The ABEL Project

First Interim Evaluation Report

July, 2003

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Technical Report 2003-2

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1. Introduction

The Advanced Broadband Enabled Learning (ABEL) Project that this interim evaluation report addresses is a technology-mediated teacher professional development program that was funded through the CANARIE Learning Program and ABEL partners at the start of 2002 for a two-year period. The project's mission statement is as follows**:** "The ABEL Project will develop a professional development program that engages a new culture for teaching and learning through the use of broadband networks and information communications technology." The overall objectives of the Advanced Broadband Enabled Learning Project are to:

- establish an interactive collaborative learning model for educational delivery and teacher professional development;
- support the dissemination of leading-edge instructional design and educational expertise; and
- develop the basis for sustainable inter-jurisdictional and inter-institutional collaboration in supporting professional development of teachers.

Participating organizations include York University, the University of Alberta, Edmonton Public Schools, the York Region District School Board, the Toronto District School Board, and Seneca College, as well as other public and private partners. Thirty-two teachers from six secondary schools, three in Edmonton and three in the Greater Toronto Area, are participating in the learning component of the project.

This report first provides a literature review pertaining to research and development work in the area of broadband implementation in education to help inform project development. It then presents interim findings on the state of the project as of June 2003. The data sources used include the following:

- survey data on participant teachers' teaching philosophies, practices, and technology experience
- interviews with all participating teachers and principals
- interviews with project leads and management team
- observational notes from large and small group learning event videoconferences
- case studies of four teacher learning projects
- system usage data supplied by management and learning teams.

2. Literature Review

This chapter provides a review of literature related to the use of broadband technologies in education, with a particular focus on videoconferencing and case studies involving it that are relevant to the ABEL context. Among the issues it explores are: the impact of broadband tools and technologies on teaching and learning; changes to pedagogical practices that result from these new technologies; obstacles and limitations to full use of the technologies, and participants' perceptions of ABEL-enhanced educational practices. The review is divided into three parts: the first part summarizes work addressing general technical and logistical questions regarding these technologies; the second part looks at literature on teaching and learning; and the final section focuses on specific implementations as reported in the literature. References are listed at the end.

2.1. Technical and Logistical Issues

Although its specific applications vary in different contexts and for different purposes, it is fair to say that Internet use has become quite ubiquitous in many educational arenas. Broadband, defined as "the technical capacity to transfer at a rate of 220 kilobits per second in one direction," permits Internet users to "run quality, high-speed applications (such as video)" (Sern,1999:9), which have been used in areas such as telemedicine and distance schooling for some time but which are now making their way into mainstream educational settings.

There is a widespread perception that participants in distance education, and particularly those who reside away from major centres, receive particularly significant benefits from video technologies. Reports by Roine-Taylor et al. (1998), Taillon (2001) and Martineau (1999) cite its usefulness for education-at-a-distance: Martineau's report on connectivity issues calls videoconferencing a key application, and supports bi-directional multimedia applications, including videoconferencing, for remote and rural areas. Videoconferencing is recognized as a significant potential contributor to community building within and among isolated groups, such as rural aboriginal communities in the US and Canada (OTA, 1995).

Two interesting issues arise here. First, it is worth noting that paradoxically, the same distances that make broadband technologies so useful for remote areas also render them very expensive, due to the costs of the fibre optic access that must be provided (BC, 2003:20). Furthermore, even where basic provision of facilities is not an issue, insufficient funding can be problematic: the final report of the Instructional Design (ID) component within the LearnCanada project notes that while use of videoconferencing technology improved considerably over the course of that project, a shortage of funding proved an ongoing challenge that tested the patience and perseverance of participants (LearnCanada, 2002). Second, it is significant that while broadband technologies have been and continue to be useful for distance learning, their utility extends well beyond that context: in a university-level implementation of online learning, consisting of an asynchronous framework making use of broadband technology targeted to distance

learners who would access course materials from individual desktop locations, Harris and DiPaolo (1996: 447) were surprised by the high level of use of and enthusiasm for the technology by on-campus students, who they had expected would simply attend classes in person.

Other technical concerns are raised in the literature. Reporting on their examination of a teacher-training program that used videoconferencing to connect a faculty of education and a primary school for the purposes of observing classroom teaching and discussing pedagogical issues, Kinnear et al. (2002: 25) stress the importance of good quality links, stating that technical quality "predicts to a certain extent the overall degree of satisfaction for those involved" in videoconferencing. In a similar vein, Whittaker (1995: 511) points out that adding video to audio can impair communication by detracting from the quality of the audio component, a contention that argues strongly for the importance of adequate bandwidth to accommodate both components. And in a Finnish study (Roine-Taylor et al., 1998), which explored, among other things, the use of videoconferencing in a remote school in Lappland, where over a three-year period 17 percent of learning was conducted virtually, found that audio quality was the single most important technical issue, in the sense that poor vocal transmissions at various points during the study were thought to reduce both motivation and learning (25-26). Nevertheless, overall achievement (as assessed through final examinations) was not compromised. (For further discussion of the relations between bandwidth, audio and video quality and performance, and participant satisfaction see also Daly-Jones et al, 1998; Papa & Spedaletti, 2001, Tiene, 2003.)

In 1999 in British Columbia, the Provincial Learning Network Policy Working Group (BC, 1999) was assigned to assess videoconferencing in BC's secondary and post-secondary schools in regard to its usefulness, both current and potential, and to making recommendations for furthering its use. Part of the report focuses on *connectivity,* which is the capacity of facilities at different sites to be linked, and *interoperability*, or the extent to which these distinct systems can be coordinated to facilitate videoconferencing success (1999: 10). In addition, it addresses logistical questions, such as classroom space and configuration, scheduling, fees, technical support, and points to limited bandwidth, uneven quality of service, and overall cost as among many interrelated factors that might tend to limit videoconferencing's potential (1999: 12). The BC report identifies five critical challenges to successful integration of videoconferencing: adequate bandwidth; network component integration; standardized equipment; appropriate classroom design and configuration, and sufficient and useful professional development for teachers (24).

Generally, however, the literature views broadband, and especially videoconferencing as one of the applications it makes practicable, in a positive light with regard to education at multiple levels and for various participants. And the perceived significance of videoconferencing as one of a number of useful broadband implementations is evidenced by the many technology plans, devised by school districts, that include it as a priority (see, for example, Connetquot Central School District, 2001; Pasack Valley, n/d; and Pfennig et al, n/d).

2.2. Teaching and Learning

Work that addresses questions of professional development for teachers in relation to broadband, particularly videoconferencing, includes that of Emond et al. (2001) and Moore (2001). Moore, in particular, discusses broadband as effective for facilitating the convergence of multiple applications and activities, allowing a teacher to "sit at her computer, search a Website for lesson plan ideas, preview a high-quality video clip that she plans to use the next day, carry on a telephone conversation with a colleague in another state (without long-distance charges), and listen to her favorite BBC radio broadcast, all at the same time." Other evaluations cite broadband, and videoconferencing in particular, as a timesaving technology, allowing teachers to collaborate with colleagues in the same institution or around the world (Fetterman, 1996; MOREnet, 2002; Owston, 1997); overall, it is understood as being beneficial for the development of teachers' knowledge and pedagogical techniques.

The LearnCanada project (Spence, 2002) is an example of a Canadian implementation that had as its mandate the creation of a broadband enabled learning community for Canadian K-12 teacher professional development. Expertise from various disciplines was integrated into the design and implementation of professional development methodologies that maximized teacher engagement and collaboration during both synchronous and asynchronous peer-to-peer interaction. Teaching, research, and professional development teams were involved in the design and evolution of an innovative videoconference environment dedicated to the optimal engagement and meaningful contribution of all participants. Findings of one evaluation component of this project, a summative questionnaire designed to evaluate the impact of broadband technology on teachers' professional development, indicate that teachers perceive the project, and by implication the broadband/videoconferencing technologies incorporated in it, as having a significant positive effect on their daily teaching methods. Moreover, when asked about the specific areas of professional development that broadband technology would be most conducive to enhancing, ninety percent of the teachers provided responses that identified multiple areas of professional development that this technology could enhance (Spence, 2002). Seventy-five per cent indicated that participation in the project led them into regular communication with other teachers across the country, communication that would not have happened otherwise.

The LearnCanada project's final report from the Instructional Design Team (LearnCanada, 2002) highlighted several important "lessons" from the project, including the following:

- Time is a commodity for teachers. If you want participation you have to create time.
- Collaborative projects require a high degree of initiative on the part of the participants.
- New technologies require a high level of technical support, time and perseverance.

For learners—and here we include both teachers and students—the potential benefits of broadband are significant. First among these is the degree to which these technologies allow real-time communication that fosters a sense of connection for participants: the importance of this real-time aspect of broadband, particularly as applied to videoconferencing, cannot be overemphasized. Real-time communication using multiple media allows for a richer experience both cognitively and affectively – "Broadband communication technologies give the opportunity to realize advanced and interactive virtual classroom situations…[which allows] real time communication…[and] a rich kind of communication between the teacher and the learners as well as among learners" (Papa & Spedaletti, 2001: 231; for similar discussion see also Fetterman, 1996).

This real-time communication advantage is further articulated by Peters (2001). Although he works primarily in a university context, the comparison Peters draws, between both audio- and videoconferencing on one hand and more traditional forms of distance education on the other, holds across educational levels and for all participants. For Peters, the latter seems to be "content with merely enabling access to studying" while the former facilitate interpersonal relations in ways that "provide students with help and support through communication, thus returning to distance education the lost essence of learning and teaching" (2001: 140).

As noted above, the study by Kinnear et al. (2002) examines the usefulness of a videoconferencing link between a primary school and a teacher education facility. While focused on beginning teachers, rather than on either school pupils or practicing educators, this study is helpful for understanding advantages of videoconferencing technology in addition to those associated with immediate contact with peers; in Kinnear et al. teacher candidates remotely observed classrooms "in action" and were then able not only to reflect on their observations but also, and particularly relevant to the ABEL project, to engage in videoconferencing with the practicing teachers they had been observing, in order to further their own learning. Citing Burt (1997) and Mason (1994), Kinnear et al. (2002: 23-24) emphasize the importance of human interaction in the development of understanding, and argue for videoconferencing as a way to access subjective experiences and ideas of participants, so as to supplement observational data.

Occurring as it does in "real time", face-to-face communication is widely believed to be the most authentic and the most useful form of interpersonal relating, in that it allows individuals to form multi-sensory perceptions of an interlocutor's cognitive understanding, affective state and level of comfort (Whittaker, 1995; Daly-Jones, 1998). Preferable though it may be, however, it is not always practicable. In such cases videoconferencing proves a useful (and with improvements to bandwidth and other technical aspects a closer) approximation of in-person contact. Students in Sewell (2000), for example, asserted that the videoconferences they had participated in were somewhat less intimate than one-on-one interactions: nevertheless they preferred it to simple audio or email, recognizing that through videoconferencing they were able, as one put it, to "learn a lot about people through their body language" (Sewell, 2000: 8).

In his research involving secondary school classrooms taking part in the Learning through Collaborative Visualization (CoVis) project, Fishman (1996) investigates

questions around why and how students use videoconferencing and other broadband technologies. Following Korzenny's (1978) notion of "media propinquity"—a subject's perception of closeness to another during mediated communication—Fishman argues that videoconferencing ought to be perceived as more useful than text-based tools or audio tools, because it more closely approximates face-to-face communication (Fishman, 1996: 44). Not surprisingly, his research subjects rated a particular videoconferencing tool (Cruiser) as useful for accessing individuals at a distance, outside the classroom (152). The somewhat more surprising finding that the tool was put to limited use in his study is attributed by Fishman to a lack of opportunity (in classrooms in which the teacher was not comfortable using it, or for which there were few outside contacts made available *for* interaction), and to the complexity of its interface in terms of operation: it was rated difficult to use by a majority of subjects (196).

Whittaker (1995) reviews literature citing non-verbal cues as helpful for discerning participants' cognitive understanding and for recognizing their emotions and attitudes, and as useful for organizing regarding turn-taking and the like. He examines a number of studies that seem to suggest that while it has not been conclusively demonstrated that the addition of a video component (or indeed even face-to-face interaction) contributes significantly to improved cognitive problem solving (508-509), video nevertheless "supports the transmission of social cues and affective information" and "is perceived to…lead to more natural conversations that are more interactive [and]…allow one to determine whether one is being attended to" than audio alone. Berge (1995) similarly emphasizes the importance of synchronous communication (whether video or audio) for the promotion of social interaction.

Daly-Jones et al. (1998: 34) challenge the views taken in Whittaker (1995) and elsewhere (for example Anderson et al, 1996) regarding video mediation of communication as arguably offering little more than audio on its own. Daly-Jones et al. report on experiments that examined various configurations of audio/video quality, camera placement, participant logistics and so on, to conclude that interpersonal awareness was much improved with the use of video. They also emphasize the importance of recognizing that subjective understandings of videoconferencing as beneficial "cannot be overlooked" as a significant component of and contributor to the success of video technologies in communication.

Relatedly, in another study (Tiene, 2003) students also found videoconferencing helpful, though in the particular context of the study, where a single camera meant that only one individual could be seen at a time, they evaluated class discussion as less intimate and less spontaneous than in a traditional classroom. Interestingly, however, some researchers suggest that rather than being less intimate, de facto, than face-to-face communication, videoconferencing actually "supports dialogues which, through close-ups, can have an *even more penetrating effect than physical presence*" (Peters, 2001: 237, italics added). It may be that participants' perceptions of the spontaneity (or lack thereof) of discussion are coloured by preconceptions about the quality of the technology, and expectations about what it ought to be able to do; Kinnear et al. (2002: 25) note that students who had had previous experience with videoconferencing, and therefore had more reasonable

expectations as to its quality than those who had not, tended to report a greater degree of satisfaction with their experience of its use.

While comparisons between videoconferencing and face-to-face communication may be useful to a significant degree, for their part Dourish et al. (1996) argue that video must be examined "as a communicative medium in its own right" and not merely compared with the real-world baseline of face-to-face communication. Their point is that as video becomes more ubiquitous it will evolve its own particular communicative practices, and have its own implications, that must be explored on their own terms; for them "the role of video communication is not simply to simulate copresence…[but to] extend the range of possible encounters between participants, both in form and opportunity" (1996: 37).

But it is not only social skills and communicative practices as such that benefit from technological advances. Harris (1998: 8) outlines how videoconferencing facilitates a "telepresence" that makes learning more real and relevant, and also enumerates various other learning activities, such as question-and-answer sessions, information exchanges, telementoring, global classrooms, peer feedback activities and parallel videoconferencing as pedagogical activities that can help learners to increase their awareness of world events, making issues that are less immediate to them more meaningful, and help them develop connections with other youth and adults in many walks of life; examples include Canadian students virtually "meeting" Prime Minister Chretien (Zak, 99: 10), or being taught music by Pinchas Zukerman (Hendry, 2003: 52). More generally, videoconferencing permits them to "become aware of what is happening in the world and the ways in which we are interdependent" (Brady, 1999: E3).

This view is supported by the perceptions of learners themselves: according to Sewell (2000), who interviewed youth at the Broadband Applications and Demonstration Laboratory (BADLAB) to assess the impact of broadband videoconferencing on communication and learning, students valued videoconferencing for its ability to expose them to different environments, cultures and ideas in more direct ways than traditional textbook-based learning. In the BADLAB study videoconferencing was also understood to augment learning by enabling discussion of topics such as the lectures of guest speakers heard simultaneously by groups of students at different locations. Here, one aspect understood as beneficial was increased exposure to the ideas of both the guest speaker and the other learners, which is understood to help students move away from "the same ideas going around in circles" within the confines of their own classroom (Sewell, 2000: 7).

Kinnear et al. (2002) found that "pupils had noticeable gains in their concentration spans and appeared more aware of their appearances and styles of oral communication" and that they "adapted very quickly to the presence of the camera in the classroom" (2002: 25-26). It is further worth noting that initial concerns that the primary school pupils being observed in that study by the trainee teachers would be captivated and/or inhibited by the presence of the technology did not materialize (Kinnear et al, 2002: 21). In fact, "the teacher of the primary school class noticed that her class seemed more motivated…and were more concerned with their…oral communication than they normally would have been" (24-25). This is significant because it helps allay concerns that the novelty of

broadband technologies as such, including videoconferencing, may detract from learning in the initial stages: Kinnear et al. (2002: 21) suggests that this is not the case.

2.3. Specific Implementations

Much of the literature on videoconferencing in particular, and broadband more generally, takes a theoretical orientation to questions of its usefulness. Consequently, there seem to be relatively few field or case studies that actually evaluate implementations specifically in terms of improvements to learning or changes to pedagogical practice. Nevertheless, it is useful to look at the work that has been done in this area, in order to help inform the process and the outcomes of the ABEL project.

Focusing on two-way desktop videoconferencing, Zsiray et al. (2001) offer a helpful summary of a number of application types which they organize into three categories: one-to-one, one-to-group, and group-to-group applications. The first category includes collaboration or technical discussion between teachers and colleagues, and counseling or special needs-related interaction between teachers and individual students. One-to-group videoconferencing includes applications for training teachers (similar to that outlined in Kinnear et al., 2002), and professional development activities involving consultants and groups of teachers, and the facilitation of courses simultaneously at more than one institution despite a shortage of specialized teachers. As examples of group-to-group implementations, the authors cite collaborative art study projects between the Utah State University and an elementary school in Nevada, as well as videoconferencing connections that have been made between elementary and secondary students in Cache County, Utah, where the latter assist the former with presentation design.

Videoconferencing has been demonstrated as particularly useful for language learners. Butler and Fawkes (1999) summarize a study that used desktop videoconferencing to develop “real communication…between real people and in real time, rather than an artificial role-play in the classroom” (1999: 46). In that study, 18 year 12 and year 13 British students studying French used videoconferencing over a period of five months. Two-thirds of the students showed “a marked improvement in their spoken French in terms of accent, intonation, accuracy and fluency…[and] confidence in speaking” (46). Another study of videoconferencing in the language learning context is that of Rose et al. (2000); this article reviews a project called TeachSpeech, which uses videoconferencing as support for language and speech therapy in schools. Here the authors cite greater administrative and pedagogical efficiency, financial savings, and focused interactions among students as among the benefits.

Another language-related study involves California’s Project REBUILD (reported in Green, 1999), in which "CNN quality interactive videoconferencing systems used across the K-12 spectrum and at all grade levels” have been shown to “accelerate student learning, improve self-esteem and increase individual student achievement,” particularly for students with low proficiency in English. Students participating in that project have dramatically improved test scores in comparison with students not involved in the study, a result the researchers believe can be directly attributed to the use of advanced technologies, including broadband and desktop videoconferencing. As well, schools in

the Pomona Unified School District are involved in "web-casting and videoconferencing to deliver interactive professional development to both administrators and teachers throughout the district…with a focus on K-3 professional development on reading literacy" (CENIC, 2002). Additional examples of language learning contexts using videoconferencing, but which focus on primary and college-level applications, can be found in Firestone, 1999.

The natural and social sciences are other curricular areas in which videoconferencing has been used to augment learning and teaching. Jobe (1999) cites some of the learning activities that have been facilitated through videoconferencing at elementary schools in Tennessee and North Carolina, which have involved not only groups of students collaborating together but also virtual field trips to the Smithsonian Institute, Antarctica, Ireland and Belgium. Secondary-school-level implementations she discusses include a collaborative project involving high-school students in New Jersey and university students. In that collaboration videoconferencing is used as a kind of electronic writing workshop, which offers secondary students "university feedback and the opportunity to experience other cultures, and [the university students] the challenge of mentoring younger writers." According to Jobe, "The liveliness of voice and image make this technology deliver the fullness of rich, human contact." Jobe's list of the benefits of videoconferencing, drawn from that study, includes its appeal to different learning styles; exposure to primary sources for multicultural education; increased motivation, and improved technical, research, presentation and communication skills.

In April of 1996, a project entitled the Learning Community brought together learners and teachers from four cities in Ohio for a multidisciplinary investigation and exploration of the environmental, economic and cultural importance of rivers (Burke et al, 1997). Using broadband, fiber-based audio/video connections, desktop videoconferencing connections, and computer-based Internet/e-mail connections, a telecommunity was created, involving by July of 1997 three elementary and three secondary schools, with the technical possibility of four of those sites interacting at a given time. The project involved videoconferencing in professional development and collaborative opportunities for teachers, and in student projects involving online collaboration with peers and research (including the sharing of results) with professional scientists. Burke et al. (1997) conclude: "Telecommunication technologies [including] videoconferencing units…[do] indeed increase communication possibilities for teachers and students." They state: "Using the power of computers to communicate, analyze and evaluate data and prepare presentations, students were able to solve real-world problems. …Videoconferencing allowed students to interact with other students in real time to discuss research findings and also provided teachers with direct access to consultants and specialists."

