INNOVATIVE MODELS OF WEB-SUPPORTED UNIVERSITY-SCHOOL PARTNERSHIPS

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This study explored how the Internet bridges theory and practice. Teacher educators, teachers, and prospective teachers used collaborative technologies to design networked communities embedded in three distinct perspectives: the networked learning community, the networked community of practice, and the knowledge building community. Networked communities prompted the development of solutions for integration of information and communication technologies (ICTs) at the elementary, secondary, and post-secondary levels. These communities provide opportunities for sustained theory-practice dialogue between teachers at different stages of their professional development and opportunities for 'boundary spanning' between courses, practica, pre- and in-service education, graduate seminars, and collaborative research activities.

Key words: teacher education, professional development, collaborative reflective practice, networked communities

Cette étude explore les possibilités d'Internet, entre autres, le Web et certains de ses outils pour soutenir des échanges propices à l'établissement de liens théorie-pratique au sein de communautés en réseau. Trois modèles sont présentés, chacun ayant conduit à la mise à l'avant de solutions novatrices pour l'intégration réussie des technologies de l'information et de la communication (TIC) aux niveaux primaire, secondaire et postsecondaire. Les communautés en réseau ont fourni des occasions de réflexion et de mise en relation d'activités de cours et de stages, de formation initiale et continue ainsi que de recherches réalisées en collaboration.

Mots clés: formation des enseignants, développement professionnel, pratique réflexive, communautés en réseau

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University-school partnerships devoted to the renewal of learning environments have been promoted for almost twenty years (Cole, 2000; Goodlad, 1990; Hawley & Valli (1999); National Council for Accreditation of Teacher Education [NCATE], 2001; Resnick, 1995; Russell, McPherson, & Martin, 2001). In the United States, The Holmes Partnership, following the footsteps of The Holmes Group (1990), has created the *professional development school (PDS) strategy*, which aims to renew the learning environment, whether in a public school or a higher education setting, by reducing the distance between theory and practice combining pre-service education (field experiences and student teaching), teacher professional development, and collaborative research. The PDS strategy has been facing issues of feasibility, sustainability, and scalability (Bullough *et al.,* 1999; Clark, 1999; Levine & Tratchman, 1997; McBee & Moss, 2002; Sykes, 1997; Teitel, 1997). According to Bereiter (2002), there is a divide between the research and the practice cultures. Could new socio-technical designs make a difference in teacher education and professional development, by combining teacher groups, places, activities, and Internet-based technologies?

The idea that the Internet could help renew learning environments by helping bridge the distance between theory and practice was explored within the TeleLearning Network of Centres of Excellence (TL-NCE) (Canada, 1995-2002) [1]. The emphasis was not to design online courses or communities. Instead, as teacher educators and researchers, our design efforts were applied to the creation of hybrid learning environments for

pre- and in-service teachers to acquaint them with Internet-based tools and their effective use in learning environments. As far as school learning environments were concerned, the teachers we worked with were interested in fostering school learners' acquisition of twenty-first century skills such as computer literacy, higher order thinking, collaboration, and lifelong learning. Electronic connectivity was developing in all educational institutions. Our research and development team used information and communication technologies (ICTs) to connect teachers at different points in their professional development, and design networked communities using collaborative technologies. Most of the team effort went to make sense of, and support, online social interaction for learning and/or knowledge building purposes within networked communities. Participants met onsite and online (hybrid formal learning environments) within the context of university-school partnerships developed by three universities and their local school districts. Participants explored how the Internet, and especially the Web, could help develop and sustain communication and collaboration among teachers (prospective teachers, in-service teachers, and teacher educators). In more recent years, this activity engendered other projects such as the Remote Networked School Initiative (2002-2008).

The purpose of this paper is to report on the circumstances and outcomes of three inter-connected initiatives in teacher education with collaborative technologies within the general frame of university-school partnerships. First, we discuss the relevant theoretical foundations informing our work: socio-cultural models of learning that include the role of collaborative processes, social context, the negotiation and mediation of thinking and learning, reflective practice. Second, we present the methodology, including the design experiment approach used to explore possibilities for new socio-technical designs to take place (networked communities). Third, the results are presented at three distinct levels of analysis: macro analysis (the sites' basic constituents and combinations), meso analysis (networked communities' activity, viable models of networked communities), and micro analysis (collaborative online discourse). Fourth, the results are discussed, and key benefits identified.

