areas of interest directly to the experts across the country.

> *...I think if...had it not existed we would have not been aware of the strengths and the areas of interest of people...I do want to say you know I'm very thankful. And it made a significant impact on how I function and what I may be able to do. I think it has been a very good thing [the VC] and I hope it can continue...*
>
> *(Participant 06)*

Study participants thought the VC opened their eyes to the wide spectrum of research projects being done under the umbrella term HI, which they had thought was much narrower prior to joining the VC. They were amazed by the amount, diversity, and potential of research being conducted in HI, and felt fortunate to have had access to the latest emerging knowledge through the VC.

> *...The whole idea of sharing knowledge especially the knowledge that's emergent, that's coming out of all these projects, that's taking place all across Canada. I would have never had access to that information had I not been part of that community...so I'm thinking of all the work that the faculty and students brought with them from the universities...*
>
> *(Participant 07)*

One Mentor believed that PhD students cannot learn in a "vacuum." Therefore, it is important for them to connect with other students at their level and learn from one another. He believed the VC presented a great opportunity for the few PhD students in the field of HI across the country to connect and benefit from each other's training experience. Similarly, Trainees valued the exposure to other Trainees in different universities. This allowed them to discuss their research projects and methods, and compare the graduate training they were receiving to what was available in other universities.

Another Mentor thought the VC brought a new dimension to information scientists with an interest in HI. He believed that the interaction with health care professionals allowed them to understand better healthcare needs and issues, at times difficult for those that didn't have a health professional background. Similarly, some Trainees with a medical background thought that having computer scientists in the VC helped them better understand computer science concepts and jargon often used in HI.

Increasing Health Informatics Research and Training Capacity

Study participants agreed that the CHPSTP-VC had contributed to increasing research and training capacity in the field of HI. They believed the large spectrum of activities in different areas of HI covered by the CHPSTP-VC added value to their own areas of expertise. They thought the VC offered them a great opportunity to learn about the research process in general, not only in the HI field. They learned how experienced researchers frame their interest and put their ideas together, organize research projects, prepare research presentations, and organize conferences. One Trainee believed PhD students needed to "learn how to learn", that is, learn how to get organized and find

resources. He thought the VC had been a great learning source to achieve this. Trainees overall believed their knowledge of HI research methods and tools had increased as a consequence of their participation in the VC. Through the discussions and lectures they were able to clarify concepts, obtain new relevant information and resources, and reinforce previous concepts.

Mentors believed the Virtual Community had been key to advance HI training in Canada by supporting their collaboration at a distance around curriculum design and program implementation activities.

> *...probably the biggest contribution is actually creating a focus.....around HI training, like just having a presence. I think it has been valuable to get people thinking about what should be happening in HI training in Canada....so in a way we are a bit of a lobby group to advance this whole area...*
>
> *(Participant 03)*

Some Mentors thought the VC empowered HI researchers in giving them more credibility when applying for research funding. They believed their participation in the VC gave them access to collaboration and support from experts in different areas of HI which was an added value that made their applications stronger, contributing to increased research capacity.

4.3.5 Outcomes

Mentors and Trainees in the study identified publications in peer-reviewed journals as the main outcome they expected from the CHPSTP-VC. They agreed that achieving this goal required time for the VC to consolidate and advance in joint research projects to have enough material for publication. Therefore, their expectation to produce joint manuscripts for publication was subjected to a reasonable time of VC activity. They

all agreed that showing tangible deliverables such as publications, grant applications, conference presentations and increasing numbers of Trainees enrolled in the program was beneficial and key to getting more funding to further the VC.

One of the Trainees raised the issue of who deserved to get credit for the outcomes of the VC. She believed it was difficult to measure the VC outcomes because, in many cases, the publications and work produced inside it were more attributable to a particular Mentor or Trainee than to the community at large.

The second most desired outcome for study participants was the development of joint research proposals that would be translated into grant applications, in which the different areas of expertise represented by the Universities and Mentors in the program was present.

In terms of specific outcomes of the VC at the time this study was conducted, a number had been completed or were in progress. These included: two Trainees working on a joint manuscript; a Mentor partnering with three Trainees from different universities to perform a Meta study of telehealth literature; two Mentors from different universities partnering to develop a research project; Trainees from different universities partnering to develop a website to share HI resources; and Mentors collaborating virtually to put together two face-to-face workshops and a pre-conference workshop during a national e-Health conference.

4.4 Characteristics of a Community of Practice in the CHPSTP-Virtual Community

In the study participants' perceptions of the VC development and interactions between members, the researcher was able to identify some of the characteristics as usually present in any CoP [identified in the literature]. However, some of these manifested in particular ways that differed from the literature's description. The similarities and differences between the CHPSTP-VC and CoPs described in the literature will be discussed in Chapter 5.

The CoP characteristics of the CHPSTP-Virtual Community were organized into the following categories: Shared Passion/Practice, Value of Expertise, Support from Virtual Community Members, Sharing within the Virtual Community, and Mechanisms for Reproduction.

4.4.1 Shared Passion/Practice

According to the study Mentors, the CHPSTP was put together as a response to a common need of a group of HI researchers across Canada. They had met in the past, knew each other's work and had a common interest to advance the HI discipline. The PI of the CHPSTP started the process by contacting a network of people working in HI in Canada, who then spread the word and got other people involved. Trainees in the study got involved in the CHPSTP as a result of searching for HI training themselves, or being invited by one of the Mentors that was aware of their interest in HI.

Mentors and Trainees in the study believed they shared a passion for HI as well as HI research with the other members of the CHPSTP-VC.

> *...Do I share a passion? Absolutely, I mean that's one of the key drivers for us putting together the initial proposal....is that all of us are keenly interested in research in HI and we um...we have a very small number at each university, and one of the things that we lack is the critical mass. And so I think it's the passion that pulls us together because there's very few people outside HI that know about it that even care about the research, but we care about it a lot...*
>
> *(Participant 12)*

In spite of the fact that study participants felt they shared a passion for HI, they felt somewhat disconnected to other VC members in relation to their more specific areas of interest. In this regard, they believed they shared a passion with very few VC members or in some cases none of them:

> *...Within the particular group there are a few people that I do feel connected to. There are others that you know, I am interested in their work, but I don't really feel that I have a connection with them. Except within the round of...we are all working towards or on this common goal of developing HI within Canada, and I feel certain kind of collaborative sharing with regard of that aspect of it...*
>
> *(Participant 11)*

4.4.2 Value of Expertise

Overall, Mentors in the study believed their expertise in HI research was valued by the VC members. They were aware of other Mentors' areas of expertise and thought both Mentors and Trainees in the program were aware of their areas of expertise. They felt they had something to add to the CHPSTP-Virtual Community and something to learn from the other experts.

> *...I think there's interest in the area that I'm working in and I think the knowledge that I have is valued because students do work with me.....and other faculty as well. I mean that we have to continue to come together on projects besides this one. So I do believe people do value the work that I do...*
>
> *(Participant 12)*

Two of the Mentors felt their expertise was not valued by the VC members because their research area was not considered mainstream in HI. However, they believed they had something to add and to learn from the other VC members.

Similarly, most Trainees thought their expertise was not valued by the Virtual Community. They believed neither Mentors nor Trainees in the program knew what their areas of expertise or background were. They felt they didn't have as much to add to the program as they had to learn from the experts, and hoped to gain expertise from interaction with HI experts. Only a few Trainees thought the VC valued their expertise and believed they had something to add to it.

4.4.3 Support from CHPSTP-Virtual Community Members

Overall, Mentors and Trainees in the study believed they needed the support of the other VC members to advance their research. Some study participants disagreed with this, yet liked getting feedback from other VC members and collaborating in projects where they thought collaboration would lead them to a better end product. Most study participants believed the VC supported the HI field at large.

> *...I think I need the support of the other VC participants. Even for me who has already sort of established in the field, I continue to have to draw on collective intellectual wisdom and the support of colleagues. You know, what they are doing, what other people are doing...*
>
> *(Participant 05)*

> *...I think we need each other's support because we are so young a discipline. We need to be understanding of the different ways that can help it grow....I mean it's a fabulous opportunity to have this grant over a reasonable period of time to help it grow. So I think we are carrying the torch for growing the academic discipline of HI in Canada....so I think it's quite a bit of responsibility...*
>
> *(Participant 02)*

Most Mentors believed VC support was necessary to frame their new research ideas as well as to receive feedback regarding appropriate research methods and strengthen research proposals when applying for grants. Some Mentors believed a great amount of learning was achieved without any traditional academic structure, but rather just working through problems with people that share the same interests and issues, in particular learning from more experienced people. For them, the need to learn together reinforced the value of the VC. Most Trainees agreed with this and expected to learn from the experts in the Virtual Community.

> *...Yes, you need your research methods course and you need your other courses, so on. But the way that you really learn research is by doing the research with more senior persons...*
> *(Participant 02)*

4.4.4 Sharing Within the CHPSTP Virtual Community

Overall Mentors and Trainees in the study said they didn't feel a need to share their ideas or newly acquired knowledge with other VC members. Moreover, they were not comfortable with sharing their ideas or work before it had been published in a journal. They argued that researchers had to be extremely cautious with issues such as plagiarism and protection of intellectual property present in research environments.

> *...We have to be very cautious about [sharing] because we've had problems with plagiarism...And some of the stuff that we are doing has intellectual property rights that are being protected by patent...*
> *(Participant 13)*

Only one Trainee said he had shared some of his work and references with the VC, and one Mentor said he would eventually share his ideas and work but selectively with people he knew well and trusted.

4.4.5 Mechanisms for Reproduction

Study participants hoped the interaction and contacts generated within the VC would continue after the program's funding was over. Most of them expected another grant application to come out from the VC members that would allow them to sustain the VC over time.

A concrete example of the groups' will to continue with the VC activities was a website that a group of Trainees started after the VC took a break. The goal of the website was to share up-dated and relevant literature in HI and continue the asynchronous discussion around HI topics and issues that was initiated in the CHPSTP-VC.

4.5 Role of Technology in the CHPSTP-Virtual Community

The VC used two different technologies to support communication and collaboration: CentraOne® for synchronous presentations, meetings and discussion; and Blackboard for asynchronous discussion, collaboration, and document storing and sharing. Study participants extensively discussed their perceptions regarding the use of these technologies to communicate and collaborate in the CHPSTP-VC. The use of technology in the Virtual Community was organized into three categories: technology overall, CentraOne®, and Blackboard.

4.5.1 Technology Overall

Study participants identified overall advantages and disadvantages of using technology to communicate and collaborate, issues related to its use, and experience with technical support while participating in the Virtual Community. In the following section these findings are organized under the following sub-categories: advantages,

disadvantages, technology as a tool to communicate and collaborate, and technical support.

Advantages

Most of the study participants expected both technologies used by the VC would be user-friendly and allow them to work together at the distance. In general, their expectations were met. They thought both CentraOne® and Blackboard had been effective to communicate and collaborate. As well, they felt empowered by engaging in VC activities with people with the same interest from eight different Universities across Canada without having to travel. They valued the flexibility the technology offered to access these activities outside of the scheduled tasks they had to complete in their own Universities. They believed neither Blackboard nor CentraOne® were perfect but provided them with the basic tools they needed to function as a HI research community.

> *...and having a meeting, and an effective meeting, where you got people that are coming in and connected from remote sites. So I mean I am a big supporter of that I don't know if Centra is the best, I don't know if Blackboard is the best, but I know something...technology needs to happen...*
>
> *(Participant 09)*

> *...I wouldn't have met and worked with the people that I was able to work with if the technology was unavailable. Because I worked with of course people from the University of Calgary and I worked with someone from Ottawa, and I was here. And I am quite convinced that wouldn't have happened if that technology wasn't available...*
>
> *(Participant 11)*

Disadvantages

A few Mentors and Trainees felt they didn't have the time required to learn how to use both CentraOne® and Blackboard enough to gain the most from their capabilities. Most Mentors and Trainees believed engaging in asynchronous discussion required

uninterrupted time, which was hard for them to set aside and the lack of visual or non-verbal cues was a big disadvantage when engaging in technology mediated discussions.

Technology as a Tool to Communicate and Collaborate

Mentors and Trainees identified technology's role as mainly to bridge the gap between HI researchers' physical locations. They all preferred the face-to-face contact and thought this could not be replaced by the technologies available at the time this study was conducted. Some Mentors believed the main reason technologies used by the Virtual Community worked well was that most Mentors in the VC had met and collaborated face-to-face prior to collaborating in a virtual setting.

> *...In terms of face to face encounters.....I think it was pretty well balanced ....I met the majority of the people in there. I, I've actually seen their faces before. And I know who they are. If they were strangers to me I think it would be much less comfortable to use the technology...*
>
> *(Participant 01)*

Some study participants believed the technology by itself didn't foster collaboration, but rather successful collaboration was an outcome of participants' attitudes. Accordingly, VC success was the result of its members' commitment to collaborative work. If this attitude had not been present, with or without the support of the technology, the CHPSTP-VC would have failed.

