**Blended learning for professional development in diverse urban settings:
Findings from three project evaluations[1]**

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Abstract

This study synthesized the findings of three program evaluations of teacher blended professional development programs from the perspective of situated design and implementation, development of community, changes in teacher practice, and impact on students. We found that the blended programs were effective in providing teachers with an opportunity for learning on the job and collaborating with other teachers, and they influenced teacher classroom practice moderately and affected student learning to a limited extent. Our study supports the contention that blended learning is a viable model for teacher professional development.

Introduction

Professional development involving teachers in online learning communities is rapidly gaining popularity (Dede, 2006). Research indicates a number of benefits for teachers from online professional development, including anytime/anywhere professional development (Swenson & Curtis, 2003; Varsidas & Zembylas, 2004), instant access to a network of professionals with useful skills and knowledge for continuous training and professional development (Charalambros, Michalinos, & Chamberlain, 2004), and the fostering of a professional learning community (Chapman, Ramondt, & Smiley, 2005). Yet developers of online professional learning communities face significant challenges in organizing and maintaining a virtual community in which participants develop the sense of belonging, trust, and support which are a prerequisite to learning in a community (Charalambros et al., 2004). One strategy to address the challenge of community building in online environments is to utilize a blended approach to professional development. This method integrates into the online experience face-to-face components that are intended to strengthen the social cohesion of the learning community and develop a collective momentum for implementing meaningful change in teaching practices.

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In this paper, we synthesize the outcomes of evaluations of three different blended professional development programs with the view to understanding how blended learning programs can meet the primary requisites for the effective design of professional development programs as found in the extant literature. Our goal is to provide guidance to professional development designers and, more generally, to contribute to our knowledge of blended learning as a professional development approach.

Literature review

Blended learning

There are many interpretations of the meaning of blended learning, or hybrid learning as it is sometimes called, largely because the usage of the term is evolving (Graham, Allan, & Ure, 2005; Oliver & Trigwell, 2005; Whitelock & Jelfs, 2003). Driscoll (2003), in a survey of literature, found four different uses prevalent: the mixing of traditional face-to-face instruction with instruction technology; the mixing of different forms of technology such as CD ROMs with web-based technology; the mixing of pedagogical approaches such as constructivism with behaviorism irrespective of whether learning technology is used; and the mixing of instructional technology with specific tasks to be accomplished. Oliver & Trigwell (2005) even find the term blended learning problematic and call for a re-conceptualization of its meaning because 'blended' implies a differentiation between pedagogical approaches that may not exist, and because the term describes an instructional approach rather than learning *per se*. Nevertheless, the term is increasingly being used to designate a combination of face-to-face experiences in which learners are co-located with online experiences where learners are not at the same location.

Even though most now ascribe to this latter viewpoint (including the authors) there are still differences in understanding of the term. For example, the Sloan Consortium (Allen, Seaman & Garrett, 2007) sees blended learning as having no less than 20% nor more 79% of the content delivered online, whereas others are not concerned with the apportioning of instructional modes. Some emphasize that technology should not be simply "bolted on" to an existing face-to-face learning program, but that blended learning requires a redesign of the teaching and learning relationship (Bleed, 2001; Garrison & Kanuka, 2004; Richards, 2002). Related to this is the question of whether seat time should be reduced when integrating online technology into a redesigned traditional course (Garrison & Vaughan, 2007). And finally, there are differing perspectives offered on the rationale for blending a learning experience with technology: (1) improved teaching and learning; (2) increased flexibility in and access to learning; and (3) cost effectiveness (Graham, 2006). Typically, the motivation to design a blended learning experience does not rely on just one of these reasons, but more likely with two or all three of them.

With regard to improved teaching and learning, Garrison and Kanuka (2004) argue that the combination of face-to-face and online learning can result in a transformative learning experience because course participants can benefit from being connected to a learning community regardless of whether they are apart or together. They add that when the dynamic of fast-paced, spontaneous verbal communication characteristic of face-to-face learning is combined with the potential for thoughtful discussion and reflection online, the educational

possibilities are multiplied. Faculty appear to favor the approach and report that they interact more with their students (Dziuban, Hartman, & Moskal, 2004; Waddoups & Howell, 2002; Wingard, 2004) and get to know them better as individuals in blended courses than they would ordinarily in traditional lectures (Owston, Garrison, & Cook, 2006). Student satisfaction is reported to be higher in blended learning courses than in comparable face-to-face courses (Dziuban, Hartman, Juge, Moskal, & Sorg, 2006; Owston et al., 2006; Twigg, 2003) and withdrawal rates lower (Dziuban et al., 2006; Twigg, 2003). Students also tend to achieve higher in blended courses than traditional courses overall (Dziuban et al., 2006; Twigg, 2003), and both faculty and students report that the online component of blended learning encourages the development of critical thinking skills (Owston et al., 2006). Additionally blended learning facilitates student engagement in the online environment itself, in dialogue, as a group, and in course content (Ziegler, Paulus, & Woodside, 2006).