Another project, more specifically history-focused, connects students in North Dakota schools with others along the historic Lewis & Clark Trail, offering "a comprehensive and easily accessible collection of resources that provide enriched educational experiences", including videoconferencing and videostreaming, for teachers and students (Internet2, 2003b). In the area of biology and nature studies, the Digital California Project includes implementations such as the Parks Online Resources for Teachers and Students (PORTS) Project, a "virtual field trip project" that incorporates archived multimedia

resources and the potential videoconferences with interpreters in state parks (CENIC, 2002).

Earthwatch Global Classroom is another science-related implementation which uses videoconferencing to connect the Mote Marine Lab in Sarasota, Florida, with a school in Rhode Island; similarly, the Jason Project explores climate-related issues and involves students in videoconference with meteorologists and other scientists (Internet2, 2003a). And the Ward Melville Heritage Organization (WMHO, 2002) has devised and implemented, at the middle-school level, a distance exploration of wetlands, involving videoconferences with a naturalist working "right at the water's edge."

Cifuentes and Murphy (2000) report on a study named Cultural Connections, which involved students, a significant number of whom were designated at-risk, in grades 5, 6, and 8 in two Texas schools. These students engaged in videoconferencing nine times over an academic year. Activities included collaborative projects, portfolios which students created and shared with their counterparts at the other school, and reflective writing about their experiences on the part of both students and participating teachers. Cifuentes and Murphy list four themes that emerged as significant for both teachers and students: growth in terms of increased multicultural understanding and decreased cultural misconceptions; empowerment in the sense of "an increase in academic aspirations among…at-risk…students"; comfort with technology use; and mentoring between teachers, between students and teachers, and among students (2000: 76-79). They conclude that "teachers and students are eager to participate in learning activities across distances and that…computer networking may be of most benefit to students who traditionally do not perform well in schools." Further, they assert, "distance technologies can foster powerful relationships" among teachers and students (80-81).

In the Canadian context, research has been done into the use of two-way videoconferencing in five First Nations communities in northern Canada (Taillon, 2001). Taillon points out that in addition to allowing isolated and diverse communities to showcase their cultures, videoconferencing has helped to improve learners' self-esteem, and has allowed them to remain in their home communities, with their families, rather than travel sometimes enormous distances to attend school. This latter finding reflects that in Roine-Taylor et al. (1998), the Finnish study noted above, in which students responded positively to the possibility of remaining at home for their education rather than transferring to another locale.

2.4. Conclusion

While there is a very limited range of research available on broadband use to date, what evidence there is suggests that the potential of broadband as a technology to enrich education is considerable. By enabling real-time, multimodal, and interactive connections between groups of learners (and teachers), broadband offers a powerful new medium that when integrated into the appropriate pedagogy can help teachers foster learning that is both more collaborative—as students are afforded the ability to work together with others—and more authentic, extending beyond the artificial boundaries of the classroom. But the experiences related in the reports considered here suggest that success is only

likely when a number of preconditions are met. These include the development of a "virtual teacher community" with a strong and ongoing commitment to exploring new forms of teaching, and which provides a collaborative networking space in which teacher to teacher connections—the basis for project-building—can be built and sustained. Reliable and high quality videoconferencing signal transmission is also critical to success. Other important requirements include a strong technical and administrative support structure, extended professional development opportunities, teacher time for project development, and sufficient financial resources to support project implementation.

3. ABEL Projects and Resource Use

This chapter outlines the technical architecture of the ABEL network resources and components and reviews usage data from the past year. It also provides a list of student learning events which made use of the videoconferencing system that took place over the past school year.

3.1. Network Architecture

The ABEL network architecture is based on the CA*Net 4 network, to which all participants have to be able to connect. CA*Net 4 serves as the network backbone that provides the necessary bandwidth and freedom from congestion that makes the multicast videoconferencing used in the project possible. However, local connectivity issues can create a bottleneck for the resultant network traffic. At York, for example, the CA*Net 4 traffic coming to campus has had to share "throughput space" in the local network architecture with the regular Internet traffic entering and leaving campus, which can lead to badly degraded performance in videoconferencing (which has been an intermittent occurrence over the past year). CA*Net 4 traffic had initially only been assigned 5 megabits/second of bandwidth in the York data lines, but this proved inadequate, and so the bandwidth was doubled. However even that proved insufficient to resolve intermittent videoconferencing breakdowns. An Orion node being established on York's Keele campus will be operational in the fall of 2003, which will provide more direct CA*Net 4 access to York. It is anticipated that this may bring some improvement in the reliability of videoconferencing at this location.

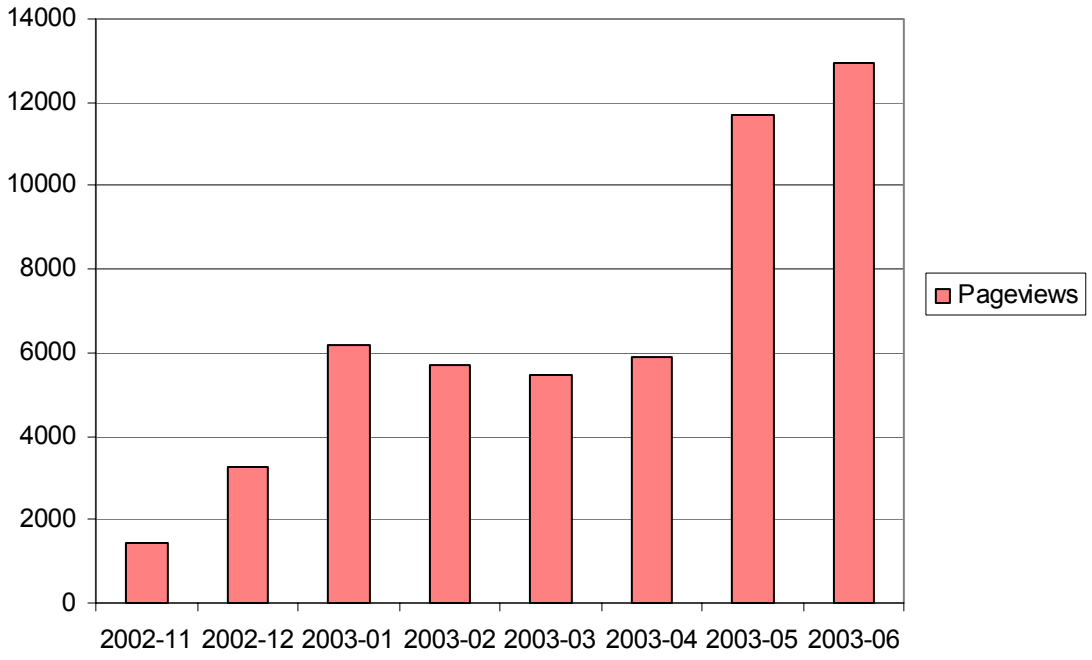
A number of applications tools used in the ABEL project are housed at York at its main data centre. The two chief ones until late spring 2003 were the ANLON learning content management system (since dropped from the project), and Tutor Buddy (renamed "Insite"), which streams video selected from an online catalog of educational videos. One of the ANLON replacements, WebCT, is housed at York as well. A recent addition to the set of ABEL learning resources, the Forever Learning Video Library, is also based at York.

Other ABEL applications and tools are served from different locations, including Galileo's IO software which is hosted on the Galileo server in Alberta. The Community Zero Web site (sometimes referred to in the project as "the ABEL Community site"), which serves as the central nexus for ABEL resources, chats, discussions, event calendars, help files, and tool links, is housed on a server at Community Zero, a Canadian company. A number of other resources are served from their own base, such as Estat, the Statistics Canada statistics toolset and teaching resource; Historica, the history project and resource site for educators and students; the National Film Board, which provides access to about 10,000 titles from its library; and several TVO resources. The Ontario Ministry of Education Learning Object Repository, which was brought to the project in the spring of 2003, resides on a Ministry server.

3.2. Usage Data and Project Activity

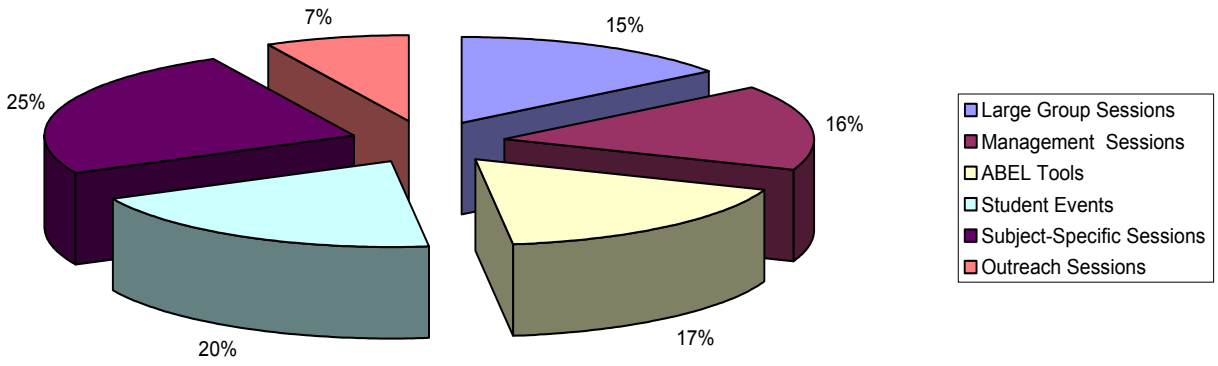
In spite of repeated requests to the ABEL Technical team, very little usage data has been made available to the Research team. Part of the difficulty arises because most of the tools and resources being accessed by ABEL participants are hosted remotely, and ABEL traffic is intermingled with other access traffic at those sites. At the time of writing, the only quantitative reporting received is data on the number of page views on the ABEL Community site, which are shown by month in Figure 1.

Figure 1: ABEL Community Page Views per Month



Usage of the site has shown steady growth since its inception. The dramatic increase in activity in May and June reflects the large jump in ABEL activity generally in the last few months of the school year, as many ABEL teachers implemented projects and activities that they had been planning over the previous months. This increase can be seen clearly in Figure 2, a graph of ABEL videoconferencing activities over the year.

ABEL Broadband Events Totals by Type Usage for 2002-2003



Of the total of 81 videoconference events that took place in the 2002-03 school year, 12 were large group sessions in which all teachers were asked to participate; 13 were management sessions for team leaders, Advisory Board meetings, or similar events; 14 were ABEL Tool events, which focused on learning to use one ABEL tool or resource and considering its potential applications in project work; 20 were subject-specific meetings in which groups of teachers in a specific discipline or subset of disciplines (math, English, art, science, or social studies) worked together to brainstorm and plan for collaborative projects; and 16 were student events, in which videoconferencing was used with students in the course of a curriculum project implementation. With two exceptions occurring in the late fall of 2002, all of the student events took place in the April-June time frame, and student events comprised 20% of the total usage through June 2003. A total of 20 subject specific sessions (an average of four per subject area) were held from January to June. The tools events covered the use of the ANLON content management/authoring system (2 sessions), Tutor Buddy, video streaming, the Learning Object Repository, WebCT, IO, and Dreamweaver. A minority of the tool sessions took place as face-to-face events at school sites rather than by videoconference.

The major student learning videoconference events are listed in Table 2, together with brief descriptions and the month of the event.

Table 2

Event	Description	Month
Space event	Interactive talk by astronaut Steve McLean hosted in York Region	November 02
Forensic science	Presentation by Toronto detective at Middlefield on forensic advancements; videoconference with Victoria on temporary line	December 02
Peace and Security in the 21st century	Panel discussion and Q&A with Sen. Roche and others; J. Percy Page hosts	April 03
Innovative Thinkers Series	Two artists from Banff Centre for the Arts discuss landscape in their work from Banff via videoconference with Ursula Franklin Academy (UFA) students	April 03
Innovative Thinkers Series	Lawyer discusses patenting life and legal issues related to same, and answer questions at UFA; J. Percy Page students participate	April 03
Innovative Thinkers Series	Peace activists discuss work and answer questions at UFA; Alberta students participate	April 03
Innovative Thinkers Series	Dr. Ursula Franklin at UFA interviewed on peace work by UFA students, viewed by Alberta students	April 03
Embryology presentation	Presentation by Prof. Bagnall on fetal development at Victoria with remote participation at Middlefield C.I.	April 03
Math P2s project	Mathematics problem solving challenge shared between J Percy Page and UFA students with academic mentors (2 videoconferences)	April-May 03
Hanna's Suitcase	ANLON-based novel studies unit culminating in Middlefield student videoconference Q and A with author (held in conjunction with Nat'l Library of Canada Broadband Book Club)	May 03

Ontario Science Centre virtual field trip	Genetic fingerprinting lab: Middlefield students, with remote participation by J. Percy Page class	May 03
John Manley address	Address by John Manley at Vaughan S.S. and ensuing discussion, , with J. Percy Page students and staff online	May 03
Barbara Reid	Students at Middlefield have workshop with author/illustrator Barbara Reid (2 schools in Ottawa and Nunavut participate)	May 03
Ancient Greece project	Grade 11 students at UFA tutor two classes of Calgary grade 6 students in classical Greek history, answer their questions	May 03
Human Rights Fest	J. Percy Page and Victoria students participated in Vaughan presentation by Raheel Raza on "Women and Islam"	May 03
Energy project	Culmination of web-based collaborative project work as science students at Vaughan and Middlefield presented and discussed their work on energy consumption and production via videoconference	June 03

Several other activities and project were implemented that did not make use of videoconferencing. These included:

- The development and deployment, using IO, of a student survey project at J. Percy Page using data from Estat on Canadian diversity, unity, and regionalism
- Student creation of video tutorials on the use of graphics calculators at UFA
- An Arts Group project to create an animated video that advocates the arts in holistic learning involved English, graphics, composition, and animation students at Victoria
- The application of Tutor Buddy video segments in several courses in York Region
- The use of IO to design and deliver a Grade 11 English ISU project for a class of ESL students.

4. ABEL Large Group Learning Events and Participant Survey Results

4.1. Learning Needs Survey

Prior to and during the ABEL Summer Institute in August 2002, ABEL community members (teachers, administrators, and education faculty) completed a survey intended to collect benchmark information on ABEL participants and assess their professional development needs. There were 33 respondents out of a total possible number of 37. Fully half of those responding indicated that they either possessed or were in the process of obtaining a graduate degree, or were planning to commence a graduate-level program in the near future. Chief among the gains that most hoped to achieve through the ABEL project were professional upgrading, contact with other teachers, educational experts, development of an online community, and opportunities to share ideas and project work. Other significant but somewhat less universal goals included contact with technical experts, access to digital content, and opportunities to do graduate level research. Very few respondents named increased release time and reduced workload and higher salary placement as personal goals.

Seventy-one percent of respondents reported that at the inception of the project they possessed advanced or moderate computer skills—the latter consisting of the ability to "run a wide variety of applications". Consistent with these skill levels was the relatively infrequent mention of technical training and skills development as interests in relation to the ABEL project, although skills sessions were frequently named among activities participants wished to undertake, presumably in order to develop their proficiency with the particulars of the video streaming technology and digital learning objects they hoped to use to enable their students to collaborate for project work. Somewhat less frequently mentioned were interests in using videoconferencing to connect with other teachers and to form or participate in online learning communities: teachers' goals appeared to a significant extent to be oriented toward classroom practice. Other activities in which respondents wished to engage within the ABEL context, both in general and specifically with respect to the upcoming ABEL Summer Institute, included hands-on activities related to online tools and resources, online and face-to-face discussions, as well as small-group, subject-specific videoconferences. They wished to learn more about the ABEL project itself, as well as the technologies and tools related to it. About 40% of the teachers indicated a desire to participate in an action research project and/or a case study. Anecdotal comments by respondents suggest a high level of initial enthusiasm about the project as a whole, with the following comment by one respondent serving as a summary of many of the sentiments expressed:

> I am very interested in using technology to enhance the delivery of instruction to my students. Ultimately, this program interests me as a means to a rather simple yet ever elusive end which is to motivate and see students achieve. I would like to be able to offer my students a method of seeing/hearing/interacting with

curriculum supporting experiences through technology. Any way I can enhance their understanding and improve their achievement is key.

4.2. Summer Institute Survey

In August 2002, most of the teaching staff and faculty in the project participated in the three-day Summer Institute held in Toronto. This afforded participants the opportunity to learn more about the project's rationale, goals, and strategies, and to begin to collaborate in learning teams in the design of project modules and applications of the technology. In addition a number of ABEL tools (ANLON LCMS, Tutor Buddy, IO) were discussed and demonstrated, as was use of the videoconferencing equipment.

At the conclusion of the Institute, 32 participants responded to an online questionnaire designed to ascertain their perceptions of its usefulness and effectiveness. In general, they rated the Institute "very good" overall. Comments indicated that they valued the opportunity to meet and network with colleagues, and found discussions with colleagues concerning the potential of the technologies that were demonstrated "beneficial" and "inspiring".

Other comments—in response to the question, "What do you need more information on?"—illuminated concerns with respect to technical support and hands-on learning, the involvement of students and of teacher colleagues not already participating in ABEL, and the need for guidance regarding logistical, conceptual and methodological issues such as record-keeping and how to begin and conduct action research. While it appears that some participants' needs may not have been fully met by the Summer Institute, at the same time there is tension between these perceptions and those of others who spoke of "information overload" and of a feeling of being "more than a little rushed" during the Institute.

4.3. Monthly Large-group Learning Events

September. In the first large group videoconference following the Summer Institute, Karen Andrews [the ABEL Learning Lead] reviewed the draft plan for the Learning Component, which described the roles and responsibilities of the ABEL teachers and support team members and mapped out the professional development program. Teachers were asked to generate lists of learning fundamentals and skills they wished to acquire, as well as objectives and learning measures for each.

October. The October large-group learning event incorporated a short presentation by Sharon Friesen of Galileo on inquiry learning, followed by each school presenting a critique of an inquiry learning project they had previewed. This was followed by presentations and discussions on the elements of inquiry, organizing your classroom for inquiry, and ways to collaborate with and support each other in implementing inquiry. Inquiry pedagogy resources and links were provided to participants. No survey data for this session have been reported.

November. The learning event in November addressed the issue of "collaboration at a distance". It commenced with each site sharing what was to be brief five minute presentation on this topic, although several ran considerably longer. The session also included round tables on building a shared culture, and facilitating subject-specific collaboration. Seventy-five percent of the 23 respondents to the followup survey about this videoconference rated the event as either "good" or "excellent" overall. Particularly appreciated were the format of the event, along with the session on distance collaboration; the subject-area project roundtable was less enthusiastically received, although a majority found these discussions at least "somewhat helpful" as well. The highest number of "dissatisfied" responses were made in response to the question about the technical quality of the event. Consistent with (and perhaps partly due to) this less than satisfied response to the technical aspects of the event, close to a third of respondents found the broadband environment offered either a "poor" or a "very poor" level of interaction, as compared with a face-to-face scenario. In contrast, of those who had utilized the ABEL tools sessions for training on the LCMS in the period leading up to the September 28th event, all had found them at least "somewhat helpful" with a majority rating them "very" or "extremely" helpful.

December. The focus of the December 12 learning event was on sharing the elements of inquiry by means of video clips developed at each site that illustrated aspects of inquiry. These illustrations were each discussed in turn after their presentation. A purely social element was also introduced; each group was to make some "gift" to share with the group at the conference (a joke, card, music, etc.) This event was observed from Ursula Franklin Academy; a shortened narrative of the event is presented below that illustrates some of the technical and other issues that the large-group events typically encountered in the fall and winter of the 2002-2003 school year. It needs to be emphasized at the outset that the lack of course release time for Ursula Franklin Academy (UFA) teachers in the project, combined with the after-school timetabling for the scheduled sessions in Ontario, led to lower-than-average attendance at most large-group events by the 11 participating UFA staff (many of whom would have conflicting after-class responsibilities) relative to all other ABEL schools.