THEORETICAL FOUNDATIONS

Socio-cognitive and cultural perspectives on learning (Vygotsky, 1978; Wenger, 1998) informed our socio-technical designs aimed at the renewal of learning environments. The design of a learning community, whether its members make use or not of Internet-based tools, is typically informed by socio-cognitive and cultural perspectives on learning (Brown, 1997; Cole & Bruner, 1971; Engeström, 1987; Resnick, 1989). Important elements of these socio-cultural models of learning include the role of collaborative processes, social context, and the negotiation and mediation of thinking and learning between the pupils and the teachers (Rice, 2002). Brown and Campione (1994) put forward the community of learners model, and Scardamalia, Bereiter and Lamon (1994), the knowledge-building community model. Brown and Campione made little use of ICTs in the classroom, whereas Scardamalia, Bereiter and Lamon's collaborative research relied on a specially designed electronic forum (Computer-supported Intentional Learning Environments, CSILE). According to Bielaczyc & Collins (1999), computer-supported learning communities are ones in which all members become involved in a collective effort of comprehension. With regards to informal learning environments, Lave and Wenger (1991), who highlighted learning occurring in a community of practice through participation, developed a language and framework outlining a social perspective on learning.

Online learning communities (Palloff & Pratt, 1999), online communities of practice (Barab, Kling & Gray, 2004; Johnson, 2001), and knowledge building communities are examples of socio-technical designs resulting from new combinations of social groups, places, activities, and Internet-based technologies. Their purpose may be learning or knowledge building. Except for knowledge building communities (Scardamalia & Bereiter, 2003), research on socio-technical designs using collaborative technologies is just now emerging (Heo & Breuleux, 2005; Lamon, Laferriere & Breuleux, in press).

A key assumption in our own study was that the Internet, and especially the Web, can support social interaction in a classroom-based, a school-based, or a PDS-based community. Another key assumption was that collaborative-emancipative practices seldom found in site-based teacher education could also be found in online settings. Schön's (1983)

notion of reflective practice and Van Manen's (1977) levels of the practical were the conceptual frameworks with which we approached electronic discussion forums in a number of contexts and situations. The former perspective informed the process of taking participants beyond technical rationality (Grimmett & Erickson, 1988), engaging them in collaborative reflective practice onsite as well as online. The latter perspective was used to analyze the content structure of the forum discussions: the technical (*techne*), practical judgment (*phronesis*), and emancipating/critical reflection (Allaire, 2006). Computer-mediated communication research (Harasim, Hiltz, Teles & Turoff, 1995) and computer-supported collaborative learning research (Koschmann, 1993) provided us with early evidence on the potential and the limits of electronic networks for collaborative learning and knowledge building. Informed by what this literature was saying, and also not saying, participant engagement and progressive discourse were identified as critical indicators of success in the design of networked communities. A number of ICT-related innovations in the field of teacher education and professional development (Bull, Harris, Lloyd, & Short, 1989; Merseth, 1988; Riel & Levin, 1992; Schauble & Glaser, 1996) were reviewed for a more complete understanding of the research that could inform the design of networked communities. One very visible and highly researched model in the United States is that of "Professional Development Schools" (PDS) which have been described as "a learning-centered community that supports the integrated learning and development of P–12 students, candidates, and PDS partners through inquiry-based practice" (National Council for Accreditation of Teacher Education   [NCATE], 2001, p. 9).   However, this model and accompanying literature does not emphasize collaborative technologies.

Our own research and development team focussed on creating innovative models of networked communities working within a general frame of university-school partnerships for teacher education and professional development.

METHODOLOGY

Design Experiments

We adopted a *design experiment* (DE) methodological framework to

undertake our project. In this section we briefly define DE with reference to current literature, and identify the main reasons justifying our choice to adopt a DE approach.

Design experiments have developed as a research strategy to handle situations with many important characteristics (see Bell, 2004; Brown, 1992; Collins, 1992) including the following specifically relevant to our case: a) the phenomenon under investigation is emergent, partially developed, or immature, b) it is a "complexly constructed social system in which it is simply not possible to be sure at all times what combination of factors is at work" (Cole, 2001), c) theoretical tools are available to guide further principled development of the phenomenon, d) controlling variables is undesirable or nearly impossible because it would interfere massively with the emerging phenomenon, and e) design studies are "highly interventionist" (Cobb, Confrey, diSessa, Lehrer & Schauble, 2003).