Increased flexibility in and access to learning, which together constitute the second rationale for blended learning, are perhaps the most commonly cited reasons for its use. By its very nature blended learning offers more flexibility to learners because some of the learning takes place at scheduled face-to-face times, while other parts of it may occur online at their convenience. This feature is especially attractive to mature learners who have to balance job and family responsibilities with their studying, and to those who do not want to sacrifice entirely the social interaction that comes with face-to-face learning. Blended learning models that have face-to-face components at the beginning and/or end of a course and an online experience in between also allow learners living at a distance to enroll in a program that they otherwise may not be able to.

The third rationale presented for blended learning, cost effectiveness, is more equivocal, and research findings depend on which cost factors researchers choose to include in their study. For instance, the Pew Charitable Trust Foundation sponsored Program in Course Redesign (Twigg, 2003) reported significant cost savings largely through a reduction in faculty and substitution of teaching assistants for faculty; however, the research did not take into account factors related to computing infrastructure. Hartman (2007) on the other hand reports that at the University of Central Florida saved $7 million in construction costs and over $277,000 in annual operating costs through implementation of blended courses, although he does caution that cost savings will not be realized if technology is just added onto existing courses without pedagogical change. Cost savings in corporate training environments where widely distributed employees would have to travel to a central location and remain for an extended period seem clearer. IBM, for example, saw as high as a 47 to 1 return on investment (costs of developing and deploying a training module) in a unique blended program for managers (Lewis & Orton, 2006).

Blended learning and teacher professional development

Moreover, there appears to be a strong rationale for blended learning based on the body of research about the design of effective teacher professional development programs. This research shows that professional development is most effective and can impact student achievement when it is long-term, collaborative, school-based, focused on the learning of all students, and linked to the curricula that teachers have to teach (Cohen & Hill, 2001; Garet, Porter, Desimone, Birman, & Yoon, 2001; Hiebert, Gallimore, & Stigler, 2002; Wenglinsky,

2000). Blended learning lends itself well to incorporating these design principles. For example, blended learning programs can be designed to extend to a full school year or even longer because teachers do not need to be removed from classrooms for extended periods in order to participate. Face-to-face sessions can coincide with district professional development days or teachers can be replaced with substitutes for several days throughout school years to attend face-to-face sessions. Alternatively, if these arrangements are not possible, teachers can participate in face-to-face summer sessions. In any of these scenarios teachers can continue to participate in the program via online sessions. The possibility of arranging blended teacher learning programs that extend beyond a school year is particularly appealing because the longer a program functions, the more likely deep change will occur in teacher practice (Shields, Marsh, & Adelman, 1998; Weiss, Montgomery, Ridgway, & Bond, 1998).

Collaborative communities are a hallmark of high quality professional development, whether they meet face-to-face (Little, 2003; Louis & Marks, 1998; McLaughlin & Talbert, 2001) or online (Barab, Kling, & Gray, 2004; Koch & Fusco, in press; Schlager & Fusco, 2004). With blended learning, the collaborative possibilities are numerous. Teachers within the same school can collaborate in face-to-face sessions "hands-on" material development or review, for instance, and share online their thoughts and experiences in using them. The online discussions could be with their colleagues in the same school or beyond their school with other teachers engaging in the same activities. The blended model would also appear to support the "critical friends" approach to professional development that aims to increase student learning by creating school-based teacher communities whose members carry out practice centered collegial conversations (Curry, 2008; Dunne, Nave, & Lewis, 2000).