> The learning event took place in the school's large (50' by 30') videoconferencing room, which had a cluster of tables pushed together in the enter of the room forming a large conference table with the videoconferencing equipment and monitor located at one end. Three Macintosh computers had been set up on the conference table by students prior to the conference. Two were connected to separate data projectors which sent images to 2 side-by -side screens – one was to show the conference chat through Community Zero, the other to serve as a backup, providing video clip access via the Web if the teachers' video could not be successfully transmitted via the videoconferencing system. The video for the conference itself was displayed on a large 36" monitor via the Vcon computer/conferencing unit.
>
> At 3:35, as the conference is just starting, Anne Kerr [the principal], a teacher, and 2 student helpers who set up the videoconferencing equipment for the session are discussing how to access the Community Zero based chat–they have not been

able to get it working The ID and password provided by Obadiah don't seem to work and there is some disagreement about which Web site they should be using to access the chat. Anne places a few cellphone calls to Obadiah, and after about 10 minutes of activity it is determined that someone has changed the default ID and password and so he sets a new one. At this point there are a total of three teachers of the 11 officially involved in the project actually in the room—most are focused on the activity around the computers and are not paying attention to the start of the videoconferencing. The quality of the video image on the monitor of Karen Andrews as she speaks is quite good, but the image has a remote feel to it as the camera is set to take a very wide shot of the entire room she is in.

Jim Poole (York's videoconferencing expert) comes onscreen to help one site fix the high levels of background noise arising from that site's failure to turn off the automatic audio gain control on its microphone. (It turns out at the end of the videoconference that there is the same problem at UFA, and Jim walks a UFA student helper through the proper setup after the conference.)

At 3:45 the UFA vice-principal and a fourth teacher enter the room. Teachers are still not focused on what Karen is saying. The Seneca site is trying to mute its mike, which has also been introducing background noise.

After a short introduction by Karen, Jim starts relaying the first video clip on inquiry learning produced by teachers over the videoconferencing system. The audio is suddenly lost at all sites after a few seconds of playback. He restarts the video and this time sound works properly.

By 3:55 a student teacher has joined the group–find out later she is a York teacher candidate, and to date she has had no involvement with any ABEL activities; this is her first exposure to the project. It's a little hard to see the projection screens as all the lights are on in the room. Shortly after four someone turns them off.

As the videos are being displayed on the monitor, the four student helpers in the UFA room are occasionally talking amongst themselves or making asides to teachers. Only a minority of staff at any one time are paying attention to the videoconference. On most of the video clips being played the audio is poor, making it hard to hear. In clips of actual class activities, the background noise levels are so high that it is virtually impossible to understand what is being said at times. Both the principal and the vice-principal are talking in the room and there is some moving of chairs.

At four pm, Anne acts to get her staff to focus on the conference. She reminds them that they are supposed to be assessing why the activity being presented in the video clip is inquiry-based teaching. A video being played has considerable sound problems, and playback has to be recommenced 2 times before everyone can hear it properly.

At one point Jim Poole shows a humorous PowerPoint presentation of cartoons that projects clearly through a direct digital data feed much like a local data projector would use, and the presentation catches participants' interest—many chuckles ensue.

Sharon Friesen from Galileo comes onscreen to comment on each video after it has been presented. In one instance, for example, she talks about the value of an enzyme lab video, emphasizing that what students were doing came out of their own interests. She suggests the teacher link the student activities to life beyond the classroom. "Why would you do this outside the lab? Put it in a larger context".

Despite solicitations from Karen, not one participant other than Sharon makes any comments on any of the videos or their relation to inquiry learning during the entire conference.

At 4:10 Vaughan loses its Community Zero chat connection. Chat was used by some groups to submit questions to Karen, especially in the last part of the conference. Vaughan's video clip quality is good but again the audio is poor and hard to hear. Vaughan teachers are acting out a class scenario: three staff portray students. The "teacher" is presenting the start of what is intended to be an inquiry learning project.

By 4:15, chat appears to have crashed at all sites, but Karen's audio and video remain very clear. Seneca finally attempts to join the conference: their video feed is stuttery, horribly pixilated, and unrecognizable for the most part. Not having CA*Net 4 access, they are attempting to connect to the videoconferencing bridge over the regular Internet, and the resultant low bandwidth clearly shows the advantages CaNet4 offers for reliable videoconferencing.

Anne again moves to focus the group, this time on the J. Percy Page video. These teachers read a humorous poem focusing on the ABEL project using "Twas the night before Xmas" music.

One teacher introduced his video of a science activity, framing it as an inquiry project, but the video was so noisy it was not possible to determine much of what students were really doing. Sharon could not comment on it as she lost the audio feed for the segment.

Some schools are still on the chat according to Karen, but UFA's chat has been down for over 10 minutes. After several attempts to reconnect involving 2 teachers and a student success is achieved. Anne had to inquire over the videoconference for assistance to get this resolved. Another teacher has joined the group at UFA now.

Centre High presents its clip on eye dissection. Very loud pop music on the audio track makes it impossible to figure out what students are talking about as they work. No discussion of the teaching or learning processes relating to this clip were presented by the school so its relation to inquiry learning was not clear.

Once it is UFA's turn to present, everyone in the room focuses on a student who reads a quote from Dr. Franklin, the school's founding principal. Mary (a math teacher at UFA) then introduces a clip of her math students working on Pythagorean theorem problems. Students are working on math worksheets, and it is not clear how their activity relates to inquiry learning. The audio is very poor, with an ambient roar in the background that makes it impossible to hear what students are saying. Sharon asks Mary about student grouping for the activity. She then loses her audio connection again.

Following the video presentations, Karen discusses the new forums in Community Zero and the new newsletter coming out, and Obadiah talks about Community Zero and its role as a portal for accessing other tools and resources. Teachers are asked to complete the session survey. The Community Help Desk on the Community Web site, with its folders for each ABEL tool, is presented as a resource for teachers seeking answers to procedural questions, and the York ABEL help email address is given out. Karen asks teachers to come up with topics for quicksheets and short videos for training on small tasks that they feel would be helpful.

Karen indicates that the direction in the new year will be to focus on organizing around project work, and she lays out the upcoming subject-oriented sessions. "Let us know how your subject groups want to proceed". For small group sessions she indicates that a coordinator and a reporter will be required, and that a mechanism is needed for feedback and reporting, but none is specified. She states that the subject groups will be largely self-run in terms of format and procedure, and that expertise will be available to help with content, resources, and pedagogy, but no examples of how this might work are given. She states that the next whole-group session will focus on the use of videoconferencing with students, and that there might be some look at skills relating to the use of lighting and sound. "We will have each group of teachers do research and background work on one aspect of videoconferencing." The session ends with good wishes being expressed by all groups for the holidays.

The range and extent of videoconferencing technical issues varied from event to event over the fall and winter of 2002-2003, but intermittent problems similar to those seen at this event were the norm rather than the exception. The almost complete lack of collaborative reflection amongst participants in the whole-group session portrayed here was not so typical; other events engendered more discussion, but in nearly every case the majority of time participants sat listening to presentations rather than engaging in dialog. The use of the chat facility in Community Zero (later renamed the ABEL Community) did allow those sitting near the chat computer to pose questions or respond to the speaker without interrupting the flow of events. This procedure usually helped to increase the interactivity by bypassing the difficulties inherent in a speaker attempting to monitor three or four small video windows portraying groups of participants, looking for someone wishing to interrupt or ask questions.

Forty-one participants completed the online survey about the December event. The overall perception of its utility was down somewhat from the previous one, with approximately 44 percent of respondents rating it as "good" and none as "excellent" (in contrast with the previous event which earned good/excellent ratings from over 75 percent of respondents). The sharing session on inquiry was positively perceived by a majority, however, and the format of the event received similar, if slightly less positive, responses as the previous learning event. The general perception of technical issues was substantially improved, with 55 percent rating this aspect as good or excellent, compared with less than 40 percent for November's event.

Interestingly, while the multiple-choice questions revealed a decrease in approval of the learning event, the positive responses to the open-ended question indicated a high rate of interest in and appreciation for ABEL. As with the previous learning event, anecdotal comments ran the gamut from enthusiasm to ambivalence, with some participants concerned about the timing of the sessions in general, and in particular about a lack of time at the event for discussion of their individual projects, and with issues related to an apparent miscommunication concerning requirements for providing individual presentation: "The short time frame given to produce the video was not adequate to meet the requirements that Sharon had in mind…these requirements were not made clear at the inception of the assignment." Other participants reported feeling encouraged and excited. Said one: "I think we are beginning to make real progress in developing the 'community of teachers/learners' that is so vital to this project. We are getting to know each other better, and beginning to establish links which should lead to collaboration." Illustrative of the perceived movement toward individual and project goals from the previous learning event was the comment by one participant that "We're starting to move in the right direction."

January. The January whole group event had three main components. The research and evaluation plan was reviewed and evaluation activities upcoming in the next few months were introduced and explained. Then the subject area project groups, which had held their first meetings by that point, each gave a quick overview of their goal and project development activities. Karen then outlined plans for the upcoming learning event on videoconferencing, and after group discussion, each site chose one of the topic areas that Karen had set forth to present on at that session. There was also a brief discussion as to when to hold a face-to-face meeting for participants. Karen concluded by announcing two new ABEL resources, one a set of TVO curriculum resources and the other access to the Ontario Learning Object Repository.

In the post-event survey, 64% percent rated the event as "good"—an increase from the previous session. It is worth noting, however, that for the first time some individuals (eight percent) rated it as "very poor". Some reasons offered for these ratings included technical difficulties (also rated more problematic than in the previous survey), and the sense that little progress was being made in pedagogical terms from one event to the next. Similarly, criticisms of the large-group portion of the event seemed to centre on technical matters (such as inconsistent or inadequate visual and audio components), personal discomfort with a still-unfamiliar method of communicating, and a sense of stagnation in terms of learning.

Most participants felt that they could effectively access information distributed via email and the ABEL Community site, although 20% indicated that they didn't know how to access information on the site. Asked how they would prefer to receive learning component information, about two-thirds selected both email and the ABEL community site as the best means of delivery.

Interestingly, however, when asked about the small-group, subject-oriented sessions that had taken place over the prior month, ratings improved significantly, with over three-quarters of respondents rating these sessions either good or excellent. The comments elaborating these ratings suggest that two main differences between large- and small-format activities were perceived. First, technical issues, and the comfort-related concerns arising from them, were generally easier to overcome in smaller sessions. And second, a deeper sense of relevance and collaboration came into play in these subject-based learning experiences, in which pedagogical goals were shared and initial plans were collaboratively developed. Participants described communication in these sessions as more effective and focused, such that they were able to "fuse the concrete with the conceptual in a more relevant and practical way" to "start the ball rolling". It also allowed them to make closer personal contact with other teachers in their own specialties, a critical part of the community-building process.

Once more, anecdotal comments on the large group session were mixed, although in general they seemed to show an increasingly approbatory view of the project. A couple of comments were less than positive: one individual felt that the goals of the project were being lost in the dynamics of the process, and that this event had been a step backwards. Still, in general there seemed to be a sense of, as one participant put it, "feeling good about ABEL now that we're up and running". The project is, for some, "proceeding well now," and one individual's suggestion that "We really need to facilitate on-line communication within the subject groupings so discussions can continue at more than two-week intervals" suggests that ABEL was viewed as useful.

February. The February session started with a PowerPoint presentation from the Victoria School for the Performing and Visual Arts that focused on video production considerations (backgrounds, lighting, sound, camera work). A tour of each site noting changes made since the last session was done, with Victoria staff providing feedback to schools. Janet then outlined some help resources now available on the Community site, including a videoconferencing tip sheet and quick tips for ABEL tools. J. Percy Page teachers used a PowerPoint presentation to provide suggestions on videoconferencing etiquette designed to facilitate communication. Finally, guests from new content partners E-STAT and the Ontario Ministry of Education discussed the potential uses for E-STAT and the Object Learning Repository.

The reaction to this learning event was markedly more positive than responses to previous events, with almost 97 percent of the 35 respondents giving it a rating of either excellent or good overall. Though some technical (particularly audio) difficulties seemed to persist, respondents viewed the event as having proceeded smoothly, much better than previous events, and "the best we have ever had".

Respondents were divided in their wish for a summer institute: although half approved of the idea, seeing it as an opportunity to meet and collaborate face-to-face in ways that would supplement their online ABEL work, others believed it would "detract from the real experience of struggling with the technology and relationships" or were simply unsure.

Ideas about what the project ought to focus on in upcoming months were abundant, ranging from small-group, subject-oriented videoconferences to large group sessions on presentation skills and pedagogical issues; and from training sessions on such applications as video streaming, IO, National Film Board, and Galileo to guest speaker sessions on project development and teacher presentations on successes and challenges in their own project work.

Once more, participants' comments revealed a growing satisfaction with and enthusiasm for the project. A few examples:

- Well done! The best session yet! We really are learning and growing.
- We've come a long way!!
- I am heartened by the strides we have made in the last few months. Our conferences are becoming less disjointed as we learn to use a common language and become comfortable with the equipment. I am getting a sense of community developing.

March. The March event focused on planning and facilitating a videoconference. A PowerPoint presentation by a Vaughan teacher addressed the steps involved in planning a videoconference, using the recently completed videoconference with the astronaut Steve Maclean as a model. (The PowerPoint file can be found on the ABEL community site). A teacher from Middlefield then did an oral presentation about "doing a videoconference with a guest speaker". The audience was asked to read some text about videoconferencing tips and then answer some questions in an online quiz. Each site spent about 15 minutes reading text and responding to the quiz, but the quiz answers were never discussed, nor was the content of the presentation. Dawn Mercer from Seneca followed with a talk about facilitating a videoconference, and she asked participants to respond to some questions by chat, but people focused on their video connections and other topics and did not deal directly with these questions for the most part. After Janet announced the availability of access to the Ontario Object Learning Repository, a Magic Lantern staffer talked about the latest version of Tutor Buddy, called InSite, and used a PowerPoint presentation to overview its features, but the screen shots of the tool could not be read. She was seeking input as to whether the project wished to switch to this revised version, but no decision was made. Karen announced that in response to requests and feedback gleaned from the last learning survey, there would be no large group event in April so that the time could be given over to smaller subject-oriented videoconferences.

This session required about 15 minutes of sites trying to connect and getting people's attention before it started. The audio and video quality varied considerably over the

course of the session, which no doubt contributed to some of the loss of focus and the low level of interactivity observed. (It was later learned that with the start of the war in Iraq web traffic was up considerably that day, which may have impacted conferencing quality.) No survey data was reported for this event.

May. At the May large-group event Karen outlined the project's videoconferencing usage patterns over the school year and discussed some of the challenges the community faced in coordinating and scheduling use of the MCU videoconferencing bridge well in advance to avoid problems that were arising due to very late bookings, such as two groups trying to use the bridge at the same time for different conferences. The need for a tool that can address these advance reporting needs and simultaneously permit better communication amongst teachers about upcoming events they might wish to participate in was a major focus for the session. Karen had drafted and distributed an event reporting form that she sought feedback on, both in the videoconference itself and the follow-up online survey.

This conference, which was witnessed by a researcher present at UFA, provides further exemplars of the kinds of technical challenges that were still arising at the end of the school year. It took the UFA student helpers about 15 minutes to resolve a connection problem that was never fully understood before UFA staff could join the conference, and the simultaneous display of the PowerPoint presentation that Karen had requested was not possible because the presentation could not be accessed on the Community site (nor could the event chat be joined). Karen later asked participants to open the example event reporting form online, but after 20 minutes UFA staff had still not been able to access the community site and so were unable to do so, nor could they respond Karen's request to answer the four questions about the template using the online survey form.

While the UFA experience of this conference was more problematic than that of other sites participating, the recurrent technical problems encountered at this school were seen to have a corrosive effect on the willingness to participate on the part of those teachers with only marginal commitment to the project. The frustration felt by the few staff present was evident in their comments—and these were the teachers at the school who had been the most active in ABEL projects to date. Given that UFA has the largest contingent by far of teachers enrolled in ABEL (11), the difficulties at this one site alone raise significant challenges for the whole project.

Because the UFA teachers did not respond to the post-event survey due to their work-to-rule action, the results obtained do not reflect that school's difficulties with the event. Of the 25 participants signed in, only eight completed the survey. Respondents were largely positive regarding the event notification template, with most considering it good and a few, excellent. They provided many suggestions for changes in format and raised procedural issues around such topics as avoiding the need for repeat entries for regularly scheduled events. Providing users with an automatic process for contacting a project's leader when a project of interest was read about was suggested, and the capacity to search through events entered by subject, site, and date was requested. Plans outlined for the Summer Institute were also regarded favorably.

5. Teacher Interviews

Thirty teachers from six secondary schools in Alberta and Ontario were interviewed in small groups either toward the end of the first semester or near the beginning of the second prior to major ABEL project implementation, using an interview schedule containing a series of open-ended questions. Responses were taped, transcribed, and qualitatively analyzed using *Atlas.ti*® software[1]. Three of the secondary schools are located in Alberta—Centre High School, J. Percy Page School, and the Victoria School for the Performing and Visual Arts—and the other 3 schools are in Ontario—Ursula Franklin Academy, Middlefield Collegiate Institute, and Vaughan Secondary School. The teachers taught courses in a wide range of subject areas: Science, Math, Social Science, English, New Media, Computer Programming, Technology, Geography, History, Visual Arts, Music, and Networking. Their levels of expertise in using Information and Communication Technologies (ICT) varied. On one side of the spectrum there were interviewees who were facilitating a CISCO Networking course or teaching computer programming at the time of the interview; and on the other were a few teachers who for the first time were getting in touch with technology in the ABEL Project. Overall the Albertan interviewees were more experienced and familiar with the technology than their Ontarian colleagues. In fact, some of the Albertan teachers had previously participated in the LearnCanada project that employed similar broadband technologies to those used in the ABEL project.

The focus of the interview questions were around the hopes and expectations of the teachers from the ABEL project, their plans in the context of the ABEL project, their sufficient access to equipment and resources, the strengths and weaknesses of the ABEL's professional development activities, collaboration with other teachers, barriers and limitations, and the most significant development anticipated in their ABEL activities over the next two months from the date of the interviews.

5.1. Hopes and expectations

The initial hopes and expectations of the teachers participating in the ABEL project were that this project serve them as a learning as well as teaching tool that can be integrated in classroom activities. They anticipated learning about new ICT tools that might be used in everyday practice and to start integrating these technologies in their teaching. A teacher from Centre High, for example expected "to learn about some of the learning tools such as learning content management systems (LCMS), ANLON, Blackboard, and WebCT". The teachers viewed ABEL from a technical perspective to some extent, seeing it as offering a great opportunity to focus on learning about technology, but also as a vehicle for exploring how technology can be used to facilitate the learning of curriculum. The ABEL project was anticipated as providing an opportunity for the teachers to work with technology and learn about its capabilities.

[1] This same analysis procedure was applied to the principal and project lead interviews.

A number of Ontario teachers expressed some concerns about being relatively unskilled in the use of computer tools compared to their more experienced colleagues in Alberta, who had been using some of the ABEL tools prior to the project. “People from Alberta have been using these tools in their classrooms for ages. I have never used PowerPoint in my classroom, they have,” stated a teacher from Middlefield.

Some of the teachers expressed dissatisfaction with the explanations proffered in the learning events regarding how ICT is to be used to move education and learning forward. But generally participants considered involvement in the ABEL project as being a learning process that was gradually improving. A UFA teacher remembers her first encounter with the ABEL project and stated, “The first session was very bad but it is improving and that is part of it, That is why we are doing it, the first session wasn't that great, the next a little better and I think we will get more comfortable as we get attuned with technology and how it will be productive for us”. Another teacher, however, believed that a lot of their “learning of the technology has been self-taught and [we are] not getting much from the actual learning sessions that we have”. Staff expected ABEL to enhance their online learning in order that they be able to bring some of its benefits into their classrooms. A teacher from Vaughan remarked, “My initial expectations, when I became involved with the project, were to enhance my own online learning, as well as bring some of those experiences into the classroom”.

In their interviews, most of the teachers emphasized ABEL’s potential as a teaching tool that could be employed in their teaching practice. One teacher stated “I look for what technology can do for me to enable me to do things that would otherwise be impossible”. Integrating technological tools into classroom teaching was of considerable interest to most participating teachers. A Percy Page teacher shared a common perspective:

> What I have to do and what I think I do all the time is to reflect on how I can use those tools and incorporate them into what I want to teach kids from the music perspective. And my particular interests are in relation to integrating technology in teaching through project based learning.

In the view of most respondents, the technology was not an end unto itself, but an enabler that could potentially enhance the quality of their teaching. In this respect a teacher from Centre High commented, “I'm very technology focused, but not on technology for the sake of it, rather looking at what works in terms of course content delivery”. Another teacher from Centre High added, “It's one thing to hook up equipment and the gear, the switches, the routers, and everything else, but what about the educational opportunities or learning opportunities that are available?”. To these teachers, the purpose of the ABEL project is to give teachers the tools and the time to be creative and come up with something on their own. One teacher held the view that the project had been proceeding too uncritically, ignoring potential downsides to technology use: “I don't feel that much attention is being paid to the sociology and the psychology of what is happening with this project. People are not talking about how technology is alienating or can be alienating to others”.