> *...you know, in an ideal world people could do that [meet face-to-face]. You know, [virtual] probably doesn't work quite as well, but under the circumstances it's the best option that's around at the moment.....well, a lot is ....not so much the technology but the circumstances in which you need it...*
>
> *(Participant 03)*

Technical Support

Most of the study participants did not require technical support to install or use the technologies chosen for the VC. They believed the reason for this was that they had used similar technologies in the past and therefore it was easy to become familiar with CentraOne® and Blackboard. During the few occasions in which they needed technical support, they recalled it was efficiently provided in a timely manner. Only one Mentor reported having ongoing difficulties using CentraOne® and felt the support provided was not good enough to overcome technological difficulties.

4.5.2 Use of CentraOne® Technology

In order to access the virtual meetings and participate in the synchronous discussion, Mentors and Trainees were enrolled in CentraOne® by the Learning Commons (a department at the University of Calgary that provides technical support for CentraOne®), and received a username and password to log on. Lectures and meetings included PowerPoint presentations that everyone attending the session was able to view. All the sessions were recorded and made available to VC members for playback at their leisure. CentraOne® used voice over IP (transmission of voice over Internet Protocol networks), and allowed VC participants to interact and express agreement, disagreement, laughter, and applause using icons available on the screen.

Advantages

Most study participants enjoyed using CentraOne® for synchronous meetings and discussions. This was mainly because it provided them with the opportunity to meet (in real time) with other VC members across the country, without having to travel.

> *...I think for the type of processes it is [collaboration at a distance], it certainly gets the job done and people don't have to travel...*
>
> *(Participant 06)*

Mentors and Trainees thought CentraOne® was a user friendly technology that didn't require much time to get used to and could be easily downloaded and installed on their computers. They believed presenters needed some time at the beginning of their lectures to get acquainted with the use of the technology. However, only a few minutes later their comfort level increased resulting in very interactive and pleasant virtual sessions.

During the sessions this technology enabled the conversation to be well controlled by the presenters, giving everyone equal opportunity to participate in the discussion. For most study participants, CentraOne®'s icons to express emotions worked well allowing good levels of interaction during the sessions.

> *...I thought this was a wonderful way of exchanging ideas at distance and almost real time and uh... almost in a meeting format...It worked flawlessly; the tools were included on the website, were very comprehensive, it did good scanner of the computer resources, and the connection, reliability and speed, so everything was pretty well-done...I didn't need any support and it loaded flawlessly...*
>
> *(Participant 01)*

> *...Well, I would say Centra is amazing...and I just got to remember my password...Centra is pretty straightforward technology. It has proved advantages of putting together people for...for presentation... the voice works, manipulating the PowerPoint works, uh... the animation works, people do ask questions...*
>
> *(Participant 02)*

Some Trainees who usually participate infrequently in face-to-face lectures because they don't feel comfortable speaking up in public, were surprised they felt comfortable participating in CentraOne®. Because nobody could see them, they didn't

feel like they were "in the spotlight" and therefore, felt freer to ask questions or give their opinions.

> *...I don't know. I am shy. I try not to speak up in front of the whole large crowd. So in here I know I am all alone but at the same time with other people.... you are participating and you are not in the spotlight. And you want to speak up, yes you can. But if you want to keep quiet, you can always keep quiet too...*
>
> *(Participant 04)*

Disadvantages

Study participants identified some limitations of CentraOne®'s Whiteboard (feature that allows presenters to draw while presenting and attendees to look at the drawings). Although overall presenters were able to handle the sessions properly, they were never able to use the Whiteboard correctly. They believed the reason for this was that they only used CentraOne® once for their presentations and thus, didn't have enough time to learn how to use additional features. However, this was considered a relatively limited disadvantage as they thought that being able to follow the lectures with the aid of a PowerPoint presentation was good enough, and therefore, didn't miss the use of the Whiteboard.

Some study participants didn't feel the communication icons supported by CentraOne® added value to the virtual sessions. They commented that often people either forgot to use them or the presenter didn't respond to their cues, which interfered with the communication flow. Some Mentors agreed that the icons were useful only if the session leader paid attention to them and responded to participants' interactions.

Mentors and Trainees missed looking at the facial expressions and non-verbal cues during the virtual sessions, and wished they had used the version of CentraOne® that includes web-camera capabilities.

> *...It would be better if we had some facial contacts. Yeah. Because you can see expressions and things like that. Sometimes because of the... you know, you don't have any visual cues any feedback, except what you hear or what you see on the board, there is um...to me that is a little bit of problem. Because I don't know exactly what to say sometimes, I don't know if people are following or not...*
>
> *(Participant 07)*

> *...The only thing that I was missing with the Centra was really the non-verbal communication...*
>
> *(Participant 11)*

One Mentor had difficulties with the voice over IP feature in CentraOne®; he joined the sessions using his laptop and had problems getting clear audio. This became a problem for other VC members attending the sessions because they couldn't hear him well. He said he never tried using a different computer and thought his computer might have been the problem, as he never heard anybody else complain about the voice over IP in CentraOne®. Another Mentor preferred teleconferences rather than computer conferences in CentraOne® for real time meetings with other VC members. He thought the nature of the interactions in CentraOne® was too sequential and didn't leave space for spontaneous interruptions. He believed that the PowerPoint feature in CentraOne®could be substituted by sending the PowerPoint presentation files in advance to the meeting attendees, which they could follow during the teleconference. This way, meeting attendees could interrupt at any time during the meeting. A third Mentor said he couldn't access CentraOne® from a Mackintosh computer. This was a big limitation as this was his home computer and therefore, he could only access CentraOne® from his computer at work.

4.5.3 Use of Blackboard Learning System™

To access Blackboard and participate in the asynchronous discussion, VC members were assigned a username and password by the Project Manager. They accessed the Blackboard environment through the World Wide Web. Once there, they had to access the discussion boards where the questions and discussion threads were managed.

In general, Mentors didn't use Blackboard to communicate and collaborate in the Virtual Community. As a consequence, during the interviews some of them felt they didn't know the technology enough to comment on it. For example, some Mentors noted they were not aware of Blackboard's capabilities for collaboration other than storing documents. They said they never tried logging on to Blackboard or attempting to participate in the discussion because they didn't know how to use it and didn't have time to learn.

A few Trainees in the study participated actively in the asynchronous discussion on Blackboard. Some Trainees said they didn't participate much mainly due to time constraints. However, they were aware of Blackboard's capabilities and thought it was a good software choice that met the communication and collaboration needs of the VC.

Advantages

One of the few Mentors that had previously used Blackboard to teach courses in his own university thought it was a great resource. He liked Blackboard's assignment capability that allowed professors to give feedback to their students in a timely and convenient manner, and thought it was a very effective technology to communicate. However, he didn't use it to participate in the VC's asynchronous discussion because he

didn't find the time to log on and post comments, and therefore his comments applied only to his past experience.

The few Trainees in the study that participated in the asynchronous discussion in Blackboard thought it worked better for them than the synchronous discussion in CentraOne® during the virtual lectures. The reason for this was that they believed asynchronous discussion encouraged reflection and thus, participants' opinions became more substantial.

> *...Yeah that worked out ok. That was ok. I think that posting after the session works better than attempting to discuss during because of the reflection. Reflecting on what you have learned and then sort of...ok I think that the process....you read the papers you have the presentation and the online discussion and you then have more things, then you get into the forum...*
>
> *(Participant 06)*

Some Trainees thought they could get fast responses from other VC members if they took the time to respond right away. They believed the perceived slow responses in communicating in Blackboard were due to lack of commitment to participate in the discussion rather than a software limitation.

> *...Actually it's very good. You can post messages on the Blackboard and discuss with other people. And sometimes others are online and you can get instant responses...*
>
> *(Participant 01)*

In general, the study participants that used Blackboard liked the technology and its capabilities such as document sharing. They liked being able to log on and participate in the discussion at their own pace and time. They really enjoyed getting responses and feedback from other VC members whenever they made a posting. They felt it was user friendly and adequate for the purposes of discussing HI topics.

Disadvantages

In general study participants thought it was hard to remember their usernames and passwords to access Blackboard and post a message. They said they had to remember too many usernames and passwords for accessing a number of internet sites and computer programs and viewed this as a barrier to participating in the Virtual Community asynchronous discussion.

Mentors thought asynchronous discussion in Blackboard was much more time consuming than synchronous discussion in which responding to a question or giving an opinion could take only a few seconds. It required remembering their usernames and passwords, logging onto the Blackboard site, searching for the right discussion board, reading other people's postings, reflecting on the discussion, elaborating an answer, crafting the grammar and then posting. They viewed this as a long process that represented a barrier for participating in the VC discussion.

Study participants thought it was frustrating to post a comment in Blackboard and then having to wait for a day or more to get some feedback from other Virtual Community members. They thought it was not an efficient technology to communicate with other VC participants when compared to regular e-mail. They appreciated the e-mail's capability of showing new messages without having to log on to it and search for them. They thought it was a waste of time when collaborating on a project with other VC members to have to log onto Blackboard and search for messages from collaborators.

> *...I did a lot of that project with another trainee, and we decided to communicate through email because you know I can see if I have a new email every second. While the other one you have to log on I mean it's really something that you have to integrate your daily schedule. Otherwise you would miss it...*
>
> *(Participant 10)*

For this reason, they preferred direct face-to-face dialogue where they could get an answer immediately.

> *...So I think it's just...it's uh...inhibiting, it's a barrier almost. You know as you can't ...you don't feel like you are communicating. And you never quite know I mean you post something it goes out to the Blackboard; you really don't know what's going to happen. Where as again in the face to face you speak to people they'll speak back again. I think you might ... you have the feeling that is all rhetorical basically, you are kind of speaking to yourself...*
>
> *(Participant 03)*

4.6 The CHPSTP Overall

During the interviews study participants were asked questions regarding the CHPSTP-VC in particular, but often shared their thoughts regarding the CHPSTP in general. This emergent theme is closely related to the theme CHPSTP-VC and often overlaps with its sub-categories.

Study participants discussed issues related to sustainability, different roles of participants in the CHPSTP, collaboration, communication, leadership and management. They criticized some aspects of the CHPSTP and discussed HI issues. The issues discussed under this theme were organized in the categories Sustainability, Roles of the CHPSTP members, Collaboration, Leadership and Management, Areas for Improvement and Suggestions for Future Development, and Health Informatics Overall.

4.6.1 Sustainability

Study participants were thrilled that the CHPSTP had been funded by CIHR. Most of the Mentors that participated in the grant proposal thought the program was a great idea and yet were not confident that their application would be successful.

> *...I mean the fact that the program was successful in getting CIHR grant I though was pretty amazing really. Cause I didn't give it a high chance of success. The fact it was successful I found quite motivating...*
> *(Participant 03)*

However, once the initial funding was secured, some of Mentors expressed their concern in terms of what the future of the CHPSTP would be like. They were not sure of the best way to implement the program and how to organize it better. They raised the issue of program accreditation, and thought it was important to acknowledge Trainees' participation in the CHPSTP, which would also raise the program's profile and attract more participants. Some Mentors were concerned that Trainees' commitment was directly related to funding to participate in the program. They believed Trainees were more likely to participate in CHPSTP activities when being funded and therefore, all Trainees in the program should receive funding as a way to ensure their participation.

4.6.2 Roles of the CHPSTP Members

When asked about roles in the CHPSTP-VC, Mentors and Trainees often discussed roles in the CHPSTP-VC interchangeably with roles in the CHPSTP at large. They clearly identified players in key role within the CHPSTP. They also discussed their perspectives of what Mentors' and Trainees' roles were generally, as well as what they perceived were their own roles in the CHPSTP. The key roles identified by the study participants included: the Principal Investigator (PI) of the CHPSTP; the Program Director (PD) at the time the study was conducted; the Program Manager (PM); Mentors that took the lead on organizing the CHPSTP-Research Learning Experiences (RLEs); and one Trainee that participated as the Trainee's representative in the Program Advisory Committee (PAC) of the CHPSTP.

Principal Investigator

The PI of the CHPSTP was clearly identified by all the study participants as key to the development and success of the CHPSTP-Virtual Community. He was seen as a responsible, inclusive, and enthusiastic leader whose vision of the CHPSTP had lead to a successful growing collaborative endeavour. The PI was also seen as a leader and an advocate of Health Informatics in general, and also an expert in hospital information systems. All the study participants agreed that the PI was a hardworking leader that had done a great job of connecting HI researchers across Canada in order to put a proposal together, and get funding to make the CHPSTP a reality.