Blended learning allows for the possibility of professional development programs to be grounded in schools as in the examples given above and to provide opportunities for teachers to share and reflect on their practice. The notion of learning in one's own physical and social context is considered by many as critical for effective learning (Brown, Collins, & Duguid, 1989; Greeno, Collins, & Resnick, 1996; Lave & Wegner, 1991). Thus blended learning that incorporates school based components would appear to be consistent with this situated perspective on learning. Nevertheless, there are limitations if teacher learning is restricted to studying teaching practice within one's own school. Putnam and Borko (2000) argue that teachers need to study in multiple contexts, especially if the goal is for teachers to think in new ways because the pull of the school's existing environment and culture may be too strong to engender change. Traditionally, summer workshops held in locations other than their own school are used to introduce teachers to new instructional ideas. However, the online component of blended learning can provide teachers access to different contexts in which they can learn. For example, expert online facilitators or guests can challenge teachers' existing practices and introduce alternative perspectives. Similarly, if teachers from other schools and school systems are brought into the online conversations new ideas and suggestions can be introduced and discussed.

The requirement for professional development to focus on the needs of all students and the curriculum teachers are required to teach stems from research linking professional development curricula to improvements in student achievement (*e.g.*, Cohen & Hill, 2001; Garet, Porter, Desimone, Birman, & Yoon, 2001). To be sure, fully face-to-face or fully online

professional development programs can be designed with this focus in mind. Blended learning can offer this possibility as well through careful design regarding which aspects will be dealt with online and which with face-to-face interactions. An added of advantage of blended learning appears to be that teachers are able to immediately tryout ideas in their classrooms that are proffered in the online community rather than waiting, thus providing the opportunity for "just-in-time" professional development (Northrup & Rasmussen, 1999).

Although in theory the blended model appears to support teacher learning well, to date the empirical research on the application of blended learning to teacher professional development is limited. Holmes, Polhemus, and Jennings (2005) analyzed a blended in-service professional development program for K-6 teachers that focused on integrating technology into teachers' practices. The blended approach introduced teachers to affordable and efficient technologies, provided scaffolding for the development of a learning community, and facilitated the autonomy and independence of teachers. Vogt and her colleagues also examined blended learning as a means of helping teachers integrate technology into their classroom practice (Vogt, Almekinders, van den Akker, & Moonen, 2005). Their study suggested that blended programs can help teachers better understand and implement technology into their classrooms and, to a lesser extent, adapt exemplary materials for their own settings. In another study, Owston, Sinclair, and Wideman (2008) report that a blended learning program for middle school mathematics and science teachers positively influenced teacher attitudes and content knowledge on specific curricular topics and motivated many participants to transform their classroom practice. This in turn led to more positive student attitudes towards the subjects. Of interest in all three of these studies was that researchers reported difficulty in sustaining effective online communities citing reasons such as teachers lacking time for participation, lacking familiarity with the technology, and not being accustomed to collaborating with colleagues either locally or at a distance, and as well as issues related to moderating of the online discussions. Additionally, Henderson (2007) in two case studies of blended programs for secondary teachers reported that the moderator of the online communities has to step in to assist in sustaining the communities if teachers were not socially engaged.

The above studies examined teacher inservice blended programs designed with a specific professional development focus in mind. Some research is also available on formal university teacher education courses. This research shows that blended learning provides an effective model for meeting the needs and learning styles of busy teaching professionals because it allows for a more flexible study schedule than a lectures only course (Swenson & Curtis, 2003). Blended learning can help teachers within a university course structure to develop relevant skills through face-to-face sessions, while at the same time provide them with an opportunity to reflect online about their practice (Motteram, 2006). Related to this, blended learning can be designed around authentic online learning experiences to bring meaning and purpose to teachers' activities (Oliver, Herrington, & Reeves, 2006).

Research questions

From this brief review of the literature on blended learning four issues emerge as central and deserving further investigation if we are to advance our understanding of blended teacher professional development. First, we need to know how blended learning programs can be

designed and implemented so that they emphasize situated, on-the-job professional learning that focuses on the curriculum teachers have to teach. Second, we need to understand how teachers' sense of community and collaborative skills can be strengthened by integrating face-to-face and online experiences. Third, we need to gain a more detailed understanding of how blended programs can help teachers transform their classroom practice, and, fourth, how this transformation ultimately affects student learning. We sought answers to these four questions in the current study. We did this by synthesizing the evaluation reports of three separate blended learning programs for teachers. The two senior authors of this paper undertook the original program evaluations. The three programs are described next as part of the methodology.