Our project falls mostly in the category of "cultural psychology design-based research" (Bell, 2004) because we were particularly concerned with the diverse cultural–historical foundations of development in our different local contexts, and attentive to the local customization and sustainability of "patterned interactions between individuals and artifacts". In relation to the range of contexts illustrated by Cobb et al. (2003), ours was a pre-service and in-service development experiment. In the work reported here we are particularly interested in what Wenger (1998) terms the *regime of competence* of a community of practice, that is, not only the ability of individuals to perform certain actions but also the ability to engage with other members, to understand the overall enterprise of the group, and to contribute to the shared repertoire and influence the historical development of the community, sometimes with innovative work. In our design work, we consider the regimes of competence of both teachers and students in the class. Moreover, certain design results may be considered at a very local level (e.g., prospective teachers' reflective analysis on their teaching of arithmetic in a classroom-based learning community) or at a more macro level (e.g., the classroom organization practices of teachers from different schools adopting the same pedagogical approach). A distinct characteristic of teachers forming a professional community is that they

engage in reflecting on their own practice. Our design work took these types of contextual factors into consideration. Furthermore, in a design experiment, an important part of the inquiry is to build on or establish appropriate contexts (in our case, university-school partnerships) that have practical value, and that delve directly into the participants' knowledge to ensure that the objectives are met at the end of a certain number of iterations. As Tabak (2004) has underlined, this problematizes context. It is important, consequently, to adapt the usual scheme of the research report to allow for the combination of results and context. Thus, in other words, the dynamic description of locations and participants (communities) is already part of the results (Breuleux, Erickson, Laferrière & Lamon, 2002). In this study, however, we present the participants in the methodology section. The reader should keep in mind that participants are part of the designs developed and tested through iterative cycles and they are, therefore, also part of the results (innovative models of viable networked communities).

Participants

Each of the three primary local sites (University of British Columbia's Community of Inquiry in Teacher Education (CITE) in Vancouver (Erickson, Farr Darling & Clarke, 2005; Farr Darling, Clarke, & Erickson, 2007); McGill's TeleLearning Network of Professional Development Schools in Montreal (Breuleux, Laferrière, & Bracewell, 1998), and Laval University's TACT Community in Quebec City (Laferrière, 2006)) developed and co-designed networked learning environments. Prospective teachers, in-service teachers, and teacher educators contributed to the creation of online resources and tools to support the integration of digital technologies to learning and teaching. These communities focused on learning-to-teach in network-enabled classrooms through collaborative inquiry. Participants engaged in site-based inquiries that focused on learning to teach with digital technologies through collaborative inquiry. Furthermore, all three sites were committed to pedagogical innovation in teacher education and of having partnerships with primary or secondary schools: at one setting, a community of inquiry for teacher education was just beginning; at another setting, a network of partner schools was being implemented; at

a third setting, a summer institute was already in existence and particular attention was paid to the Internet connectivity of the schools. All of them were in different ways exploring how to connect research and practice for the purpose of designing better teacher education and professional development programs. The three groups, each with their lead researcher/teacher educator, came together as part of the TeleLearning Professional Development Schools (TL-PDS) Network, and developed a number of innovative models as a result of a set of design experiments on several levels and at all three different locations. Each site offered a diversity of opportunities and challenges, including those related to program features, and had in place its own distinct character of cultures, partnerships, and professional relationships. Site participants varied according to time and location. On the whole the membership of each networked community reflected the annual intake of prospective teachers, after graduation circumstances, teacher professional development offerings, and teacher educators' research interests.

Iterative Design Process

At each site the lead teacher educator initiated a process of participatory design with university- and school-based teacher educators, in-service/prospective teachers, and, in some cases, university administrators. At first, the focus was on technology integration. Web-based tools such as Knowledge Forum, Virtual-U, WebCT, and First Class discussion forums were selected and used [2] for support and communication, for collaborative inquiry and for other delocalized activities. Each site explored different types of design experiments by combining social relations within and between groups, activities, and technology-in-use (see Barab et al., 2004). We examined the nature of these collaborative relationships at three distinct levels: the university-school partnership (macro level), the networked community (meso level), and the online discourse (micro level).

