George Zhou, Stanley Varnhagen. Myrna R. Sears, Susan Kasprzak, Gail Shervey

Authors

George Zhou is an Assistant Professor in the Faculty of Education, University of Windsor. His current research interests include the use of technology in science education, technology and teacher development, and argument in science education. Correspondence regarding this article can be e-mailed to:gzhou@uwindsor.ca

Stanley Varnhagen is currently the Academic Director of Learning Solutions in the Faculty of Extension at the University of Alberta. His unit's major responsibility is supporting learning projects through the use of evaluation and instructional design. He can be reached at stanley.varnhagen@ualberta.ca

Myrna R. Sears works in administration and e-learning at the Carey Theological College, on the campus of the University of British Columbia. Her interests focus on instructional technologies and applied educational research. She can be reached at msears@careytheologicalcollege.ca

Susan Kasprzak holds an M.A. in Social Sciences from Carleton University, and is an experienced program evaluator. At the Provincial Centre of Excellence for Child and Youth Mental Health at the Children's Hospital of Eastern Ontario, Susan is currently leading a two-year evaluation for the Ministry of Children and Youth Services and providing consultation in program evaluation to children's mental health professionals across the province.

Gail Shervey completed her M.A. in Educational Technology at the University of Calgary. After completing a project which involved designing distance education resources for teachers in western China, Gail is now consulting as an instructional designer and teaching in the University of Calgary's teacher preparation program.

Abstract: The purpose of this study was to evaluate an online professional development course for inservice teachers in the area of information and communication technology (ICT) and concurrently explore the factors that influence online professional development. The study integrated quantitative and qualitative methods including survey, focus group and interview, and

was conducted during the progress of the course and approximately nine months after the course was over. Data show that the online delivery of ICT professional development for inservice teachers was successful. However, a learning community was difficult to initiate in an online learning environment. Teacher participants experienced great challenges when applying what they learned from the course into their teaching. The study suggests that further online ICT professional development should incorporate face-to-face sessions and enrol more than one teacher from the same school. Professional development aiming at changes should be considered as an ongoing process and supported with school change.

Résumé : L'objet de la présente étude consistait à évaluer un cours de perfectionnement professionnel en ligne pour les enseignants qualifiés dans le domaine des technologies de l'information et de la communication et à étudier les facteurs qui ont de l'influence sur le perfectionnement professionnel en ligne. L'étude a tenu compte de méthodes quantitatives et qualitatives, notamment un sondage, un groupe de discussion et une entrevue réalisée alors que le cours était donné et environ neuf mois après la fin du cours. Les données indiquent que la prestation en ligne du cours sur le perfectionnement professionnel sur les technologies de l'information et de la communication pour les enseignants qualifiés s'est avérée une réussite. Toutefois, il a été difficile d'initier une communauté d'apprentissage au milieu de l'apprentissage en ligne. Les enseignants participant ont éprouvé de grandes difficultés à mettre en pratique dans leur enseignement ce qu'ils avaient appris. L'étude suggère que les prochaines séances de perfectionnement professionnel en ligne sur les technologies de l'information et de la communication devront comprendre des séances en personne et devront être offertes à plus d'un enseignant par école. Le perfectionnement professionnel qui vise des changements devrait être considéré comme un processus continu et appuyé alors que l'école change.

Introduction

It is well known that teachers need to be trained in order to integrate information and communication technology (ICT) with their teaching (Batane, 2004; Jacobsen, Clifford, & Friesen, 2002; Mitchem, Wells, & Wells, 2003; Yildirim, 2000). However, inservice teachers, particularly those from rural locations, usually do not have time and financial support to participate in face-to-face professional development (Alberta Teachers Association, 1999). The need for professional development that is affordable in time and cost has pushed many organizations to develop online professional development programs, which take advantage of computer-based technology to create an asynchronous learning environment that allows professionals to access training from a remote site and schedule learning at their own pace (Childs & Crichton, 2004; Mather, 2000). This movement creates a need for research on the effectiveness and issues of online professional development (Barnett,

2002; Lieberman, 2000; Marra, 2004).

Funded by the Calgary Board of Education, the authors conducted a study of an online ICT professional development program for secondary inservice teachers. This paper reports our findings about the following questions: Is online delivery a successful alternative to other forms of professional development for the integration of ICT with teaching? What are some of the opportunities and challenges associated with delivering online ICT professional development?