Methodology

Three blended programs

All three of the teacher professional development programs took place at different times, had different teachers involved, and were set largely in the Greater Toronto Area, one of the most linguistically and culturally diverse urban centers in North America. The project names were: Advanced Broadband Enabled Learning (ABEL) Program (Wideman, Owston, Morbey, & Granger, 2004; Wideman, 2007), the Teacher eLearning (TeL) Project (Owston, 2004, 2005), and Learning Connections (LC) (Owston & Wideman, 2007). The projects focused on the improvement of mathematics and science teaching at the high school, middle school, and upper elementary levels respectively, particularly in schools with large enrolments of English language learners from diverse cultural backgrounds. ABEL had an additional focus on teaching English and the Arts, and LC also focused on literacy teaching skills. All projects shared the common goals of promoting continuous professional learning on the job through collaboration and sharing with colleagues. Additionally, they emphasized teachers' use of student-centered, inquiry-based approaches in their classrooms that involved all students. Both ABEL and LC continued to operate after our evaluations concluded, while TeL was designed as a two year project.

Although the three projects shared common goals, they differed in their design and implementation. ABEL used a blended learning model that combined online activity throughout the school year with face-to-face summer institutes. Teachers voluntarily joined ABEL because their school districts decided to join the project and they thought that the project would be of value to them. There was no structured program organized for teachers. The underlying philosophy of ABEL was to give teachers access to powerful digital tools and the means to collaborate electronically and then help teachers develop collaborative projects. To this end, ABEL provided teachers with a web portal, a set of online tools and resources, videoconferencing equipment, and the project leaders organized periodic events for participating schools that brought in via videoconference external experts who presented and interacted with students and teachers. The summer institutes brought participants together for five days where they shared their successes with their colleagues and listened to keynote speakers. Some institutes also involved students who shared their experiences from participating in collaborative projects the previous school year.

LC was modeled after ABEL in its design and implementation, but it had a very specific focus on improving the skills of literacy and numeracy lead teachers in Ontario elementary schools. Funded by the Ontario Ministry of Education, LC was a pilot project that was part of a

strategy to help the province achieve its student literacy and numeracy goals. Schools were chosen by school district administrators and lead teachers in the schools were asked by their principals to participate. The project employed similar tools to ABEL's, however it had a more formal structure. Specialist teachers employed by the project organized and facilitated online projects to be tried out by teachers in their classrooms and reported on later online. They also facilitated online discussions and assisted the project leaders in organizing online guest speakers. LC summer institutes were similar to ABEL and, in fact, were combined after our evaluation concluded.

TeL, the most structured of the three programs, used an entirely different blended model. In the first school year the project began with a daylong face-to-face session followed by an eight week online session while teachers were in their classrooms carrying out their normal teaching responsibilities. This cycle was repeated three times during the first school year but only twice during the second year because the project leaders believed that the three cycles imposed too heavy a burden on teachers. Year one focused on teaching science and year two, which involved different teachers, focused on mathematics teaching. During the face-to-face sessions teachers typically spent the morning listening to a resource teacher introduce practical ideas for improving subject teaching, and during the afternoon they shared their classroom experiences in small discussion groups. The online sessions provided teachers with weekly readings and activities to try out in their classrooms. Teachers were also expected to participate in facilitated online discussions and to maintain an online reflective journal.

The project evaluations took place over three years for ABEL and LC and two years for TeL. The primary sources of evaluative data were semi-structured interviews with teacher-participants, project leaders, and other stakeholders, focus groups conducted with the teacher-participants, teacher and student surveys, transcripts of teachers' online discussions, in-class observations, and observations of the programs' professional development activities such as videoconferences and face-to-face sessions at summer institutes and workshops. We provided interim evaluation reports each year for each project and summative reports at the end of the evaluation phases.

Data analysis

The above evaluation reports were the primary data source for this study. We undertook a cross-case comparative analysis. The steps in this process are essentially the same as an intra-case analysis: data reduction, data display, and conclusion drawing and verification (Berkowitz, 1997). Each of the three evaluation reports formed a "case" for the purposes of this analysis. Data reduction began by re-reading the reports in light of the three research questions related to (1) program design and implementation, (2) teacher collaboration, (3) change in teacher practices, and (4) impact on students. We coded report sections that dealt with these questions and then wrote notes that summarized these categories and relevant subcategories that emerged. For the data display phase we wrote higher level abstractions of the key categories and subcategories. The final phase involved drawing conclusion based on our abstractions. When we were doing this we revisited the original reports several times to verify our conclusions, and occasionally we went to the original evaluative data sources of the three cases if we needed to obtain further elaboration or clarification.

