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Just-in-time online professional development activities for an innovation in small rural schools

Activités de perfectionnement professionnel « juste-à-temps » pour l'innovation dans les petites écoles rurales

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Abstract

This article describes the just-in-time online professional development offered to teachers in the Remote Networked Schools (RNS), a systemic initiative funded by the Quebec Ministry of Education (Canada), which aims at enriching the learning environment of small rural schools with the use of information and communication technologies (ICTs). The design experiment method studies the activity identified and the types of professional development offered by a university-based intervention team (UBIT) over six years of deployment..

Résumé

Cet article décrit le développement professionnel en ligne « juste-à-temps » proposé aux enseignants dans les Écoles Eloignées en Réseau (ÉÉR), une initiative systémique financée par le ministère de l'Éducation du Québec (Canada), et visant à enrichir l'environnement d'apprentissage des petites écoles rurales par l'utilisation des technologies de l'information et de la communication (TIC). La méthode des plans d'expériences étudie l'activité identifiée et les types de développement professionnel offerts par une équipe d'intervention en milieu universitaire pendant

Keywords: Professional development, innovation, ICTs, online support, rural education

Mots-clés: développement professionnel, innovation, TIC, support en ligne, éducation en milieu rural

Introduction

The Remote Networked Schools (RNS) is a systemic initiative funded by the Quebec Ministry of Education (Canada)[1], which aims at enriching the learning environment of small rural schools through the use of information and communication technologies (ICTs). These rural schools face many issues given the substantial demographic decline and rural exodus experienced in the schools' communities. Indeed, because of their geographic isolation from urban regions, these schools face challenges such as lack of specialized resources for students, multi-grade classrooms, small numbers of registered students, and professional isolation (caused by low numbers of teachers per school, high turnover, etc.). To face those challenges, schools engaged in innovative teaching by using ICTs to enrich their students' learning environments by introducing two electronic tools: iVisit, a desktop videoconferencing system designed to facilitate synchronous verbal interactions and the Knowledge Forum, an asynchronous writing tool designed to promote written interactions and knowledge building (Scardamalia & Bereiter, 1994, 2003). The introduction of these two technologies afforded collaboration among students from different schools. Over the years, four collaborating universities along with participating school districts offered both onsite and online professional development activities. This paper focuses on types of just-in-time online support provided to teachers.

Literature Review

Innovation in education is a complicated process because school culture is often understood as resistant to change and very effective at eliminating practices that diverge from standard or current practice (Christensen, Johnson, & Horn, 2008; Cuban, 1986; Fischman, 2000). Thus, a teacher's choice to innovate by using ICTs in the classroom is not a simple task, and teachers are therefore reluctant to using them because of the many obstacles encountered (Cuban, 1999; Karsenti, 2004; Larose & Karsenti, 2002; Plante & Beattie, 2004). Cuban (2000) specified that the lack of teacher commitment regarding the integration of ICTs is mostly related to technical issues (ICTs are said to be too unreliable) or inadequate technology choices for the classroom. Moreover, Law, Pelgrum and Plomp (2008) found that the use of ICTs is not related to computer/student ratios. Teachers also claim not having sufficient time to effectively use these tools during class time (Cuban, 2000; Ely, 1999). Other factors are also present, including teacher professional development because its influence is crucial according to Becker and Riel (2000), who found that active teachers who participate in professional development activities are more susceptible to developing best practices involving the use of ICTs in accordance with new curriculum orientations and updated orientations about learning.

Research has shown teacher professional development to be hardly transferable to actual classroom practice without consideration of the importance of experiential learning and collaboration (Fullan, 2001; Lieberman, 1995; Lieberman & Miller, 2001). Professional development activities appear to be more effective when they consider teachers' needs (Guskey, 1995) by involving them in the decision-making process and in the implementation of the innovation at all stages (Cumming & Owen, 2001; Ely, 1999; Hargreaves, 2003). These

[1] CEFRIO, an organization working mainly on knowledge transfer, innovation, and ICTs use in francophone organizations, has coordinated the implementation of RNS with the Ministry and the research team.

conditions allow teachers to take instructional risks as they adopt new roles and responsibilities (Dede, Ketelhut, Whitehouse, Breit, & McCloskey, 2009; Pink, 1992), thus allowing them to enrich their professional competencies (Day, 1999).

With classroom dynamics being often a matter of immediacy (Doyle, 1986), just-in-time models aimed at addressing teachers' professional needs as quickly as possible seem to be an interesting path to explore (Dede et al., 2009). For this purpose, a key element of any support system becomes the Internet: web-based resources such as tutorials or best-practice videos, webcasts, online modules or courses, electronic forums or teleconferencing software. Some systems are designed for structured, individualized learning, while others provide on-demand assistance to support individual teachers or communities of practice. Just-in-time content delivery may occasionally serve the needs of a community of practice, but such an activity is then embedded in a process of participation in learning activities that differentiates it from the act of physically attending a specific course without the connection to the participants' working context (Mackey & Evans, 2011).