> *...I think he's done more than double than anybody else [the PI]. I think he really believes it and he does it for all the right reasons. I think he's a great leader. And I think if you ask him he probably figures he probably would say he could have done more, we should have done more, could have accomplished more. I don't know I am putting words.....And I think anything that we haven't accomplished is not because of lack of desire or effort by the PI, I think he has done a fabulous job...*
>
> *(Participant 09)*

Program Director

The Program Director (PD) is a rotating role taken over by one of the CHPSTP Mentors every two-year periods. This study was conducted at the end of the first two years of the CHPSTP. The PD of that period had, among other responsibilities, to organize and supervise the Virtual Community activities. All the study participants thought this role was key to the success of the CHPSTP. They expected the PD to organize the CHPSTP activities such as the Virtual Community, choose topics for discussion, invite guest speakers, and keep everyone in the program acquainted of the

activities and timelines. They all viewed the PD as a committed Health Informatics researcher that directed the program in an efficient and innovative manner.

> *...I certainly see the PD as you know, kind of integral. She seems to be the cog in wheel. And I think that she is very important and particularly in terms of the online get-togethers. Even if she's not there for the whole session, lots of time she's there just to kind of introduce, kind of get everybody together online. Um...and then she may...it's almost like she's the hostess...*
>
> *(Participant 11)*

Program Manager

Most Trainees and Mentors in the program thought the role of the Program Manager (PM) was essential to suitable functioning of the VC. They thought the PM did a great job in reminding the VC members about the guest lectures, deadlines, meetings and VC activities in general. They thought they were too busy to remember these activities on their own and preferred to be reminded by e-mail prior to any event.

Mentors

Mentors in general thought the Mentor's role was to guide and support Trainees throughout their graduate experience. This included supporting the CHPSTP activities in general by participating actively in courses and virtual discussions, and providing constructive feedback to Trainees regarding their research ideas. Mentors' role was also to act as a catalyst for Trainees' activities in finding appropriate research matches between Trainees and potential Mentors across the country. This idea was shared by some Trainees in the study who believed encouragement and direction from their Mentors was crucial for them to advance towards their doctorate degree. One Mentor thought it was also a Mentor's role to actively recruit Trainees for the CHPSTP and keep them engaged after they had joined the program.

Most Mentors felt comfortable with the role of mentoring Trainees at their own Universities. However, one Mentor believed they should be open to support any Trainee in the program regardless of their physical location, as this was one of the benefits of collaborating virtually.

Mentors that didn't play a key role in the CHPSTP felt they did not have the time or the desire to commit to larger responsibilities such as the program direction or take over a leadership role. However, a few Mentors expressed their desire to get more involved in the organization of the CHPSTP-Research Learning Experiences (RLEs) and the program direction in the future. Most Mentors thought they didn't get involved enough in the organization of CHPSTP activities due to time constraints, and said they had great respect for those Mentors that did get involved despite their busy schedules. Study participants in general could easily identify the Mentors that had organized the different CHPSTP-RLEs. They appreciated their commitment and were very satisfied with the quality of their work. They thought they had put together interesting material that the whole VC benefited from. One of the Mentors thought that Canada's bilingual quality was well supported in the VC by a mentor that played a key role among the French speaking participants.

Trainees

Trainees in general thought their main role in the CHPSTP-VC was to enhance their knowledge in HI research and strengthen their area of expertise. In the future, they expected to share their acquired knowledge and expertise with new Trainees joining the program. One of the Trainees thought Trainees could get more involved in helping

Mentors organize the RLEs and wished they were given an opportunity to do so sometime while in the program.

Most Trainees could identify the Trainee that represented them in the Program Advisory Committee. They thought she was very committed to the CHPSTP and did a great job in connecting Trainees across the country according to their research interests. One Mentor thought of this Trainee as the VC's "gate-keeper." He thought she played a key role in keeping Trainees informed of what was going on in HI across the country.

4.6.3 Collaboration

Mentors and Trainees in the study widely discussed issues related to collaboration between Mentors and Trainees in the CHPSTP.

Opportunities

Mentors and Trainees in the study agreed that they had plenty of opportunities to collaborate in both the VC and CHPSTP at large. They were invited to participate in the VC synchronous and asynchronous discussions, attend all face-to-face workshops, and to attend a CentraOne® session in which they were asked to showcase their research. In this particular session they had the opportunity to invite VC members that had similar interests to collaborate.

Study participants valued the opportunities presented by the VC to collaborate with other Mentors as well as Trainees from different Universities across the country. Most Mentors said they were given the opportunity to participate as guest lecturers in the VC and also get involved in organizing the RLEs. They believed opportunities were present to get as much involved as they wanted, but not everyone took advantage of them. Mentors involved in the organization of RLEs thought these provided a great

opportunity to collaborate with other Mentors and bring together their different areas of expertise to the CHPSTP. They thought that together they added novel components that were introduced to the Trainees which generated stimulating discussion. A couple of Mentors had the opportunity to collaboratively present their work at a conference which they viewed as valuable for the advancement of the HI discipline from a multidisciplinary perspective. One of the Mentors with a computer background said he had a number of graduate students in computer sciences that were interested in HI and willing to work on HI projects. In addition, he believed the CHPSTP provided the platform for medical experts to collaborate with computer science experts. Some Trainees had plans to work with some of the Mentors in a different University for a few months as a result of contacts established through the CHPSTP.

Facilitators

Some Mentors in the program believed having different backgrounds and research interests facilitated collaboration. They thought bringing different strengths to the table enhanced the quality of the end product. Alternately, other study participants believed having a common interest area facilitated collaboration as it enabled discussion using common terminology.

Most Mentors and Trainees in the program thought that having virtual meetings and face-to-face encounters through workshops which were coordinated in advance, facilitated their availability to attend those events, and as a consequence enhanced collaboration. Study participants agreed that face-to-face encounters were crucial to gain trust and build a sense of community. Both these media were key for successful collaboration.

> *...I think we need the workshops, I mean we need some, at some point, we, you know, the face-to-face meeting is almost essential. I would really have a hard time developing collaborative research if I could not see someone...*
> *(Participant 10)*

They thought that having face-to-face meetings early in the collaborative process facilitated subsequent virtual interactions that enhanced collaboration. One Trainee thought it was important for Trainees to know each others' background and state of advance of their PhDs/Postdocs for successful collaboration.

Another facilitator for collaboration was communication. Mentors and Trainees in the study believed good communication was key to successful collaboration. Good communication for the study participants meant keeping other CHPSTP members informed of each others' new publications, research grants awarded, conferences, interesting papers that had come out recently, meetings and general CHPSTP and HI activities. For Mentors it also included keeping each other informed of Trainees progress and issues and academic activities in each other's universities.

Obstacles

In general study participants viewed lack of commitment as one of the major barriers to collaboration. Mentors that had put together the CHPSTP grant proposal and always participated in the program activities were disappointed because some Mentors that had originally committed to participate did not actively do so. They felt they were equally busy and yet, because they had committed to the program, found the time to participate. They were also disappointed with those Trainees in the CHPSTP that didn't actively get involved in the program's activities. They expected Trainees to participate, regardless of whether or not they were funded by CIHR to be part of the training program.

> *...well I think one of the....the very large obstacle for me is the faculty that... and students that... become part of the program and then don't contribute...that don't follow through on....you know, helping develop RLEs or participating in the RLEs or attending, um...I think that to me is the biggest hurdle...*
>
> *(Participant 12)*

Most Mentors and Trainees said the major barrier to collaboration in the CHPSTP was time constraints. They thought the program was interesting and beneficial to HI researchers but they didn't have enough time to participate. Some believed other commitments that were paying their salaries were their first priority. These included research grants that were important to the institution that employed them and presented a barrier to commit the time necessary to participate in CHPSTP collaborative projects and activities. One Mentor added that the CHPSTP implied additional work that wasn't recognized at their institutions. He believed this was also a barrier to collaboration because it made efforts seem like a burden for already busy people, for which they were not being acknowledged.

One Mentor disagreed with the above and thought it was not about time limitations but rather the way the RLEs were structured. He believed they did not closely align with the individual interest of the majority of the Mentors and Trainees in the CHPSTP and for that reason they were not getting sufficiently involved.

> *...Mmm, again I hate to use time as the excuse. I think perhaps more important is how relevant you know where the common interests would allow us to have something to share to talk about, to exchange. Without that as the basis, then there is nothing to talk about... perhaps the way that we structured the learning experience does not closely aligning with the individual interests...*
>
> *(Participant 05)*

Several study participants believed people's different backgrounds, areas of expertise, and interests, were barriers to collaboration. They thought it was difficult to get

people involved in collaborative projects if they didn't feel they were relevant to their research areas.

> *...I think one of our difficulties is that health informatics is such a broad topic, people's expertise is really quite varied and their specialty interests are often very different. So it's difficult for others in the group to see the direct link to what they themselves are doing...*
>
> *(Participant 03)*

For example, the way Trainees were organized within the CHPSTP was a barrier to collaboration as it didn't consider the differences in background. Some Mentors believed MDs in the program should be organized in a separate cohort from PhD students as their interest was completely different. They argued that the MDs' interests were basically related to learning HI to improve efficiency in their clinical practice, whereas PhD students' interests were more research focused. These Mentors also thought differences in completion level of PhD students' graduate programs was a barrier for collaboration because some of the Trainees were working on their thesis research whereas others were just initiating their course work. They thought it was hard for Trainees to collaborate when they had such an uneven research background and training.

Some Mentors in the study thought that the lack of representation of some CHPSTP partner Universities during management meetings was another barrier to collaboration.

> *...I guess the other issue around the collaboration is that I can hardly recall a meeting when the entire group was on the phone, that it was represented. That makes it a bit difficult...Well I just think it's fine to have the meetings but it would work much better if the entire group was participating. So for example the meetings I have been to; Waterloo is not usually represented, McGill is not usually represented...you know there is a sort of core group that regularly participates but not the whole group...*
>
> *(Participant 03)*

Most study participants didn't view time differences as barriers to collaboration. Only a few Trainees thought the virtual lectures of the VC were not scheduled at a time that was convenient for them. One of them let the organizers know via e-mail and asked for the timing to be changed, which could not be done as the time chosen was convenient for the majority of the VC members.

Funding for research was also identified as a barrier to collaboration by one of the Mentors. He believed the CHPSTP had sufficient people with expertise in the different HI areas, who had interesting and innovative ideas, but could not pursue them due to lack of funding.

Another obstacle to collaboration identified was the little understanding some of the information scientists in the CHPSTP had of the health system. They thought this presented an obstacle as it required time to explain and understand these needs before getting started in real collaborative projects.

Communication was another major barrier to successful collaboration. The main communication channels used within the CHPSTP were e-mail, the website and program newsletters. In general study participants believed these channels had been somewhat effective to communicate but could be improved. Most of them recognized they didn't rely much on the website or the newsletter to get program updates and preferred to be informed of everything directly via e-mail. However, counter to this, they didn't recall receiving information that was sent through e-mail to all the CHPSTP members by the PM. When asked for the reason for this, they explained they received too many e-mails and therefore, it was difficult to keep track of all the activities of the CHPSTP. When

asked for suggestions on how to improve communication they were unable to identify better communication channels than the ones currently used in the CHPSTP.

Some study participants thought people's attitudes presented a barrier to successful collaboration. They thought some of the CHPSTP participants gave the impression that what they said was more important than what others said, or their ideas were more important than others' ideas. They thought this attitude presented a barrier for collaboration because it was intimidating for other Trainees and Mentors who didn't have a strong personality and didn't feel comfortable sharing their work and ideas in this sort of environment.

Some Trainees thought communication between Mentors and Trainees was not very effective. They recalled Mentors had offered Trainees opportunities to collaborate in certain projects during a CentraOne® session and never heard about them or their projects again. These Trainees were interested in getting involved in those projects and felt left out as they were unable to connect back with those Mentors. When asked why they didn't contact them, they said they were waiting for more information and an open invitation to participate in each project's proposal writing.

A few Trainees thought they didn't have enough opportunities to meet exclusively with other Trainees to interact as a sub-group within the CHPSTP. They thought a Trainee gathering would have been beneficial to solidify collaboration among Trainees in the program.

Face-to-face vs. Virtual Collaboration

Trainees and Mentors in the program were asked about their experience with virtual collaboration in the CHPSTP-VC compared to their previous experience with

face-to-face collaboration. Most of them preferred face-to-face collaboration to virtual collaboration. The main reasons cited were that they liked human interaction and visual cues when communicating with each other.

> *...Online...I think....I think it's difficult to be interactive because you know, it's faceless people out there that you are talking to....once you get to know them better it's more comfortable...*
>
> *(Participant 06)*

However, they thought virtual collaboration had the potential to be as equally efficient as face-to-face collaboration when the commitment to collaborate among the working group members was strong.