Findings

Situated design and implementation

Our first research question deals with how blended learning programs can be designed and implemented so that they emphasize situated, on-the-job professional learning that focuses on the curriculum teachers have to teach. As pointed out earlier, research suggests that teachers need the opportunity to learn on the job and try out ideas in their classrooms that are directly related to the curriculum they have to teach (Borko, 2004). All three programs that we studied emphasized situated and relevant professional learning, but they varied in the extent to which they were directly relevant to teachers' needs. ABEL by the dint of its unstructured nature was the most relevant because teachers had the freedom to design their own collaborative activities related to the curriculum they were teaching. A consequence of this was that ABEL did not have a broad impact on all teachers registered in the program because only a minority of teachers actually completed projects; the rest started projects but did not complete them or else they just stood on the sidelines not creating any at all. Nevertheless, the teachers who chose to participate appeared to have benefited substantially from their involvement as illustrated by comments from two teachers:

> Before I went into ABEL I was quite skeptical because my experience with using technology in the classroom has always been that the technology drives the curriculum. …But then…when I saw what Alice was doing with the math and what Marlene was doing with her history course I got excited because for the first time I [was] seeing that this is the way it should be—a curriculum should be the driving force and the technology should only be the support (Wideman et al., 2004, p. 23).

> Within the ABEL project there is an expectation that you'll try something and if it fails, that's okay. And I don't see that in the provincial curriculum, the assessment of teachers and so on. They say go ahead and take risks, but don't you dare fail. But ABEL says go ahead and take the risk, to see how it works. If it works, great. If it doesn't, what have we learned from it? (Wideman et al., 2004, p. 24)

On the other hand both TeL and LC functioned more like typical inservice courses. LC had scheduled classroom based activities with deadlines for when they were expected to be completed. The deadlines were flexible and often had to be extended because teachers had not completed their projects on time. This design allowed teachers a measure of flexibility in carrying out the activities in their classes directly related to their curriculum as the deadlines were often a month or two later. TeL was the most structured with weekly assignments and readings directly related to provincial curriculum expectations teachers were required to teach. Teachers in TeL were not all teaching the same topics at the same time, therefore when asked to try out a particular mathematics or science activity almost all teachers had to alter their curriculum schedule to fit in the activity or else skip it entirely. As a result the program did not have the immediacy that the other two did.

The design of the face-to-face sessions of ABEL and LC were similar, as described earlier. They took the form of summer institutes that lasted several days and had a combination of keynote speakers, teacher sharing, and breakout sessions. In the case of LC time was also spent on hands-on sessions about how to use various technologies since, as a group, these teachers were less skilled in this area. TeL was slightly different in organization because the face-to-face sessions were compressed into one day. TeL differed as well because one day was focused entirely on teacher sharing of culminating classroom projects. While teachers generally appreciated keynote speakers in all three programs, what we repeatedly heard was that they wanted more time devoted to just sharing and discussion of each other's ideas, activities, successes, and disappointments. Even though program designers were aware of this, there was still a strong urge to organize a formal program for participants that left a relatively small amount of time for teacher sharing and discussion.

A remaining issue that emerged about design and implementation was the length of time between the online and face-to-face sessions. Teachers in ABEL and LC had to wait an entire school year before they could meet, whereas TeL teachers met approximately every eight weeks. Our research found that there was a distinct advantage for community building by meeting more regularly like TeL teachers did. Both ABEL and LC had introductory summer institutes when the program began and in neither did a sense of community emerge until the conclusion of their second summer institute. This was the case even though within a year teachers in all three programs met for about the same number of days in total. Clearly there are increased costs with the TeL model, but given a choice it is preferable for the face-to-face sessions to be held more often, especially if one is concerned with accelerating the pace of school reform through teacher professional development.

Development of community

As the literature suggests the blended environment has the potential of producing a stronger learning community than either fully face-to-face or fully online learning environments (Garrison & Kanuka, 2004). Generally, program developers have a well-developed sense of how to structure face-to-face sessions to ensure a strong community, but for most developers online environments are generally unfamiliar and very challenging territory in which to work. To make matters more complex, there is the difficulty of developing a program so that the face-to-face and online components blend seamlessly. A high rate of teacher participation online over an extended period is one indicator of the strength of a learning community. Of the three programs we studied, TeL had the strongest online participation, LC the weakest, and ABEL was somewhat in between although the project did not focus on online community building per se. Even though TeL had much higher participation rates than the other two programs its rate was not particularly high. For example, in the first half of the science course, which was offered in the second year of the project, 76% of participants posted two or more reflective pieces online, while in the second half of the course the rate dropped to 57%. Participation rates were considerably lower in the first year mathematics course.