5.2. ABEL plans

At the time of their interviews, teachers were planning a number of different project types. These fell into four categories:
1. Inquiry-based projects. These were projects in which teachers and students conduct independent or collective self-directed inquiry. An example of an inquiry-based project is seen in the plans of the teachers at Percy Page for a project on peace and security in the 21st century. In this project, they intended to have their students do some research, through historic websites and the UN websites, to develop questions for the "experts" who would be participating in a videoconference on the topic. Another example is the project of a Middlefield teacher who had already created a unit around Michael J. Fox. "It is inquiry-based so the kids think of the questions that they would like to ask and they go do the research. The whole thing is on ANLON".
2. Collaborative projects. These are projects in which inter-school or inter-class collaboration is involved. One example is the J.Percy Page teachers' plan to have a math project in conjunction with Ursula Franklin in Toronto in which a videoconference is use to present students with math problems, after which they are to be given some time to work on it and then come back for another conference to conduct a debriefing on their solutions (see the case studies).
3. Cross-grade projects. These are interschool or intraschool projects in which students from different grades are involved. As an example UFA has a tradition of having a cross grade project that each grade level does in grade 9 and 10 and a teacher intended to make use of ABEL to develop an integrated cross-year project.
4. Single events. Several teachers had plans for "one-off" events which did not readily fall into any of these categories, such as videoconference-based Q and A sessions with experts.

5.3. Access to equipment and technology resources

Most of the teachers participating in the ABEL project reported having sufficient access to equipment and other hardware and software needed in their project activities. In this regard a teacher from Centre High stated, "I'm well taken care of in terms of technology and access and I have no frustrations that way. Within the school we're wired very—fairly extensively in terms of computers, overhead projectors, you know, access to the Internet".

Another teacher from Percy Page notes the outstanding position of their school in terms of hardware and software and remarked, "there's everything in my disposal and I do have the luxury of having a very good computer, an updated computer, all the audio, and the equipment that goes with it". He adds, "I feel very strongly that we're very lucky at this school because we have nearly unlimited access to videoconferencing technology. And we have been able, in the past in other projects and in this one, to hook up on a moments' notice to other schools and to other teachers. In that area we're very lucky here. And I feel very empowered that way". The teacher believes that the previous placement of Karen Andrews in his school and her commitment to this technology is one of the main reasons he has access to these resources.

Victoria, Middlefield, and Vaughan teachers in the project also felt that they had sufficient access to the equipment, hardware, and software they needed. (Teachers at Middlefield and Vaughan had recently been provided with individual laptop computers after expressing concerns that they had no useable technology access to work on their projects.) However, Vaughan's teachers expressed concerns about a lack of working space, saying they had no resource room in which to participate in videoconferencing events or work collaboratively to plan projects.

Teachers at UFA had a different perspective. Nearly all thought their access to technology was insufficient. Most of them complained that their limited number of computers do not function well, and they didn't have access to LCD projectors. One of the UFA teachers stated, " I think that it is actually kind of a crock that we are expected right now to be doing this when we only have four computers in our staff room and of those only one has only consistently worked all year." Network and Internet access issues also plagued the school, which had just moved into its new location in the fall and still had not completed the needed infrastructure development. While the school did have a non-teaching room set up for participating in videoconferencing events that could hold 20-30 people, the teachers still felt isolated from the resource; none had their own keys for the room, and student help was needed to set up the equipment, as extra computers had to be brought into the room and the Vigo system set up and plugged into the network. A UFA teacher explained:

> The resources that came specifically with ABEL, they are here in this room and so we can access it but as of today we have never used it on our own. We have the Board technicians helping us and the kids are helping us with it and those kids are ready to help us and teach us but I couldn't just walk in and say that I am going to setup a video conferencing through this room because I don't know how to do it. So we don't have full access in this sense.

5.4. Perceived ABEL strengths

The commonly perceived strengths of the project were the affordances it provided for building up relationships with other teachers, the opportunities it gave for professional development, and the effectiveness of small group project work.

Building up community. The teachers participating in the ABEL project consider the opportunity to build relationships with their colleagues as the primary strength of the project.

A teacher from Centre High explained:

> I'm really glad to be able to be involved in ABEL project and to work with these fine people and collaborate with my colleagues around the country. To me the great strength of the project is the access to colleagues and experts no matter where they are. The obvious advantage of video conferencing is that you can have a meeting anytime without having people to fly to you or you fly to them. So the fact that I can be having a real time discussion with somebody or I could be

> talking to somebody from York University or whatever, there's a real advantage and to have the other kinds of e-mail links and chat links and various things that we have through the project is very useful.

According to a Victoria teacher, the " Strength within my school is to be able to work with peers and being able to look at various technologies". She added, "I'm really hoping to establish that with teachers across the country and hopefully with the technology that we're using in ABEL we can enhance that and continue it after ABEL is finished and collaborate online".

A teacher from Percy Page emphasized collaboration, stating:

> Ultimately if I get nothing out of this project, it's collaborating with other teachers and especially from my point of view musicians and music teachers who can be isolated in their own little islands a lot of the time. I can even get outside that scenario and collaborate with other teachers, math teachers, cross curricular to other music teachers.

Another teacher said, "My interests initially related to working with other teachers in a capacity to build with and have opportunities to learn from other teachers".

Professional development. From a professional development perspective, the ABEL project was expected by the teachers in Centre High to generate a network of professionals. Teachers elsewhere expressed much the same view. They saw ABEL as providing the potential for reaching new levels of skill and professionalism in teaching with technology, and for learning about both the technology tools and the professional collaborative practices that could improve the quality of their teaching.

According to a Middlefield teacher a major strength that the videoconferencing and other ABEL tools had in this regard was that it no longer became necessary to travel long distances to participate in meaningful professional development. "If you have to drive somewhere for professional development you probably won't do it", she noted.

Small group interactions. Many of the teachers perceived a greater level of utility and effectiveness in the small group and discipline-specific videoconferences and meetings as compared to the large group sessions. Teachers at Vaughan and Middlefield noted the relatively greater importance of the smaller sessions and one of them argued, "when you're sitting around a table one on one, without the technology, it's even better". A Middlefield teacher gives an example in this regard, saying "this morning is a perfect example. Amber came in from ANLON and gave us a tutorial on the ANLON system and it was a small group and was so productive. 'Here's how you can be a problem-solver'". The teachers at Centre High had a similar perspective; as one expressed it, " smaller meetings are better because it's not a big huge group; it's not a wide variety of topics; it's more narrow and more focused". The Middlefield teachers emphasized the idea of having online conference forums that are focused on specific tools so that if one has questions they could be posted there for a response.

5.5. Perceived ABEL weaknesses

In their interviews, two weaknesses in ABEL were commonly cited by respondents: Equipment issues and concerns about the quality of the large-group sessions.

Equipment. A few schools had expected their equipment to be delivered much earlier, in order to be able to push forward their collaborative projects (Vaughan, Middlefield). By late fall they were still 'wasting time ordering furniture". Centre High had a major concern about their ongoing lack of access to CA*Net 4 at the time of the interviews. A teacher there pointed out, "It's hard to talk and show people what ABEL is when you don't have it. Here at Centre High we don't have our connection yet". As discussed above, teachers at UFA expressed concerns about a lack of access to computer and videoconferencing equipment.

Large group events. These were subject to several critiques by teachers, and the reasons offered were varied, but several felt that there had been a failure of these sessions to demonstrate effectively what was possible with the ABEL technology—a failure to provide a vision of possibilities they could relate to. They wanted to see exemplars of best practice in their own specialties. Some (but not all) staff expressed a sense of lacking direction and of vagueness regarding their role in the project, and felt that more specific directions were needed. They wanted more guidance about what they should be doing. This vagueness was especially evident at UFA, where many teachers had missed more than one of the large group sessions over the past several months.

There were also frustrations expressed about the technical difficulties that interfered with participation and communication, and the technical and social awkwardness introduced when several large groups were participating in one big conference. Such a context was seen as inhibiting collegial exchange and community building. The use of a parallel chat channel in conjunction with a videoconference was seen by a UFA teacher as critical because it provided an avenue of communication to react immediately to events. She thought point-to-point conferences had greater immediacy and focus than larger events. Others cited a need for more practical hands-on sessions with the various tools as opposed to abstract presentations on teaching methods.

One Middlefield teacher saw the project, and particularly the large group events, as being impeded by the different levels of knowledge of the participants:

> There are 40 teachers involved and everyone is at different levels. If we had a classroom situation, we would be working with groupings according to levels. But, right now we are all thrown into the same classroom, from beginner to ultra-advanced and we also have other people who are there for different reasons (York University, Seneca people). So every meeting has been an information session for stakeholders. We are saying: give us something practical; we don't need to hear the speech for the stakeholders. We are finding that the individual needs of the groupings are not being met.

5.6. Barriers to success

Three major barriers to moving forward in both their professional development and ABEL project work emerged from the analysis:

Time. All the teachers who participated in the interviews commented that the most critical barrier for them with respect to their full participation in the ABEL project activities was a lack of time. This was true even for the teachers from the York Region District School Board who had 80 minutes a day of course release time to work on ABEL activities. (The teachers in the three Alberta schools had 80 minute periods of release time provided to them every second day; those at UFA had no regularly scheduled course release time, but the school did have a $5,000 per year budget to hire substitute teachers to release ABEL teachers when requested.) The lack of regular release time and the problems inherent in relying on substitutes for getting extra time (namely preparing all the class work for the substitute to supervise) was the major concern expressed by the UFA teachers as they considered the scope of their potential ABEL activities. These teachers thought that creating a unit using the ABEL tools and resources would take a great deal of time, and many had other commitments (coaching etc.). Conflicting commitments were also mentioned by staff at J. Percy Page and Victoria as being a problem. Finding mutually satisfactory times to work together synchronously via videoconferencing was also a challenge, especially given the time zone differences between Ontario and Alberta.

Curriculum coordination. Concerns were expressed by several teachers who had begun thinking about collaborative projects regarding the difficulties in finding common curriculum objectives across classes that could serve as a basis for joint collaborative projects. This issue was especially salient across the provincial divide, because due to differences in provincially mandated curricula in the two provinces many topics were taught at different times of the year and even in different grades. Teachers could see that some creativity and flexibility would be needed to adapt mandated topics to shared projects.

Technical issues. The ongoing if intermittent technical problems experienced during videoconferencing raised concerns amongst some staff. One noted that teachers had the patience to deal with these bugs, but if they were to manifest in sessions in which students were participating, technical failures would quickly lead to a loss if interest on their part. A few commented that the technical limitations were impeding the quality of group interaction. A Vaughan teacher questioned the criteria upon which Vaughan has been chosen for the project, mainly due to the lack of perceived technical support being provided for the program.

5.7. Anticipated developments

When the teachers were asked about the most significant development anticipated in their ABEL activities over the next two months, they had different responses. Teachers at Centre High mentioned gaining more comfort working with technology, learning to use the Web more fully, and working on the peace and security project.

According to teachers at Percy Page, they intended to work on a collaborative math project in which outside experts will present problems to Percy Page's and UFA's students via videoconference. "The students will have an opportunity to ask clarifying questions. We will then meet a week later and the students will present their solutions and how they derived the solutions to the problem. It is a joint project with the students in Toronto". Conducting research, working on the online newsletter, and participating in an online course using videoconferencing are the types of other significant developments that were expected by these teachers.

At Victoria, some of the teachers anticipated talking to people during videoconferences using a videoconferencing setup in which no one is aware of the video camera and the microphone, and participants engage in interaction in a more naturalistic, conversational manner. Victoria teachers expected to have something concrete for the ABEL project, although they were not specific about what, while the UFA teachers intended to make connections with other people, develop a unit on Greece using ABEL tools, run their annual Innovative Thinkers Symposia as videoconference events, and have more meaningful discussions and dialogue with students and colleagues about this new technology in the two months following the interview. UFA teachers were also planning on conducting ABEL-enhanced cross-grade projects.

Getting the students involved in projects was the major focus at Vaughan. Other activities teachers at this school planned for included more effective use of time, learning how to use Tutor Buddy and LCMS, and how to communicate using these technologies.

6. Principal Interviews

This chapter presents an analysis of the interviews with the six school principals, which were conducted at the same time as the teacher interviews. The interviewees were: 1.) Cecil Roach, Middlefield Collegiate Institute, 2.) Joseph Ravesi, Vaughan Secondary School; and 3.) Anne Kerr, Ursula Franklin Academy (all from Ontario); 4.) Geoff Buxton, J. Percy Page Secondary School, 5.) Glenn Iriye, Centre High, and 6.) Andrew Gambier, Victoria School for the Performing and Visual Arts (from Alberta).

The interview questions dealt with the principals' leadership role in general, their role in ABEL project, and how the principals evaluate their school's development to date with regard to the ABEL project. Sufficient access to equipment and resources, barriers to meaningful participation, and the expected outcome of the project were also among the topics of the questions posed to the principals.

6.1. The principal's leadership role

The principals saw their central roles with respect to the ABEL project as being to provide facilitation and support, and to build collaboration and communication. Facilitating ABEL activities was considered an important responsibility. It was seen as having several elements: offering verbal support for the project and the risk-taking it entailed within the school; speaking to the rest of the staff and bringing them "on board"; and helping to provide the resources of time, space, and equipment the project needed. Creating an environment that conducive to risk-taking was thought to inspire creativity. A principal commented "my role is to help provide a safe, secure environment to take risks. Those risks then they can let the teachers' 'creativity flow". Another stated that "My main role is to provide as much support as is possible for the teachers who are involved in the project". He continued, "we have to constantly reminding the staff that there will be some benefit for the school in terms of our teachers becoming better pedagogues and also having some instructional strategies that can perhaps be transferred to as many classrooms and teachers as possible".

6.2. Development of the project

Principals reported that in the first months of the project their schools were facing different sets of challenges in relation to space, staffing, and connecting to broadband. (A few schools were still not on CA*Net 4 at the time.)

Gradually the schools overcame some of the challenges and in the next phase of the project, the principals saw their teachers actively engaged in ABEL. As one principal put it, "I think that now we are at that stage things seem to be working better". Another said, "Everybody's involved and we've all taking the time to try out some of the different tools

and we've all fooled with Tutor Buddy and the various tools have been made available to us".

Active involvement had led to community building and at the time of the interviews, according to some of the principals, the ABEL community was well identified in their schools.

The principals noted several examples of ABEL activities by their staff: Active engagement in online discussion groups (Middlefield), fairly active role in the teleconferences and the video-conferences (Percy Page), developing work to be done with students in terms of a project base learning (Percy Page), producing a video about inquiry-based learning and the Innovative Thinkers Symposium (Ursula Franklin Academy), and the United Nations project involving a seminar for students (Victoria School).

6.3. Sufficient access to the equipment and resources

With the exception of Ursula Franklin Academy, the principals generally felt that their schools have sufficient access to equipment and resources but noted certain shortcomings such as budgetary constraint (Centre High), space limitation (Middlefield), and the lack of some equipment (Victoria). The UFA principal cited a lack of equipment and school networking issues as limitations in supporting UFA teachers in the project.

6.4. Barriers to meaningful participation

The most important barrier to meaningful participation in ABEL, according to the principals, was the lack of available time. For Ursula Franklin's principal, "Time is the biggest constraint right now. Part of it has to do with the Toronto Board and the fact that other boards have given their teachers one less class to teach". Percy Page's principal argues that "the fact is that we have a little bit of release time, but [because of non-synchronous release time] we cannot actually talk to each other or go sit down and get online with somebody, or have a little one to one video conference or just do some e-mail or chat with them". For other principals, time is also the most important barrier to participation.

The challenge of building projects of relevance to the curriculum (Middlefield), "The need for a certain level of expertise with the technology" and "the sad fact… that the governments don't give schools enough funding for things like this" (Percy Page) are examples of other barriers seen by the principals. Victoria High School's principal notes another problem in this respect. "I think one of the main problems that we face in the ABEL project at the moment is bridging that difference between what would be considered professional development for teachers and [having an] instructional focus for students. So one of the things that we're trying to do is to get confident with the technology. This the technical aspect of the ABEL project. Once we've got the technical taken care of, we can then look at the instructional focus". Keeping abreast with so many projects, keeping up with different passwords to get to different site such as Galileo and

Tutor Buddy (Victoria), and having absolutely no budget in the school to operate the program (Vaughan) are other types of barriers for more active participation that the principals of the six high schools are facing.

6.5. Project outcomes

Several outcomes to date had been noted by the principals, either through direct observation or (more commonly) through teacher reports. These included higher levels of engagement by students in collaborative activities, better attendance, and higher student self-esteem (Central), and the active and enthusiastic participation of teachers in the professional development events (Middlefield). Middlefield's principal also emphasized the enthusiastic engagement of the students and said, "Once we get the enthusiasm of the students going it naturally snowballs and carries to the day that this project leads to the next project and to the next".

The development of a learning community was seen to be unfolding, and this was valued by the principals. Victoria's principal talked about "the build up of a community of learners across Canada that could expanded to other sites in the world". He added:

> I would just conclude that we've seen a lot of collegial work, we've seen a lot of collaborative work, we've been getting to know staff, breaking down barriers, we've seen a lot of improvement in terms of the facilities for our technical aspects in the school. So you know, it's really encouraging. And the staff are very enthusiastic here as they are about everything.

The gaining of skill and knowledge by teachers involved the project was another outcome pointed to by the principals. Middlefield's principal stated, "I am hoping that the school will reap some of the rewards from that, in the sense of transmitting this kind of knowledge and expertise in the classrooms". Victoria's principal argues that a spin-off of this project he foresees are improvements in learning and teaching at his school.

The eventual integration of the broadband tools and teaching strategies into the classroom that the teachers are currently exploring was cited as an important but as yet unrealized outcome. In this respect, Victoria's principal was looking at "how we can apply what we've learnt in ABEL in the student community. How ABEL can assist us in the arts world, maybe it would be possible to have master classes in another location, which would be transmitted to us and then some of the student productions that are outstanding here could also be shown to other people outside". He concluded that they were searching for "some other models where video conferencing on broadband has been used to improve or provide students with opportunities".

6.6. Other issues

The principals raised other interesting points in their interviews. The Vaughan principal was hoping to see his participating teachers disseminate the knowledge gained to other staff, and that these other teachers be given the opportunity to try out the broadband

technology. Another principal expected that “ABEL project allow us to connect across Canada and throughout the world. This opens up the possibilities. Connectivity, hopefully, brings into play the creative thought process that the teachers can hook into”.

The Percy Page principal noted the leadership role his staff had taken in moderating the new subject-specific groups. “It wasn't a surprise to me that when we started to try to set up the individual subject specific groups, the only people who volunteered to coordinate them were our teachers”. Most of these teachers had had exposure to broadband use in the earlier LearnCanada project.

The Ursula Franklin Academy principal, acknowledging the ABEL project’s role as a research and development effort, counseled her staff and colleagues not to be demanding perfectionists when employing new technology. She quoted Karen Andrews’ saying that “If at first try technology succeeds, hide your astonishment”.

7. York Faculty Interviews

The three York University Faculty of Education members who were part of the Learning Team were interviewed in the spring of 2003 regarding their participation in the ABEL project and the involvement of pre-service teachers in ABEL activities to date. The faculty were Wayne Scroll, the Course Director for the Individual and Society course; Heather Miller, who teaches in the visual arts program for intermediate and senior level pre-service candidates; and Paul Kortenaar, a science specialist teaching in the Math, Science, and Technology B.Ed. Program. All three are responsible for supervising the practicums of pre-service candidates and sit on the Faculty ABEL curriculum committee.

7.1. Pre-service teacher involvement

Heather indicated that her pre-service students were placed in ABEL schools and they were introduced to the program, but their teaching days were not on the ABEL event days and thus the timetabling just didn't work out. “I chatted with the teachers, but there was no relationship between what the students were doing and the ABEL project in the end”.

Paul’s intention had been to involve his students in ABEL activities. He arranged with Janet Murphy [the ABEL Project Manager] to enroll all of them on the ABEL Community, and he spent some time in class going into ABEL with the 28 students, trying some of the tools. However none of his students were placed in ABEL schools.

Wayne had two students who were actively involved in ABEL, one working with IO and the other with ANLON. “My connection with the host teachers, both of which I had previously known, was pretty sporadic. We touched bases a couple of times throughout the year just to ensure that the student teacher was doing good work generally but also that the students worked in ABEL. The outcome was that both teacher-candidates produced units of study which I still have to look at and grade”.