Literature Review

Online professional development has some advantages compared with the traditional face-to-face training, such as professionals' control over the pace of their learning and the minimized limitation of physical locations. Particularly, online professional development sounds very promising since many scholars claim the potential of ICT for increasing communications between students and instructors in the context of online education in general (Harasim, 1990; Pringle, 2002). However, the difficulty in quality assurance of online learning has been a central concern with the rapid growth of online courses and programs. Despite the evidence that suggests online education can achieve similar or superior results when compared to traditional courses (Verduin & Clark, 1991), issues such as students' low satisfaction with online learning, high attrition rate, poor quality of interaction, heavy reliance on students' proficiency with technology that does not always exist, etc. have dogged online learning (Johnson, Aragon, Shaik, & Palma-Rivas, 1999; Packham, Jones, Miller, & Thomas, 2004; Rovai, 2003).

In order to address the quality concern of online learning, one of the key points that scholars have focused on is social presence. Social presence is defined as "the ability of learners to project themselves socially and affectively into a community of inquiry" (Rourke, Anderson, Garrison, & Archer, 1999, p. 50). Social presence refers to the affective domain as it relates to interpersonal communications (Garrison, Anderson, & Archer, 2001). Gunawardena and Zittle (1997) found that when online learners experience a high degree of social presence they are more likely to be satisfied with their learning experience. Garrison, et al. suggested that social presence was a necessary condition for higher-order thinking to occur in a computer conferencing environment. Rovai (2002a) argues that high social presence links to high sense of community, which is described as "a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' needs will be met through their commitment to be together" (McMillan & Chavis, 1986, p. 9). According to Tinto (1993), those students who possess strong feelings of community are more likely to persist than those students who feel isolated. Studies provide evidence that students with a stronger sense of community tend to possess greater perceived levels of cognitive learning and a higher satisfaction with their learning experiences, and possibly results in fewer dropouts (Rovai, 2002b).

The studies of social presence and sense of community remind us of the importance of

learning communities that learners belong to and can rely on for support. In the area of professional development, learning community is defined 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, McDermott, & Snyder, 2002, p. 4). Scholars argue that learning communities can help teachers build a sense of shared purpose and overcome the feeling of isolation experienced by most of them in the work setting (Gordin, Gomez, Pea, & Fishman, 1996). By sharing a way of knowing and a set of practices, and by experiencing the shared value of the knowledge that comes from the processes of knowing and practice, learning communities can have significant influence on the beliefs and practices of individuals (Riel & Becker, 2000). By modeling lifelong learning and engagement, learning communities can provide professionals with opportunities to learn new content and new ways of thinking about content, to cultivate and practice leadership among their members (Havelock, 2004). Learning communities are therefore believed to be a powerful context to support teachers' ongoing professional inquiry, providing a basis for their self-sustained lifelong growth (Ball & Cohen, 1999).

To achieve the best possible outcomes, online professional development should therefore promote learning community building. Online learning communities are claimed to have similar functions as offline communities and in particular, can increase participants' social presence in an online learning environment (Baym, 1998). The bad news is that online learning communities are not easy to set up (Havelock, 2004). For many reasons, teachers tend to prefer face-to-face communication as Stephens and Hartmann (2004) found in their study. The availability of communication technology can not guarantee a successful network across physical locations. In addition, studies of online professional development have reported other difficulties teachers face in participating in online communities including the limit of time and the isolated school culture (Moore, 2002; Stephens & Hartmann, 2004). More research is necessary to help online professional development overcome these difficulties.

The Professional Development Program of ICT in High School Learning

Given the importance of ICT in school teaching and learning, Alberta Education, the provincial Ministry of Education, has introduced an ICT program of studies into its school system[1]. The ICT program of studies provides a broad perspective on the nature of technology, how to use and apply a variety of technologies, and the impact of ICT on students themselves and on society. It specifies what students from Kindergarten to Grade 12 are expected to know, be able to do and value with respect to technology. It also provides illustrative examples and an assessment tool kit. The illustrative examples clarify the intent of the outcomes and convey their richness, breadth and depth. The assessment tool kit provides a support framework for determining student competencies in the ICT outcomes within core subject courses. With a belief that technology is best learned within the context of applications, the ICT program of studies is structured as a 'curriculum within

a curriculum', using the core subjects of English Language Arts, Math, Science and Social Studies as a base. In other words, the ICT program of studies is not intended to stand alone, but rather to be infused within core courses.