Three reasons were cited in the TeL evaluation report as to why participation was relatively low: lack of time, low relevance of the discussion topics, and weak facilitator skills. The reasons were largely the same for the other two programs as well, so we will illustrate them

with TeL. TeL participants were divided up into groups of 12 to 15 teachers with each group being led by an experienced curriculum resource person from a school district. Teachers were expected to post reflections on assigned readings or weekly activities that they tried out in their classrooms. First of all, teachers reported that they did not have enough time to make regular postings despite being provided with a (generous) half day of teaching release time each week for this and other project activities. We concluded that time was essentially a proxy for the second reason—lack of relevance of the readings or activities to their everyday classroom teaching. This became evident when teachers stated at the end of the project that they should have been grouped by grade level, instead of by more or less random assignment, because they would have more in common with their colleagues. It appeared that teachers were simply not motivated to discuss issues online when they were not directly related to their immediate needs. In the TeL report we concluded that:

> Teachers best enjoyed the assignments that permitted them to implement new ideas in their classrooms as opposed to just reading and writing a response; the practical value of the former was viewed as an opportunity to implement change and also to work on something relevant, grade specific, and pertinent to the lived classroom experience. (Owston, 2005, p. 37)

The third reason for low participation related to the group facilitators. Their role was to stimulate group discussion, ask probing questions, correct any misunderstandings, and overall to keep their group functioning smoothly. During the first year of the project the facilitators did not have any particular facility in performing these tasks, nor were they provided with any training. As a result some facilitators did not react to teachers' postings at all, while a few did make an attempt to comment on each teacher's posting. This was discouraging as one teacher in TeL said:

> The one thing I found about [the online discussions] was that I get all these ideas and I do some writing and stuff and then press the button and it goes. Mentally it goes out there somewhere. I don't know does anyone see it? No response: does anyone care? (Owston, 2004, p. 41)

Teachers reacted to the overall weak facilitation skills by participating less frequently or by dropping out completely from the online component. At the end of the first year our evaluation report recommended ongoing training of the facilitators in the second year which did occur. Project leaders credited the higher teacher participation rate in the second year directly to the improved facilitation.

Despite the relatively low participation in the online discussion groups, teachers in all three projects regarded the blended experience as very worthwhile. However they felt that the face-to-face experience was the "glue" that held them together as a community, and many thought that they would not have continued in a fully online environment were it not for the face-to-face sessions. A strong majority of participants in all three programs reported that being given opportunities to share experiences and innovative ideas in face-to-face sessions assisted not only in strengthening their professional connections with colleagues, but also to addressed the feeling of isolation of being the only teacher in a particular grade or subject at a school. The findings also indicated that the facilitators in the face-to-face sessions were able to assist the participants

to develop their expertise in new teaching methodologies and to integrate technology into their teaching practice. They encouraged the participants to take risks and analyze the mistakes made in classroom settings with their students. Such engagement with facilitators, together with practice boosted teachers' confidence and professional growth in innovative pedagogical practice.

Change in teacher practice

Both ABEL and TeL appeared to have the most significant widespread impact on teacher classroom practice, while the impact of LC appeared to be much more focused on a few skill areas. For example in one of the most recent surveys of ABEL teachers, a majority reported making shifts in their teaching practices as a consequence of the program. About 70% indicated that they put greater emphasis on engaging student interest and provide more opportunities for students to take the initiative in their learning, and over 50% said they had students undertaking more collaborative work, were eliciting students' opinions and ideas more frequently, were giving students more opportunities to figure things out for themselves, and were providing more opportunities for students to present and communicate their knowledge and understandings. The use of inquiry-driven discussions and the provision of out-of-school audiences for student projects was said to have increased by about half of those surveyed. Nearly all teachers reported actively seeking out new ways of teaching their course topics, and rethinking their ideas about teaching and learning as a consequence of their exposure to ABEL and participation in ABEL-augmented projects. One teacher summarized her experience as:

> The satisfaction lies in discovering a new way of teaching that I hadn't ever thought about before. And it has been overall completely and totally beneficial to myself and the students. So I am going to be continuing [to participate in ABEL]. (Wideman, 2007, p. 26)

These data, together with data from interviews we conducted, strongly suggest that teachers who made use of ABEL resources and technologies made significant shifts towards more constructivist and student-centred teaching practices, although in this evaluation we did not confirm the teacher reports with classroom observation.