7.2. Initial hopes and difficulties encountered

Asked about her initial hopes for ABEL, Heather stated:

> I think my hopes for it were that it would be this big, exciting project that would make Canada smaller and bring us together with other people doing interesting things, and that our students would have access to perhaps a learning method of the future, and so they would be on the cutting edge of what was possible.

Paul saw the ABEL initiative as lacking a goal when he joined the project, and found it was difficult for his student teachers to come up with defining specific projects on their own. He was surprised to see that while ABEL schools received monitors, computers, and other technology to work with broadband, the Faculty of Education received nothing

in the way of resources or technical support, nor did they get any assistance in helping students work with the Broadband.

Wayne noted the vague role definitions in the ABEL project, where everything seemed open. He reminded his colleagues of this at the regular meeting of the three faculty members who work on curriculum, and indicated that "as soon as you develop curriculum and start using ABEL tools, you start doing something instead of other people doing that for you".

Heather thought that if the faculty had been involved in the project from the very early days and had access to the relevant technologies, it could have played a more vital role in the project. She added, "I also found that since students weren't connected with an ABEL teacher, I was thinking how can I be doing this, what can I be doing--and the weeks would be flying by". Heather considers the team building of the three faculty member committee as an important turning point for her approach to the project.

7.3. Shifting roles

Wayne had had a recent meeting with Janet and Obadiah [George, the Assistant Project Manager] that left him feeling more interconnected with the project. He indicated that his involvement with ABEL as a whole in the past had been limited to the monthly large group events, in which he felt fairly passive. Once the faculty team started working together, it became clear that collectively they had a lot of skills and abilities that they could draw upon and contribute to the project.

Heather also commented on recent changes in the faculty members' sense of their role in the project:

> I think the thing is that we have shifted how we see ourselves within the ABEL project. At the beginning we were simply supervising students within the school setting, which is quite different than thinking of how to incorporate this into the program in some way. I think this makes a difference to what you need in your own classroom.

She argues that if the faculty's role in the project consists of only supervising teacher candidate activities, then all technology-based activities take place in the host school by the host teacher:

> [Then] it is external and we are sort of cheerleaders for it. What we decided was that this wasn't working well for us and so we said how could we do something more meaningful? And wouldn't this be great if it is the education for the future if all our students have access to it and we somehow make use of it".

Paul emphasized the need to make videoconferencing available to his students if they are to participate in the project:

> It is not that we need a computer in the class with a projector, but what I would have liked to have had in retrospect was one of these cameras so that I could lead a videoconference with my class. I can't do that; I don't have the technology, the hardware to do that. I don't think that most of my students know what a videoconference looks like because we haven't had that opportunity to have it in our class.

7.4. Project plans

Heather explained that it was the intention of the committee to develop a process where they would use one of the tools and present ABEL as a larger concept to all of their students in September. The team plans to introduce and use one of the tools as a method of introducing inquiry-based learning to their students. "We would take the tool to develop an instructional piece. We would introduce ABEL, get them excited about the tool and we would at the same time teach them about inquiry learning". She mentioned that Janet and Obadiah have told them that what they are going through is exactly what the teachers at the other schools are going through as they develop their projects. Heather's view was that virtually all that is on ABEL can be done without Broadband in most cases with the exception of videoconferences:

> I want to make sure that what I am presenting to my students is doable or is a vision of the future that will be doable at some time in the future so that they can hold on and aim for that as they go along. I don't want to introduce them to things that, once they get out there, will be impossible. With the broadband this is a big thing, and it will be very difficult for them. I want to present this to them so that it is possible for them in the future.

7.5. ABEL strengths

Heather believed that the best thing about the project is the collaboration of the three faculty members it led to. "I found this enriching and I also found it interesting to learn about the possibility of the tools that are available to us and I guess what it did was plant seeds of what it could be. I think it is a stimulating process from that viewpoint".

Paul thought that the best thing to come out of the project to date is the networking and collaboration of the practicing teachers. "So regardless whether any project gets completed, I am thinking of Steven working at Middlefield with Jason in Victoria and now they have made a connection and write curriculum together".

Wayne believes that the most positive outcome could be—under the right conditions—the connection of the host teachers with the student teachers. "I saw an example when I went out to supervise a student teacher in the classroom and the host teacher was working with her and they called up Tutor Buddy part way through the lesson. It was hands-on and it worked well. So for those particular people there was a lot of professional development"

7.6. ABEL weaknesses

For Paul, the biggest weakness of the ABEL initiative is that it seems to lack a clear goal. He perceived confusion over whether the project is basically inquiry-based or if the project is primarily focused on the use of broadband in teaching. Prioritizing either of these two would result in a different approach to the project. He mentioned the inability of IO to properly support teacher collaboration, even though collaboration is an important element in the project. Paul found that in talking with Janet and Obadiah it seems that everything goes back to broadband "and this is what I have discussed with Wayne many times—not what is the best way to do this but how can we do this using broadband". He sees the impetus to use broadband taking precedence over pedagogical considerations in the project as a whole, but for the faculty team, he indicates, the pedagogy comes first.

Wayne argued that maybe one should not assume that ABEL had one single goal, that being the use of the technology

> Maybe we shouldn't. Maybe it is a dichotomy. Any particular project can have and needs to have more than one primary goal, or two or three. Maybe if we had a better sense of inquiry being way up there, that good curriculum is way up there with the use of broadband, so there are several goals in mind. But if in fact as we have seen it, that all of these things are secondary to the technology, then it provides a different light on it.

Wayne thought that even the students who were involved in ABEL with a host teacher had a really slow start. "I just got this feeling because even talking to my students in November and December, they were not clear of what they were going to do and what the nature of their involvement was. It wasn't until mid-spring that they knew what their involvement was". Wayne believed that if the goals were clear, the project could have got moving much faster.

7.7. ABEL challenges

Heather indicated the need for longer-range planning so that better links can be made between faculty members, their students in the field, and the ABEL project. "I am assuming that I will have a teacher who is involved in the ABEL project and I would like to make that a strong game plan so that I know what is going to happen and so that I can hold myself accountable for it." She saw no point in having students involved in ABEL if they were not working with an ABEL teacher in the host school.

Like Paul, she sees a need for other tools to support collaborative curriculum development. IO does not do what they want it to do, so they were planning "to develop a website that allows us to have video and has less text so that it is more interactive and so on and I think that Dreamweaver will definitely do that for us if we want to".

Paul cited a need for greater collaboration in the project:

> I don't feel like I have any more connection to teachers in the field than I did before. This is something I would like to have developed and it is true that I have worked with Cindy on a project but I would have liked to make those connections with more people somehow.

Heather indicated that the project needed a better justification than the capacity to stream video for its implementation:

> I need more information to see what else Broadband can do other than we can stream lots of video but we can stream a whole DVD over high-speed cable meaning that we don't need broadband to make that happen. I think this is a really big issue because broadband is really expensive to get into the schools and the majority of schools don't have access to it. So if we are pushing for Broadband it needs to do something outside of what high-speed cable or conference calling can do. That's our big, burning question.

8. Project Lead interviews

This chapter discusses the experiences and reflections of the ABEL project learning and technical Leads, as well as well as the project managers, who were interviewed in the late winter and early spring of 2003. Together their different perspectives and experiences in the project provide critical insight into some of the major successes the project has had to date, the problems they have perceived and how the leadership has attempted to address these, and the kinds of challenges it still faces.

8.1. The personnel

Project Manager: Janet Murphy. Janet has had a 27 year career in education. In the early 90s, when she was employed by the North York Board of Education, she became interested in networked learning and did a lot of professional development training of teachers around how they would use Information and Communication Technology (ICT). When this Board amalgamated with the Toronto District School Board., she asssumed a central leadership role in the area with the Toronto board. Most recently Janet had been a manager with the LearnCanada project, a earlier exploration of the use of broadband for project-based learning (see literature review).

Learning Lead: Karen Andrews. Karen is a resource teacher with the Edmonton District School Board working in the field of technology integration. She had also played a key role in the LearnCanada project.

Technical Lead: Sue Spence. Sue is the Director of Computing Services for York University, and in this capacity is responsible for the planning, deployment, and management of various facets of the computing environment at York.

Assistant Project Manager: Obadiah George. In his prior position at the Toronto District School Board, Obadiah was helping to set up the virtual school programs, and simultaneously he was involved with the LearnCanada project. “We were working with teachers and subject matter experts. Probably the larger part of my role was figuring out how we were going to distribute the content to the various students wherever they were, and in the best way possible. So the biggest problem there was to do it in a dynamic way as opposed to the static approaches that were taken by a number of the vendors of our products”. His responsibilities for ABEL include providing technical consulting and support to members, and assisting Janet.

8.2. Successes

Janet thought that the project had been successful in developing some prototypes and models that school districts or educational institutions could adopt at the school level, the district level, and then at the provincial level. She cited as an example the aggregate of Internet-based tools and services ABEL has brought together, which she termed a “learning engine”. She saw ABEL changing teacher behavior and how teachers use

technology, giving them the potential to become technical innovators. “The minute that the teacher starts to see a change in how their students respond to the delivery of the curriculum, they start to see all kinds of other applications, they get all those teachable moments coming up”.

For Karen, a strong indicator of success of the project was the exponential growth in the use of broadband over the past few months. “The participants in the ABEL learning community very quickly realized the potential of the technology and grasped it for a variety of uses such as the ABEL 501 course, and the subject area group sessions.” She also thought the building of a learning community was proceeding well, and collaborations were starting to be fruitful. Teachers from Alberta and Ontario who did not know each other before were now working together to build better learning opportunities for their students. Karen cited the example of the Ontario Science Centre field trip (presented in the case studies) as “an incredible epiphany for the teachers and myself as an observer”.

Another critical and successful component of the program in Karen’s view had been the use of learning event surveys on a regular basis. “That feedback is used directly in shaping events and activities so that we make everything we do very relevant to what the teachers are saying their needs are”. She also received feedback by conferencing with leads and through email.

Karen was pleased with the state of the project at mid-year. “We’ve been very successful in keeping our project on the tracks.” But she saw the program being at a critical juncture. “Teachers who have tasted it and tried it, if they don’t get the support and if we don’t keep encouraging the collaboration, if we don’t improve the technology then they will slide. And we will lose them.” She see the upcoming Summer Institute as critical in this respect:

> …to keep the momentum going and reduce any slide. If the teachers can form a bond between themselves, they get professionally developed at the same time as they’re working with kids that’s very real. It’s a real job embedded professional development model.

Comparing the ABEL project’s state of development to that of the LearnCanada initiative at a similar point in its timeline, she thought ABEL was twice as far along.

Sue cited as a major contributor to any success her team has had the collaborative relationship she has developed with Janet, Karen and Obadiah. “I think it makes a huge difference.” Speaking of Obadiah, she noted, “There’s no way I could have done it without him there, so he’s been great at working to make sure you try and follow through, make sure you don’t step on toes or anything, and you’re going to the right people.”

8.3. Perceived challenges

The first challenge Janet faced when she came to the project arose as a result of her “not being engaged from the beginning”. This had made tasks difficult for her, especially

since the project proposal writing and budgeting was done through outside consultants and senior people at York, in the York Region, and at Seneca, without the participation of the grass roots people that have to do the work.

She viewed her current chief challenge as one of maintaining good communication in the project. She commented that she is constantly asking herself ""Do the people really understand the language we use, and do we all have the same context for the language?"

She noted that there had been some lack of success in getting collaboration from the postsecondary groups in the project and postulated that the postsecondary faculty from both institutions, York and Alberta, see themselves as being outside of the work that the teachers are doing. At York, she says, "the University has a Research and Innovation office. But there's a lot of people at the University whose services Research and Innovation need to use in order to do the work that don't see research and innovation as part of their job responsibility". She also cited the failure (up to that point) of the University of Alberta faculty to participate in the project.

Technical capacity limitations were also a concern. Janet has found it "problematic that there isn't a lot of capacity at the university in the technical area, and in some of the other areas to do the R & D from the existing staff". Institutions need to be looking at "next generation models of staff development or next generation applications of software and hardware so that you can make informed decisions when the time comes. And this is where a project structure such as CANARIE creates difficulties for institutions when they don't have that embedded in their culture".

Karen considered certain technical shortcomings of the project as the biggest obstacle that she was facing. "The fact that not all of our schools are connected to CA*Net 4 …that is a huge barrier from a project perspective, it's a huge barrier from a participant perspective". She stated that when a site is not connected to broadband, "people in that site feel distant and do not consider themselves as part of the group". She said that the project was finishing its fourth quarter and moving into the fifth quarter, and still two sites (Centre High in Alberta and Seneca College in Ontario) were not on CA*Net 4. (Centre High and Seneca did receive their own CA*Net 4 connection in the spring of 2003).

Another significant barrier she mentioned was the varying arrangements for teacher participation. "We have one site [UFA] that basically is asking their whole teaching group to volunteer to participate in ABEL, without reducing their workloads". She saw this as a huge barrier to participation. "When you have teachers that are already in survival mode because of circumstances beyond their control and then you introduce a whole gamut of new technologies for them to learn and then you expect them to participate in a new way of teacher professional development and then you expect them to volunteer their time on the project, obviously we're not going to get a full participation rate from those teachers".

Karen was also exploring ways to reduce or eliminate the cost of the ABEL 501 graduate course offered by the University of Alberta to ABEL participants. "we are looking at

ways to overcome the barrier of cost to teachers who are trying to work on their Masters degree." (This endeavor was successful—the course was eventually made available free of charge to ABEL teachers.)

The technical challenges seen by Sue Spence stemmed in large part from cultural differences existing between the partnering organizations involved in supplying and supporting the hardware and tools. The profit-oriented focus of corporate partners that she deals with have created some difficulties in establishing agreements:

> We just come from a whole different space than they [ANLON and Tutor Buddy] do. We sit and we talk about doing things with no sense of make money on it. Whereas their bottom line is they have to be able to justify all of this by the return they are going to get from it. The Tutor Buddy people wanted particularly that the whole project be planned with all the deliverables, and everything they were going to be getting written up before they even were going to do a thing. And so Janet and I had a series of meetings with those two vendors because it was just not a very good relationship, we were just kind of butting heads. So eventually we got over it."

As it turned out, ANLON was dropped from the project in the spring, and WebCT and Dreamweaver brought in to replace it (causing some problems for one teacher who had a fully implemented ANLON-based unit which then had to be transferred to Web CT).

Sue found that meeting the technology staff from the private sector partners was unproductive, and Janet took over that responsibility, reporting back to Sue with the issues and action items. Another challenge Sue noted was the logistics of connecting with the technical staff at York Region and Toronto school boards.

For her own York department the project has been a challenge as well, because providing support for research "isn't embedded in our thinking with our jobs. It's always an add-on kind of thing". She finds herself spending a day per week on project-related work, more than she had anticipated.

The biggest challenge Obadiah had seen in the project to date as been the establishment of relationships between participants that can sustain a momentum of dialog, especially when troubles arise. Otherwise, he argues, when a difficulty emerges there is a tendency just to leave it until the next videoconference or face-to-face meeting. "I think it can really be helped if people feel confident enough to contact each other, and when they do decide to contact each other, the contacts are made very easily and seamlessly". Another challenge he sees is ensuring the transferability of skills developed in the project, so that rather than simply knowing how to use one model of videoconferencing equipment, "videoconferencing [can be done with] whatever camera and microphone you happen to have—this is the way that you should be able to make it work for you".

Obadiah sees the differences in the flexibility of access to broadband at the various sites also presents challenges for the project. Whereas the YRDSB schools can access CA*Net 4 from any network drop in the school, allowing flexibility of use, UFA only has access in their videoconferencing room and the school library.

He places importance in expanding the capacities of videoconferencing beyond talking heads to incorporate the sharing of documents, presentations, and video clips in real-time collaborations. “So we are not just talking about a videoconferencing system where we can both talk, but something where we can share ideas and show different ideas. That has put a pretty big twist on the technology that we have to date.” Looking to the future, he hopes the project can begin to explore more naturalistic approaches to communication:

> Wouldn't it be better if having a course online meant my instructor is online, he or she is talking to me, or talking to the class and through his talking we then can break out into groups that allow us to talk to the other students in the class. Either synchronously or asynchronously but image and audio are together. And so that idea in my head is sort of stuck with me and I look at applications that line up with that kind of thinking.

9. Case Studies

The following four case portrayals document the development and delivery of ABEL curriculum projects, and also analyze project outcomes. They were developed from interview, observational and document data (see each case for detailed descriptions). They are representative of the range of projects occurring in the first year in their general form and scope, though not in their details. The first two case studies are reported together as they involved the same pair of teachers who conducted the events sequentially. The last case presented is longer as it is a portrayal of the planning and implementation of an entire subject unit that was part of an ABEL project.

9.1. Science Learning Events: Middlefield Collegiate Institute & Victoria School for the Performing and Visual Arts.

Introduction

This case study focuses on the evolution of a collegial connection and the co-development and implementation of learning activities made by a 12th grade science teacher in a community in Ontario (Steven) with another 12th grade science teacher in Alberta (Jason). In the first of the two[2] projects, Steven's class at Middlefield Collegiate Institute watched a videoconference presentation on embryology by Dr. Bagnall in Alberta that was attended in-person by Jason's class from the Victoria School for the Performing and Visual Arts. In the second, Steven's class went to the Ontario Science Centre for hands-on lab work and connected with Jason's class in Alberta.

The following data sources were used to support the findings of this case study:

- Interviews with Steven conducted prior to the start of the ABEL project as a whole, as well as, before and after each of the learning experiences.
- Observations conducted on site during the two ABEL learning experiences.
- Two focus groups conducted with a total of seven students who participated in both ABEL learning experiences.
- Post-conference written feedback provided by Jason's students after both events.
- Informal discussions with Jason.
- On-line communications between Steven and Jason on the ABEL community website forums.
- Steven's daily curricular materials used during the learning experiences.
- A PowerPoint documentation of the learning experiences posted on the Community Zero site that also listed student responses.

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[2] A third videoconference learning experience was conducted early in the ABEL project, but was not observed by researchers as were the two related in this report. As such, it will be referred to as mentioned by the teacher during interviews. This case study will focus on the two main projects, the embryology expert speaker event and the Ontario Science Centre field trip event.

- E-mail correspondence between Steven and the researcher throughout the ABEL experience.

This case study investigates the use of the ABEL technology within three spheres: 1) Steven's collegial connection with Jason in Alberta; 2) The two curricular experiences as co-designed by the teachers; and 3) Steven's and Jason's students' reactions to the two learning experiences. Finally, General reflections about the ABEL learning experiences mentioned by Steven, Jason, and their students are discussed as well.

Steven's collegial connection with Jason in Alberta

Steven began his collegial interaction with Jason after the ABEL Summer Institute in August 2002. They first used email to discuss potential points of interest. Both Steven and Jason admitted feeling uncertain at first about the ABEL project as a whole and about how to start using the tools provided through ABEL. Steven felt much of the success of his ABEL experience was in the connection he was able to develop with his colleague Jason, in Alberta.

Their first learning experience (not documented by researchers for this case study) was a presentation by a forensics expert. This speaker was arranged by Steven and shared via broadband with Jason's science class in Alberta. Steven's continued planning with Jason became easier as they used email, phone, the ABEL community forum (set up by ABEL for all participants), and videoconferencing to communicate. Steven sees his relationship with Jason as having grown stronger through these collegial interactions and they are discussing the possibility of aligning the timetabling of their 12th grade science classes next year so that they can team-teach. Steven noted that the time difference between Ontario and Alberta made the collaboration difficult at times, but that they are both excited about the potential of continuing their exploration of these ABEL technologies, especially the prospect of team-teaching using broadband video.

Description of the two learning events

The first learning experience centred around a presentation made by Dr. Bagnall. Jason knew that Dr. Bagnall, a professor in the department of anatomy at the University of Alberta, was an excellent speaker on embryology. Jason recommended that Dr. Bagnall's presentation be broadcast to Steven's class. They tested the videoconference connection with Dr. Bagnall in advance so that they could resolve potential technical problems. Steven invited Grade 9 students to participate with his Grade 12s since the topic was centered on embryology, an Ontario curriculum focus for grade 9 students.

All the students were, for the most part, listeners during Dr. Bagnall's presentation. They were given an opportunity at the end of the presentation to ask questions of the speaker and several students did. Dr. Bagnall also periodically elicited interactions from the audiences (both the local Alberta students and those in Ontario) by asking them questions as he introduced new information and ideas about fetal development.

Steven noted that the use of broadband video was an important component during this ninety-minute presentation. He explained that the speaker was excellent, but "…if it was just [Dr. Bagnall's] voice, [students, 9th grade students in particular,] would have lost

him. The fact that they are able to see him and see his body language and to see how active and interactive he was… is why they were kept [attentive] for the whole time."