Study participants identified a number of advantages of face-to-face collaboration compared to virtual collaboration. They thought it was a good complement to virtual interactions as it facilitated participants' engagement in the community, and also enhanced collaborative work by helping build trust among community members.

Mentors and Trainees thought in the context of lectures, the dialogue was easier face-to-face because it enabled them to establish visual contact with each other, get an immediate response to questions, and have access to visual cues of the lecturer and the lecture dynamics. The body language available in face-to-face interactions was considered very important for communication.

> *...and you also get a sense of body language that you don't get technology wise. I am a big believer in not only what people say but how they say it....if they are a little bit confused, whether they actually say those words or no, you can tell from their reaction, their body language. That.....I think that is one of the things that you'll miss from technology...*
>
> *(Participant 09)*

A Mentor thought that in general it was easier to engage students in a discussion when they were physically present in a classroom, even if they were not well prepared for the

class. He also believed it was easier for him to answer questions during virtual sessions after he had met the Trainees face-to-face and was familiar with both their background and research interests.

Some of the Trainees shared feelings of isolation and stress while undergoing graduate studies. For this reason, they valued the face-to-face interactions, which gave them the opportunity to feel part of a group with similar interests and objectives and diminished their feelings of isolation.

> *...online is....less appealing....yeah that would be the best way to describe it. I actually enjoy the personal interaction because I have so little of it. You know you do your PhD you were very isolated a lot of the time. I really... I like that interaction. I like being in the room with people. It's very stimulating. It's very exciting. It's something I almost ...I find that I need to keep me going. I just find that the online issue doesn't quite.... kind of do it for me personally...*
>
> *(Participant 15)*

Study participants felt they greatly benefited from the face-to-face workshops held twice a year in the CHPSTP. These workshops made them feel they were part of a group and more prepared to collaborate virtually. Meeting face-to-face was believed to enhance the completion of different pieces of a collaborative project by diverse team members. They believed the amount of interaction between group members was higher; the feedback faster; and people felt more pressure to get their sections completed when they had to meet with other team members face-to-face rather than virtually. They believed collaborative tasks were easier when they were able to put a face to a name.

> *...I always compare this to another CIHR funded network that I'm part of that meets face to face, I forget ...I think that is every two weeks or so, but meets quite regularly face to face.....it probably is moving a bit faster because the meetings are a bit more frequent and they are face to face so it's easier to discuss...*
>
> *(Participant 03)*

> *...It seems like when its online, it's a little bit easier to say 'oh I didn't do it', because you don't see the people and I guess you are not as close to the product that you are trying to produce. So the virtual collaboration I think got a little bit different tenor than the face-to-face...*
>
> *(Participant 11)*

Study participants said it was important to keep a good balance between face-to-face and virtual encounters, and thought that having one or two face-to-face workshops per year was reasonable to keep that balance. However, they believed greater benefit could be obtained from the face-to-face workshops by holding them earlier in the process of virtual collaboration. They thought the first face-to-face meeting of the CHPSTP was held too late in the process and therefore, it took longer for them to get a sense of community and become engaged with it.

A few Trainees said they view no difference between face-to-face and virtual collaboration. They said they would have collaborated the same way whether they had interacted exclusively face-to-face instead of virtually. Moreover, they said virtual collaboration was more advantageous in that it expanded their collaboration network and scope of feedback. Another Trainee agreed with this and added that the people who collaborated face-to-face were the same ones who collaborate virtually and therefore, the collaboration medium was not as relevant as the people involved in it.

4.6.4 Leadership and Management

Study participants thought leadership and management were key issues in the success of the CHPSTP. They believed a group of people composed of professionals from different backgrounds and interests needed strong leadership to function as a cohesive group and advance in their endeavors. Most Mentors agreed that the leadership

role doesn't change when interacting in a virtual environment as opposed to a face to face one. They thought all communities need leadership regardless of their mode of interaction, and natural leaders would emerge in any community whether its members interacted face-to-face or virtually.

> *...I think [the CHPSTP] is challenging to run because people are from different backgrounds. They had to know each other and ...so they had to begin to understand how to put things into relationship...*
> *(Participant 02)*

Most Mentors thought managing such a large group dispersed across a country as vast as Canada was a major challenge, which was increased by the virtual quality of the interactions among members. They agreed that it was essential for Mentors to be reminded of the program's goals, terms of reference, expectations, activities and Trainee recruitment guidelines. It was easy to feel lost and isolated when working with a large group that didn't see each other regularly.

Overall Trainees and Mentors thought the CHPSTP was very well managed and were pleased with the work of the Principal Investigator, the Program Director and the Program Manager.

4.6.5 Areas for Improvement and Suggestions for Future Development

Mentors and Trainees in the study thought the CHPSTP had room for improvement and suggested some changes in its structure that future cohorts of Trainees joining the CHPSTP could benefit from.

Study participants expressed their willingness to have more face-to-face meetings and increase Trainees' involvement in them by asking them to present their research ideas and topics of interest, and letting them lead the discussion. Among their suggestions

were having a face-to-face meeting every year during the COACH e-Health Conference as this is a common place for CHPSTP members to meet. They also suggested a face to face meeting be held every 6 months to discuss new initiatives that might have come up within the past 6 months at the both the provincial and federal level, and include a mixture of theoretical and practical HI topics.

Some Mentors said it would be important to enhance the scientific value of the VC. In order to achieve this, one of them suggested structuring the VC using a more research oriented, rather than course oriented approach, and having Trainees get more involved in the both the research and writing processes of any given project. Another Mentor suggested organizing Mentors and Trainees in small research cohorts according to their research areas of interest and expertise, and having them work together on common research projects and manuscripts for publication in peer-reviewed journals. This idea included organizing a mini-conference for Trainees to submit their work in the form of short papers and posters, have it reviewed by Mentors and then have Trainees present it to the other Trainees and Mentors in the program.

Ideas suggested in other areas to improve the CHPSTP-VC included: placing a solid emphasis on collaborative projects as this was viewed as something of growing importance for funding agencies; generating a forum for VC members' publications to make them easier to track down and access; sending a volunteer (Mentor or Trainee) to MEDINFO and have him/her submit a report on what's new in health informatics at the high level, e.g. what's happening in the research arena, what are the trends, and what impact could this have on the CHPSTP; use Blackboard to post a short biography and picture to share their research background and interests with the VC; elevate the

program's profile to make it more attractive for Trainees across the country; and change the acronym of the CHPSTP as it was too hard to remember and brand recognition was considered highly important.

4.6.6 Health Informatics Overall

Given the CHPSTP context, study participants expressed thoughts around the value, needs, challenges and issues of the HI field overall. They believed the future of healthcare was in HI. One of the Mentors noted that the next big change in the informatics industry would be a rise in ICT utilization driven by the patients. In this change, patients would play a key role by having access to their own health information. Therefore, he believed it was crucial to start getting the patients involved in decision making, managing their health care and the health care system. Most of them agreed that the interest for HI had grown and therefore, there was a need for collaboration among the few HI experts available in Canada to advance the field and train more experts. Collaboration and training of new experts was viewed as key to leveraging HI great potential to improve the Canadian health system.

> *...given that the health informatics community in Canada is so small it was...I think important to get involved in collaborative projects like this...*
>
> *(Participant 08)*

Among challenges of the HI discipline identified by the study participants were its broad scope and the lack of a common definition as to what was considered part of the HI field by researchers and practitioners. One Trainee thought HI researchers were struggling with whether HI was really a discipline on its own or an intersection of different disciplines.

Mentors and Trainees in the study noted that given the number of researchers working in different research areas under the umbrella term HI, it was essential to collaborate in order to work around common definitions and understandings.

> *...there are a number of people doing incredible amount of work in what they are defining as HI, which is very different from what I'm doing or interested in. But all under that umbrella of HI, in very diverse fields that not everyone defined the same way, that being HI, not everyone agrees as to the definition or the kind of scope of the area...*
>
> *(Participant 03)*

> *...I think it's important to connect to other people who are um...involved in different aspect of health informatics. I think that you know we've discussed this in the group that it's important for diverse researchers or research areas to get together under the same umbrella. And if people aren't gonna work together within the diverse area of study, then it's not gonna move forward and health informatics, again I talk within Canada isn't going to develop and progress and grow as effectively, if people were separated and segregated...*
>
> *(Participant 11)*

The broad scope of HI was also viewed to affect education and training in this field. Mentors thought it was difficult to cover all the research topics, and come to a consensus as to what the core principles and course contents would be the most appropriate in a program such as the CHPSTP. Because the HI discipline was so young, they believed a thorough evaluation of training initiatives was essential to its successful development and maturation. One of the Mentors thought the CHPSTP initiative was a great opportunity to advance the HI discipline in Canada but at the same time a great responsibility.

> *...Because we are so young a discipline, we need to be understanding all the different ways that can help it grow...I mean it's a fabulous opportunity to have this grant over a reasonable period of time to help it grow. So I think we are carrying the torch for growing the academic*

discipline of health informatics in Canada. So I think it's quite a bit responsibility...

(Participant 02)

...I think there is still very much in development phase. I'll just be sure that the courses themselves are evaluated, that feedbacks are primarily from the students...

(Participant 03)

One of the Trainees thought a good idea to overcome HI issues would be to pay attention to the mistakes that other disciplines using ICTs had made and learn from them. He believed ascribing too much value to the technology was a big mistake as the focus should always be on the people using the technology instead.

One of the Mentors commented that very few people outside HI knew about it and cared for it. She believed this was worsened by a trend of HI researchers to publish their research work in either HI or Telehealth journals. She though it would be more beneficial to HI and the medical specialties in general to broaden the scope of HI publications and publish in medical journals such as cardiology, respiratory, etc., which would help disseminate HI knowledge and its value.

4.7 Summary

Study participants identified many relevant aspects of their experience in the CHPSTP-Virtual Community as important to their research careers (Mentors) and training (Trainees) in Health Informatics. Overall their experience in the CHPSTP-VC was positive and supports the feasibility and advantages of HI collaboration and training using technology.

Aspects of the Virtual Community that had positive effects on their research and training were closely related to the use of technology to communicate and collaborate

such as the possibility of meeting and working with a broad range of experts without having to travel, as well as sharing research resources and tools. Mentors and Trainees in the study also emphasized less technology-related concepts they considered crucial for the success of the CHPSTP-VC and CHPSTP overall such as commitment, participation, and the importance of face-to-face encounters.

Participant's context, including their role in the CHPSTP, time constraints, area of research interest and expertise, and level of comfort with using technology were present throughout the analysis, and influencing all the themes, categories, sub-categories and topics.

The emergent theme CHPSTP-Overall overlaps with the themes initially identified for data coding (Table 3). CHPSTP Sustainability, Roles in the CHPSTP, Collaboration and Health Informatics Overall, were important categories that emerged within this theme and influenced various sub-categories of the three initial themes.

Table 3: Matrix of Interplay between the Initial Themes and the Emergent Theme, its Categories and Sub-categories

Emergent Theme CHPSTP-Overall Categories	Initial Themes		
	CHPSTP-Virtual Community	**Characteristics of a CoP in the CHPSTP-VC**	**Role of Technology in the CHPSTP-VC**
Sustainability	- Outcomes - Contributions to the field of HI - Building Community and Trust - Building a HI Research Network - Increasing HI research and training capacity	- Mechanisms for reproduction (e.g. website) - Support from CHPSTP-VC Members - Value of Expertise - Shared passion and practice	- Technology as a tool to communicate and collaborate - Use of CentraOne® Technology - Use of Blackboard Technology
Roles of CHPSTP Members - Principal Investigator - Program Director - Program Manager - Trainees - Mentors	- Level of Participation - Building a HI Research Network - Increasing HI research and training capacity	- Value of Expertise - Support from CHPSTP members	- Technology as a tool to communicate and collaborate
Collaboration - Opportunities - Obstacles - Facilitators - Face-to-face vs. Virtual Collaboration	- Building a HI Research Network - Increasing HI research and Training Capacity - Participation - Outcomes - Level of Participation - Role of time availability	- Shared Passion/practice - Value of Expertise - Support from CHPSTP-VC Members - Sharing within the CHPSTO-VC - Mechanisms for reproduction	- Technology as a tool to communicate and collaborate - Advantages - Disadvantages - Use of CentraOne® Technology - Use of Blackboard Technology - Technical Support
Health Informatics Overall	- Building HI research Network - Increased HI research and training capacity	- Shared Passion/practice - Mechanisms for reproduction	- Technology as a tool to communicate and collaborate

CHAPTER 5: DISCUSSION

The first two sections of this chapter situate the research findings within the recent literature on Communities of Practice and virtual communities. The CoP characteristics described in the literature are compared to those observed in the CHPSTP-VC. The practical and conceptual importance of similarities, differences, and issues relevant to the use of technology to communicate and collaborate, are discussed. In the third section the researcher's reflections are briefly discussed and recommendations are made. Finally the significance of the study, future research considerations, strengths and limitations are discussed.