In the second year of TeL almost all teachers whom we surveyed were either "satisfied" or "very satisfied" with the professional learning experience the project afforded, regardless of whether they had strong science and technology backgrounds or not. Experienced science and technology teachers found the material in the course to be a helpful refresher for techniques previously learned but not necessarily implemented, and less experienced teachers valued the subject matter knowledge learned and the insights and ideas gained for effective teaching of science and technology. Teachers reported increased confidence in experimenting with different approaches to teaching science and technology that featured hands-on exploratory learning, higher level questioning, use of new kinds of teaching materials, open-ended scientific exploration, giving students greater autonomy for designing their own projects, and grouping students in mixed ability teams. One teacher said:

> I'm not as important to their [the students'] learning as I thought I was! I can actually let them "go" and they will learn certain things. I've got to create the environment, I've got

to be there to do the controlling of it, but I can let them learn a lot on their own. (Owston, 2005. p. 25)

Added to this, teachers said they gained confidence to deal effectively with the unpredicted as it arose in their classes and to venture into topics where they might not know all of the answers to questions students might ask. Although teacher reports were positive, we did not obtain convincing evidence on how much teacher practice actually changed based on a sample of classrooms in which we observed. We saw evidence of some excellent inquiry learning occurring in a few classrooms, some very "traditional" teaching, and teachers struggling to implement inquiry-based approaches, but by no means was inquiry learning widespread.

For LC we found differences in minor, yet meaningful, aspects of teacher practice over the two years of the project which were consistent with the project's intent. In a post project survey for example, mathematics teachers reported that they were more in agreement with using mathematics problems that can be solved in a variety of different ways than they were at the beginning of the project, which suggested that they valued mathematical processes more than before (as opposed to students just getting correct answers). As for literacy practices, the survey indicated that teachers were using phonics instruction less often and using more often interviews/conferencing and benchmark books for assessment purposes, findings which were consistent with the project's intent. Our classroom observations found evidence of increased skill in a few specific literacy areas such as making accommodations for diverse students and incorporating gender-sensitive practices into their classes; in numeracy classrooms we observed improvements in the use of open-ended tasks with students and more emphasis on student discovery.

Impact on students

ABEL and TeL appeared to have greater impact on students than LC which one would expect given that those two programs affected classroom practice the most. Important to note, however, is that the metrics for assessing impact were different. Conclusions about ABEL were based on teacher interviews and surveys; TeL conclusions relied on teacher and student surveys and classroom observations; and LC conclusions came from teacher surveys and interviews as well as student province-wide assessment test results.

ABEL teachers stated that their students were more engaged and on-task than usual when resources and tools made available through the project were being used for teaching and learning. The teachers whom we interviewed used words such as "excited" and "stimulated" to describe their students' response to the use of the ABEL tools and resources. Improvements in general literacy skills was one type of student outcome mentioned by a several of the teachers interviewed; also some teachers reported that English language learners who participated extensively in online discussion forums with other students improved their reading and writing skills. The capacity to communicate appropriately in new contexts with others from culturally distinct groups was another literacy skill seen to be developing in one cross-school project. It was widely acknowledged that digital literacies were also being developed as students learned to apply different tools and resources to their learning needs, participate in the larger digital world,

and assume appropriate voices for engaging in educational discussion in blogs, forums, and when using email. A high school teacher reported that:

> [Students] are learning about the etiquette of how to communicate with people [they've] never met before. And that there is a very professional attitude that has to be, a mature attitude that has to be taken up by them. Which is forcing them to go beyond their MSN Messenger and Facebook, and that kind of dialog. So that they are becoming dual technology users in my mind. Like, there is that one very casual sort of dialog that they have in one realm of their technology world. And then they have the academic technology world. And I am trying to teach them that you can't say this and you can't say that. (Wideman, 2007, p. 30)