Two projection screens were used to broadcast Dr. Bagnall's image and his PowerPoint presentation. This was an improvement from the first presentation with the forensics expert, in which one presentation screen was used. Steven explained, " …someone at [Jason's] school knew about the BNC[3] software that was a free download that let us share... the resolution was way better on the screen that we had today." Steven had also requested new speakers for the videoconference system, which he was now using because of the difficulty hearing when using the original speaker setup.

Because the embryology presentation was only tangentially part of the regular science curriculum for Steven's 12th grade science students, they were not evaluated directly on the content of the presentation. Steven explained that the fit with the grade 12 science curriculum was the connection between hormones, homeostasis and genetics and noted that the fit was not that strong. He felt that his students learned a lot in any case and was glad they had the opportunity to listen to this expert. At the time of this videoconference, Jason's science class had already finished this particular topic in class and so Dr. Bagnall's presentation provided a good review for his students.

The second learning event used videoconferencing to share a hands-on field trip that Steven's class had at the Ontario Science Centre (OSC) with Jason's class. The purpose for the field trip was for students to undertake the process of DNA fingerprinting in a DNA fingerprinting lab (the procedure incorporated Polymerase Chain Reaction [PCR] testing followed by Gel Electrophoresis). The fingerprinting was performed at the OSC. Steven and Jason worked collaboratively with a professor from York University, Paul Kortenaar, who was also an educational consultant to the OSC, as well as with the education director at the OSC in order to coordinate the event sharing with Alberta.

This learning experience was more directly focused on the Ontario science curriculum. Steven had been taking his students to the OSC for the past three years for this hands-on experience in the DNA lab. Because Jason's students also had genetics as a curricular focus, Jason was very keen on having his students share this experience, so he arranged to send his students' eyelashes to the OSC lab so that DNA tests could be run for them as well. The lab experience was a wrap-up of the unit for Steven's students. They had had a quiz on PCR prior to the OSC learning experience and had a lab report they had to complete on the OSC session after the event. Steven had not yet graded these latter reports at the time of the final interview, though he believed his students did as well or better than they normally would because of the sharing they experienced via the ABEL connection with Alberta.

Because of the size of the lab, only about half of Steven's class participated in the videoconferencing event; the other half had attended the fingerprinting lab the prior week. Steven's students present for the event would be there for most of the day, and

[3] Software that allows simultaneous multiple presentation outputs.

although he wanted to include the Alberta class as much as possible, Steven was concerned that they would be "bored to death" if they were only distant observers for the entire period. There was also a two-hour time difference between the two provinces to take into account. Steven and Jason wanted their students to have some kind of interaction. Steven expanded his students' interaction with their Alberta peers by assigning many of them parts of the lab process that they were to explain and demonstrate to the Alberta students after they had gone through the procedures themselves on their own DNA samples under the direction of the OSC lab teacher. He felt this would make his students "more responsible for the material." Steven and Jason used a murder mystery story to create a skit that several students at both sites practiced collaboratively and performed towards the end of the videoconference. Initially, Steven and Jason wanted their students to create an original script, but time pressures forced them to sideline that idea.

The actual video connection between Alberta and Ontario was fairly clean and problem-free, though at times the image was pixilated and seemed "frozen." The OSC used a T1 line and a Polycom videoconference system to connect to Alberta; they did not have access to CA*net 4. The equipment was configured to permit direct transmission of any digital feeds to Alberta, including the output of the Elmo opaque projector, which the lab instructor used to project the results of the DNA testing, and the PowerPoint presentation she used in describing and explaining the analysis procedure and findings. In addition, a second computer was set up at both locations configured for online chat via the ABEL Community tools. At the Alberta end, two data projectors were used to display the videoconferencing and chat screens.

The OSC instructor started the lab by providing an overview of the theory of DNA and the history of PCR, using a PowerPoint presentation. This initial part of the lab event was not part of the videoconferencing, nor was her step-by-step guidance to Steven's students as they undertook the DNA sampling and testing procedures. The actual videoconference commenced about three hours into the lab, and after a preliminary talk by the lab teacher, the Middlefield students demonstrated the many steps needed to prepare a sample of DNA for testing. The instructor then went on to interpret the students' DNA results. (Jason's students had submitted samples that had been sent to the OSC by post a week prior to the event, and these had been analysed prior to the day of the lab.)

Student responses to the ABEL learning events

Middlefield High School. Steven polled his students about their responses to the embryology presentation. Technical difficulties (i.e., not being able to hear the presenter at times) and issues regarding the videoconference presentation environment (i.e., it was a large class in which some students were uncomfortable sharing in front of other students, and there was no interaction with students at the Alberta site) were the least enjoyable parts of the presentation for the students. Having the PowerPoint presentation and Dr. Bagnall's lecture presented simultaneously was perceived as a strong positive, as was Dr. Bagnall's lecture style (students agreed that he was serious about the topic, but added humor at the same time).

During the student focus groups, students unanimously echoed these issues and added that because the presenter, Dr. Bagnall, evidently could only see certain students at the Ontario site through the videoconference system, he called on only a few students repeatedly and this made them uncomfortable. These students felt that although they learned a lot from the presentation it was essentially just a "lecture," something they experience in their everyday classes. They stressed that they wanted more interaction and communication with students at the other site. During Dr. Bagnall's presentation they could not see the Alberta students and this was a negative for them as well.

The Ontario Science Centre learning event was quite a different experience for Steven's students. Being a hands-on activity, they were far more engaged in it than they would have been with a strictly lecture style presentation. They were also more engaged with fellow students in Alberta, due to Steven's decision to have them present the lab processes to Alberta. Some of Steven's students also acted out the murder mystery skit. Students felt they "improved [their] understanding of the content" more by being responsible for explaining the PCR protocol to students in Alberta. Focus group students stated that the murder mystery skit provided some "entertainment" for all the students and the interactions they had with Alberta students "made us feel closer than we actually were."

The smaller groups of students at both the Ontario and Alberta sites made it a plus in students' opinions, compared to Dr. Bagnall's presentation. (As mentioned above, due to the size of the OSC lab, Steven had to split up his class into two groups, only one of which participated in the videoconference.) One student focus group believed that the Alberta students looked "bored." Some students believed that with a face-to-face teacher lecture you were "forced to focus" on the material being presented and with a distance video connection, this was not the case.

Victoria School. Feedback sessions were conducted at Victoria after the two videoconferences. Jason had the students engage in reflection about the videoconferences. He wanted to find out information from the students such as likes, dislikes, and suggestions for future videoconferences. Students thought the first Powerpoint presentation was informative and they thought the presenter, Dr. Bagnall, was knowledgeable about the subject, had a pleasant demeanor, and was well prepared. However, the Dr. Bagnall conference encountered technical difficulties and some students felt that they "lost out on the presentation" because of it. One student commented that Dr. Bagnall mostly posed questions to the Ontario students because he was worried about their interaction level.

In the second videoconference, the OSC instructor showed the students the results of their own DNA testing, which the students felt was "exciting to see." One student remarked that "it was even more collaborative because they actually had something of ours that they were analyzing."

Students noted that the technology looked and worked better the second time [compared to the prior conference]. "There were so many ways to communicate because there was even a MSN messenger type of device used where we could ask questions and get an

immediate response from someone in Ontario." Another student remarked, "It was great because we had the video conference in our classroom, during the class period; it was as though the presentation was at our school." On the whole, the students felt that this was an informative and visually stimulating way to learn the Science curriculum.

The students stated that their teacher, Jason, really "motivates us." They said that "we know he worked really hard to bring us this project and this only makes us work harder to be successful in the class and to take part in the presentation 100% because we know how much time he [Jason] spent on it."

Regarding the technology itself, one student stated that "We're an arts school …and this technology opened up possibilities for us." Another student added that "I think that everybody…is so adapted to technology that anything like this obviously is going to help us." He added that they will be going to postsecondary institutions and this technology is "going to be all around us" so they need to know this.

Teacher comments on the ABEL project and learning events

Steven. Steven noted that he would have liked to use both the ANLON system and the IO tool from Galileo. He explained that the science curriculum is not open-ended, whereas the IO system, which focuses on inquiry pedagogy, is, in his opinion, very open-ended. For Steven, there was constant tension between using the tools to enhance student learning and moving through a rather lock-step curriculum to help students get ready to graduate. Unfortunately, by the time he intended to pursue the use of the ANLON system for a pre- and post- test on the science curriculum, it was no longer available. Jason echoed Steven's comments on this matter. Jason would certainly like to experiment with other tools in future classes.

Steven had one eighty-minute class period a day of course release time to work on his ABEL projects; Jason had approximately 80 minutes free every second day to do so. The time pressures both felt with respect to developing innovative learning experiences using the various ABEL tools were tremendous. Steven believed that the learning experiences could be made stronger by allowing students to have more frequent interactions using the videoconference system. He noted that what he and Jason had accomplished was true collaboration, something he wanted for his students, but he also saw these experiences as building upon one another, thus the need for ongoing conferencing. Steven had stressed in earlier interviews that he (and Jason) needed to have a handle on the technical system first so that complications would not ruin the unit. Later, he said, once he was more comfortable with the technology systems, he would promote more student collaboration.

The aforementioned time constraints forced Steven to abandon more complex preparation for sharing the OSC learning experience with Jason's class. Steven had hoped to videotape the OSC building and lab facilities and send the tapes in advance of the planned videoconference with Alberta, so that Jason's students would have a stronger connection with the event prior to the lab experience. Unfortunately, just getting the lab day preparations completed consumed the time Steven had. Interestingly, Steven noted in his first interview that he would be "most comfortable with the technology" when he could "talk about project content with [Jason] from out West, just as I would talk to

[colleagues in his my school]." Considering the evolution of his collaborations with Jason, this part of the ABEL experience was most successful for Steven.

Jason. Jason appreciated the time the ABEL course release time afforded him to become up-to-date with broadband technology and be able to effectively incorporate it into his repertory of instructional techniques in his science classroom. However, there were occasions when it seemed he did not have enough time to get everything he wanted done completed. Still, he was able to put all of his own notes/lessons onto PowerPoint for classroom lessons and he was also able to learn a great deal about the videoconferencing system. Even though there were several months of planning and preparation involved in this Science ABEL project before conducting the videoconferences, for him, it was certainly worth it. From the feedback he received after the event he determined that the technology definitely helped the students in their learning. His students, he stated, had been very impressed with the teaching skills of the lab instructor and had closely followed the lecture and presentation as they proceeded. Jason himself thanked the instructor at the end of the videoconference, saying "We were blown away by the great job you did! I can't get over the amount of work you put in–we have to do this again. My kids were spellbound." He also complimented Steven on the quality of his students' demonstration of testing procedures in conference. He indicated that despite a few video glitches the audio had very strong; "I don't think we missed a thing."

By presenting material using different media in such a hands-on way, Jason thought that students with different learning styles were all able to take away something from the presentations. For next year, he hopes that parallel class times could be set up with the schools involved (in Ontario and Alberta) so that the videoconferencing technology could be utilized more in next year's classes.

Jason noted that at times, the equipment would not work properly and that this was quite frustrating, but with persistence the glitches were worked out in the end. He is grateful for the positive experience he has had working with colleagues over the past year. He was able to learn from others teachers and from his students and also learn about the potential of available broadband technology. Collaborating with Steven, who was two provinces away, has been a very rewarding experience for him.

Students' general comments on ABEL learning experiences

Middlefield. In general, Jason's students were enthusiastic about the use of videoconference opportunities and were eager to have more of these experiences. They suggested that improvements in video and audio quality were necessary for future sharing to approximate face-to-face interactions. They believed that as technical improvements were made, having much more interaction with students at the distance site could enhance their experience as well. Being strictly spectators was not as appealing to them as being participants in the learning experience with students at the distance sites. For students who participated in the murder mystery skit, creating connections with some Alberta students helped to alleviate the nervousness of interacting with the distance group during the actual videoconference, because they had an opportunity to get to know each other. Steven's students enjoyed the idea of getting to know people from different communities that they would otherwise not be able to meet. One student noted that

videoconferencing will be important in the future because "people all over the world will be able to generate knowledge much easier and enjoy the personal interactions."

Victoria. Students in Alberta made similar comments about the videoconferences as those in Ontario. The students also pointed out that the technology could be applied to other subjects and not just science classes. They said that the videoconferencing system could be beneficial for any of the school's arts classes, as well. For example, in drama or acting class, students could watch a choreographed piece for a dance show or they could talk to dancers and famous artists and/or go to galleries from other areas of the world. One student commented that it would be "cool" to interact with people from different parts of the world. Overall, the students in Edmonton felt that "the ABEL project does offer a huge benefit" and they hoped that this technology will continue to be used in future classes.

Conclusion

This case study investigating two of the ABEL learning experiences from the perspectives of a science teacher in Ontario and a science teacher in Alberta highlights several issues when using broadband videoconferencing systems and other ABEL curricular tools. First, though these teachers were very interested in making the videoconference connection, time constraints were ever present. While Steven had release time of one class period a day, he used all of that time, plus after school time to meet the demands of co-creating learning experiences with his science colleague in Alberta. Jason's time was even more limited, and as a result, certain ancillary activities that had been thought about, making use of tools such as ANLON, had to be dropped.

Steven was concerned that the time constraints of a very tight science curriculum allowed no time for student driven investigations outside of the curricular focus that were not directly tied to the 12th grade curriculum, and little if any time for student collaborations at a distance, although he saw potential value in all these experiences. Steven was also concerned about collaborations with a teacher as far away as Alberta, a two-hour time difference. He and Jason believed it would be possible to overcome those limitations if they could align some of their class schedules, but he was unsure if this would be a possibility given school system constraints.

Both teachers were convinced the events themselves had been highly successful, from both a motivational and pedagogical perspective, and the student feedback on the events support their perceptions. Certainly the event brought a level of authenticity to science teaching that is rarely seen, except by the relatively few students who can and do access a facility like the OSC lab, and this project demonstrated how videoconferencing technology could effectively broaden the availability of this type of activity. The comments of Steven and Jason about the need to embed these new technologies into ongoing teaching reflects their awareness of the limitations of "one-off" events of this nature, however, in that they do not in themselves constitute a full inquiry learning experience. While the students in the lab had the chance to participate in or directly witness the steps of PCR testing, the focus of the event was largely on learning and following a step-by-step procedure, rather than student analysis or problem-solving. What needs further exploration is how the necessarily delimited knowledge gained in events

such as these can be utilized within the context of a larger inquiry learning project, in which students engage in personally meaningful, collaborative, and largely self-directed knowledge building, and how broadband technologies can contribute to this process.

9.2. P^2S Collaborative Math Project: J. Percy Page High School and Ursula Franklin Academy

The P^2S Collaborative Math Project, held in April/May of 2003, was an opportunity to explore the potential uses of Internet broadband applications, both for student learning and teacher collaboration. The project was a culmination of several months of online exchanges among ABEL schools and partners from Ontario and Alberta using videoconferencing technology.

Data utilized for this case study were drawn from

- Transcribed interviews with Elayne Dell and Mary Vella
- Reviews of related print material in the ABEL Community main and student websites
- A class-wide interview of J. Percy Page math students who had participated in the project (45 minutes) with follow-up observations and notes by myself
- Observation of the two project videoconferencing events at J. Percy Page from digital tape archives, along with observation notes
- Online student survey results from J. Percy Page and Ursula Franklin Academy

Project background

This senior level mathematics collaborative project brought together the following ABEL partners:

- J. Percy Page High School, Edmonton, Alberta – participants included students of a Grade 12 matriculation mathematics class taught by ABEL teacher Elayne Dell. Colleague Brian Smith provided technical assistance on the project.
- Ursula Franklin Academy, Toronto, Ontario – participants were Grade 10 math students and their teacher Mary Vella.
- Student mentors for the project included Dr. Ted Lewis from the University of Alberta, Kevin Pitts of Seneca College, Kelly McKie and Dr. Sharon Friesen of Galileo, and Drs. Jean Springer and Indy Lagu of Mount Royal College.

Elayne and Mary began exploring the possibility of pursuing a joint mathematics project in their first subject-oriented small-group videoconference in January. The mismatch between the Ontario and Alberta math curriculums meant that no areas for collaboration could be found within the mandated curricula of their courses, and so they decided to explore the idea of having their students work together on math puzzles as an enrichment activity. The project work began with some orientation and exploration of the technology options provided through the ABEL project. Both Elayne and Mary expressed some basic familiarity with the available ABEL tools. However, Elayne suggested that some of these tools – Historica and Tutor Buddy, for instance – were difficult to find applications for in mathematics. Earlier this year, Elayne had begun to explore ANLON, but found the program difficult to learn and use. The technology tools settled on for the P^2S project specifically were Community Zero (for both student and teacher collaboration),

videoconferencing, e-mail, and any conventionally accessed Internet sites related to the math problems themselves.

While both Mary and Elayne were conducting math projects within their own schools, Elayne felt a certain "pressure" to hold an "event." Elayne also brought a strong interest in teacher collaboration to her ABEL work, and saw the project as an opportunity to expand professional collaboration opportunities, as well as add some interest and variety to a subject that, as she noted in her interview, was at the best of times difficult to teach in novel ways.

Feedback from Elayne and Mary suggests that this collaboration was among the project's successes. Videoconferencing, stated Elayne, while awkward at first, grew to become a very effective communication tool – one she would be pleased to work more with in the future. In her interview, Mary also expressed appreciation for the videoconferences: "I prefer talking over e-mail."

First P^2S math videoconference

The objective of the first classroom-based videoconference was to introduce P^2S participants to one another, and present the math problems that would make up the heart of the project. It was also an opportunity to challenge students with a more discovery-oriented approach to mathematics. As Elayne explains it, "The idea was just to expose [the students] to a different level of mathematics and/or a different style of what they had learned….[W]e wanted…to have mathematicians present fun problems…where the math would be hidden within what they were doing."

Early in the videoconference, Richard Briggs explained the collaborative web space for the project and how it was to be used in the P^2S project. There were no visuals accompanying Richard's presentation segment, and JPP students later noted in the interview that they had not really understood the Web space well at the time. In fact, few students in Elayne's class had prior experience with chat or bulletin boards, and none had used these tools in an educational setting. As such, it is likely that students did not begin the project with a deep grasp of the workings or potential of the collaborative space.

Each project mentor then introduced and explained a math problem, using presentation techniques (lecture and whiteboard) not unlike those in any classroom. A more interactive component was planned in the form of a Q and A session to follow, in which students from both schools could pose some initial questions to the mentors. However, technology problems by this stage were interfering with the flow of the presentation, and appeared to be distracting all participants. Poor sound quality throughout the conference made the mentors' presentations difficult to follow, and many students instead began studying and working on the problems individually from the handouts that Elayne had distributed earlier.

Elayne by this stage had simply turned to her class for face-to-face discussion, comments or questions for clarification. Ted Lewis (who was on-site for the conference) provided some brief advice about how to approach the math problems, encouraging students to

attend to the processes they were using to think about the problems rather than simply seek solutions.

Preparation for the videoconference was, by Elayne Dell's estimate, extensive. A critical planning aspect was bringing together the project participants all at once. As Elayne and Mary both noted, differences in time zones made scheduling a challenge. Because of this, Elayne's students participated in the two videoconferences during their lunch hours. The conferences required some additional technical foresight in order to be accommodated in Elayne's regular math classroom. Other pre-conference preparations included the establishment of a collaborative web space in Community Zero (with the assistance of Richard Briggs) and the distribution of an agenda, an explanation of the project, and print versions of the problems to be presented.

Eight open ended math problems were chosen and elaborated upon in the print-based handout. This handout was used during the presentation, and was frequently referred to by the students.

ABEL student web site

Between the first and second videoconferences, it was hoped that students would take advantage of a community web space to explore the presented problems. As Elayne explained it, students "[could] come back [to the site] and say 'Look this is what I've done with this problem; this is how I approached it; this is where I got stuck…'" Separate forums were set up for each problem in the ABEL Students Community, and students from the two schools were invited to collaborate amongst themselves, along with the project Mentors.

Participation in the P^2S space was decidedly disappointing. All students in Elayne's class logged in to the web space once, but few followed up. Approximately ¼ of the students logged in a second time, and only two logged in more than twice. Mary's students were given two 15 minute periods to post on the web space, and most did at least onece. Some posted from home; others did internet research on their math problems from home. Some of their postings were requests for help, others offered advice.

One possible explanation for the limited use of the Web space is that the project was voluntary for Elayne's students, and they did not make use of the forum a high priority. In the group interview, several students mentioned outside commitments; further, this senior class was approaching departmental exams at the time of the P^2S event. For some, it was difficult to justify spending any significant time on this extracurricular event.