5.1 Essential elements of the CHPSTP-Virtual Community: The Domain, the Community, and the Practice

As discussed in section 2.4 of the literature review (Communities of Practice: an approach to support professional development and training in Health Informatics research), a CoP has three essential elements: a domain of knowledge, a community of people and a shared practice (Wenger et al., 2002). These three elements were clearly present in the CHPSTP-Virtual Community: the domain of interest represented by the field of Health Informatics; the community composed of HI PhD Students, Postdoc fellows, and researchers across Canada; and the shared practice of Health Informatics research. The CHPSTP-VC was composed of members with diverse expertise and experience, which transcended geographic boundaries considered another CoP characteristic (Lave & Wenger, 1998).

5.2 Stages of Development of the CHPSTP-VC

Four of the five stages of development of a Community of Practice identified by Wenger et al. (2002), potential, coalescing, maturing, and stewardship, were clearly present in the CHPSTP-VC. Some characteristics of these four stages were present as described by these authors while others disagreed with their description. Table 4 contrasts the characteristics of each stage as described by Wenger et al. (2002) with those found in the CHPSTP-VC. Following, the most important discrepancies found in this study are discussed.

5.2.1 Knowledge Sharing (Coalescing stage)

During Wenger et al's (2002) second stage of development, coalescing, the CoP focuses on establishing the value of sharing knowledge about that domain, as well as developing relationships and sufficient trust to discuss practice problems.

Knowledge sharing is "the process where individuals mutually exchange their (implicit and explicit) knowledge and jointly create new knowledge" (Van den Hooff, B. 2003 p.121). Knowledge sharing is an important activity of CoPs in which new knowledge would be used to extend professionals' understanding and command of their own situations, as well as to advance the knowledge base for the field as a whole (Buysse et al., 2003). In this study, Mentors and Trainees reported overall they didn't feel a need to share knowledge with other CHPSTP-Virtual Community members; moreover, they weren't comfortable sharing new knowledge (e.g., unpublished research), unless it was through public sources such as journal articles or books. One of the reasons that may explain this discrepancy between knowledge sharing practices is the research context of the CHPSTP-Virtual Community. The research culture is highly competitive and thus,

researchers are extremely cautious about sharing their research ideas and work until authorship is ensured. Academic freedom, tenure, and contractual agreements between faculty and the administration sometimes appear to constrain faculty from thinking generously about the community (Bowmann, 2002).

The second reason that could explain the study participants' behavior regarding knowledge sharing is lack of trust among study participants. Trust was an important factor in their decision to share knowledge with other Virtual Community members. This is consistent with community development literature in which trust has been identified as a major component of the community building process, and defined as the "willingness of a party to be vulnerable to the actions of another party, based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party" (Mayer et al., 1995, p.712). Trust can be seen in the context of two people or a community in which it "develops through frequent and meaningful interaction, where individuals learn to feel comfortable and open in sharing their individual insights and concerns, where diversity of opinion is valued over commonality or compliance" (Holton, J., 2001, p. 36).

Meaningful interaction could present a challenge in a virtual environment in which traditional ways of establishing social bonds through face-to-face contact are absent. Virtual team trust has been defined as "the degree of reliance individuals have on their remotely located team-members taken collectively (i.e. as a group) (Starker et al., 2003). Reluctance of study participants to engage in knowledge sharing activities could also be a result of insufficient meaningful interaction in the virtual environment resulting in lack of trust. It has been stressed by several authors that face-to-face interaction

between community members is essential to build peer rapport in online environments (Rodrigues, S., 1999; Zieger & Pulichino, 2004; Reisetter & Boris, 2004). Findings of this study agree with the literature; Mentors and Trainees in the CHPSTP-VC considered face-to-face encounters crucial to build a sense of community and trust. They felt they were unable to accomplish this until they met face-to-face during a CHPSTP workshop. They believed the face-to-face workshops held by the CHPSTP had been key to support community development.

Trust issues are also connected to the absence of visual cues during Virtual Community interactions. Sarker et. al (2003) identified three streams of thought on trust that are particularly relevant to virtual contexts. The first, personality-based trust, develops due to a person's trusting nature; the second, institutional-based trust, is a function of an individual's belief in institutional norms/procedures; and the third and most relevant to this study, cognitive-trust, develops from social cues and impressions that an individual receives from the other. The literature on Computer Mediated Communication has reported reduced communication in virtual environments and less satisfaction with the collaborative process when compared to a face-to-face environment (Hightower, R. & Sayeed L., 1996; Ocker & Javerbaum, 2001). Communities that heavily rely on these media are confronted with significant limitations including lacking social cues, and dealing with gaps or lags in feedback (Arnold & Smith, 2003). This was also observed in the CHPSTP-VC, in which some members reported gaps in feedback as a result of missing visual cues and eye contact during virtual interactions. Also, most study participants felt their level of engagement and trust had increased after the first face-to-face workshop.

Table 4. Stages of Development of the CHPSTP-Virtual Community

Stages of CoP Development (Wenger at al. 2002)	CoP Development	
	Summary of Wenger's Stages	CHPSTP-Virtual Community
Potential	The CoP focuses on defining the scope of their domain; finding people who already network on the topic and helping them to imagine how increased networking and knowledge sharing could be valuable; and identifying common knowledge needs.	A common interest of a group of researchers across Canada of increasing research capacity and Training in Health Informatics led to the initial planning of the CHPSTP. A network of researchers in this field were contacted and invited to participate in the proposal writing and grant application process of the CHPSTP.
Coalescing	The CoP focuses on establishing the value of sharing knowledge about that domain; developing relationships and sufficient trust to discuss practice problems; and discovering specifically what knowledge should be shared and how.	Once funding was granted, Health Informatics PhD Students, postdoctoral fellows, and researchers across Canada were brought together to participate in the CHPSTP-VC. The VC was structured around topics of discussion that were chosen according to the participants' interest. Face-to-face encounters were held to strengthen the Virtual Community.
Maturing	The CoP focuses on defining its role and relationships to other domains; and managing the boundary of the community which is no longer just a network of professional friends; organizing the community's knowledge and taking stewardship seriously.	Membership required an invitation in the case of the Mentors, and an invitation and subsequent application in the case of the Trainees. Guest lecturers were invited to present in the Virtual Community. Increased administrative organization was present, e.g. Trainees were required to prepare a summary report of their activities in the program. A Program Advisory Committee was constituted.
Stewardship	The CoP focuses on maintaining relevance of the domain and finding a voice; keeping the tone and intellectual focus of the community lively and engaging; and keeping the community on the cutting edge.	Collaborative projects emerged from the Virtual Community activity. Outcomes of the Virtual Community began to emerge, e.g. research papers and conference presentations
Transformation	At this stage the community may fade away or officially close. This may also mean that the community has become redundant, or that this stage brings about the beginning of a new community. Other possibilities include merging with other communities or becoming institutionalized as a formal unit.	The fifth stage, transformation, was not present. The Virtual Community continues to function since granting was funded for a 6-year period. Therefore, its evolution and future has yet to be unveiled.

5.2.2 Legitimate Peripheral Participation (Maturing stage)

Learning in the context of a CoP is a situated activity characterized by a process called "legitimate peripheral participation" which concerns the way by which new comers become part of a CoP (Lave & Wenger, 1991, p.29). As discussed in section 2.4 of the literature review (Communities of Practice: an approach to support professional development and training in Health Informatics research), CoP members participate at different levels. The new comers stay on the periphery at the beginning, supported by the community; they start with minor tasks, gradually increasing the level of responsibility, and move from peripheral to full participation. At any one time they may be central participants in one community of practice but peripheral participants in another, and throughout time they can move back and forth between the core and the periphery; all participation, even at the periphery, is considered legitimate learning.

Three levels of CoPs' members' participation identified by Wenger et al.(2002) (Figure 2) were observed in the CHPSTP-Virtual Community. The core group, represented by a few Mentors who developed the project proposal and actively participated in the organization of the Virtual Community's activities (Trainees were allowed to participate in the core group only by invitation from Mentors); the active group, represented by most Trainees and Mentors in the program included the majority of the Virtual Community members; and the peripheral group, represented by a few Trainees and Mentors of the Virtual Community. Activity at the "outsider" level was not possible in the CHPSTP-VC because membership was restricted to Mentors, registered Trainees and invited guests that required usernames and passwords to participate.

The proportion of participants of the CHPST-Virtual Community on each level differed from that described by Wenger et al. (2002) in that the majority of the Virtual Community members participated in the middle level (active group) instead of the peripheral one. This also disagrees with what has been reported in the literature. Scholars have found peripheral participation in online virtual communities to be even greater than observed in face-to-face CoPs (Zang & Storck, 2001; Baym, 1999). Higher levels of participation in the active group as opposed to the peripheral level in the CHPSTP-Virtual Community may be explained by the graduate training context of the CHPSTP. Graduate training usually involves highly motivated adult learners that take responsibility for their own learning and therefore, may have positively influenced their level of participation. Personal funding received by some Trainees from CIHR to participate in the Virtual Community may have also positively influenced Trainees' level of participation, while institutional funding may have influenced Mentors'.

The results of this study highlighted important practical and conceptual differences in some areas of the stages of development of a traditional CoP when compared to a virtual one. The differences described above have the practical consequences discussed, and also raise important questions regarding the conceptual tenets underpinning virtual research CoPs. For example, how does technology affect participation in a virtual CoP? What are the characteristics of knowledge sharing within a virtual research CoP? How does technology shape trust within a research virtual CoP? Do the concepts underlying CoP theory change when applying technology? Further research is needed to understand these important conceptual tenets in the context of a virtual research CoP.

5.3 Sustainability of the CHPSTP-Virtual Community

Much of the latest literature regarding CoPs has focused on how to enable these informal communities to emerge, flourish and become productive. Sustainability of virtual CoPs has also been a concern for several researchers (Bronwyn & Smith, 2004; Allen, 2003; Barab et al.2001; Kim, 2000). Wenger et al. (2002) set forth seven principles for cultivating CoPs, including:

1) **Design for evolution:** Combine design elements that help catalyze community development.

2) **Open a dialogue between inside and outside perspectives:** Good community design requires both an insider's perspective of what the community is about and an outsider's perspective to help the community members see its possibilities.

3) **Invite different levels of participation:** Good community design invites different levels of participation. Not all members have the same levels of interest in the community and therefore, equal participation is an unrealistic expectation. While those on the peripheral group may not participate in the same ways as those in the core group, the peripheral members will still gain insights and knowledge through this type of participation. All members regardless of participation levels should be valued.

4) **Develop both public and private community space:** CoP members interact with each other in both public and private spaces. "The key to designing community spaces is to orchestrate activities in both public and private spaces that use the strength of the individual relationships to enrich events and use events to strengthen individual relationships" (Wenger at al., 2002, p.59).

5) **Focus on value**: Because participation in most communities is voluntary, value is key to community life. "Rather than attempt to determine their expected value in advance, communities need to create events, activities, and relationships that help their potential value emerge and enable them new ways to harvest it" (Wenger at al., 2002, p.60).

6) **Combine familiarity and excitement:** Familiarity is important for a CoP to develop, but also to have enough interesting and varied events to keep new ideas and people cycling into the community.

7) **Create a rhythm for the community:** Like individuals' lives have a rhythm, "vibrant" communities also have a rhythm which contributes to their sense of familiarity. It is important to find the appropriate rhythm at each stage of a community's development. "When the beat is strong and rhythmic, the community has a sense of movement and liveliness. If the beat is too fast, the community feels breathless; people stop participating because they are overwhelmed. When the beat of too slow, the community feels sluggish." (Wenger at al., 2002, p.60).

The role of technology in the different dimensions of a CoP (according to Wenger et al., 2002) in the CHPSTP-VC is illustrated in Table 5. This research shows that the CHPSTP-VC leaders engaged in sustaining each of the dimensions of a CoP equally. Study results indicate that technology may support all these dimensions posing minimum restrictions to community development and sustainability. Moreover one of the restrictions identified in this study, lack of visual cues, could be easily overcome in the future by choosing a version of CentraOne® that includes a web-camera. Another restriction, outsiders being unable to participate in the CHPSTP-VC, is not really an issue

as this is a research and training VC and therefore membership necessarily implies certain level of expertise and involvement in the subject. Outsiders with enough interest will probably search for such a program and request access to it.