As Jacobsen, Clifford, and Friesen (2002) observed, the ICT program of studies tends to be poorly understood by school teachers. To meet the requirements of this curriculum, a large number of teachers require professional development. They need to properly understand the curriculum, learn how to integrate ICT in classrooms, and adopt new teaching and learning approaches. In response to these needs, a 25-hour online professional development course, "ICT in High School Learning", was developed by Chinook College, Calgary. It had three major modules: ICT outcomes, ICT assessment, and ICT teaching and learning activity. These modules were designed to help participants understand each component of the curriculum and provide participants with an opportunity to design, develop, and pilot ICT teaching and learning activities. The focus of the course was not on discrete ICT skills but rather on gaining familiarity with the ICT curriculum, determining points in the subject curriculum where infusing technology would enhance students learning, and designing a teaching activity or a series of activities that effectively infuses ICT outcomes and assessment. Course participants were expected to 1) develop a broad understanding of learning and technology, 2) lessen anxiety about how to infuse technology in learning and develop an appetite for further exploration and creativity in ICT, 3) be actively and collaboratively engaged in creating ICT activities for their classroom teaching, and 4) share what they learned in the course with other teachers in schools.

The course had two more units in addition to the three major modules: "getting started" and "wrapping up". In order to promote learning community building, the unit of "getting started" was designed to facilitate participants getting to know each other and sharing expertise. Participants were encouraged to use the online communication tools that WebCT provides (However, contribution to online discussion was not set as a criterion for course assessment). For the same purpose, participants were also paired together to decrease their social distance.

Methods

This study was a combination of online program evaluation and an exploratory study; that is, it was conducted to evaluate the effectiveness of the online "ICT in High School Leaning" course and concurrently investigate factors that influence online professional development. In order to study different online learning environments, the online course was purposely delivered via WebCT to two voluntary groups of secondary school teachers: central group (CG) and remote group (RG). The central group was made up of 18 participants living within the Calgary region, while the remote group represented 16 participants residing in regions scattered across the province of Alberta. Participants had extensive teaching experience, and most had taught more than 11 years. Their teaching background covered a wide spectrum of secondary school subjects with the largest group of participants teaching math.

There were some differences in course arrangement for the two groups. The central group was offered three face-to-face sessions in addition to the online components of the course, but the remote group had access to the online components only. The three face-to-face sessions occurred at the beginning, middle, and end of the course. The pattern of pairing was different for the two groups. The central participants came from relatively larger urban schools and more than one participant often came from the same school. Those participants from the same school were paired together as a learning group. In contrast, the remote participants came from relatively small schools scattered over a wide area of the province, with no participants coming from the same school. Learning groups for the remote participants were therefore usually formed between schools.

Downes at al. (2001) identify four levels of evaluation of ICT professional development. The lowest level focuses on participants' improvements in ICT knowledge and skills and ignores the classroom context. A more rigorous level of evaluation involves investigating whether participants use the new ICT knowledge and skills in their teaching. At this level, the researcher might also look for evidence of pedagogical improvements among participating teachers. The third level of evaluation asks whether the teacher development leads to measurable improvement in student learning outcomes. The last level involves the influence of teacher development on sustainable organizational change that supports and facilitates changes in teachers' behaviours and improvements in student learning. Correspondingly, with a reference to the evaluation model proposed by Guskey (2000), Downes et al. describe six types of evaluation strategies: participants' reaction, participants' learning, participants' use of new knowledge and skills within their own locus of control, organizational change and support, participants' use of new knowledge and skills within a broader context, and student learning outcomes.

The potential influences of a professional development course on student learning outcome and school organizational change take time to happen. Evaluation at the third and fourth levels needs a longitudinal study. More importantly, these influences were not originally listed among the objectives of the course being studied. Our evaluation was, therefore, conducted at the first two levels. At the first level, the study examined participants' acquisition of knowledge. More specifically, this level of evaluation examined whether participants gained familiarity with the ICT curriculum and increases their understanding of technology integration. It was not focused on discrete ICT skills because the acquisition of technology skills was not the focus of the course. At the second level, the study assessed how participants' self-reported practices of technology integration were influenced by the studied course. The study used the first three evaluation strategies described by Downes at al. (2001), specifically, participants' reactions, participants' learning, and participants' use of ICT within their own locus of control (without challenging current workplace structures, policies or practices).