In the RNS context, participants met onsite at school district gatherings and also at annual whole-network meetings for knowledge transfer sessions. For many reasons, participant turnover was high, but the core group of participants expanded. The challenge of organizing face-to-face meetings due to the geographic realities of the participants provided an opportunity for online activity. With the community of practice of those teaching in an RNS being in its early stages, the university-based intervention team (UBIT) diversified the level of structure of online activities tutorials, best practices, thematic videoconferences, including graduate courses (Allaire, Pellerin, Beaudoin, Couture & Turcotte, 2010). Just-in-time online professional development, which supports and guides teachers' innovative practice as they integrate new conceptual and technological tools in their practice, became critical, and subsequently became the object of collaborative inquiry. To fully consider spontaneous and emergent factors inherent to teaching practice (Doyle, 1986), an important part of the online activity remained almost unstructured and depended on the participants' interest and willingness to meet the UBIT to talk about teaching in a networked small school. However, back in 2002 UBIT members were also new to this practice, and so both school and university-based participants collectively began to understand the reality of teaching in a remote networked school and classroom; hence, they combined their knowledge as new questions and challenges regarding the practice of teaching in an RNS progressively emerged.

Whether the professional development for teacher is carried out remotely or on site, the issue about teacher' practice in classroom remains the same. The online PD had to be fruitful so teacher find a meaning in implementing a new formula with their students and it had to be based on research results (Bereiter, 2002; Kirshener & Lai, 2007).

The research questions are:

- What is the nature and distribution of PD activities observed online?
- What are the variations between the different phases of deployment in the PD activity?

Method

In order to provide teachers with just-in-time support and guidance, UBIT was accessible online from 8 a.m. to 5 p.m., five days a week, during which one of its members was present on the videoconferencing system to respond to any pedagogical or technological questions, challenges, or issues raised by teachers about the RNS. This support required generic competencies, multi-tasking skills and quick and efficient reflection-in-action, since no specific content was planned. UBIT's purpose was to provide the support for the innovation – to enrich the rural school's learning environment using collaborative ICTs – to settle and consolidate the innovation (Ely, 1999; Fishman, 2000). From the onset of UBIT, the idea was that teachers would not need to disrupt a classroom activity for a long period of time because of technical issues, or wait to focus on a pedagogical issue regarding their RNS teaching practice. UBIT was also there to help teachers design networked learning activities between distant classrooms and school districts (computer-supported communities of learners). UBIT's intervention was inspired by Schön's reflective practitioner approach (1983) and Bereiter and Scardamalia's (1989, 2003) works about the concepts and principles of knowledge building community and knowledge creation.

The iVisit[2] videoconferencing system was used for a number of pedagogical and technological reasons. First, since social interaction was a key aspect of the RNS context, UBIT privileged active interactions between students instead of having them listen to remote lectures via a large-screen system. Next, iVisit's flexibility was an important aspect as teachers were able to use it directly in their classroom at any given time, without requiring any permission from the school board or having to schedule reservations. Hence, the room system was a great affordance, which contributed to this flexibility as each school district had its own space for collaboration, and UBIT had its own room for the purpose of providing just-in-time support. Moreover, remote networked schools being located in rural areas, Internet bandwidth was sometimes slower than in urban schools and iVisit could function more easily with low bandwidth. Finally, compared to other videoconferencing systems, iVisit was economical in price. Hence, all these elements allowed the university-based, ongoing online support to complement local resources for innovation.

The whole RNS initiative adopts an ecological perspective (Kaptelinin & Nardi, 2006), and takes the form of a design research (Brown, 1992; Collins, 1992, 1999; Design-based Research Collective, 2003), a proper methodology for documenting educational innovation. One characteristic of design research is its iterative process: participants are informed, through data collection, of a question pertaining to common interests. For example, participants were informed by a confidential report of the progress of classroom activities done with technology in each site. These iterative reports were customized for each site to reflect their particular situation. The reports were provided every three months or so and focused on student learning, the conditions for innovation, professional development activities and the recommended next step to take to improve the RNS implementation. Further questions/steps for better understanding and improving practice were identified. In the RNS initiative, stakeholders are involved in the iterative process, thus making the process of innovation situated, transparent, and accountable at

[2] http://www.ivisit.com

all levels. The understanding of the RNS's iterative process is necessary to this study while we focus on professional development activities.

As a part of this whole design, one specific object of collective inquiry is just-in-time online professional development. When an iteration informs online classroom discourse, it also informs teachers' competence in facilitating their students' interactions as members of a learning/knowledge-building community (Bielaczyc & Collins, 1999; Brown, 1992; Scardamalia & Bereiter, 1994), and engage in collaborative inquiry. As the RNS initiative is coming to an end (by 2012 as a formal research project), and ways of institutionalizing the RNS model are sought, the role of just-in-time online professional development has become an object of collective inquiry. The result section describes the nature of UBIT's just-in-time online professional development activity in the RNS context.

Participants

Innovation is a challenge for RNS teachers, despite the favourable context given by the implementation of a new national curriculum, which emphasizes active learning by means of developing 21st century skills and learning and knowledge building communities. Participation in the RNS initiative, through the use of collaborative tools and collaboration with the university-based team, allowed participating teachers to reduce professional isolation and improve their educational skills, even after several years of teaching (Allaire, Laferrière, Gaudreault-Perron, & Hamel, 2009). UBIT's support was accessed by hundreds of participants, who were mainly teachers but also included other stakeholders. Table 1 presents the number of participants who sought assistance at each phase of implementation; this number increased for all 3 schools districts at each phase (Phase I), to 10 (Phase II) and to 23 (Phase III).