Table 5. Wenger's (2002) Principles for Cultivating a Community of Practice and Technology in the CHPSTP-Virtual Community

Principles for cultivating a CoP (Wenger et al., 2002)	Findings of the CHPSTP-Virtual Community	
	Supported by Technology	**Restrained by technology**
Design for Evolution	CentraOne® and Blackboard allow a wide range of creative learning activities	
Open a dialogue between inside and outside perspectives	CentraOne® and Blackboard allowed inviting guest lecturers to share their research and insight with the Virtual Community members	Skills and access in using the technology
Invite different levels of participation	Synchronous discussion in CentraOne® and Blackboard forum allowed different levels of participation in a wide range of activities	Outsiders were unable to participate as "official" membership was required to access the CHPSTP-Virtual Community
Develop both public and Private Community Space	Both CentraOne® and Blackboard support both private and public spaces	While available, using these spaces still requires a formal request to access
Focus on Value	CentraOne® and Blackboard allowed discussion and collaboration of Mentors to develop the different RLEs in the CHPSTP. Blackboard allowed document sharing and storing facilitating research collaboration	Technology challenges may overshadow value of participation
Combine Familiarity with Excitement	Familiarity was supported by regular meetings in CentraOne®, e-mail and to minor extent Blackboard discussions. Guest lectures in CentraOne® supported excitement.	Lack of visual cues restrained familiarity
Create a Rhythm for the Community	Pre-scheduled meetings in CentraOne® and pre-defined discussion periods in Blackboard facilitated creating and sustaining a rhythm of participation in the CHPSTP Virtual Community	Scheduling routine sessions depends on technology availability

5.4 Recommendations and Reflections

The researcher collected and analyzed sufficient data to obtain a clear idea of participants' perspectives of their experience in the CHPSTP, their issues and contributions. Although the Virtual Community members were satisfied with the development and functioning of the CHPSTP and felt engaged with it, they were able to identify some issues and areas for improvement. Following are the researcher's recommendations to improve the structure of the Virtual Community as a result of the review of relevant literature on CoPs and virtual communities, and participants' insight regarding the CHPSTP-Virtual Community.

5.4.1 Recommendations

1) Start the program for new cohorts of Trainees with a face-to-face meeting to build a sense of community and trust at the beginning of the collaborative endeavor.

2) Break down the discussion groups into smaller groups according to community members' research interests and expertise. This may help address the obstacles for collaboration and participation as a consequence of diverse backgrounds identified by study participants.

3) Active participation of members in virtual communities accounts for community sustainability and continuity (Schwier, 2001), and therefore special emphasis should be placed on fostering it:

> *Because Communities of Practice are living things, they require an approach to organization design that more fully acknowledges the importance of passion, relationships, and voluntary activities in organizations. Rather than focusing on comprehensiveness and fit, community design concentrates on energizing participation. Rather than designing finished structures, it uses design as a catalyst for community growth and development. (Wenger, 2002, p.64)*

Assigning specific responsibilities to Trainees and Mentors may increase participation and collaboration in shared projects.

4) Incorporate a web-camera; CentraOne®'s latest versions support web-camera capabilities. This may address communication issues by enabling Virtual Community members to have access to visual cues and body language.

5) Offer Trainees more opportunities to show-case their research. Discussing their work widely contributes to knowledge sharing and construction of new knowledge, two activities highly important for any community of practice.

6) Value is key to community life in any Community of Practice. Elevating the CHPSTP-VC profile will contribute to recruit more Trainees, and increase engagement and participation of the Virtual Community members.

7) Encourage Trainees to take the "driver's seat" in their own education. Offering them interesting, novel resources and activities, participation may be increased and the quality of the research projects enhanced.

8) Implement systematic program evaluation including both formative and summative components to improve the program overall; learn by contrasting things that worked well with things that didn't from participants' perspectives.

5.4.2 Reflections

The CHPSTP has been considered a growing success, which is reflected by the increasing number of research publications, collaboration, and grant applications. The use of technology has enabled a HI national CoP to develop, function, and increase the number of members that share this interest across Canada. As a consequence, Health

Informatics Researchers have great opportunities to collaborate, increase their HI network, as well as research and training capacity.

The CHPSTP-Virtual Community continues to function, grow and evolve. The researcher is now registered as a Trainee of this community and has the opportunity to experience the community's development and evolution from an insider's perspective. The CHPSTP-VC has come a long way and continues to improve. Membership has increased considerably since this study was conducted, and the Virtual Community activities have been adapted to satisfy learning and research needs of the community members.

One disadvantage of the association of the CoP to CIHR funding is that it is not open to a broader audience. This is related to the issue of sustainability, which is also a concern. Success in the research community is measured by publications and grants. Whether the energy and time required to participate in and continue the CHPSTP momentum remains to be seen.

It would be highly beneficial to expand the research of the CHPSTP Virtual Community to explore and understand better issues that were raised by the CHPSTP Virtual Community participants, as well as to clarify conceptual constructs of CoPs theory when mediated by ICTs.

5.5 Significance of the Study

This study explored the development and outcomes of the CHPSTP-VC, and contributed to the overall evaluation of the CHPSTP initiative. It provided a better understanding of the role of technology in virtual collaboration in Health Informatics

research and training from the perspective of a group of HI established researchers and researchers in training across Canada. The study also increased the understanding of concepts related to virtual CoPs and virtual collaboration overall.

The recommendations provided by the researcher will be taken to the CHPSTP members, organizers and funders. They may help inform decisions of the CHPSTP leaders regarding future changes in the CHPSTP organization and structure, that may benefit the research training and mentoring experience of new cohorts of Trainees and Mentors in the CHPSTP. The results of this study reinforce some earlier findings of the body of literature on Communities of Practice and virtual communities, and added new insights to their relevance to Health Informatics research and training. Therefore, some of the learning from this study may inform other areas of virtual collaboration.

5.6 Future Research

Technology has extended the reach of our interactions beyond geographical limitations of traditional communities, but the increased flow of information does not replace the need for community. New technologies may support flexible collaborative spaces that can be designed in many different ways. Their implications and significance will depend on how these spaces are shaped, and the type of social relationships they may foster (Feenberg & Bakardjieva, 2004). Research contributes to understanding and describing specific forms of social life within technology supported environments, including the related advantages, disadvantages, and consequences for its participants and culture at large.

This study helped identify important conceptual issues regarding virtual research CoPs that require further clarification. Among them, trust in the context of a virtual research CoP, presented a major barrier to collaboration. Achieving trust in a virtual CoP seems to have important differences compared to what has been described in the literature of traditional CoPs (which interact mainly face-to-face). Trust was considered a preamble of an essential activity of CoPs, knowledge sharing. Therefore it is important to clarify this concept as it may be a determinant of the knowledge sharing activity observed within any given virtual CoP. In addition, the concept of participation in a virtual CoP may be different than what is observed in a traditional CoP. The influence of technology on participation needs to be further studied. Research findings in the areas of virtual collaboration and virtual CoPs should become the basis for further development of these new forms of communication and collaboration to achieve desired outcomes.

5.7 Strengths and Limitations

Strengths and limitations of this study and their implications for the research findings will be presented in the following section.

5.7.1 Strengths

The two main strengths identified in this study are the research method and the study design. The research method allowed in-depth data collection involving multiple sources of information rich in context that allowed a better understanding of participants' perceptions regarding their experience in the CHPSTP-Virtual Community. The design included several methods of verification that strengthen the study results. The researcher worked through conceptual issues with committee members during the proposal writing

stage and with the supervisor during the analysis. She discussed extensively with her supervisor her personal feelings and history related to the case study, and made efforts to bracket her own assumptions and biases throughout the study.

5.7.2 Limitations

The main limitation of this study was due to time and financial constraints. The study explored only the first iteration of the CHPSTP-Virtual Community. Because this community continues to function and evolve, subsequent studies that explore the CHPSTP-VC changes with each iteration are needed to better understand its development and outcomes.

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APPENDICES

Appendix A – CHPSTP Proposal

Canadian Institutes for Health Research Health Informatics PhD/Postdoc Strategic Training Program-Research Proposal Summary: A Collaborative HI Research Training Program

1. Rationale/Objectives
Health Informatics (HI) embodies the understanding, management and use of health information and the technological infrastructure to support its deployment. This collaborative HI Research Training Program will offer a unique training experience intended to: (a) significantly enhance the training experience of HI researchers at the PhD and postdoctoral levels in Canada; (b) nurture transdisciplinary HI research (c) establish a critical mass of HI researchers otherwise not achievable in local programs; (d) build an effective collaborative research network to bridge our current and next generation of HI researchers; (e) foster a culture of policy responsive researchers who can effectively translate between HI research and practice in health settings; (f) explore new frontiers in HI research to improve the Canadian health system and the health of Canadians; (g) address growing demand for HI leadership in health within Canada.

The Trainees in this program will work with, and learn from, leading HI research teams from different parts of Canada, as well as have an opportunity to influence the role of health information and IT in the field through innovative and relevant HI research projects.

The need for HI research capacity is well documented. While there are Canadian universities that currently provide customized HI related graduate studies at the local level, there is an acute shortage of HI experts with sufficiently broad experience and knowledge to significantly advance this discipline. Not only are there few qualified Canadian HI researchers, but many have gone to the United States to pursue their academic careers due to lack of HI research opportunities in Canada. Thus, we need to create a highly innovative training environment to nurture a critical mass of HI researchers to address this growing challenge.

2. Mentors
The key Mentors included in this proposal are accomplished researchers with diverse expertise and experience in HI and related areas in their institutions. Many are already leaders or members of existing research teams working on complex HI related projects. HI research teams from 8 Canadian universities will be responsible for this training program, including Calgary, Dalhousie, McGill, McMaster, Sherbrooke, Toronto, and Victoria. Key Mentors are identified in Appendix 1.

3. Innovation
The state of HI education and research is more advanced in the U.S., mostly as a result of two decades of generous funding from the National Library of Medicine including its

IAIMS (Integrated Academic Information Management Systems) program to stimulate the use of HI in medicine. Even though IAIMS promoted the integration of academic and clinical information systems between universities and healthcare facilities, the HI research training programs that emerged are still mostly traditional, e.g. programs independent of each other, small groups of core faculty and staff, unnecessary differentiation among medical, nursing and allied health informatics, and local course work with individual dissertation for their Trainees. In Europe, the HI discipline is also very mature, with well-established traditional graduate training programs.

This proposed program is innovative in terms of its concept and design. The program will:
focus initially in six health domains as defined by the 13 CIHR Institutes and six HI research themes based on our expertise to ensure we excel in areas with the greatest relevance and need; create a collaborative research training environment that leverages and amplifies our respective strengths; be transdisciplinary in nature, creating a new meta-environment among HI researchers and stakeholders that integrates the various reference disciplines used in HI; emphasize a value-added curriculum with flexible delivery to provide the richest training experience possible for Trainees with varying backgrounds and needs; leverage the use of e-learning technologies to maximize interactions and learning among researchers, Trainees and stakeholders regardless of location and distribution; establish physical and virtual collaboratories to bridge HI research, education and practice by working closely with stakeholder organizations solving real world problems and advancing HI as an academic discipline at the same time (Figure 1).

This proposed program will significantly improve HI research training over current practices in Canada. Pooling the expertise and resources of the eight HI research teams will create the collective intellect capable of applying a wide range of HI research approaches to enhance the health system in ways not feasible within any single institution. The different perspectives and experiences of key Mentors and stakeholders from across Canada will support transdisciplinary HI research at a level well beyond what can be achieved locally at present. The proposed curriculum and delivery will overcome the barriers in access, diversity and depth faced by existing programs. The use of e-learning and virtual presence technologies can enhance the effectiveness of teaching, learning and collaboration, which are done mostly in traditional face-to-face settings at present. Collaboration with stakeholder organizations through the use of physical/virtual collaboratories can ensure relevance and accelerated pace of HI research.

4. Transdisciplinary Approach

The program will break ground in HI research training by using a transdisciplinary approach to create a new meta-environment, or intellectual space, among HI researchers, Trainees and stakeholders within the health system. This becomes possible when fields of knowledge are integrated, interacted, and transformed from multiple perspectives into a holistic view of the problems addressed and an intellectually integrated approach, in order to define, address and resolve multiple real-world problems. This approach is supported through a collaborative research training environment that is highly focused,

using a number of physical and virtual collaboratories across the country, state-of-the-art e-learning and virtual presence technologies.

The strategic focus of our training program reflects respective strengths of the eight HI research teams mapped to regional stakeholder priorities and needs, which are organized around the six health domains of the 13 CIHR Institutes. Our six HI research themes are knowledge management, organizational informatics, intelligent systems, telehealth and telelearning, e-health applications, and e-research applications. The initial six health domains to be investigated are cancer research, aging, genetics, circulatory and respiratory health, health services and policy research, and population and public health. Specific projects from the eight teams will be used to provide the initial contexts and focus needed for training.

A number of collaboratories already in place or being launched will be used as the initial research facilities for the Trainees. The local environments where the eight HI research teams are engaged in ongoing projects will provide the *natural physical collaboratories* for the Trainees. Depending on their setup, these collaboratories may provide a living or simulated environment to conduct laboratory and/or field studies. In addition, an Internet-based *virtual collaboratory* will be established through this program to foster the development of a Virtual Community among HI researchers, Trainees and stakeholders to share their multiple perspectives and experiences.