The study was conducted during the progress of the course and approximately nine months after its completion. Quantitative and qualitative methods were integrated for the study including survey, interview, and focus group. We developed three different surveys

that were administered to both groups at the beginning of the course (initial survey), the end of the course (exit survey), and nine months after its completion (follow-up survey). Each survey was comprised of yes-no, Likert-scale, and open-ended questions. The central group was given initial and exit written surveys at the first and last face-to-face sessions respectively, while the remote group was given the same surveys online. The follow-up survey was online for both groups. The initial survey was administered to obtain demographic information of the participants along with their initial attitudes and experiences about instructional technology and professional development. This information acted as baseline data for comparison with information collected at the end of the course. The exit survey collected information regarding the participants' attitudes and experiences with the course and technology integration. The follow-up survey focused on the participants' attitudes and behaviours regarding the integration of ICT into classroom teaching. All central and remote participants completed the initial survey. Sixteen central and 14 remote participants completed the exit survey, and 11 central and seven remote participants completed the follow-up survey.

The survey questionnaires were collaborative products of three researchers and the course instructor. To assure high validity of the surveys, we worked closely to edit and discuss every survey item and made sure its wording and meaning was clear and relevant. In addition, most of our survey questions had been previously used in the evaluation of a number of online courses or programs. We examined and polished these questions every time we used them and are therefore quite confident with the validity of our surveys. We also conducted reliability analyses for our surveys. With the demographic and open-ended questions being excluded, we obtained a Cronbach's alpha value for each survey: 0.8010 for the initial survey (28 items), 0.8728 for the exit survey (22 items), and 0.8535 for the follow-up survey (21 items). Considering that each survey has a multidimensional structure measuring multiple domains including the participants' perspectives, experiences and actions (related but separate variables), these reliability coefficients are very high.

The survey provided us with an express way to collect quantified data; however, it had limitations in generating rich data for us to gain an in-depth understanding of participants' attitudes and experiences toward the course and their perspectives and activities in technology integration. Focus groups and interviews were therefore used to offset the limitations of the survey. In order to encourage participants in the discussion and dig as much information as we could, semi-structured questions were used. Focus groups were conducted face-to-face with the central group and via teleconference with the remote group at the end of the course. For the follow-up study, focus groups and individual interviews were conducted via telephone for both groups. About half of the participants from both groups took part in the follow-up teleconference focus groups or interviews. The authors also interviewed the course administrator and instructor during the progress of the course and as part of the follow-up study. All the interviews and focus groups were recorded and transcribed for analysis.

The quantitative survey data were analyzed with the SPSS software. The analysis was

primarily descriptive because of the small sample size. Qualitative data from the open-ended survey questions, interviews, and focus groups were systematically coded and analyzed with the assistance of NVivo software. Participants' comments were identified and categorized into three categories including attitudes and experiences with the course, perspectives of technology integration, and actions in technology integration. Both quantitative and qualitative analysis was validated and cross reviewed by the three researchers.

Results
Participants' Use of Computers before the Course

Taking the central and remote participants together as one group, the initial survey demonstrated that teacher participants overall had strong computer literacy. More than 94% of participants reported they used the Internet for more than two hours per day. All participants rated their overall computer proficiency at the intermediate level or above, with approximately half indicating higher than an intermediate level. Approximately 69% of the participants reported that they felt comfortable or very comfortable working with computers.

The reported high degree of computer literacy however did not correspond to the successful and wide use of ICT in the classroom. As they reported in the initial survey, participants used computers frequently for e-mailing, web searching and word processing, but were less likely to use computers to retrieve data from databases, manage data with spreadsheets, present lectures or reports with presentation software, or enrich their instruction with computer-based activities (CBA) (Table 1). More than 40% of participants were not familiar with the ICT curriculum. Close to 60% of participants felt uncomfortable working with WebCT. Less than 40% reported a frequent try of ICT activities in classrooms. Less than 42% reported they were successful integrating ICT into their teaching. Only 23% were satisfied with the use of ICT in their schools.