As a result of observations made and lessons learned during the first iteration (1995-1998) of studies (Breuleux, Laferrière, & Bracewell, 1998; Legault, 2000; Minnes Brandes & Erickson, 1998), the second iteration (1999-2002) introduced new design features and interaction opportunities, and new research questions (e.g., generic design

principles, Breuleux et al., 2002). During the third iteration (2003-2006) the university-based teacher educators continued to play a key role as they reflected on and provided feedback to the practitioners on effective ways of using ICTs in networked learning environments. The enactment of collaborative inquiry in the context of Web-supported university-school partnerships was one of the research foci for all three phases. The three following questions are addressed in this study: What are the commonalities among the socio-technical designs (networked communities) over the three sites? What is our understanding of the activity of networked communities? Are networked communities viable models for enhancing professional development?

Data Gathering and Analysis

Field notes (macro and meso level analysis), face-to-face interviews and questionnaires (meso level analysis), and online interaction analysis (micro level) were used. The networked communities became a source of data in themselves: underlying design principles, socio-technical affordances, participants' online activity objective(s) and patterns of interaction, and online artifacts (websites and related productions such as texts, digital videos, databases).

At the macro level of analysis, the basic constituents of each site (university-school partnerships) and their resulting combinations (networked communities) were observed: groups of teachers and prospective teachers, places, activities, and Internet-based tools. Commonalities were identified. At the meso level of analysis, Engeström's (1987) Activity Theory framework was applied to compare the activity of a networked community at different points of its development and to identify change. Two analyses were conducted. First, the key challenges faced by each of the emerging networked communities over the three distinct phases of the research program were identified. Phase I (1995-1998) and Phase II (1999-2002) received TL-NCE funding, while Phase III (2003-2006) was after the completion of the TL-NCE project. Although each networked community faced its own unique challenges, the over-riding concern was to try to develop localized, context-sensitive, viable models for Web-supported university-school partnerships. For the second analysis, we looked at both the

rationale and the methods that the participants offered for the use of Internet-based tools for communication and collaboration within a university-school partnership. For example, classroom teachers had the explicit intent of creating learning environments that would enable their students to develop contemporary media and technology skills. We also looked for emerging roles, rules and routines, as well as artifacts within the networked communities. We complemented the presentation of viable models with illustrations of instances of collaborative online discourse drawn from previous analyses.

RESULTS

Networked Communities' Basic Constituents (macro level results)

Within the context of university-school partnerships, the constituents that combined to create networked communities were as follows: groups of teachers and prospective teachers, places, activities, and Internet-based tools. In spite of the differences among each university-school partnership, some commonalities were found. First, all the socio-technical designs made use of Internet-based tools to support their communication and collaboration activities. For instance, the CITE community wanted more integration between their campus-based courses and had a strong focus in their whole program on inquiry on the part of the instructors as well as the prospective teachers. The TACT community wanted to add coherence to the discourse of university- and school-based teacher educators working with prospective teachers doing field experiences and student teaching, and more substantive reflective discourse on the part of the latter. At the McGill TLPDS community, the classroom teachers wanted to encourage innovative student work in the classroom in concert with the teachers' own developing capacities in the new learning technologies. Second, each networked community was renewed and sustained through a regular input of new prospective teachers, teachers, and graduate students. Each new cohort was a small community within the larger one. Third, at all sites, the design experiments included groups of teacher educators, pre- and in-service teachers, and graduate students who explored the possibilities of Internet-based tools from constructivist and socio-constructivist perspectives.

The features related to the basic constituents of these socio-technical designs (CITE, TACT, and McGill TLPDS) are presented in Table 1 with an emphasis on their commonalities. Differences are disclosed when the reader clicks on the networked communities' hyperlinks and reads descriptions of the three networked communities. Although face-to-face interaction was predominant at all sites, each design experiment had at least one online forum or discussion space for discussing the activities, issues, and problems emergent at that site. In two of the three designs school pupils were an integral part of the experiments.