On the survey of TeL students, they indicated that on the whole they viewed science and technology as more important than they did at the beginning of the project and that their confidence in their ability to succeed in the subject increased. According to teachers, students started to enjoy science and technology more than they had previously; they were more engaged in and motivated to learn by the inquiry-based approaches that teachers had began to try; students took more ownership in their work; and better teamwork skills had begun to develop. This view was supported by one teacher who said:

> I have witnessed or noticed that students are more engaged, they are more motivated. They seem to be really into the science, and some of them have chosen science as their favourite subject now whereas it wasn't before. (Owston, 2005, p. 25)

As for mathematics, teachers reported that students enjoyed the mathematics activities they introduced from the course and that students found them very engaging. They both saw signs of improvements in students' self esteem, attitudes, motivation, and better on-task behaviour as a result of TeL activities. We noted improvements in engagement, interaction, and higher level discussions in about half of the classrooms in which we observed. On the other hand, by the end of the program, significantly more students reported on a survey at the program's end that they appeared to value mathematics less, felt it is of less importance to their lives, and found mathematics more boring than at the beginning of the TeL program. We could not discern whether these differences in student attitudes between science and technology and mathematics were a function of the subjects themselves or whether it was a program effect.

As a whole students in LC tended to improve their performance on provincial reading and writing assessment tests between the project beginning and end; however for most schools mathematics scores decreased. The extent to which these changes can be attributed to the project was unclear as LC was only one of several professional development initiatives in which teachers from those schools participated. We concluded that because there few significant changes in teacher practice, the program had minimal impact on students.

Discussion and Conclusions

Our study examined the findings of three evaluations of blended professional development programs from the perspective of situated design and implementation, development

of community, changes in teacher practice, and impact on students. The literature suggests that all four of these factors need to be better understood vis-à-vis blended professional development if we are to advance our understanding of the field. With regard to the situatedness, research suggests that teachers need the opportunity to learn on the job and try out ideas in their classrooms, as well as in other contexts, that are directly related to the curriculum they have to teach (Borko, 2004). All three programs that we studied provided that opportunity for teachers, but they varied in terms of how successfully they were able to accomplish it. There appeared to be a relationship between program structure, in terms of content and online expectations, and relevance. The more structure that a program imposed, the less flexibility it provided teachers to experiment with activities in the classroom at a time when they were planning on teaching them. ABEL, for example, allowed teachers to use the project resources whenever they wanted, whereas TeL had a fairly rigid timetable for teachers to complete specified activities. At the same time flexibility seemed to be directly related to online participation. In other words, a highly flexible program like ABEL saw weak online participation and the most structured program, TeL, saw relatively strong participation. Therefore, developers of blended programs need to be aware of these trade-offs when designing the overall structure of a program.

In the three programs a sense of community developed among participants. We would not characterize any of the programs as a "community of practice" as the term was articulated by Wenger (1998) *i.e.*, as "a collection of individuals sharing mutually defined practices, beliefs, and understandings over an extended time frame in the pursuit of a shared enterprise." Rather they functioned as a community of teachers striving to improve their professional practice. On the whole teachers did not engage in online discussion very extensively, a problem documented by other researchers of online communities (Charalambros et al., 2004). Therefore, the face-to-face component of the blended experience became critical for continuity and for strengthening the sense of community. This finding is consistent with the work of Rovai and Jordoan (2004) who found that teachers in a blended learning graduate course experienced a greater sense of community than those in either traditional or fully online versions of the course. Furthermore, we found that a shorter period of time between face-to-face sessions resulted in a stronger community, so the blended model that had face-to-face sessions interspersed throughout the school year is more effective than the same number of days concentrated into a summer institute or similar intense session.

All programs had as a major goal to change teacher practice from a traditional pedagogical orientation to an inquiry-based, student centered approach. We found evidence that all three had some impact on teacher practice in directions intended by the program developers, especially ABEL and TeL. The degree of impact seemed to be related to how closely the programs met teachers' immediate needs: the move relevant the programs were to teachers' everyday work, the more likely they were to change their practice. This change, in turn, was directly related to the degree of impact on student work.

In conclusion, our study supports the contention that blended learning is a viable model for teacher professional development. The approach allows teacher learning to be situated in classrooms where teachers learn best, it provides access to on an online community where collegial sharing and discussion can occur, and it offers face-to-face sessions that can strengthen community building. Moreover, blended learning can have a positive impact on teacher

classroom practice, and consequently, there is some evidence that student attitudes toward learning and achievement can be enhanced as well.

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