Table 1: ***RNS participants***

Stakeholders	**PHASE I** (2002-2004)	**PHASE II** (2004-2006)	**PHASE III** (2006-2008)
Teachers	12	118	206
Principals	5	28	63
Pedagogical consultants and ICTs experts	2	13	26

Data collection

Following each online session, no matter its length, the UBIT resource person completed an electronic form in order to briefly describe the event and identify methods for follow-up. Such information not only helped coordinate the interventions between university-based personnel, but also served research purposes. Each electronic form included the date of the session, the name of the site that sought support, the name of the UBIT resource person who provided the support, the meeting's duration, and an assessment of the quality of the videoconference (sound and image

quality, fluidity). There was also an available section for entering the description of the activity, the needs of the person who had consulted UBIT, and the follow-up carried out when necessary. Below is an example of the electronic form (Figure 1). The electronic forms were kept on a secure server accessible only to UBIT.

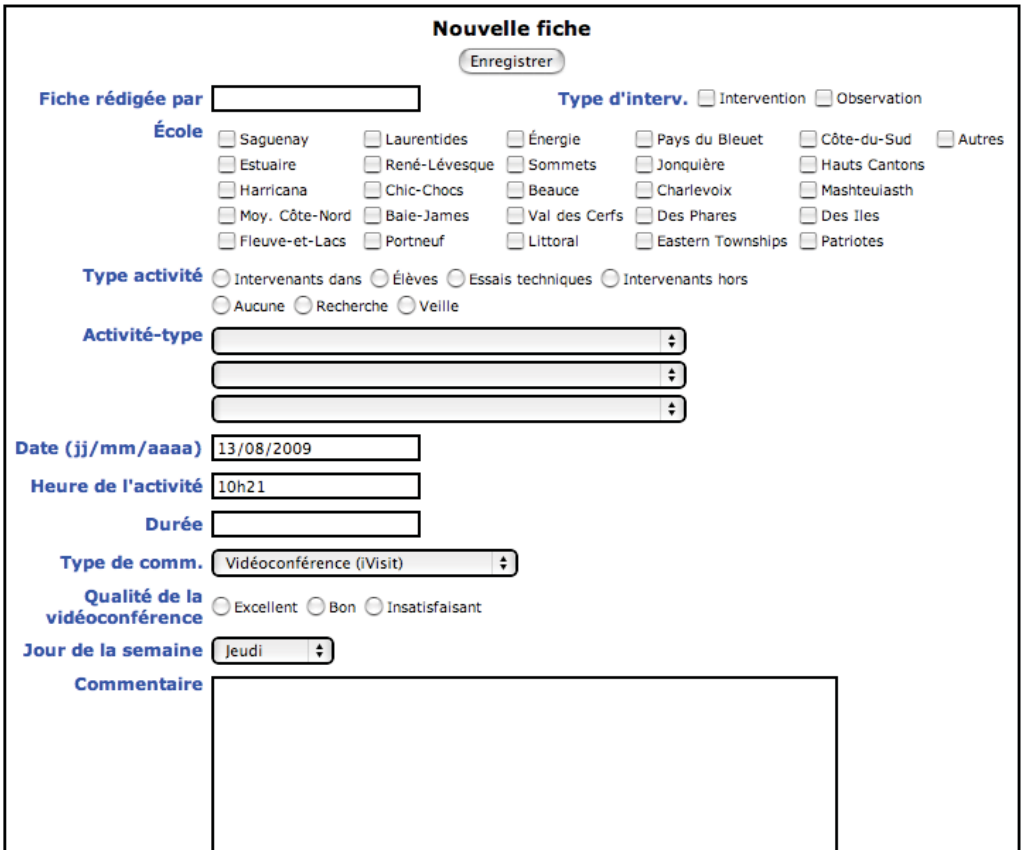

Figure 1: **UBIT's electronic form**

Table 2. ***Distribution of the electronic forms (2002-2008) (n=2,590)***

Phase I		**Phase II**		**Phase III**	
Year 1 2002-2003	Year 2 2003-2004	Year 3 2004-2005	Year 4 2005-2006	Year 5 2006-2007	Year 6 2007-2008
189[1]	249	788	835	275[2]	440

[1]The first database was corrupted following technical problems and approximately one hundred electronic forms were lost.

[2] A smaller budget was allocated to each site in Phase III as the bulk of the pilot initiative was completed, and also because the budget confirmation was received late in the all. School districts had to commit or renew their commitment to the RNS's emerging model and find local resources to engage in the third phase.

Table 2 presents the number of electronic forms (n=2,590) filled every year over the six-year period since the onset of the RNS initiative. The online database was password protected and available to the UBIT team only as an intervention and research tool.

Data analysis

A constant comparison method was applied for the categorization of the PD activity. This method combines inductive category coding with continuous refinement throughout the date collection and the analysis. Events are constantly compared with previous events bringing feedback into the coding process (Goetz & LeCompte, 1981). The professional development (PD) database, which grew in size over the six-year period, was analyzed using quantitative and qualitative analysis methods. In the first two years, the ethnographic electronic forms were analyzed in order to identify emerging categories of the PD activity's nature (Laferrière, Breuleux, & Inchauspé, 2004), and to facilitate subsequent interventions and analysis. PD activity categories were first formulated and then submitted to participants for validation and improvement purposes.