Table 1

Basic constituents of socio-technical designs for teacher education and professional development

NET WORKED COMMUNITIES	Groups of teachers (or partners)	Places	Activities	Internet-based technologies
CITE	Teacher educators Prospective teachers In-service teachers Graduate students	University cohort-based teacher ed program Field placements (schools) Field site	Courses, practica, seminars Early field experiences and student teaching Reflective practice and inquiry in the use of ICTs Graduate work	WebCT Internet browser & server, HTML editor HTML editor iMovie HyperStudio
TACT	Teacher educators Prospective teachers In-service teachers Graduate students Peer tutors	A school-within-a-school program PDS Laval Network Field site	Practica and seminars Early field experiences and student teaching Reflective practice and inquiry (focused on	Knowledge Forum Internet browser & server, HTML editor iMovie

			high access to networked computers) Graduate work	
McGill TLPDS	Teacher educators Prospective teachers In-service teachers Graduate students Peer tutors	Summer Institute (University) Field placements (schools) Field site	Practica and seminars Early field experiences and student teaching Teacher ethnographic research with iMovie Graduate work	Knowledge Forum WebCT Internet browser & server, HTML editor iMovie

Networked Communities' Activity: Challenges, Contradictions, and Discontinuities (meso level results)

The use of Web-based tools to mediate the interaction (communication, collaboration) between participants raised challenges related to technology, pedagogy and governance. Networked communities evolved as contradictions experienced by participants pondering the use of new tools led to observable discontinuities with prior activity (Engeström, 1987). Table 2 summarizes the key challenges faced at each of the three phases in the life of the networked communities, and identified contradictions and discontinuities.

In the first phase of the research program (1995-1998), it seemed to be contradictory to have pedagogy in mind and to have to spend much time on learning about and teaching how to use Internet-based tools. Over the years, this contradiction lessened: an increasing number of participants had basic knowledge in the use of such tools and attention centered on pedagogy supported by Web-based tools. This discontinuity did not lessen another contradiction between the technological approach to teaching (technical rationality) and the reflective practitioner approach (Schön, 1983). However, we endeavoured to introduce Web-based tools as a support for constructivist pedagogies. As regards to the choice of

collaborative technologies, local consensus on the choice of tools had to be achieved. Their use was to complement instead of replace face-to-face communication and collaboration.

In the middle years (1999-2002), the main technology challenge was partner institutions' software choices for scalability purposes. We favored ones offering more support for social interaction because we wanted to add to rather than reduce social affordances with the use of Web-based tools. Although we had access to advanced collaborative technologies through TL-NCE (e.g., Virtual-U, Knowledge Forum), we could not disregard the convenience of using institution-wide tools (e.g., WebCT). This was a challenge in the face of wanting to offer participants tools that provided best support for collaborative reflective practice or community inquiry. Participants were teacher leaders, including prospective teachers, who had their own preferences regarding the use of the Internet in a classroom-based learning environment and computer tools to use to support constructivist pedagogies (e.g., Internet browser, html editor, iMovie).

In the maturing years (2003-2006), technology and pedagogy issues and challenges lessened considerably as the networked communities had found ways to create hybrid learning environments for prospective and in-service teachers as well as school students. Sustainability-related challenges arose as TL-NCE funding ended. The CITE community of inquiry, which was well established within University of British Columbia Faculty of Education, continues to explore and experiment (Farr Darling et al., 2007) and admits 36 post-graduate students per year. The TACT community, which continues to receive extensive financial external support, keeps on supervising the field experiences and student teaching of about 30 students per year within the PROTIC school-within-a-school student-owned laptop program. The McGill TLPDS networked community has engaged in a joint initiative with the TACT community (*École éloignée en réseau*/Remote Networked Schools Initiative, 23 school districts), and took the leading role in a similar undertaking with Anglophone school districts.

Table 2

Networked Communities' Activity

Phases	Issues/ Challenges	Contradictions	Discontinuities with prior activity
Phase I (1995-1998)	Technology challenge: Learning about Web-based tools Pedagogy challenge: Teacher educators' use of new tools to enhance constructivist pedagogies Governance challenge: Early adopters' consensus on using collaborative technologies to complement onsite meetings	Technology use as time consuming or time saving: a hurdle or a tool The use of new technologies as a step forward (reflective practice) or backwards (technical rationality) Face-to-face or online interaction	Recentering on pedagogy instead of technology Teacher educators' reflective practice: Identification of design principles for networked communities Combination of onsite and online interaction
Phase II (1999-2002)	Technology challenge: To match technology use with institutional technology Pedagogy challenge: Prospective and in-service teachers use of Web-based tools to support constructivist pedagogies Governance challenges: Teachers' convergence of interests in pedagogy and	Learning environments with technology or social affordances The use of technology for individual/ collective learning or knowledge building Internet as a door to anywhere or as a place to meet for learning/knowledge building purposes Convenience of place-based practicum assignment versus opportunities for	Use of technology in (socially) interactive learning environments Collaborative reflective practice/inquiry using collaborative technologies (electronic forums, video capture, and the like) Students' use of the Internet and especially the Web as an educational resource Resistance on the part of student placement office continued at one site. At another site it