It is also possible that students did not fully appreciate the role of the web space in the project. In an informal class poll, only about half had experience with recreational chat rooms, and none had any experience with web boards or chat in an educational setting. Students found the P^2S community "messy" and somewhat difficult to follow. Students agreed when asked if a visual overview of the site – at the time of the first conference as Richard Briggs was explaining the application – would have helped them to navigate and use the space more effectively.

Finally, the space may simply not have gained enough momentum to maintain students' interest; there was not enough activity to encourage students to keep checking back. In a group interview, some students noted that they had not returned after the second time because nothing was happening; few students or mentors were contributing to the discussion forums. "There was collaboration?" questions one in a survey response, "The forums were quite dead, you know."

Despite weak participation in this aspect of the project, Elayne remains interested in chat, web sites and discussion boards as a means to extend and support her traditional classroom teaching. In the student group interview, she probed her kids as to whether a synchronous chat format might motivate them more than an asynchronous discussion board. Approximately half expressed interest, although as Elayne and I later speculated, graded assignments using chat would most certainly improve participation.

Second P^{2}S math videoconference

The second of the two videoconferences was intended to showcase the students' work over the preceding two weeks. Student from both schools had planned to present their approaches and solutions to the math problems. The high quality of work prepared by the students in both Elayne Dell's and Mary Vella's classes suggests that students were motivated by the project, particularly given that the work was entirely voluntary.

A possible explanation for the work's high calibre, proposed by Elayne, is that her kids were somewhat "on the line": showing up empty handed at the videoconference would have made them look bad in front of their peers in Ontario. As one student put it, "People are watching you, so don't do anything to embarrass yourself." Also, in general, students expressed that they enjoyed working on the math problems – they were fun. Here then, both the context and the content may have facilitated student motivation.

The event itself, however, "crashed and burned." Technical difficulties with wiring Elayne's room for the event left her class unable to link up with other participants. As students had given up their lunch hour to participate in the conference, and in some cases prepared presentations on the problems, frustrations ran high. Students' negative feelings about the technology are evident in survey comments: "Crude, inefficient and unnecessary," one stated succinctly. Another: "The technology we have is interesting, but not developed enough to have a purposeful conference."

Having "seen" little of one another in the first videoconference, the two classes had looked forward to more peer interaction in the second videoconference. Students from both schools indicated that they were curious to see how others had approached the problems. The lack of exchanges between students themselves thus served as another source of frustration. In fact, the lack of face-to-face between classes was, by student standards, among the great disappointments of the project. Stated one student in a survey response, "[T]he other students didn't really talk. It would have been more interesting if the other students were more interactive with us." Another offered, "I thought if more collaboration had taken place it would have been more fun. We didn't even get to meet the students."

Though the videoconference did not take place, Elayne still had the students who had completed projects present to the class. Projects – well done – included an illustrated book and a colour poster. Another student used the Queens problem to learn more about chess, which she had never played. Elayne's students also presented to each other and the Seneca mentor present. Evidence of the intensive work put into their problem tasks was seen in the elaborate and elegant computer-generated displays they had created that they used in narrating their solutions.

The presentations were followed up by an interesting discussion among Elayne and her students, captured on digital videotape. Elayne asked her students how they had felt about the project, and what might be done to improve similar projects in the future. Most of the content of this conversation was captured again in the student group interview, and the individual interview with Elayne.

Analysis

Interviews and data gathered for this case study create a rich portrait that rather belies categorical evaluation. Most certainly it was an excellent learning experience for the teachers and participants. Elayne Dell expressed that despite the time demands of the project and the great disappointment of the second videoconference failure, the project had been worthwhile. Her students were less convinced that the project had been a good use of their time, but in dialogue demonstrated a real thoughtfulness about the value of videoconferencing and more broadly the value of technology, to their learning. Mary Vella's students also had some thoughts on ways in which videoconferencing could be made more "student directed."

Collaboration and Interaction. While many of Elayne's students were ambivalent about the value of videoconferencing—and in some cases technology more generally – for their learning, most were still intrigued by the prospect of interacting with others outside of the classroom. One student commented, "I think it would be neat if a teacher from a different province or country could teach us a math lesson."

In the group interview, students were asked about the role of the mentors. Some comments suggested that their expertise was dismissed as the same stuff coming from a different teacher, although one student did note "[I]t felt kinda cool to know I had these math genius' at my disposal to ask any questions or seek advice." It is also difficult to assess the effectiveness of the mentors in the conference because technical difficulties so badly damaged the quality of mentor presentations.

Beyond these technical difficulties, however, Elayne expressed some disappointment that the project mentors had not taken a stronger initiative to engage the students – either in the videoconference or following up in the web space. This highlighted the importance of strong teaching skills and the ability to engage students. Technology here was no substitute for gifted, enthusiastic teaching, and presenters must be carefully chosen for their ability to bring outside expertise to students in meaningful and engaging ways.

Another clear theme to emerge was the desire of students to interact not with mentors or other teachers but with other students. In the group interview with Elayne's class, almost

all students expressed that their interest in the project lay in seeing and talking to another class. Mary Vella's class expressed a desire for a more "student centered conference." While the exact meaning of this is unclear, survey comments suggest that students want to talk and share in videoconferencing just as they might in group work in their own class. The simple fact of having to present to other students led to changes in student behavior. Mary noted that she was highly pleased to see students who "were once in a competitive mode now [working] in a collaborative mode" when they had to present the problem solution steps together to the J. Percy Page group,.

In the group interview with Elayne's class, students made some interesting comments about the challenges of structuring collaborative videoconferencing so that students in on class were actually engaged with students in the other class, and not simply talking "at" them.

In short, students, while curious and often enthusiastic about the technology used, never lost sight of the ultimate objective: to learn in relationship with others.

Pedagogy and learning. In their comments, it was clear students understood the distinctions between content and pedagogy (here facilitated by ABEL technology) and were able to consider the merits of each.

Pertaining to content, in the group interview, students generally related that they had enjoyed the open-ended nature of the problems: "[I learned] an approach to problem solving by starting small and finding patterns." Another student comments "I learned how to think a different way when attempting a question." However, we noted that this inquiry had mostly been undertaken individually. In other words, the technology did not successfully facilitate the collaboration that might have enriched a discover approach.

The question was raised as to whether the technology had value as a learning tool, or simply created interest and motivation because it was novel. In the survey, one student wrote "…Students look at this event as entertainment and a field trip. They just want to have fun." Another stated, "I think that because of the entertaining circumstances we learned less than we would in class; we were far more pre-occupied with watching the cameras and doing stupid stuff." Others recognized the novelty factor but believed that it contributed to their motivation: the technology was "neat" or "cool" or "interesting."

As most everyone in Elayne's class had previous experience with videoconferencing, the students, as a group, appeared to grasp the notion of the novelty or "wow" factor, and respond to it in a balanced and reasoned manner. Generally, students seem to appreciate the potential of the technology to make their learning more fun and interesting, but see videoconferencing and other forms of technology in the classroom as some among many tools and strategies to facilitate learning. As one student suggested, videoconferencing should be used "not all the time but…sometimes. It's good to have around. Some kids can learn better this way and some can't so the traditional way of teaching and this way should be mixed together."

Technical difficulties and the value of technology. Student comments reflect a real mix of opinions on the value of technology in the classroom. Responses in the online student survey range from full-blown enthusiasm ("I think it is a wonderfully expanding new approach to learn.") through indifference to scathing critique.

The majority (though not vast majority) of the comments suggest that students see potential in videoconferencing as a learning tool. Many noted that were it not for the overwhelming technical difficulties, videoconferencing could be an interesting alternative to traditional in class delivery. Said one, "[It] provides variety, choice, builds community." Another commented that "If the technology is good then possibilities are great." In general, comments suggest that students see videoconferencing as a potentially interesting and effective addition to—rather than replacement of—traditional classroom delivery.

However, even if improvements to technology render the videoconferencing seamless, the issue of its value for learning is not universally supported. Some students questioned whether the online interactions were of any more value than those they would receive from their own teacher and peers in their own classroom. In the survey, one suggested: "[The] same results can be achieved with traditional teaching, with very small margin for error." Another: "I don't see how expensive contact with distant peers is different from talking to the student beside you and the experts don't really contribute much: I believe teachers will provide far better instruction."

In the group conference, students in Elayne's class appeared to take a real interest when I explained the potential applications for videoconferencing in schools that lack the staff and resources of major urban centres like J. Percy Page. For some, it perhaps gave more meaning or importance to the ABEL work being done in their school. In survey responses, some students recalled this discussion: "[It] allows people in remote areas to attend school." Another: "Everyone should get the chance to experience this."

In this project, as clearly recognized by all participants, problems with technology were time consuming, frustrating, and generally hindered the learning experience. However, for most there was recognition that with time and practice, the technology itself will become less an issue than what it is achieving for teaching and learning.

Future directions

Elayne was deeply discouraged with her ABEL work when the second videoconference failed. As she recalls, "For two days afterwards it was like forget it. I'm never touching this again."

After reflection and discussion with colleagues, however, Elayne's enthusiasm for ABEL was renewed. She concluded that she learned a tremendous amount about collaboration, and her own teaching. In particular, the experimental nature of the project helped Elayne to take some risks in her teaching. As discussed in her interview, the discovery approach—both in the math content for the project and at the level of the project itself—drew her closer to her students in some ways. This project was different because Elayne had to say "Hey guys…this is new for me [too]."

From the above insights, Elayne concluded that she would like to pursue more discovery-oriented approaches in math classes, and still hopes that ABEL technology can facilitate this. She remains interested in the potential of synchronous and asynchronous discussions online, and open to experimenting further with videoconferencing. For the upcoming school year, Elayne and her colleagues are interested in developing an International Math Club that will allow students to meet and collaborate with students from another country.

Mary came away from the experience with a similar level of enthusiasm. Despite the difficulties encountered she thought the collaboration had "definitely" been worthwhile; given that the event was a new experience she was not surprised that it took a considerable amount of time to set up, and required "a lot of improvisation": "We were on our own with this one." She did feel that this type of project is more suited for smaller sized classes. She wanted to think more about how to engage students in a project who are not strong in math so as to "get them thinking." She called the event a "rich learning experience", and intends to learn about more ABEL tools and pursue other projects in the fall.

9.3. Greek Studies Unit: Ursula Franklin Academy

Background

This case study offers a view of the experiences of Cathy and her class as she planned and implemented a five week long inquiry project in her Greek studies unit, part of her grade 11 History course. Both Galileo's Intelligence Online (IO) tool and videoconferencing were employed in this work, which took place in the late winter and early spring of 2003.

Data for the case was gathered by several means. Three formal interviews with Cathy were held before, during, and after unit implementation, and these were supplemented by several informal conversations. In addition, regular observations of her class were made while the unit was being taught, and the videoconference event was also observed. Interviews with two small groups of students were conducted after the unit had run its course. Documents analyzed included the project development plan created in IO as well as the interactions Cathy had around the project via email and Io discussion; student contributions to the project's online student forum; photos taken of student mind maps; student survey results; and copies of all materials distributed in the class. The Alberta teachers whose classes participated in the videoconference responded to a questionnaire.

Project development

The provincially mandated curriculum for Cathy's grade 11 pre-1600 history course includes a unit on ancient Greek history, and Cathy decided to make this unit the basis for her ABEL project for several reasons. She had been exposed through the ABEL whole-group videoconferencing sessions to the Intelligence Online (IO) inquiry curriculum development tool provided to the ABEL group by Galileo, and she thought that the inquiry question about Greece that she had asked her students to address at the tail end of the unit the previous year ("Was ancient Greece glorious?") would be a natural "fit" to the kind of inquiry question that IO was structured to help teachers develop inquiry projects around. It also fit her class schedule for the year well: "When I heard about IO it seemed like it was already a nice self-contained unit that I already had an idea about, kind of an inquiry and seemed that it wasn't too soon and not too late that I would have enough time to plan for it." She also thought it was a unit that once developed could be used again in future years. As far as other ABEL tools were concerned, she had not been impressed with the videos in the Tutor Buddy library—she had seen them under the Magic Lanterns label and considered them old and out of date. She did not think that ANLON could have contributed significantly to what she wanted to do and its use would have taken "a huge amount of time". "IO was the only one of the three that would do what I wanted, which was inquiry-based learning."

Cathy found the process by which IO guides teachers in developing goals and ideas for inquiry learning units and actualizing those ideas in a curriculum plan and set of activities and rubrics provoked a great deal of thought on her part about teaching strategies. She took a day of release time to go through the step-by-step process of responding to the questions and prompts that were in the online development template. These asked her to identify a topic, determine a timeframe, focus the topic by writing down possibilities,

gather information, define understandings, establish fundamental concepts, integrate technology, create meaningful tasks, and develop assessments. She later described the process as “unnerving, but very helpful”, and she liked the priorities it set, and found it “user-friendly”. She did feel it was a bit better suited to the elementary level, and that it had an “Alberta slant”, but these issues were “not a problem” for her. “I could feel my brain stretch as I did it,” she remarked later. Later she wrote, “The opportunity to just sit down and plan, with good tools and advice was extremely exciting….”

She did find the development process very time consuming, however; in addition to her full day of release time work, she spent another six hours using IO the following weekend, and at that point indicated that she was only about ⅓ the way to completing her unit. But without IO, she said, “there was no way I would have undertaken this project – it would have taken all summer.” “It does take a teacher a full day to work through what matters. Teachers have often not been given time to work through what its important and significant.”

In the course of her development work she initiated and sustained a dialog with two members of the Galileo staff that focused on several aspects of the unit and its development, as well as on the use of IO itself. Cathy’s operational questions were largely relayed via email, while the curriculum oriented discussion took place using IO’s “private discussion” tool. Cathy would post her thoughts about various unit design issues and choices she faced, and ask for recommendations or ideas. Responses from Galileo staffers Sharon Friesen or Candace Saar were usually very rapid, often occurring within a few hours of Cathy’s post. Suggestions would be made for new ways of thinking about a unit objective, ideas presented for possible activities and ways to present and implement these, and references provided to resources (books, Web sites) that Cathy could use in preparing the unit and could make available to her students. (Cathy later referred to the resources as “something of a revelation”). The following thread from the IO discussion exemplifies the kinds of exchanges that occurred and the impact they had on Cathy’s development process:

> Cathy: I definitely want to emphasize connectedness. In-depth understanding would include a lot of connections between the above topics, e.g. math contributing to architecture; the importance of the ordinary citizen to the city's success in battle really helped in the development of democratic institutions. In fact, I wonder if the connections are the real clues to the nature of the civilization.
>
> The more I think about it, the more I realize that I have two goals: that they understand Greece, and then, that they analyze that knowledge to answer the question. This fits in with the two tasks: the conceptual map would demonstrate "knowledge and understanding", and the symposion would demonstrate "thinking and inquiry" as the Ontario curriculum (www.curriculum.org) labels them.
>
> But I think I might like to have a formal point, before the symposion where groups get together and learn from their specialists. They would then be better equipped to prepare their answer to the question.

> But then I ask myself - what is the minimum knowledge I would like each student to have? The specialists are just that - specialized. Somehow I need to ensure a common base of knowledge for everyone. When I think of how this could be done (required reading from the textbook, fill-in sheets, whole class watching a video) this seems too traditional and mechanical. Do you think this is necessary? Or should I try to set it up so that if a group is missing a certain specialist they could attend another group's session?
>
> Candace: In your post you mentioned that you wanted students to understand the connections and interrelationships between each of the topics as well as "the nature of civilization". Could these be the big essential understandings that you want students to ultimately arrive at? If they are then the task somehow needs to be structured to ensure that your students grapple with those issues….. How would it work to have students research the topics that you have identified in an effort to collect evidence both for and against the proposition that "Classical Greece was a highly evolved civilization whose principles we should try to emulate." So for example the cultural anthropologist would investigate the role of women, slavery, sexuality, sports & leisure, and education looking for evidence that either supports the claim or refutes it.
>
> Cathy: This is a great idea! I was trying to provide a focus by asking if we should study Greece, but I don't have the rebellious anti-traditional bunch of kids that I thought. They seem to pretty much think we should study Greece. Candace's proposition about emulating Greece or not sounds like just what I need - controversial, and focused on the essential understanding of what Greek civilization was about.
> I will be making a number of changes over the weekend.

Cathy indicated on several occasions that she found the support and guidance she received from the Galileo staff "outstanding": "[Sharon] was really, really helpful and she had lots of good ideas but didn't make me feel obliged to use her ideas…. ABEL project members from Galileo made me think about the big picture of what was important for students to learn in a very focused way." Writing later about the overall planning process, she commented that

> After using the Galileo process once, I actually feel differently about the planning process. Taking a project through all the steps really made me understand the importance of process. I have a much better understanding of inquiry-based education. I have put all the pieces together once, so it will be much easier to plan a second project.

Sharon encouraged her to solicit opinions and feedback on her project from others, and Cathy did extend an invitation on the ABEL community via the Web site and to other ABEL teachers in her subject videoconferences to comment, allowing them access by arranging for their names to be put on the "share IO projects" list for her project, but she received no response, which she found discouraging.

She also experienced difficulty in making a connection with other ABEL classes willing to participate in a videoconference around the Greek unit. Despite solicitation in the teacher videoconferences and a note placed in the ABEL community forum, no other ABEL teacher was found who was able to participate in planning a joint event. A large part of the problem stemmed from a curricular mismatch between Ontario and Alberta; Albertan students studied Greek history only in grade six. A further limitation arose because no ABEL teacher in Ontario was teaching an ancient history course comparable to Cathy's. Some initial expressions of interest in pairing her class with a high school course in philosophy in Alberta never came to fruition.

Cathy also sent an email to Sharon at Galileo seeking possible partner classes. It turned out that Galileo staff had been working with two grade six teachers on their Greek history unit, and when contacted by Sharon they expressed interest in participating in a videoconference with Cathy's students. As this arrangement was not made until early April, after the completion of the unit in Cathy's class, Cathy had to solicit voluntary participants from her students for the conference, and it was scheduled for a Wednesday (the day of the week at Ursula Franklin that is kept free of regular class scheduling to allow for "one-off" and special events that students must sign up for). The development of a teaching agenda, format, and activities for the conference involved considerable email consultation and IO-based discussion amongst the three teachers involved as well as Galileo staff, as they worked to clarify learning objectives and promote the greatest amount of interaction between the grade six and eleven students. Commenting later on how well this process worked, Cathy stated:

> It took a lot of time and I got really frustrated because it is difficult for elementary teachers to work with secondary teachers because their timing is so different…. But this is inevitable when working with a group. But I felt it worked all right and it was much easier to use email than working on IO in terms of people getting messages and it being more personal. I think there was too much of using Sharon as a bridge and I didn't feel like I had direct contact with those teachers and there was a lack of closure at the end because the videoconference was over and everyone immediately went on to the next thing they had to do.

In its final form, Cathy's Greek unit plan included a number of elements designed to support student research and inquiry into what Cathy termed the "big question": "Was classical Greece glorious and should we study it?". Students were to select two specialties to pursue for their project research. The specialty options available included were anthropologist, math-science-technology expert, historian, art historian, political scientist, philosopher-theologian, and historical geographer. Students also had to organize themselves in small groups of five with others studying different specialties so that the group as a whole could develop an broad understanding of ancient Greek civilization as a basis for addressing the "big question". Each member of a group was responsible for researching his or her specialties, synthesizing the information needed to draft a one page initial response to the unit question, and presenting his or her findings in a 10-minute intragroup seminar. Students were also responsible for contributing weekly to ongoing online forum discussions focused on the project question.

Following the intragroup presentations, each group was to develop a concept or mind map linking the major themes of their findings to each other in a manner that presented a cohesive picture of the interrelationships between the different aspects of Greek history.

Students desiring an "A" grade were also required to present a seminar to a cluster of peers on one specialty area or to participate in a debate on the central project question. All students had to attend seminars and grade the presenters using a printed rubric Cathy distributed. (Students also assessed their fellow group members' intragroup presentations using a similar rubric.)

A field trip to the Royal Ontario Museum to study the ancient Greece exhibits was also required; students were given a set of questions about Greek art and architecture from different periods to answer based upon the information provided in the exhibits.

Students were also expected to contirubute weekly to an online discussion on the unit's "big question" which was set up in the school's FirstClass conferencing system.

The final component of the project (aside from the added videoconference) and the one that was most heavily weighted in the grading was the group presentation, to be made in the whole-class "symposion". Cathy described its purpose and requirements in her "Tasks and Activities" handout to her class:

> The purpose of the symposion is to collaborate on answering the question "Was Classical Greece glorious, and why should we study it?"
>
> Each team will present their answer to the question, demonstrating their in-depth knowledge, and using authentic, performance, active presentation techniques wherever possible. The class should experience your ideas, not just hear you talk about them.