The analyses of the PD activity led to the identification of six distinctive categories pertaining to participants, context, content, and process. Three researchers worked on the formulation of the grid by repeatedly classifying each electronic form in an attempt to describe the nature of just-in-time online professional development. The interrater agreement (Miles and Huberman, 1999[3]) revealed an average of 89% for the three coders. Certain ambiguous cases were identified and a list of solutions was designed in order to improve the homogeneity within the coding. For example, certain electronic forms contained more than one coding category, while some were excluded because of their unclear defining or their incomprehensibility.

The analyses were performed on the PD activity involving UBIT only. The reader is invited to keep in mind that other online PD activities using the videoconferencing system took place among school district teachers, principals, school board pedagogical consultants, and other local experts. Moreover, participants who developed specific expertise gained legitimacy within the RNS community, and were increasingly solicited for online help by other members of the RNS community. Those activities, which also contributed to the community of practice's emergence, were neither observed, nor analyzed for ethical (confidentiality) and strategic reasons (e.g., to avoid a "big-brother" situation).

Results

The nature of just-in-time online professional development slowly became apparent as UBIT reflected on its action through the coding process and identified the analytical categories. Six PD categories emerged from the data (Table 2). A description of each of these categories is presented below.

Figure 2 shows the distribution of the PD activity (six categories) over the entire period (2002-2008), during which just-in-time online interventions were performed (n=2590 activities) using

[3] The number of agreements divided by the number of agreements plus discords (A / (A+D)).

the videoconference system. Technological startup (29%) and troubleshooting/reconstruction of technical problems (21%) had the highest percentages, which accounted for half of the just-in-time online PD activity.

Table 2: ***Just-in-time online professional development***

PD Activity Categories	**1) Technological startup.** Participants called on UBIT's assistance to get them started with the use of both collaborative tools (electronic forum, its analysis applets and videoconferencing system).
	2) Techno-emotional watch. Participants called on UBIT's support when in need of expressing emotions related to their attempts of having students conduct collaborative inquiries via new technology, or the overall RNS deployment in their local context.
	3) Troubleshooting and reconstruction of technical problems. Participants called on UBIT's assistance to help solve technical problems, including firewalls, proxies, ports, student identification codes and passwords.
	4) Planning and coordination of learning activities and follow-up. Participants called on UBIT's assistance to: 1) identify potential collaborators for engaging students in network-supported activities or projects using the electronic forum or the videoconferencing system; 2) facilitate planning sessions; 3) coordinate the long-term work schedule between teacher teams.
	5) Pedagogical support and guidance. Participants called on UBIT's understanding of project, or inquiry-based learning and knowledge-building pedagogies to help them throughout the implementation of such processes within and between their classrooms.
	6) Reflection on experience. Participants called on UBIT's analytical skills to help them analyze their RNS practices.

The type of support, which was related to these two categories, took many forms: a quick response to a clearly formulated question; clarification on a question asked; demonstration of the use of a functionality; exploration of different solutions for a technical problem, etc. Typically, a request for technical assistance was pedagogically-oriented. For example, if a given group of teachers were responsible for a collaborative learning activity involving videoconferencing, during which problems with sound were encountered, teachers were able to request immediate help by contacting UBIT support; hence, this allowed them to resume their learning activity instead of waiting onsite for a technician. Unfortunately, in schools with less than 30 students, the IT services were rarely able to devote more than half a day once every two weeks; therefore, for the sake of the learning activity, everyone had to be creative in order to find quick and simple solutions to technical issues. Moreover, the fact that technical assistance was pedagogically-oriented meant that participants learned about ICTs through authentic contexts and purposes (problem solving) instead of spending time in lengthy software training sessions. Even after six years of implementation, half of the occurrences related to technical support and reflected its importance. Over the years, many technical solutions were developed and shared among schools, UBIT members, school districts' IT services, and even with the tool developers.