	technology Expansion of criteria for field placement assignment by student placement office and student teachers themselves	richer connections between prospective teachers and veteran teachers	was not an issue and at the third site innovation was "tolerated" by student placement office
Phase III (2003-2006)	Technology challenge: Some campus and school-based educators continue to struggle to learn the new technologies Pedagogy challenge: To connect participants for better linkages between theory and practice Governance challenges: Post-TLNCE funding for networked communities Sustainability (except for CITE that had a wider base of teacher educators)	Students' use of technology can be threatening to or not supported by their less knowledgeable campus instructors and practicum teachers in the schools To deepen or diversify participation in Web-supported university-school partnerships Narrow local base of teacher educators in two networked communities (TACT, McGill TLPDS)	Incoming students require less time to be spent on learning technology basics Incoming students' or teachers' use of networked communities' tools and artefacts TACT & McGill TLPDS: University partnership with government, school districts and a knowledge transfer organization TACT: School leadership change (PROTIC program); McGill TLPDS: Leadership change

Viable Models of Networked Communities (meso and micro level results)

The models that follow (Table 3) arose from the activity (theory/practice) of the networked communities and their respective regimes of competence. Three innovative models of Web-supported university-school partnerships are distinguished. Engeström's parameters are on the left, and provide the structure for describing and comparing each model.

Table 3

Innovative Models of Web-supported University-school Partnership

Models Parameters	The networked learning community (LC) model	The networked community of practice (CoP) model	The networked knowledge building community (KBC) model
Community Context	Prospective teacher learning environment	Teacher working environment [1]	Learning and working environments
Subjects Lead teacher educator	One or more teacher educator(s) initiates a LC in relation to a course or a practicum offered on a regular basis. The participation of teacher educator(s) is visible online through the posting of learning materials and notes in electronic forums.	A practitioner (teacher, teacher educator) initiates a CoP in relation to challenging new content or context. Special funding to the lead teacher educator provides input and assures necessary technical support for leading participants to demonstrate the idea they have in mind through visible online contributions.	A researcher, a teacher educator or a teacher initiates a KBC. Participants are introduced to the knowledge building conceptual framework and related online tools (principles, database, scaffolds, analytic toolkit, virtual tours). Dedicated funding provides necessary support.

Tools			
Theoretical perspective	Constructivist perspectives applied in the context of formal education	Lave and Wenger (1991) and Wenger (1998): Learning as participation	Scardamalia and Bereiter's idea improvement notion (1994, 2003)
Web-based tools currently available at the university or in the school	Web-based tools or specific client-server applications that can be downloaded from the Resources section of the LC's website. Minimally, the LC needs a website on which participants can easily add pages using a password, and an asynchronous communication tool that is also password-protected. New tools may be added over time.	Web-based tools or client-server applications can be downloaded from the Resources section of the CoP's website. Minimally, the CoP needs a website on which participants can easily add pages using a password, and an asynchronous communication tool (chat, voice over IP, desktop videoconference) that is also password-protected. Many in-service teachers prefer online synchronous tools.	The Knowledge Forum suite of tools usually supports the KBC.
Subjects Members	Most members are prospective teachers registered in a course or a practicum. They meet on site and online. New members arrive every semester or year. Most graduating teachers leave the LC after completing assigned work but they keep their access to the interactive website. A few members may have two, three, four or more years of active membership. A few teachers participate through online postings related to their own	Most of the members are in-service teachers or school principals. An on-site meeting is scheduled to launch the CoP. Other members join in later. Other on-site meetings are helpful, and conference calls. All keep their access to the website and electronic forums even when not active contributors. Administrative support is most important: It provides encouragement to participants and recognition of the value of their doing. A few	Most KBCs are classroom-based. Participants may be school learners, prospectivee-service teachers, in-service teachers or graduate students. New members (individual expert or members of another KBC) are invited in the password protected collaborative online space to make relevant contributions.