Table 1. *Participants' purposes for using computers before the course*

Computer Use (%)	Database	CBA	Spread-sheet	Presentation software	Word processing	Internet search	E-mail
Not at all frequently	35.3	26.5	23.5	20.6	0	2.9	0
Not frequently	38.2	14.7	14.7	14.7	2.9	0	0
Somewhat frequently	17.6	35.3	29.4	20.6	5.9	0	5.9
Frequently	3.0	11.8	20.6	23.5	8.8	14.7	5.9
Very frequently	5.9	11.8	11.8	20.6	82.4	82.4	88.2

Group Differences Before and After the Course
The initial and exit surveys revealed significant differences between the central and

remote groups (Table 2). For the yes-no questions, a Chi-Square test was used to study the group differences. For the Likert scale questions, a t-test was conducted to compare the responses of the two groups. The statistical significance was set up at a level of 0.05 for both tests. In the initial survey, approximately 53% of the central participants had experience with computer-mediated conferencing (CMC) prior to taking the course, while only 11% of remote participants had this experience. Close to half of the central participants had previously taken a course with a major online component, whereas only 5% of the remote participants had similar experiences. These differences indicated that the central group appeared to have more experience with online courses than the remote group. Table 2 also shows that the central group had faster Internet connections at home.

Table 2. *Response patterns by central and remote participants*

Survey	Questions	Response (%)	
		RG	CG
Initial survey	Communicated using CMC prior to the course (yes)	11	53
	Taken a course with a major online component (yes)	5	47
	Taught a course with a major online component (yes)	5	40
	Participants younger than 39 (yes)	74	20
	High-speed Internet connection at home (yes)	39	69
Exit survey	Course had clear/consistent structure (agree or strongly agree)	73	93
	Criteria for success was clear (agree or strongly agree)	60	87
	Communication with the instructor (very effective)	54	94
	Instructor interacted frequently/constructively with students (strong agree)	54	94
	Communication with other students (effective or very effective)	20	67
	There was valued and dynamic discussion between participants during course (agree and strongly agree)	14	67
	Participants formed a supportive learning community (agree or strong agree)	20	74

RG = rural group
CG = central group

In the exit survey, approximately 94% of the central participants thought that their communication with the instructor was very effective, but only 54% of the remote participants held the same attitude. When asked whether participants formed supportive learning communities, approximately 74% of the central participants agreed or strongly agreed that learning communities existed during the course, but only 20% of the remote participants agreed or strongly agreed. Approximately 53% of the remote participants disagreed or strongly disagreed with the statement that participants formed learning communities during the course, while none central participant disagreed or strongly

disagreed.

Group differences were also noticed in the follow-up study. We found that, nine months after the course was complete, any sense of learning communities that may have existed for either the central or remote participants were no longer present, aside from those which existed between course participants in the same school. In other words, most of course participants did not keep in touch with each other for whatever reasons; however, those central participants who came from the same school still continued their mutual support.

Findings about the Success of the Studied Online Course

The course instructor was generally satisfied with the quality of participants' assignments. In an interview at the end of the course, she stated that most participants demonstrated through assignments an engagement with the course and an understanding of the influence of ICT on teaching and learning, and created good ICT activities that could be used in their classroom teaching. At the end of the course, the instructor compiled all the ICT activities participants developed for the course onto a CD-ROM. The CD-ROM was distributed to participants for future reference. In the exit survey, 90% of participants reported they were familiar or very familiar with the ICT curriculum, compared to 55% at the beginning of this course. Participants indicated an increased level of comfort with WebCT and other computer technologies, and expressed interest in applying ICT in relevant ways to their teaching practices (Table 3). All participants agreed or strongly agreed that the instructor constructively and frequently interacted with students.

Table 3. *Participants' comfort level with ICT before and after the course*

Questions	Responses (%)					
	Initial survey			Exit survey		
	RG	CG	All	RG	CG	All
Difficulty level of integrating technology in classroom (easy or very easy)	53	57	55	50	76	64
Comfortable level with online professional development (comfortable or very comfortable)	51	53	52	80	87	84
Comfortable level with WebCT (comfortable or very comfortable)	30	53	42	80	80	80
Comfortable level working with technology (comfortable or very comfortable)	58	79	69	86	87	87

Note: "All" refers to all participants.