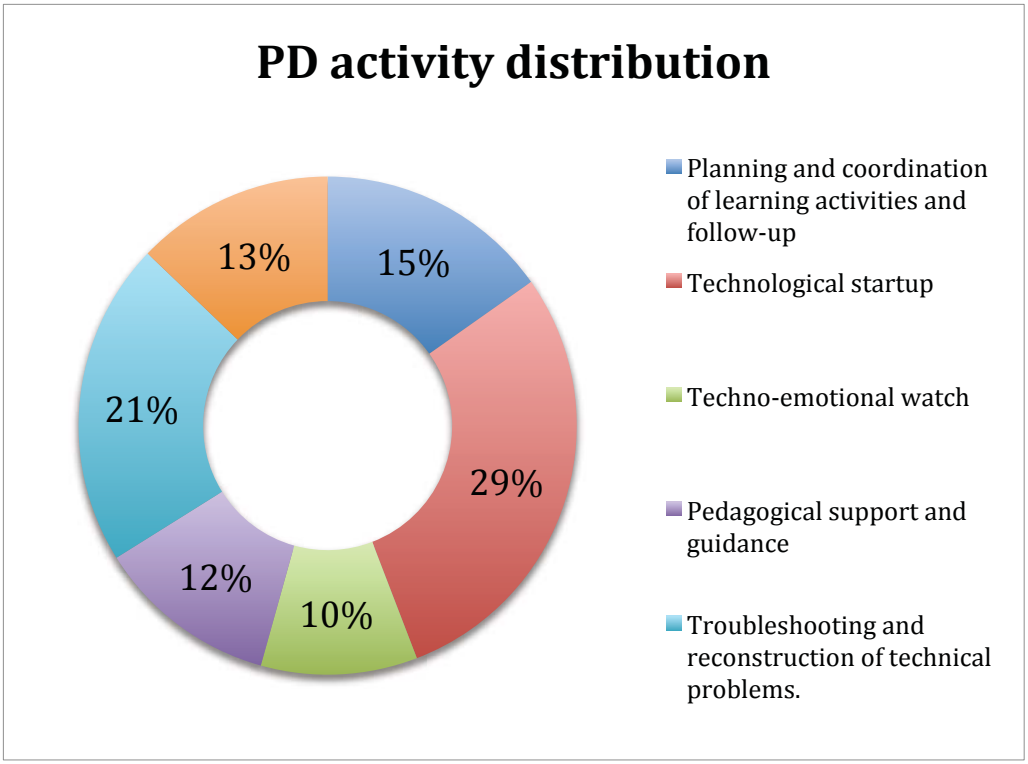

Figure 2: **Distribution of the just-in-time online professional development activity categories (total)**

As for the other 50% of ICT involvement, it was strictly pedagogy-related: the planning and coordination of learning/knowledge building activities (15%), reflection on experience (13%), pedagogical support and guidance (12%), and techno-emotional watch (10%). These PD activity categories were created to meet the different needs of every teaching team. Moreover, teachers were in the process of understanding and implementing a new curriculum as they became familiar with UBIT's knowledge-building approach, which they found demanding and confusing. Also, conversations between teacher(s) and UBIT revolved around certain issues (e.g., the demands of the new curriculum and those of the RNS initiative, UBIT's approach and its link with the new curriculum) and challenges (e.g., ways to bridge the new curriculum's underlying pedagogical concepts, including the learning community concept and knowledge building principles; ways to have students improve their discourse through online classroom discussions through enhanced questioning and higher explanation levels). Throughout each procedure, UBIT members had to respond, as much as possible, to the teachers' needs and ideas. As for school principals and school board pedagogical consultants, conversations focused on the clarification of their understanding of specific aspects of the RNS initiative and strategies in order to assist their local team.

While the overall results were evenly distributed between technology and pedagogical domains of support/PD, Figure 3 shows their evolution over the six years:

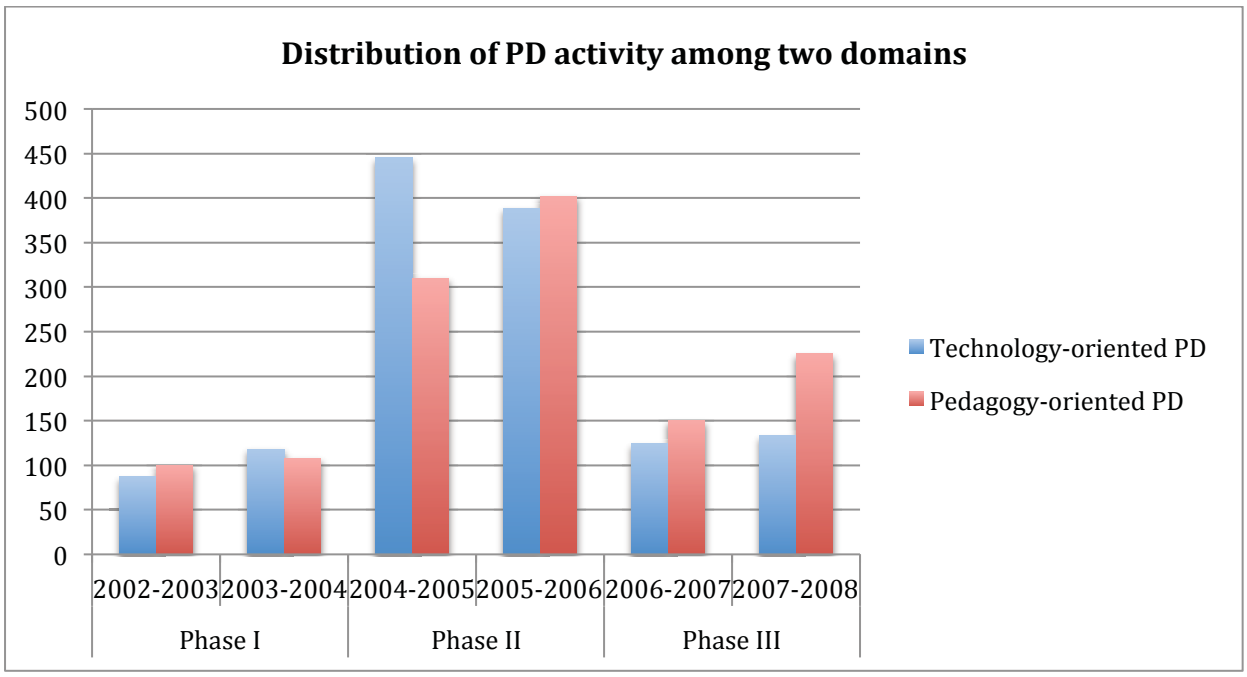

Figure 3: **Distribution of the two main domains of PD activity**

In Phase I, given the number of stakeholders involved, the number of PD occurrences was lower, and a relatively equal distribution of requests between the two domains was observed. However, in the first year (2002-2003), the pedagogical requests (53%) were higher than the technical (47%) but the trend was reversed in the second year (2003-2004). It is to be noted that during the first year, UBIT intervened onsite because there were only three sites involved in Phase I and because of the available budget. Additionally, each school district had assigned a technician for the RNS schools only, a helpful decision according to both teachers and UBIT members. In the following years, UBIT's onsite interventions were kept to a minimum. Also, the first year's main focus was on the participants' adaptation to the new concept and the implementation of technological tools. On the other hand, the second year's main focus was on learning activities occurring between schools dealing with more technical issues due to their extended use of technologies.

Phase II produced a different profile because ten new school districts had engaged in the RNS initiative. The technologically-oriented PD occurrences were predominant (58%) in the first year (2004-2005), whereas in the second year (2005-2006), an almost equal representation of technologically and pedagogically-oriented occurrences was observed. The main technological challenge that participants had to overcome was the use of the videoconferencing system between schools and school districts with secure Internet protocols. Indeed, every school district had its own security criteria and different server setups (proxies, firewalls and so on), and the problems were therefore difficult to diagnose. The use of the electronic forum (Knowledge Forum) also created new challenges (e.g, having to support a large amount of classrooms using the software simultaneously), even for the tool developers, given the innovative nature of the work done by the RNS classrooms. Hence, with the collaboration of each school district's IT services, UBIT had to reproduce the problems encountered in order to find the proper solutions for the local teacher community. In spite of the growing expertise in this area, there were always

new technological challenges to overcome given the growing complexity of local setups. As a result, pedagogically-oriented PD addressed the needs of novice and experienced teachers, which allowed novel uses of the collaborative tools to emerge during that phase. These uses included online services offered to remote students by speech therapists and learning disability specialists, and also, to teachers by pedagogical consultants who also began offering just-in-time support through videoconferencing.

In Phase 3, ten school districts joined the RNS initiative, but had access to a limited budget. Therefore, Phase III results seemed more representative of the just-in-time support perspectives in the years to come for school districts committed to the institutionalization of the RNS innovation. Technologically oriented PD decreased between 2006-2007 (45%) and 2007-2008 (37%), and pedagogically oriented PD increased from 55% to 63%. While some technical problems had been solved, some remained or emerged. For instance, firewall issues became more difficult as the implementation of new security measures entailed new technical problems, and bandwidth was increasingly used for assorted purposes. Also, during videoconferencing sessions between two schools districts, issues relating to a private-private IP connection and other firewall-related problems were encountered, and subsequently persisted after solutions had been found and shared with the IT services in the RNS network. According to the participants, the use of a second web-based videoconferencing system simplified the collaboration process outside their school district. Moreover, UBIT had underestimated the technical problems that participants would have had to face with a new version of Knowledge Forum. The next figure (Figure 4) shows the relative importance of each category of PD activities across phases.

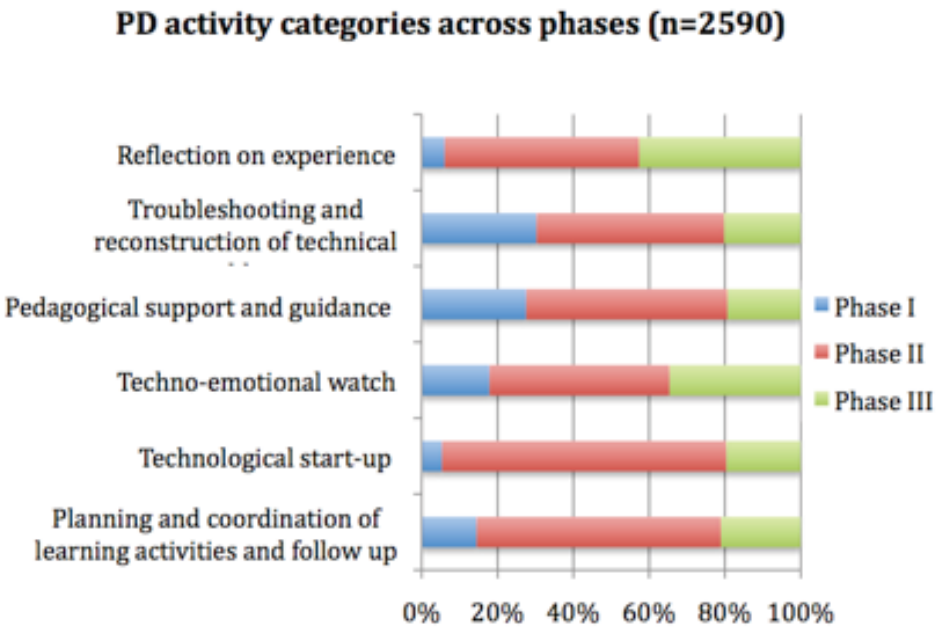

***Figure 4*: PD activity categories across phases**

It was during Phase II that UBIT was more active, with a total of 60% of the whole PD activity for the three phases (Phase I = 16% and Phase III=24%). Also, 53% of the activity was a technology-oriented PD (technological start-up and troubleshooting) as there were many participants who had newly joined the RNS and who therefore had less expertise and were less

efficient when sharing their knowledge and experience with others. The whole process of implementing collaborative technologies in schools that had no broadband Internet in 2002 involved time and energy to identify the installation and the design that would best suit and support the collaborative work of students, teachers and principals. The purpose was not only to use technology efficiently for learning and teaching, but also to use it safely on the school district network. As Phase III unfolded, the two technology-oriented categories (categories 2 & 5) became less important (40% of the total of the PD activity); therefore, UBIT's focus seemed more related to pedagogical issues and challenges.