This proposed program will incorporate the latest e-learning technologies to enhance research and learning opportunities for its Trainees. These include development of interactive technologies to enrich virtual learning, multimedia learning objects and repositories, interoperability standards across e-learning platforms, evaluation approaches for e-learning, HI research/learning resources, as well as the use of CA3*net as a high speed communications medium.

5. Curriculum and Delivery

Three key principles guide the content and format of this program:

Non-duplication: all elements of the collaborative program will be complementary to and enhancements of the participants' existing programs, not replacements for them;

Collaboration-dependency: only those elements that depend (and flourish) on the collaborative input of the participating programs will be developed and offered; what can be done locally in individual programs will be done locally; and

Criticality of Assembly: each element will provide a kind and quality of educational experience that is only achievable through the creative assembly of the appropriate faculty, Trainees, and tools contributed by multiple local programs.

Currently, all of the participating institutions have an HI or related PhD/post-doc training program in place or being planned. The existing graduate program structures within the respective institutions vary significantly in their course requirements. Presently, the graduate coursework, research projects and dissertation topics are dependent on expertise and resource availability within the local institutions.

This proposed program will allow Trainees to register in any one of these existing programs, while taking advantage of the collaboratively developed and offered educational experiences. These Trainees will have to comply with current degree requirements as stipulated by the individual programs, but will access the collaborative program to both enhance and complete their training. Our concept of "research learning experiences" (RLEs) implies structured events intended to provide intense and in-depth hands-on learning through interactions among multiple faculty, Trainees and stakeholders. They may be considered as "courses" to assist in their local management and recognized for credit within the local programs where the Trainees are registered. While participating in these RLEs, Trainees are also expected to enroll in other required/optional courses in their local program.

In this proposed program, we will introduce five transdisciplinary RLEs over a 30 month period in an effort to incorporate HI content that cannot be delivered by any one local institution and enrich the local curricula. RLE's will take advantage of face-to-face workshops and e-learning technologies in the following areas: *Frontiers of HI Research, HI Research Specialization, HI Virtual Community, HI Knowledge Transfer and HI Onsite Experience.*

The training approach includes two intakes of 20 PhD/Postdoc Trainees each, totalling 40 Trainees for the initial offering of this collaborative program over a 6-year period. This translates into one preparatory year and two rounds of RLEs (30 months each to complete). New and existing PhD/postdoc Trainees from local programs may apply to take part in this program as deemed appropriate by their supervisors and key Mentors in the program. All Trainees will be matched with specific Mentors and stakeholders in small groups within the eight HI teams depending on research and logistical fit.

6. Recruitment/Tracking/Evaluation

Trainees will be recruited via the participating programs through key Mentors. (Potential Trainees will have been tentatively accepted into their home institutional program prior to consideration for the HI research training program.) Materials will be developed to assist the Mentors in identifying potential candidates for the program, determining candidate eligibility and fit with the program, and motivating candidate participation.

The program administrative structure is shared with a separate, but complementary, initiative currently underway called the National Health Informatics Collaboratory. The program will be managed by a core group of 4 Mentors:

The Program Chair: Responsible for the general leadership of the program in consultation with all Mentors (2-year term).

Associate Chair Education: Responsible for developing and fostering the development and maturation of the program's educational offerings (1-year term).

Associate Chair Research: Responsible for developing and fostering the research-related foci of the program (1-year term).

Associate Chair Operations: Responsible for organizing interactive events and maintaining information resources (2-year term).

A Program Advisory Committee (PAC) of approximately 10 members will provide continuous input from critical stakeholders. Members will include HI researchers and educators from university programs, potential recruiters of students (e.g. private sector research organizations, universities and colleges), HI curriculum developers and representative students. The PAC will review the program's strategic plans and critique key management frameworks and processes. The PAC will also provide oversight of the nature and quality of the program, assuring that both excellence and production goals are satisfied.

Partnerships, Collaborations and Institutional Support

Letters of support indicate a broad range of institutional commitment for this project is present. National organizations (e.g. COACH, HEAL*Net,* CIHI) as well as provincial and local organizations are supportive. Long term sustainability is assured through integration with existing programs.

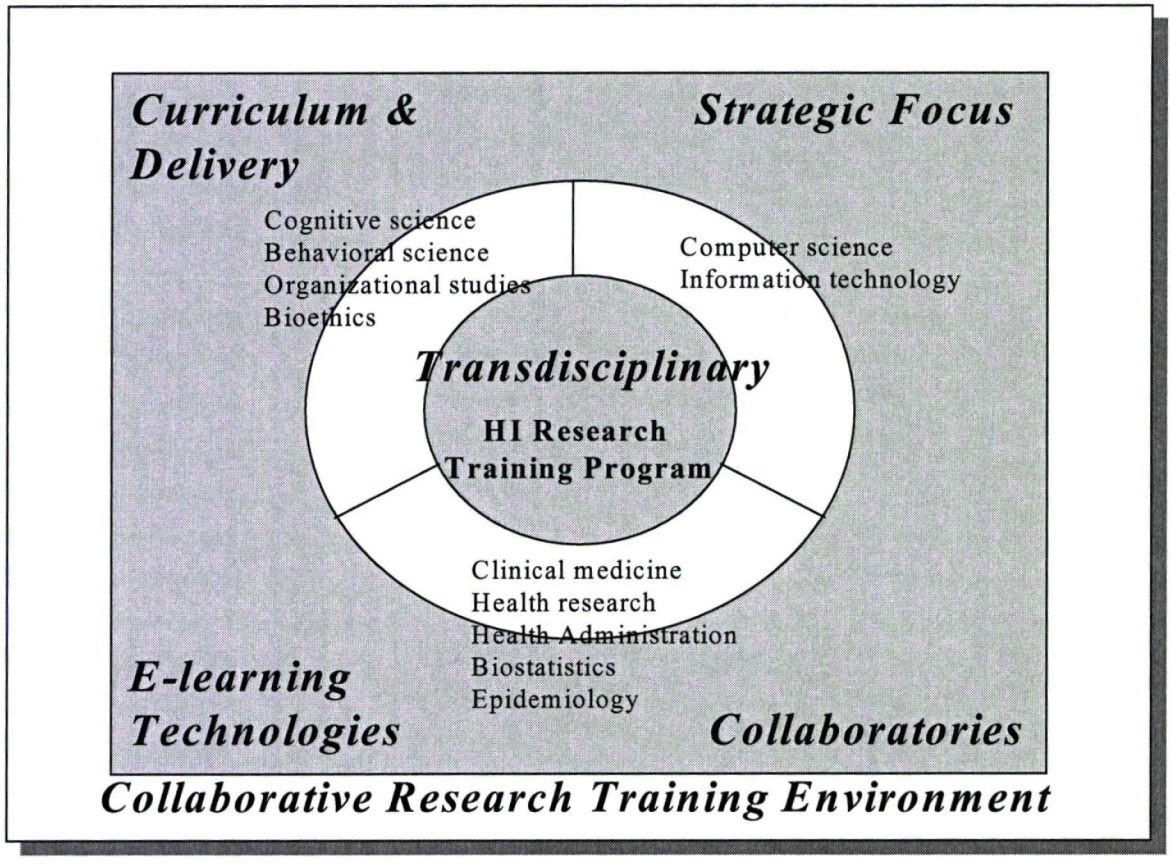
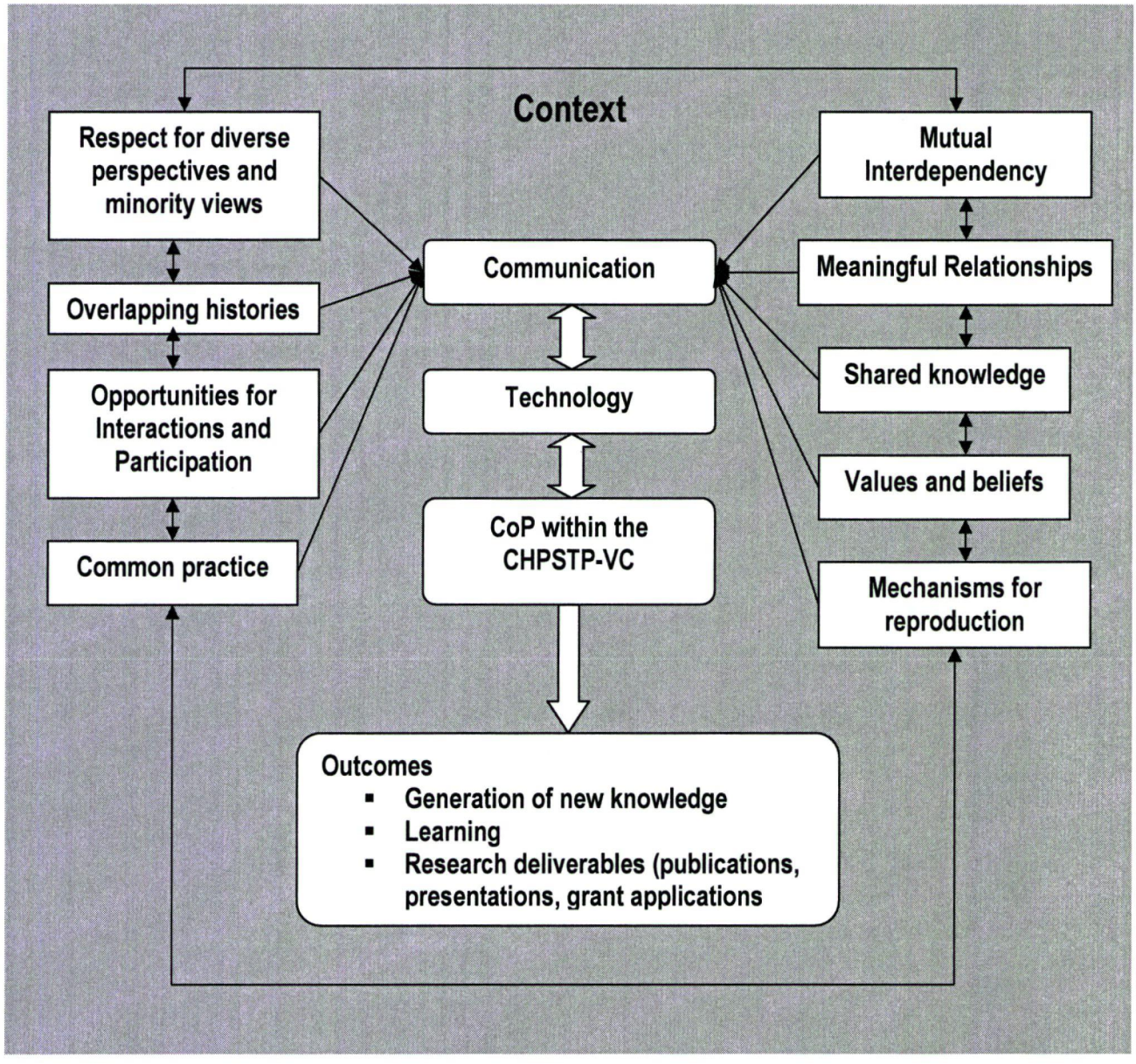


Figure 1 - A Schematic View of this Proposed HI Research Training Program

University	Key Mentors	Expertise
Calgary	Marilynne Hebert, Penny Jennett, Richard Scott from Health Telematics Unit in the Department of Community Health Sciences.	Telehealth/telelearning research, application and evaluation
Dalhousie	Grace Paterson, David Zitner and John Ginn from Department of Medical Informatics in Division of Medical Education	expert systems, computational neuroscience, data mining, human-computer interaction and information retrieval as applied to outcomes management, population surveys and health metrics to measure health, comfort, function and prediction
	Mike Shepherd, Raza Abidi and Malcolm Heywood from Fac. of Computer Science	
	Ingrid Sketris from College of Pharmacy	
McGill	Allen Huang and Robyn Tamblyn from the Departments of Medicine and Epidemiology and Biostatistics	IT implementation research in health organizations, deployment of the electronic health record for the medical office, disease management, and bioethics/law
	Alain Pinsonneault and Lurette Dubé from the Faculty of Management	
	David Roy and Pierrôt Péladeau from Ethics & Law of the Institute of Clinical Research in Montreal	
McMaster	Rolf Sebaldt and Anne Holbrook from the Centre for Evaluative Medicine	the study of large prospective clinical databases, electronic medical record and privacy/security issues
Sherbrooke	Andrew Grant and Guy Bisson from the Centre for Informatics Evaluation Research in Health and Health Systems	intelligent systems, bioinformatics, and genomic and population analysis
	Gertraud Burger of the bioinformatics group from the Montreal University	
	Denis Gingras, Marc Frappier, Richard St-Denis, Ruben Gonzales-Rubio and Soumaya Cherkaoui from Sherbrooke's Institute of Materials and Intelligent Systems	
Toronto	Kevin Leonard and Alex Jadad	e-health innovation - focuses on the conceptualization, design, development, application and evaluation of new ways of using existing/emerging IT in health sector.
Victoria	Allan Best, Eike Kluge, Francis Lau, Malcolm Maclure, Jochen Moehr and Rick Stanwick	HI research design, evaluation methods, randomized policy trials, organizational informatics, knowledge management, behavioral sciences and bioethics
Waterloo	Jose Arocha, Dominic Covvey and Chrysanne DiMarco	intelligent health systems, cognitive science, health information management, image analysis, health user interface and interactive systems, mathematical computing in health, and health system architectures

Appendix 1 – Key Project Mentors and Expertise

Appendix B – Conceptual Framework



The Diagram above is a conceptual framework developed to guide the data collection and analysis outlined by the review of the literature; it illustrates the possible interconnections of the different features typically present in a CoP. These elements are expected to amalgamate through technology and context for a HI CoP to emerge.