	attempts to improve student learning.	prospective teachers participate.	
Object-outcome(s)	A sense of purpose drives participation, one that, for instance, relates to the improvement of school learning through the improvement of learning environments (e.g., effective use of ICTs in teaching and learning, application of new learning theories, curricular approaches, etc.). Specific collaborative inquiries are conducted.	Participation in the CoP brings benefits, ones that, for instance, relate to the improvement of one's work, social influence or time management. The collective practice also advances -- through better management of explicit knowledge, solicitation of implicit knowledge, and innovation.	Authentic and real problems that participants want to help solving by working online in a collaborative way drive the KBC. Knowledge advancement is the goal.
Roles	All participants have the potential to move from a leadership role to a membership role and vice versa when needed.	The facilitator encourages and model participation, and knows when to step aside when participants take a more active role.	The teacher is also a member of the KBC, making online contributions at the content and process levels.
Norms or rules	Participants are expected to read assigned materials and self-selected learning artifacts left by previous participants. They are to be visible online, that is, to make contributions, and to behave in a professional manner as regards their own postings and other members' postings. They are to create some learning artifact(s) of their own, ones that will be of benefit to current or upcoming members	Participation can hardly be contrived. The reading of materials is up to the participant, and so is making contributions (a reference, a written comment, a picture, a video). Norm building is regulated by what makes or keeps participants going online.	Participants are expected to consider their ideas as improvable. They are to make them explicit online, and revise them as other contributions are made. Progressive discourse occurs as participants add contributions of value to others.

	of the LC. And they do.		
Routines	A few participants access the website daily. Most prospectivere-service teachers access the website of the LC on a regular basis, ranging from three or more times a week to once a week when registered to a particular course or practicum. Postings follow some rhythm depending on the circumstances of use as regards management of time, content, and behavior.	One member in a facilitative role accesses the website daily. From analyzing a number of online forums a pattern emerged: When 25% or so of the members access the website of the CoP in a visible manner (a posting) and on a regular basis, the community is well established and growing.	During class time, rotations to access the communal database are preferred to all participants (school learners, prospective students or graduate students) accessing it at once. Another routine is that of the instructor discussing the content of some contributions in the database with the whole class or a small group or exploring some new ways for participants to contribute. Outside the classroom participants access the database.
Artifacts	The posted content of the LC is of an evolving nature. Archives of the first collaborative inquiries as well as recent ones are available. They translate into new resources for the community or publications on the Web or on paper. Access to the content of an electronic forum may be limited to participating members, with or without posting of the results to the whole community.	The online content of the CoP reflects participants' practical questions or problems. What works translate into new resources for the community (e.g., a policy), besides already existing resources such as official documentation or participants' sharing of teaching materials. Access to the content of an electronic forum may be limited to participating members as confidentiality may be at issue.	The database, which participants can improve by revising, referencing, synthesizing or eliminating notes, is an evolving repository in itself. Participants create virtual tours for guiding incoming participants or visitors into collective knowledge advances.

Onsite and online connections that actually took place among participants were manifestations of the potential of networked communities for better integration of theory and practice. Here are some illustrations.

Moreover, results at the micro level were understood to be also reflective of what can be done and achieved in university-school partnerships that create networked communities. Two main processes emerged from previous online discourse analysis (e.g., Allaire, 2006; Campos, Laferrière, & Lapointe, 2005): Collaborative reflective teaching and Collaborative knowledge building. Collaborative reflective teaching occurred at the three sites and involved student teachers joint reflective online journaling, and collaborative interpretation of artefacts from practice. Collaborative knowledge building was observed through knowledge building exemplary practice accessible through the Web (virtual tours, Laferrière, Lamon, & Allaire, 2005), in-class ethnographic video-recording by teachers, prospective teachers writing reports and case studies. More details on these observations are available.

DISCUSSION AND CONCLUSION

This article has described three networked communities that were designed to take advantage of the Web and other digital learning technologies to support university-school partnerships with an overall aim of better integrating theory and practice. Three key benefits stand out. First, all networked communities extended educators' capacities in using ICTs to enhance learning environments. Reflective of constructivist and socio-constructivist perspectives on teacher learning, the networked communities were hubs of innovation for authentic and real problems, use of digital tools, and peer learning. They worked as a system both locally and across sites, and achieved a variety of solutions to the problems of integrating information and communication technologies (ICTs) into elementary, secondary, and post-secondary schools/institutions and classrooms: use of laptop computers, electronic forums, digital videos, electronic portfolios, and others. Second, networked communities offered a better range of opportunities for sustained theory-practice dialogue between teachers at different stages of their professional development. Teacher educators encouraged active