Table 3: ***Distribution of each category (%) for each phase***

Categories of PD activity	**Phase I**	**Phase II**	**Phase III**
1. Planning and coordination of learning activities and follow-up	13.8%	16.4%	13.1%
2. Technological start-up	9.7%	36.4%	23.3%
3. Techno-emotional watch	11.4%	8.1%	14.4%
4. Pedagogical support and guidance	20.3%	10.5%	9.3%
5. Troubleshooting and reconstruction of technical problems.	40.0%	17.5%	17.4%
6. Reflection on experience	4.8%	11.1%	22.5%

Table 3 shows that among the three pedagogy-oriented categories, pedagogical support and guidance was more present in Phase I (20.3%), but decreased by almost 50% in Phase II (10.5%) and Phase III (9.3%). Meanwhile, the artifacts of the emerging community of practice on teaching in a remote networked school (RNS), reified by the UBIT team in collaboration with teachers at the end of Phase I, began to accumulate[4]. As for the category, planning and coordination of learning activities and follow-up, it had barely fluctuated (13.8%, 16.4%, 13.1%) across all three phases. However, the techno-emotional watch category had culminated (14.4%) in Phase III, whereas the Reflection on experience's results increased notably from 4.8% (Phase I) to 22.5% (Phase III). Additionally, Table 3 shows that in Phase 3, the different types of PD exchanges were more evenly distributed.

UBIT eventually had a schedule, which allowed them to offer, four times a month, more structured PD events via a web-based videoconferencing system. Based on the most frequently asked questions and the most demanding elements of teaching in an RNS, every session was planned with an object of inquiry to be discussed among participants for an hour. The shared object was either basic, such as how to initiate a learning activity on the electronic forum, or more complex, such as assessing the students' contributions on the electronic forum while considering their use of knowledge building principles. A constant challenge faced throughout discussions was not only to stay focused on the teachers' needs, but also to ensure that the discussions progressed and that some tentative conclusions were reached, including new practical steps to be taken, or questions to be documented.

[4] Available at http://www.eer.qc.ca

Discussion

An important element that arose from our results was the interplay between technology and pedagogy; however, technology was rarely the sole object of concern during the just-in-time support. As a matter of fact, the use of technology and its corresponding problems often derived from pedagogical intentions. As recommended by authors such as Guskey (1995) and since the RNS initiative was systemic and ecological, professional development opportunities were linked to the classroom and school contexts. Just-in-time online professional development activity was meant to assist participants of the RNS initiative in their attempt to offer a richer learning environment supported by collaborative tools.

UBIT's contribution to just-in-time online PD was characterized by a sustained assistance in the RNS teachers' planning and coordination of learning activities, and follow-ups; this contribution remained rather stable (13.8%, 16.4%, 13.1%) across the three phases. UBIT was also instrumental in the process; they helped the emerging community of practice on teaching in a remote networked school (RNS) develop web-based tools and artifacts. A possible interpretation of the reasons why pedagogical support and guidance was more present in Phase I (20.3%), but decreased by almost 50% thereafter, was that the tools and artifacts were perceived as helpful, especially by the incoming participants. The web-based tools and artifacts represented the technical and pedagogical aspects of videoconferencing and knowledge building, and also provided examples of how learning/knowledge-building activities, which provided curriculum-related links, were accomplished by the collaborating networked classrooms. Combined with just-in-time support, these resources offered more possibilities to the teachers seeking resources, support or help.

Over the years, teachers became confident towards UBIT, and likewise, UBIT gained even more confidence towards RNS teachers. The activity category reflection on experience (category 6), which increased from 4.8% (Phase I) to 22.5% (Phase III), presented informative results. While there seemed to be more instances of onsite rather than online reflections within the UBIT team in Phase I, the two subsequent phases showed an increase of online reflections. This could be explained by UBIT's strong familiarity with the context within which teachers were evolving, and/or by the effective implementation of the RNS initiative within local contexts. The increase may also reflect the teachers' ease at engaging in online reflection subjects pertaining to their experience and practice. Since the beginning of the RNS, Schön's approach on the reflective practitioner (1983) had oriented UBIT's interventions. Moreover, as the initiative progressed, teachers began to ask further questions about knowledge building. When teachers were either planning or using the Knowledge Forum, UBIT offered pedagogical guidance on authentic questions as a way of engaging students both in knowledge building and on idea improvement – based on Scardamalia and Bereiter's (2003) principle on real ideas and authentic problems. On the other hand, experienced teachers sought guidance for other issues, such as the rise-above concept, another knowledge building principle described by Scardamalia and Bereiter for stimulating online classroom discussions through synthesis, and for moving discussions beyond their current state (rising-above).