Participants appreciated the flexibility of the online learning environment and became more comfortable with online professional development after taking the course. In the exit survey, about 67% percent of participants indicated that they preferred online over face-to-face delivery of professional development. A t-test revealed no significant difference between the two groups in this regard, except that some remote participants reported a preference of face-to-face format while no central participants had this preference but

remained a neutral position between the two formats. Over 83% participants felt comfortable or very comfortable with online professional development at the end of the course, compared to approximately 51% at the beginning of the course. During the interviews, participants frequently cited the convenience of working at their own pace as an attractive feature of the course. As one participant remarked: "*It sounds like a lot of us like to be independent and work at our own speed and that was the benefit of WebCT for me and if I got something beyond that, that would be okay.*"

When asked what they expected to achieve from the course, both the remote and central groups made similar comments: they expected to learn how to integrate ICT into their teaching and wanted to learn more about technology in general. The exit survey data showed that participants obtained what they had expected and were generally happy with the course design and course delivery (Table 4). For example, approximately 77% of participants reported that they became more capable to integrate ICT after the course, 70% better understood the appropriate teaching methods for ICT integration, and 90% had a better understanding of ICT related issues. Approximately 80% of participants were happy with various aspects of the course.

Table 4. *Participants' responses on the course effectiveness in the exit survey*

Questions	Response (%) (Agree or strongly agree)		
	RG	CG	All
Better able to integrate ICT after the course	74	80	77
Better understanding appropriate teaching methods for ICT integration	73	67	70
Overall better understanding of issues related to ICT	97	84	90
Course supported learning needs of participants	59	93	77
Course had a clear and consistent structure	84	84	84
Course criteria for success was clear	59	87	74
Course encouraged participants to develop abilities to use technology in relevant ways to their own practice	71	86	79
Course was effective to teachers looking for ways of ICT integration	72	87	80
Learning environment was structured to encourage development and success	66	100	84

In the follow-up survey, participants still reported their positive attitudes toward the course, which we consider are even more convincing than the exit data regarding the successes of the studied online course since these attitudes were reported after participants applied and reflected upon what they learned from the course through their teaching practices. Approximately 88% of participants agreed or strongly agreed that the course expanded their knowledge of using ICT in teaching; 94% reported the course

increased their understanding of how to design ICT-based activities; 71% reported that the course increased their use of ICT in teaching; 94% thought that the course was an effective form of professional development. Approximately 74% of participants implemented the ICT activities they developed during the course; 88% applied the knowledge learned from the course by creating new ICT activities; 65% thought they successfully integrated ICT into their teaching after the course. Approximately 71% shared what they learned from the course with their colleagues (Table 5).

Table 5. *Follow-up survey*

Questions	Response (%)
Course expanded knowledge of using ICT in teaching (agree or strongly agree)	88
Course increase understanding of how to design ICT-based activities (agree or strongly agree)	94
Course increased their use of ICT in teaching (agree or strongly agree)	71
Course has been an effective form of professional development (agree or strongly agree)	94
Comfortable level with implementing ICT activities in teaching (comfortable or very comfortable)	94
Successfully implemented the projects I worked on during the course (agree or strongly agree)	74
Successfully implemented the knowledge learned from the course by creating new ICT activities (agree or strongly agree)	88
Successfully integrated ICT into teaching after the course (agree or strongly agree)	65
Shared what they learned in the course with colleagues (agree or strongly agree)	71

Discussion

Given the evidence from participants' positive attitudes and experiences with the course, and their self-reported increased knowledge and actions in ICT integration, the course appeared to accomplish the first level of evaluation criterion on ICT professional development and to some extent, met the second level of criteria as set by Downes et al. (2001). This study therefore suggests that ICT professional development by distance can be a successful alternative to conventional face-to-face professional development.

Learning Community

Although the studied course appeared to have achieved its goals, the two groups of participants reported different learning experiences. The central participants were more likely to report a supportive learning community than the remote participants. This difference might be contributed by two sets of factors. One was related to the initial differences that the two groups brought to the course as described in Table 2. The central participants had more experience with online courses and communication than their

remote counterparts. This greater familiarity with an online environment might make them more apt to use computers as a tool for the purpose of communication, which possibly led to more social presence and stronger sense of community. More central participants also possessed high-speed Internet connections at home. One may think that the slower Internet connection might not motivate remote participants to frequently communicate with partners online. However, if we take other data into account, we doubt that the technology factor significantly influenced participants' communications during the studied course. In the initial survey, 41% of all participants reported that they used the Internet more than five hours per week at home, 38% used the Internet for four to five hours per week, 15% used the Internet for two to three hours per week, and only 6% used the Internet for less than one hour per week. If their Internet connection allowed them to surf the Internet, it should not be a significant obstacle for their online communication with other participants.