Appendix C – Consent to Access CentraOne® and Blackboard

HEALTH INFORMATION SCIENCE

University of Victoria

April 22, 2004

Dr. Marilynne Hebert
Assistant Professor
Health Telematics Unit
Faculty of Medicine, University of Calgary
G240-3330, Hospital Drive NW
Calgary, AB T2N 4N1

Dear Dr. Hebert,

RE: Request for permission to access the data generated by the CIHR Health Informatics PhD/Postdoc Strategic Training Program (CHPSTP)-RLE #1 Virtual Community.

As discussed and agreed to at a CHPSTP Faculty meeting, graduate student Maria Palacios Mackay was granted permission to access the information stored in both Centra ® communications software and Blackboard System, for the purpose of completing her Master's thesis research "Case Study of Virtual Collaboration in Health Informatics" under your supervision.

Regards,

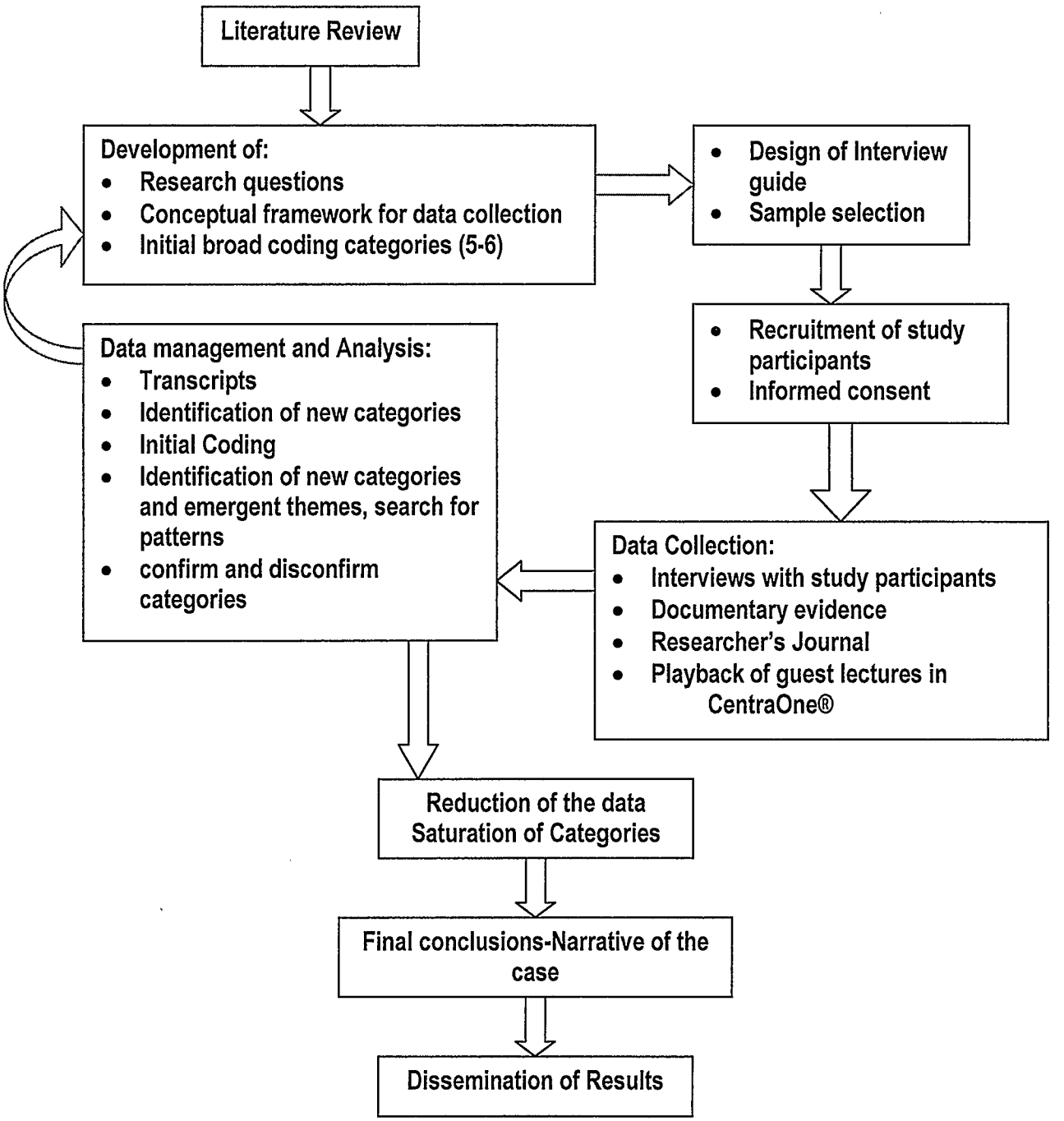
Dr. Francis Lau
CHPSTP Principal Investigator
University of Victoria

c.c. Maria Palacios Mackay

School of Health Information Science
PO Box 3050 STN CSC
Victoria British Columbia V8W 3P5 Canada

Tel (250) 721-8575
Fax (250) 472-4751
E-mail his@uvic.ca Web http://hinf.uvic.ca

Appendix D – Diagram of Research Methods



Appendix E – Data Collection Matrix

Sources of Data	Nature of data collected	Time/Frequency of Data Collection
Interviews	Trainees' and Mentors' individual experience in the CHPSTP-VC	June 2004. One interview with each study participant.
Postings in Blackboard	Text of all messages posted; number of postings per Trainee or Mentor	July and August 2004
Playback of all the sessions held by the CHPSTP-VC in CentraOne®	Retrospective observation of what occurred during each session; Trainees and Mentors' attendance; discussion generated during the guest lectures.	July and August, 2004
Reflection Journal	Summary of researcher's experience in the project; observations, feelings, comments that were recorded in the journal	Throughout the life of the project

Appendix F – Interview Guide

Example of Questions to be asked during the interview:

I Personal Interest in HI

- Tell me about your experience in HI? [Prompt: what are your particular research/working interests around HI?]
- How did you become interested in this HI Training Program?

II Virtual Community

- Tell me about your experience with the CHPSTP-Virtual Community
- What were your expectations around using the technology?
- How is this technology-mediated collaborative work different from other face-to-face collaborative work you've experienced?

III The use of ICTs to collaborate

- Tell me bout the technologies you've been using in the Virtual Community to collaborate [Prompt: did you use Blackboard and/or CentraOne®?]
- What has your experience been like using these technologies? [Prompt: have they been easy/difficult to use?]
- How has the support for using these technologies been? [Prompt: your own university/CentraOne®/the project manager's support]
- Have these technologies been effective to communicate, why/why not?

IV Collaborative process

- What opportunities have you had to share your experience-knowledge with other Virtual Community members?
- What have you learned from them?
- Do you feel your expertise is valued by the Virtual Community members?
- What has been the contribution of the Virtual Community to the area of HI? [Prompt: for example: research grant applications, manuscripts, shared projects]
- Do you look forward to participating in the Virtual Community every week (posting, attending lectures, etc.)
- Have you found obstacles that get in the way of the collaborative process of the CHPSTP-VC? [Prompt: time difference, language barriers, lack of experience using the technology]

V Community of Practice

- Do you feel you share a passion or practice that bonds you to the other Virtual Community members?
- Do you feel you personally need the support of other members of your group and if so, why?
- Do you feel a strong urge to share your current ideas and newly acquired knowledge with other members of the Virtual Community and why?
- Who do you perceive plays key roles in the CHPSTP-VC? [Prompt: tell me more about that role, e.g. leadership, mentoring, generating new ideas]
- What role do you feel you play in the CHPSTP-VC?

- Is there another role you'd like to play in this VC? [Prompt: leadership, mentoring; what prevents you from playing it?]

Appendix G – Narrative for Telephone Interview

My name is Maria Palacios Mackay. I'm a Master's student in the Department of Community Health Sciences, Faculty of Medicine, University of Calgary. I am currently working on my thesis research titled Case study of Virtual Collaboration in Health Informatics, and am in the process of collecting data to write my dissertation and other academic papers and presentations on this topic.

The Principal Investigator of this research is Dr. Marilynne Hebert from the Health Telematics Unit, Department of Community Health Sciences, Faculty of Medicine, University of Calgary, who is also my thesis supervisor. Other members of my thesis supervisory committee and co-investigators in this study are Dr. John Parboosingh, and Dr. Wilfreda Thurston, also from the Community Health Sciences Department at the Faculty of Medicine, University of Calgary.

The primary objective of this study is to explore how Health Informatics (HI) research collaboration among Trainees and Mentors in the CIHR PhD-Postdoc Strategic Training Program-Virtual Community (CHPSTP-VC) is mediated by information and communication technologies. Specific objectives are to gain a better understanding of how technology is perceived to impact the CHPSTP-VC participants' training and mentoring experience, and to identify patterns of factors that may enhance and/or hinder virtual collaboration in HI research

Your participation in the study is voluntary and it only involves your participation on one telephone interview of approximately 60-90 minutes duration. No further commitment is required from you regarding the study after the interview is completed. This study has no risks and/or benefits associated to your participation.

It is difficult to ask questions and write down all your answers. I want to capture everything you say, so I would like to record the interview. Someone will then listen to the tapes and type down what you have said. I will use these written summaries to write my thesis report. All the tapes that result from this interview will be destroyed when the thesis is completed.

Do you agree to have this interview recorded?

Only the investigators involved in the study will have access to the information collected in the interviews. I will be interviewing other CHPSTP-VC members and will not attribute comments to any particular individual in my thesis report. However, you should be aware that even though names will not be used in the report, the participant's identity may be evident for other members of the CHPSTP Project.

Do you have any questions before we begin?

Do you agree to participate?

I want to remind you that, even though you agreed to participate in this interview, if at any time you feel uncomfortable or choose not to continue, you are free to say so.

Appendix H - Ethical Approval

MAY-03-2004 10:14 U OF C OFF. MED BIOETHICS 403 283 8524 P.01/01

FACULTY OF MEDICINE | UNIVERSITY OF CALGARY

2004-05-03

OFFICE OF MEDICAL BIOETHICS

Room 93, Heritage Medical Research Bldg
3330 Hospital Drive NW
Calgary, AB, Canada T2N 4N1

Telephone. (403) 220-7990
Fax: (403) 283-8524
Email: omb@ucalgary.ca

Dr. M.A. Hebert
Department of Community Health Sciences
HMRB
Calgary, Alberta

Dear Dr. Hebert:

RE: Case study of virtual collaboration in health informatics

Grant-ID: 17770

The above-noted thesis proposal, Narrative for Telephone Interview, and the Interview Guide have been submitted for Committee review and found to be ethically acceptable.

Please note that this approval is subject to the following conditions:

(1) access to personal identifiable health information was not requested in this submission:
(2) a copy of the informed consent form must have been given to each research subject, if required for this study;
(3) a Progress Report must be submitted by 2005-05-03, containing the following information:
  i) the number of subjects recruited;
  ii) a description of any protocol modification;
  iii) any unusual and/or severe complications, adverse events or unanticipated problems involving risks to subjects or others, withdrawal of subjects from the research, or complaints about the research;
  iv) a summary of any recent literature, finding, or other relevant information, especially information about risks associated with the research;
  v) a copy of the current informed consent form;
  vi) the expected date of termination of this project.
(4) a Final Report must be submitted at the termination of the project.

Please note that you have been named as a principal collaborator on this study because students are not permitted to serve as principal investigators. Please accept the Board's best wishes for success in your research.

Yours sincerely,

Christopher J Doig, MD, MSc, FRCPC

Chair, Conjoint Health Research Ethics Board

CJD/am

c.c. Dr. T. Noseworthy (information) Research Services Dr. M Palacios Mackay
Office of Information & Privacy Commissioner