As for the effectiveness of UBIT's online interventions, this result could not be isolated from those of the whole initiative and from the input of many stakeholders. The following micro-level results were prominent: 1) Over time, the analysis of online classroom discourse revealed that

the questions, either asked to, or by students on the KF, became more open and authentic, and generated longer answers on behalf of the students (Laferrière, et al., 2008); students improved their use of scientific vocabulary which was linked to the curriculum (Allaire & Gagné, 2008); 28% of online classroom discourse was of a knowledge-building nature (Hamel, 2007; Laferrière et al., 2008). Moreover, students improved their learning (e.g., their self-esteem when reading, and their competency for interpreting information as compared to students outside RNS schools (see Laferrière et al., 2008). Thereby, the pedagogically oriented PD, which had impact on student learning, also had impact on the teachers' competencies, especially in terms of collaborating and planning learning activities (Allaire, Laferrière, Gaudreault-Perron & Hamel, 2009).

Above all, participating in an emerging community of practice devoted to teaching in an RNS was, in itself, an opportunity for professional development, and as stated by Day (1999), such opportunities have the potential of enriching teachers' professional competencies. As observed in this study, the increase of reflection on experience, the pedagogical support and guidance support this notion. A crucial challenge addressed by the RNS initiative was professional isolation (Laferrière, Breuleux & Inchauspé, 2004); however, participants were able to obtain support from UBIT and from each other. Collaborative technologies also allowed participants' to expand interactions beyond local settings, thus allowing for the distribution of professional development. For instance, Laferrière et al. (2008) found that RNS teachers perceived that they had significantly developed the twelve teaching competencies[5] defined by the Quebec Ministry of Education. Among these competencies, two are specifically related to collaboration, including one with colleagues and the other with educational stakeholders. A third one also involves collaboration but refers more specifically to reflective practice.

Moreover, the social dynamics that had unfolded could be linked to the core characteristics of a community (Bielaczyc & Collins, 1999). First, the participants defined a shared object. Second, the emerging community benefited from a diversity of expertise. As the participants became more familiar with the shared object through the use of knowledge-sharing strategies, the professional community reached a collective level of understanding that no individual could have done independently. For example, over the years, participants discovered several technical solutions across sites and their ensuing expertise was shared among IT services of each school district, the research team, and even the tool developers. On many instances, metacognitive awareness was demonstrated as UBIT's and teachers' shared reflections on the ongoing process using their experience and collected data as references.

Furthermore, UBIT had to face its own issues and challenges: to be empathic towards teachers facing technical and pedagogical difficulties; to seize what was at stake within a classroom, a school, or a school district; to be resourceful in helping solve these difficulties; to coordinate the actions of its distributed team; to coordinate and facilitate the transfer of information within/between a school district and the research team; and to formulate an emerging code of practice and ethics. The latter element is a task still in progress, with reflection on practice being the key to its shaping. For instance, during a videoconference, UBIT had to respond to different emotions ranging from anger or disappointment, to joy and pride; in the former case, the member

[5] http://www.mels.gouv.qc.ca/dftps/interieur/pdf/formation_ens_a.pdf

of the team who was present online had to respond empathically by avoiding hurtful comments, but without alienating other present actors, etc. In a systemic/ecological initiative such as the RNS, every stakeholder is important, so UBIT's responses had to respect and be in line with the goals, the values, and the means of the initiative, and also had to show empathy towards the feelings expressed by each individual. UBIT's interventions also had to be subtle and open, especially when working remotely.

Conclusion

The previous results on just-in-time, online PD are to be further documented as conditions for the institutionalization of the RNS model described in Phase V (2008-2012) of the initiative. Arising questions relating to professional development are the following:

- What type of PD activities will be provided onsite once institutionalization is effective?
- Who will host the just-in-time online support infrastructure (universities, school districts, or the Ministry of Education)?
- Which organizational mechanisms need to be developed for integrating the most experienced teachers into the UBIT without overlooking the dynamic "bottom-up" situation within the community of practice on RNS teaching?

Currently, three teachers with several years of experience with RNS are withdrawn from their regular classroom practice for one day per week in order to join the UBIT team.

In this paper, the nature of just-in-time online professional development in the RNS initiative was described; this description was considered as a reflection on practice in itself. As for the effectiveness of the present work on just-in-time online PD, it was clear that UBIT's contribution on teachers' practice was difficult to isolate (Dede, Breit, Ketelhut, McCloskey & Whitehouse, 2005). However, the just-in-time online PD activity described in this article can bring new ideas regarding professional development in an innovation context. We believe that this form of professional development has been effective not only for teachers and participants in innovation, but also for the graduate students and researchers who participated. In this sense, we consider it is a joint enterprise combining practice, theory and reflection. In addition, the online presence of UBIT brings research to another level by providing researchers with a new perspective on classroom practice as well as the links between theory and practice. Furthermore, the distributed nature of the PD activities makes it more feasible for university research teams who are seeking authentic practice and are willing to engage in just-in-time online professional development to provide such support. Hence, university-school partnerships are provided with a means to maintain the focus on teachers' needs, providing their UBIT establishes itself in an authentic context of innovation. Finally, we recommend that the online support offered to teachers include a plurality of actors with different expertise to connect with isolated teachers. Future research may also investigate the contribution of perceived professional development provided by teachers and other participants to tangibly measure the impact of such support on educational practice.

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