The other set of factors entailed the different class arrangement. The pure online learning environment and between-school pairing left the remote group lacking a social context in which participants could situate discussions with their partners. The remote participants were often unknown to each other and might therefore lack emotion and comfort to communicate with partners over online. In addition, the paired remote partners were separated by distance. It was difficult for them to get together to work on learning tasks for which face to face communication was critical, such as flowcharts, conceptual maps and web pages that help focus the cognitive synergies of a team.

The situation was somewhat different for the central group. The within-school pairing and face-to-face sessions were helpful to build a close learning partnership or creating new ones. We suspect that knowing each other or at least having met each other face-to-face made partners feel more comfortable working together on and off line. Partners from the same schools had opportunities to meet together and communicate in a rich context, rather than text-based asynchronous telecommunication. A partnership from the next door would save time and energy from lengthy writing in order to explain what the question was and how it could be solved. During the interview and focus group discussion, central participants reported that being paired with other course participants from the same school enhanced their success in the course and considered them as ongoing support. For example, one central participant expressed the advantage of the within-school pairing by stating "*Because we had more than one [course participants] within our schools, we were able to share what we were doing. That was really instrumental to my learning. I think that support is vital*." Those participants who experienced positive learning communities also frequently mentioned the advantage of having the face-to-face sessions. As one participant stated during the focus group discussion at the end of course, "*I'm a visual person and I need to develop a relationship, to see your face and know who you are*." These results suggest that occasional face-to-face interaction plays an important role in an online learning environment, particularly for learning community building. This finding supports the statement of Harasim, Hiltz, Teles and Turoff (1996) that social communication was an essential component of educational activity, and the social bonds

between learners had important socio-affective and cognitive benefits for the learning activities.

After the course was over, participants lost any sense of connection built during the class except those who came from the same schools. This suggests that a distributed learning community is considerably more difficult to maintain compared to a local community once a course is over. The studied professional development course took no solid measures to keep participants in connection after its completion. Sole reliance on teachers was apparently not a successful solution to maintain a community. Since the professional development should be viewed as a process rather than an event (Guskey, 1995), additional solutions need to be in place to keep distributed inservice teachers in connection for ongoing professional development.

Transformative Practice

Transformative practice has been tied to the purposes of professional development (Cranton, 1996; Whitelaw, Sears, & Campbell, 2004). It refers to the change of participants' way of teaching as a result of professional development. For this study, transformative practice can be reflected by participants' innovative approaches of teaching through technology integration. To investigate whether transformative practice happened or not among the participants, the follow-up study focused on two necessary predictors and two indicators. The two predictors were participants' familiarity with ICT and their understanding of the rationales of ICT integration. The two indicators were how participants actually applied ICT activities in teaching and whether they shared with their colleagues what they learned from the course.

The follow-up survey indicated that, nine months after the course was over, participants still reported that the course had significantly improved their knowledge and ability of integrating ICT with teaching. Participants increased their activities in the use of ICT, and the majority of them felt comfortable using ICT (Table 5). The following comment gave us an optimal attitude about participants' actions in ICT integration: "*I have been trying to incorporate the technology pretty regularly. The course certainly helped me carry on doing that*." The overall self-reported data therefore indicated that most participants appeared to have extended what they learned from the course to their classroom teaching. In other words, transformative practice appeared to happen as a result of the studied course, although this has not been confirmed through site visits or assessed for effectiveness.