engagement on site and online. The transformation of learning environments into hybrid learning environments was achieved at each site through the use of ICT tools, the creation of digital artefacts, collaborative vs individual reflective teaching, and knowledge-building activities. Third, networked communities provided opportunities for "boundary spanning" (Engeström, 1987) between courses, practica, pre- and in-service education, graduate seminars, and other collaborative research activities within and between institutions. There were instances of such sharing among participants (teacher educators, prospective and in-service teachers, graduate students) of different courses, practica or seminars, or from different cohorts or sites. These benefits were found substantial enough to suggest extending the meaning of the NCATE PDS standards 3, 4 and 5 (collaboration; diversity and equity; structures, resources, and roles), which currently do not address boundary spanning.

Three viable models of networked communities were identified: the learning community model (LC), the community of practice model (CoP), and the knowledge building community model (KBC). Although one model was more present at one site than at others (CITE: LC; TACT: KBC; McGill TLPDS (CoP), networked communities interconnected. Both TACT and TLPDS also had LCs, and TACT and CITE had CoPs. We suggest that networked communities grounded in university-school partnerships are socio-technical designs of high pedagogical relevance. They are a new format for teacher education and professional development that not only combine onsite and online activities but theoretical and practical elements as well. They are promising ways of using ICT as technology support for collaborative learning and knowledge building within and beyond the classroom. However, there are technology, pedagogy and governance issues and challenges. Over the years, access to collaborative technology became less of an issue but collaborative learning and knowledge building presented challenges of their own at the pedagogical level. Moreover, with regard to governance, two (of three) networked communities faced sustainability issues.

Three sets of issues appeared as critical for sustaining networked communities: participation (membership/leadership), the activities conducted using Internet-based tools, and the inquiry focus. Classroom-

based networked communities got a regular intake (cohorts) of new participants (pre- and in-service teachers, graduate students). The McGill TLPDS was the most vulnerable of the three with regard to its membership intake because it was not directly connected to a pre-service teacher education program. There was also vulnerability when, as in TACT, only one teacher educator supervised student teachers. A strong element of stability was the PROTIC program, one that endured in spite of school leadership change. However, would the networked community be sustained if, on the university side, the lead teacher educator had suddenly left? As far as participation was concerned and its impact on sustainability, the CITE networked community presented the best circumstances: it involved a number of teacher educators working year after year with a student cohort in an integrated manner. The challenge with the second issue of using Internet-based tools was to put the emphasis on what could not be accomplished without collaborative technology: collaborative reflective practice and knowledge building. The inquiry focus was a third set of issues addressed in different ways by each of the sites. CITE was designed from the outset to be a community of inquiry (Erickson, Darling, Clarke & Mitchell, 2004). TACT engaged student teachers into knowledge building. The Remote Networked School Initiative was a joint collaborative inquiry venture involving both TACT and TLPDS (Laferrière, Breuleux, & Inchauspé, 2004). All networked communities produced artefacts of value to others. We suggest that networked communities are viable but challenging innovations for teacher education and professional development.

Electronic networks have particular strengths and weaknesses in comparison to face-to-face networks. The former bring flexibility to, and can extend collaborative activities over time and over large geographical distances whereas face-to-face networks bring stability and a degree of authenticity and familiarity to teacher education and professional development activities. We anticipate that the Web will increasingly bring support to university-school partnerships, as new applications are designed and pedagogical possibilities uncovered. Within the networked community frameworks that we presented here, there is a need for further inquiry into the circumstances (e.g., social, cognitive, technological) that lead to successful Web-supported university-school

partnerships. Will electronic networks support teaching and learning to teach in a similar manner and extent that they now support research? Could they add to and scale up efforts relative to theory and practice integration? These questions have gained legitimacy as several new technologies have matured to such an extent that educators can now interact with others on their campus or school, online, in or from their homes.

NOTES

[1] The research program was conducted with funds from the Network of Centers of Excellence (NCE) Program, Canada, and included a research strand on Educating Educators. Within this strand, innovative models were designed, implemented, and/or evaluated. At the same time, TL-NCE network leader, Linda Harasim, and her team were designing an Internet-based tool, called Virtual-U, with special attention given to electronic discussion forums for collaborative learning purposes. And the research group CSILE (Computer Supported Intentional Learning Environments) was actively working on developing a network application (Knowledge Forum) supporting knowledge building communities.

[2] Some discussion forums that were used such as NetForum and eGroups no longer exist.

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