This study discovered some issues associated with transformative practice in ICT integration. In the follow-up study, approximately 65% of participants reported that they successfully integrated ICT into teaching after the course, which means over one third of them did not confess a success in ICT integration (Table 5). The interviews and focus groups revealed that this result linked to some issues that needed to be addressed for more frequent and effective use of ICT by teachers. Access to appropriate equipment was frequently mentioned by participants as one barrier to the integration of ICT. They reported their difficulty in finding right ICT tools, booking computer lab time, etc. A couple

of typical comments are provided in the following:

> *Easy [to integrate ICT into teaching] in terms of the ideas and the will to do it. Sometimes difficult to have access to the appropriate ICT tools, expenses, booking computer time…*

> *Availability of computers, availability of lab time and also the speed at which the labs operate seem to be the biggest obstacles.*

Lack of time was another concern participants had for the use of ICT. This concern came out of their busy school schedule as one participant commented: "*It takes a lot of time to produce good interactive lessons for students. Time is something that teachers do not have.*" It also arose from the already tight curriculum as indicated by another comment: "*I find that it's easy to come up with ideas for projects and evaluation, but it still remains somewhat difficult and sometimes a juggling endeavour to find the time in classes and to find time in the lab.*" The packed classroom schedule stopped teachers from sharing their experiences in the use of ICT. One participant confessed that "*Everyone is so focused on getting through the curriculum and stuff that you need to do with your own particular class that I don't see that I'm necessarily spreading any new news to anyone.*" Among those who reported that they shared what they learned from the course with other teachers, some admitted that the sharing was thin, no more than circulating the course CD-ROM or giving an isolated presentation. There was no sustainable plan to help other teachers get involved.

Another fundamental issue is the teacher's teaching philosophy. Successful ICT integration in the classroom is dependent on the way technology is used (Dexter, Anderson, & Becker, 1999; Wetzel, 2001; Zhou, Brouwer, Nocente, & Martin, 2005). However, teachers' beliefs about teaching and learning are hard to change (Mitchem et al., 2003). In the follow-up survey, 53% of participants reported that they re-examined their teaching styles, which indicates that as many as half, and maybe more, of them might not have adapted their teaching strategy to incorporate effective ICT integration. The following are typical supporting comments:

> *I think [the course] has informed my teaching practice. I don't know if it's changed it. We still have our strong values and beliefs in … teaching and learning practices … Enhancing it is what it's [ICT] doing.*

> *It [the course] gave me more awareness of how to do those things [ICT] better and how to use them more, but as far as branching away from the standard kind of things that I do, no.*

> *Even before these ICT outcomes were thrown at us, we were trying to infuse and make students aware of the technology that was available out there, how to use it. I don't know if it's made a big difference.*

These comments reveal participants' hesitance to change their way of teaching as a potential result of ICT integration. To help move teachers' current teaching perspectives to more constructivist perspectives, which is claimed as more appropriate for the integration of ICT by many studies (Clarkson & Toomey, 1999; Zhou et al., 2005), we need to expose teachers to the disadvantages of their current teaching perspective and the advantages of the constructivist perspective. For this end, we agree with Schmidt et al. (2002) who recommend that professional development should provide a constructivist framework first, using constructivist teaching strategies in order that teacher participants understand the

advantages of the integration of ICT into the curriculum. For this studied professional development course, the developer could consider adding one module at the early stage of the course to discuss the constructivist approaches of integrating technology with teaching. This module would set the tone for the entire course.

Conclusion

This study suggests that an online delivery of ICT professional development for inservice teachers has the potential to become a successful alterative to traditional in-classroom professional development. However, a learning community was difficult to initiate and even more difficult to maintain in an online learning environment. Teacher participants experienced great challenges when applying what they learned from the professional development into their teaching.

This study indicates that the within-school pairing and face-to-face sessions have positive impact on the success of learning community building during and after the professional development course. This suggests that future online ICT professional development courses should enrol more than one teacher from a school or community and incorporate face-to-face sessions, where possible. This study also suggests that a short professional development course itself can not guarantee a change in teaching practice. Teachers face many contextual barriers to integrate ICT in teaching such as the lack of time and limited access to technology, and they tend to strongly hold their existing approaches and perspectives of teaching, as we found from this study. Professional development aiming at changes should be considered as an ongoing process and supported with school change.

In this study, central participants reported a stronger sense of learning community than their remote counterparts. A few factors, including initial ICT experience, face-to-face meetings, and within-school pairing, contributed to this difference. Since the sample was small, this study did not try to determine which factor was more fundamental than others. Future studies using bigger samples could attempt to answer this question.

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Footnotes

1 The ICT curriculum can be accessed at the website of Alberta Education, http://www.education.gov.ab.ca/k_12/curriculum/bySubject/ict/