The group's concept map was to be presented and explained in the presentation. Following their presentation, students' research notes, research journal, and point form outline of their presentation contribution was to be handed in.

Implementation

In her first Greek project class, Cathy explained the scope and sequence of the project, students' responsibilities, and the first tasks they were to pursue. She contrasted two views of ancient Greece by quoting two poets holding opposite opinions about its glory. She then directed students to select their specialties and begin forming their teams. She also distributed several handouts, providing schedules, task overviews and detailed requirements, a work plan form that students had to submit which included their "target marks", and self/peer evaluation and seminar sign-up forms. An immediate conflict emerged with respect to the events scheduled for the Wednesday time period (namely the field visit to the ROM and the final presentations), as some students had prior commitments on Wednesdays to the school's coop program. This forced Cathy to reschedule these events for regular class time and lengthen the planned unit timeline by a week.

In the next history period, held in the library, students completed choosing their specialties and negotiating group membership, and began researching their special areas. (Except for the final presentations, nearly all of the three-per-week, 55-minute classes held over the 5 weeks of the project took place in the library, which had a seminar area with round tables that could seat the class. A collection of about 50 books on various aspects of ancient Greece were made available for research purposes on a trolley there, and a significant number of these books were at a college level (e.g. *History of Philosophy* by Bertrand Russell). Students also had access in the library to a lab of computers to conduct research on Greece, and Cathy provided a range of Web resources for students to explore on a project Web site.)

About ⅓ of the class of approximately 30 present (there are 37 enrolled in the course) chose to conduct their research on the Internet and the rest selected books. Cathy spent most of her time conferring with students to confirm specialties and group membership, and review work plans in the next few classes, and was only occasionally observed roving to actively monitor student work. Students did approach her with questions. A substantial minority of the groups at the library tables would be off-task at any given time over the next several classes, engaging in social interactions, occasionally reading magazines, or doing other schoolwork. Those undertaking web research were more focused on their project research, although they did occasionally visit non-project related sites.

By the third class numerous students were reporting difficulties getting into the project's online forum to contribute, and Cathy remarked that only ½ of the students had read any discussion. She had been hoping to rely on the online conference to distribute instructions but now she is forced to spend class time doing so. She reminds students to complete their project plans and discuss them with her, and outlines grading standards. Cathy then gives a short talk on Greek religion; students are given a short-answer worksheet to fill out based on her presentation. Background talk levels in the group are high, making it hard to hear Cathy from the back of the work area. After she is finished, research resumes. Two boys at one table are taking detailed notes from hefty advanced texts, one on Greek mathematics, another on Archimedes. (Most students work with less weighty fare, often heavily illustrated.) The two boys are approached by another pair who wish to join with them in a group; these two agree to adjust their topics to allow the others to continue with their specialties of math and philosophy.

Student research continued over the following week, and most of Cathy's time continued to be caught up in administrative and scheduling paperwork (collecting money and approval forms for the ROM field trip at the end of the week, and overseeing the scheduling of next week's seminars).

During the 90 minute visit to the ROM students travelled in small groups amongst the Greek exhibits, viewing the displays and reading their legends in order to answer the twenty-odd short-answer questions relating to the displays that Cathy has adapted and augmented from those provided by the ROM's educational service. Some questions were factual, others higher-order ("What ideas and conditions may have inspired all this building activity in 5th century Athens?) One related directly to students' project work

("If you could take one object to use as part of a presentation on your specialty, which would you choose and why?") Cathy collected completed forms for grading as part of the unit mark.

Following March break, the seminars and debates were to take place; but as it turned out no students had organized any debates. The seminars were scheduled such that two would simultaneously be taking place in the seminar room adjunct to the library. Students signed up to both give and attend seminars, and this process tied up most of Cathy's time so that she only observed a few seminars. The student presentations were largely factual, elaborating knowledge within their specialization but usually offering few theoretical conceptualizations or analyses relating to why Greece was great or worthy of study. The degree of detail in the presented information varied considerably across students, as did the level of conceptual integration. One boy presenting on Spartan culture, education, and socialization processes is able to talk very coherently and in some detail on these topics with barely a glance at his concept map outline. A discussion ensued between himself and two other students about the Spartan war and why it was lost. He also asked the group whether they thought the Spartan utopian ideals he had described were valid, which led to another discussion. However seminars of this depth were the exception.

The evaluation forms students were completing during seminars required them to list a question they have asked of the presenter, and nearly all students do ask questions. In the above case, for example, the presenter is asked about how the Spartan government was organized and how it worked, which he was able to answer clearly and in detail.

At the other end of the spectrum were the least developed seminars, in which a presenter would verbalize a list of facts related to some aspect of his specialty without providing any integration, or make broad claims or generalizations without any supporting evidence (e.g. "Art was big with the Greeks"). Some of these students would run out of content to present well before the allotted ten minutes was over. However most seminars fell between these two extremes, with students presenting a series of facts related to their topic and then fielding what were usually factual questions, with some exceptions (e.g. "Were some of the Greek festivals as commercial as ours?").

Following three periods in which students continued to research and present seminars, Cathy distributes a handout providing guidance in constructing mind maps, passes around a few examples of maps for students to examine, and has the groups begin working on their maps for their final presentations. "Put your complex elements in the middle, and the progressively more simple elements on as you get to the edges. Put the stuff you think is most important in the map." She reminds the class of the central question the project is addressing, and that they should be focusing on this for their presentations. She encourages students to use multimedia elements ("If you are doing art get overheads made for art work.") As the groups begin their mapping work, several stray off-topic in their discussion; but a few get right to work and begin sketching out potential models. In one group a member drew a model with Greece in the centre linked to four major nodes: science, military, society, and art. He provides a rationale for this design and the others come to agreement on it and begin adding secondary items to each of the 4 main nodes. When one member draws a link directly between science and society, another questions

this. The drawer states that science was necessary to produce many societal artifacts such as architecture and medicine.

A discussion with Cathy at this point indicated she was getting anxious about the time the project was taking. “This is taking longer than it should. Six weeks is too long for ancient Greece. I think there was a bit too much time in the first weeks for what they were doing, but this is the first time I have done it, it will be shorter in the future.”

After another session working on mind maps and giving brief and often desultory presentations on their fields of study to fellow team members (who evaluated these using a supplied form), students began the first round of whole-class symposion presentations. After describing what a “real symposion” would be like, Cathy asked students to take notes from the presentations to build up cases for and against the glory of Greece and the utility of studying it. (Each group had been provided with a procedure sheet for their presentations the previous week, which emphasized making an authentic presentation involving media, enactments, or interaction to avoid plain recitation.) Cathy used an evaluation rubric she had developed to assess each group presentation. The rubric provided detailed criteria for evaluating group work on several dimensions: thinking/inquiry, application, and communication. She graded each group as a whole as well as the individual participants’ contributions. Each group started their presentation with a brief explanation of its mind map, which is presented on bristol board. These maps vary widely in complexity, depth, and degree of integration and abstraction. Presenters quickly pointed out the main features of the map but typically gave little rationale for their particular mapping choices. Then each group member presented for about 2 minutes on their specialty. Some students merely recited lists of facts they had researched and/or made unsupported claims about the significance of Greek contributions; but a minority developed more carefully reasoned argumentation augmented with supporting evidence as to why Greek contributions in their area were significant and/or worthy of study. An example of the former can be seen in one boy’s presentation on a broad range of topics, including architecture, bridge and road building, trade, agriculture, fishing, and metallurgy – all in about two minutes. He would make one or two points about each topic (“One of their strong points was building – they made strong walls that had to be carefully cut.”) and then move on to the next. At the end of one particularly weak presentation in which numerous unsupported assertion were made, Cathy reminded the group that they needed to provide evidence and not just give opinions.

An illustration of more coherent and carefully reasoned presentation can be found in the work of a group who started with a general premise – “Generally, the reason we think Greece was glorious is because it has had such a large influence on our society now” – which was then addressed directly with supporting evidence by the students (as when one student discussed the genesis of western philosophy and science in Greece and its emerging importance as a countervailing force to religious belief).

Only a few groups attempted to make significant use of media or enact their presentations. One girl narrated a poem that summarized some of the major historical and cultural events in ancient Greece; she was accompanied on guitar by the poem’s author. Two other groups used PowerPoint to present examples of works of art and architecture

which were discussed. A fourth group used enactments; one boy assumed the role of Pericles, talking about his achievements and impact on Greek society, and another assumed the persona of Aristotle, presenting his accomplishments in mathematics and philosophy. In another group a girl read a monologue written by Aristophanes that argued against the Peloponnesian War.

Following the completion of the symposions, which stretched over three class periods, students submitted a self-evaluation form indicating their degree of participation in the online Greek forum, and rating their contributions. They also met in their small groups to develop a pie chart showing the relative contribution of each member to the group's work. Volunteers were solicited to participate in the videoconference with the grade six classes in Calgary, which had been arranged by this point. It was suggested by Cathy that those with poor marks in the presentation could enhance their grade by participating effectively in the videoconferencing event, and that it might count towards some community service hour credits. About ½ of the class expressed interest.

After the class presentations Cathy expressed disappointment with the average quality of what she had witnessed, noting that most just presented facts that everyone else also presented. "No-one wants to take risks, or to focus on the overall question." She wasn't sure why, and suggested it may be a function of their age and developmental level. She said she had focused on the same type of question in earlier essay work and the outcome had been better. She thought debates might provide a better mode to get students to focus on the central issue and planned to use them next time.

The videoconference was scheduled for May 6, which concerned Cathy somewhat at first as it was so late and her students had moved well into studying Rome. However she was able to get a group of ten students – all girls – to participate in the conference (they received credit for their participation in lieu of completing a class assignment on Rome), and they held a preconference meeting and online forum discussions to plan the agenda and format together, working with an outline from Sharon Friesen, who was coordinating with the two team-teachers participating from Calgary. The format was designed to enhance the interactivity level of the conference and to inject some variety and entertainment value into the session by embedding a few short "Cool Facts Quizzes" in between presentations, and incorporating Q and A periods in which the grade six students could ask the grade 11 "experts" questions.

The teachers and students in Calgary engaged in extensive preparations for their participation in the conference:

> Planning began with Dr. Pat Clifford from Galileo. We [the teachers] were able to spend a morning with her developing our inquiry. We utilised IO a great deal to guide and focus our inquiry. We did our planning on IO, as well as setting up a web page for our students and their parents. We also used IO to communicate with all the people involved, including the teacher in Toronto. Students began by finding out 3 interesting and exciting facts about Ancient Greece, bringing them to the group. Pat assisted us in deciding on groupings for students' interests. From there, the students chose one topic of interest. We accessed help from two U of

> Calgary students, Mike Gladstone and John Cheeseman, who had particular backgrounds that helped the Grade 6's think more deeply about their topics. We had a presentation by the mayor of Calgary about briefing notes. Our students then prepared their own briefing notes in order to participate in the videoconference. Collaboration was an extremely important component of this inquiry throughout. One small difficulty was the time frame; we were unsure at first if our students could complete the amount of research required to participate in the symposion. However, with all the assistance we received and the motivation of our students, we were ready in time.

The teachers' goal for the conference was "to make the study of an ancient civilisation come alive for the students. We believed (& still believe) that any age of students should be able to be experts on a topic of interest, and are capable of sharing this knowledge and learning with others. "

On the day of the videoconference, which started at noon ET, preliminary connection checks were run prior to the event with no technical problems encountered. The session was held at the Ursula Franklin Academy end in the videoconferencing /school committee room where nearly all UFA videoconferencing was conducted, a roughly 40' by 20' room with a central cluster of modular desks forming a large conference table, and in Calgary students were brought to a large videoconferencing–enabled lecture hall at the University of Calgary. This latter facility had microphones at each student desk, and desks were tiered around the large video projector screen in semicircular rows. Because this facility was so big it was very difficult to make out students seated at the desks, and so students wishing to talk to Ursula Franklin Academy came to the front to a speaker's podium to do so, where they could be clearly captured by the video camera.

Sharon Friesen acted as the MC for the session, introducing the teachers and the two classes to each other and talking briefly about the history of the symposion format and outlining the ABEL project in a few sentences. Cathy then presented an overview of the central question for the Greek inquiry her students conducted, and mentioned the three topics that speakers would be covering (there are discussed below). A group of three Ursula Franklin Academy students then presented a summary of "Greece's contribution to western civilization". One talked for a few minutes about main figures in Greek philosophy and touched on their contributions; the next looked at the emergence of science and medicine form the religious culture, focusing on Pythagoras; and the last student overviewed Greek architecture, using terms like "iconic" with out defining them, but making an effort to interact with the grade six students by asking if there were any Greek-influenced buildings in various cities in Canada.

Sharon then asked for questions from the grade six students, and one by one a few came up to the podium and asked questions they had developed from their studies. Some of these were quite advanced relatively speaking, and the Ursula Franklin Academy group was not always able to provide correct answers. For example one girl asked who had discovered Pi in mathematics and how they figured it out. A Ursula Franklin Academy student knew who the discoverer was but provided an incorrect explanation of how Pi was deduced that Sharon discretely corrected. Questions ranged from how the Greeks

deduced that the earth was round to whether the Greeks should have all their ancient art returned to them by other countries.

Two further seminars were given by groups of three Ursula Franklin Academy students during the conference, with the first focusing on what made Greece glorious and remarkable, and the second on Greece's relevance to the present. Both of these seminars lasted about ten minutes. The first dealt with Greece's glory in battle and military engineering, and their splendor as producers of great art an architecture. This was followed by several questions from the grade six students about the Greek-Persian war and as well as the conflict between the Spartans and the Athenians, focusing on the tactics, training, and technology that allowed success. There were also questions about how the Olympics got started, and one adult asked a question about the role of slavery in Greek culture which a Ursula Franklin Academy student answered in considerable detail, pointing out that slave labour on farms allowed young men to devote their time to mastering military arts.

Between the seminars one of the Ursula Franklin Academy students asked a short series of true –false or multiple choice questions of the grade six students that were designed to capture their interest and break up the didactic nature of the seminars. The whole group would call out their answers, but one student at the microphone would respond. Questions asked in the "Cool Quizzes" included "Did the Greeks fight in Asia?" and "Was Nike the god for fertility, victory, or wealth?"

The final seminar discussed the relevance of the Greek physical ideals for contemporary athletics, and the parallels between the Greek invasion of Persia and the American war in Iraq. "We visited your Web site and saw your interest in the war on Iraq" a Ursula Franklin Academy presenter noted. Parallels were drawn between Bush's campaign and Alexander's thrust for glory in his empire building, and the difficulty in both eras of imposing democracy on foreign cultures was raised. At the conclusion of the final seminar a few last questions were asked by the Alberta students and videoconference wrapped up after about 90 minutes, with thanks being expressed by all parties and Cathy telling all that she thought it had been "an unqualified success". "I was very impressed with what you knew" she said to the grade six participants. Sharon indicated that there would be follow-up on the session for the grade six students through IO and a Web site. "We had about 12 students who had questions they didn't get a chance to ask."

After the session the Ursula Franklin Academy students indicated in a conversation that they were very impressed with the level of knowledge on the part of the Alberta students. There were times when they themselves did not know how to respond to a question, and Cathy had to step in with an answer. "Being on camera forced me to stay alert" one student commented. Cathy said as students left that she was quite impressed at the level of participation by her group. There were no breakdowns in the link between sites, and both audio and video transmission were smooth and free of jitter. However the camera-position presets that the technology student group had programmed into the remote didn't seem to function properly; luckily a few of the group members were present and so could function as camera operator using the remote, which worked effectively.

At all times the students at Ursula Franklin Academy were highly focused on the interactions taking place, even when they were not active in presenting or dialoging. This was in marked contrast to some of the behavior observed earlier when their own peers were making group presentations in the classroom. No off-task talk took place, and the Ursula Franklin Academy students clapped and smiled when a grade six student correctly responded to a quiz question. They seemed to be engaged by and enjoying the experience.

Student experiences

Interviews were conducted with six UFA students in April, about one week after students had completed the Greek unit (but prior to the videoconference). All of the students interviewed indicated that they had access to computers and the Internet at home, and made use of it for research, text processing, and other school project work such as the creation of presentations. Additional data on students perceptions was gathered via a feedback survey that was distributed in class after marks had been determined for the unit. This form was developed largely by Cathy but with some input from the researcher. The survey included three quantitative Likert scale questions as well as several open-ended queries that asked students what elements of the project they liked the least and most and why, what aspects were most interesting, and what elements taught them the most and why. It also solicited suggestions for improving the inquiry unit.

Table 1 summarizes the results of the Likert items.

Table 1

Question and Response	Mean	Standard Deviation
Compared to other units you have had in this course, was the Greek project more or less interesting? 1 = much more interesting; 5 = much less interesting	2.3	.8
Compared to what you usually learn in this class in five weeks, do you think you learned more or less in the Greek project? 1 = much less; 5 = much more	3.5	.9
Is this way of studying a unit (working in teams and making presentation, etc.) something you would like to do again? 1 = definitely; 5 = definitely not	2.5	1.0

The results shown in Table 1 indicate that students on average found the unit slightly more interesting than other units, and thought they had learned slightly more than was

typical, although as indicated by the standard deviations there were substantial variations between individual student responses. Students were evenly divided as to whether they would like to use this same way of working again.

In interviews and in their open-ended questions, the class had much to say about what they perceived to be the strengths and limitations of the inquiry project.

Not surprisingly, the ROM field trip was cited most frequently (by ⅓ of the students) as the most liked component of the unit, simply because it was interesting or enjoyable, although a few respondents mentioned that it made the ancient Greek period seem more real and vivid. A substantial minority, however, cited either the individual research or the seminar presentations as the most liked elements. Individual research was valued for allowing students to work at their own pace and pursue topics of personal interest in greater depth. Individual research was indicated as being the most interesting element of the project, as well as the one that taught them the most, by a third of the students, for the same reasons. Both the seminars and the intra-group presentations were most liked and were thought to have taught the most by several students, as they provided a venue for learning interesting things from other specialists that students did not study on their own, and afforded opportunities to ask questions about aspects of the subject they wanted to know more about. A few students talked about how the use of specialization in combination with the symposion in the project gave "a more compete picture" than that developed in other units: "the other ones I could tell you like their religion was so and so, but I couldn't tell you anything else." The wide range of resources available to them for their research was also appreciated: "it's better than taking from pages of a textbook." Mind mapping was valued by a few for its ability to assist in making connections between what the different specialists had learned: "It kind of shows you the big picture; everything branches out but it is all tied back to the main words." A few students placed the greatest value on the online forums as a way to understand the subject matter and to communicate without having to speak in public.

Other perceived strengths of the unit were cited in student interviews. Students noted that their research for the Greek project went into greater depth and ran considerably longer than was typically the case for other subjects. They also appreciated trying something new. They had done a few other in-depth papers in other courses (World Religions was cited as an example) where they had to conduct in-depth research, but this had not involved collaboration in any way. The process of leading specialist seminars was a new experience, but they had made group presentations at other times. They had also had exposure to mind-mapping in English class, and the online conferencing system had been used by some students in a philosophy course. Asked if the methods of learning used in the unit gave them a more complete understanding of the civilization than they would have received in a typical class, there was general agreement that they did learn more, especially about their specialties. But two of the students strongly resisted the strategy of having different students in the small group responsible for mastering different specialties; both found it "extremely stressful" because although these two had had to work with another person "who ended up not doing anything until the night before". But others disagreed; as one put it, "If we all picked the same topic we would just be learning like micro differences in things, dates or stupid stuff like that."

As to what they disliked the most, by far the highest number of students (over a third of the 31 surveyed) cited using the online forum. Common complaints were about the high number of contributions they had to make to it per week (3 per week were required for an A grade). Posts were critiqued for being too short and weak on content; "posting for the sake of posting" was mentioned as a problem. In interviews students noted that many posts were repetitive, lacking evidence to support opinions, or were the result of the splitting up of longer posts in order to get the required number in. One student remarked that this was especially true in the first few weeks, "because nobody had all the information so everything was just their opinions. And I didn't see the point of me spending time looking at others' opinions, it wasn't going to help me learn anything."

A significant number of students had problems accessing the forum both at school and from home, which led to difficulties in making the required contributions. One mentioned that the regularity of posting didn't fit with her research style; she would have preferred to post more towards the end when she had enough knowledge to share. But a second student found the discussions in the forum very useful: "You see people's opinions and things."

There was also a shared sense that the distribution of time to tasks had been somewhat imbalanced—too much time was devoted to library research and not enough to preparing the mind maps: "Just spending like periods after periods in library where most people didn't really do anything, it was pretty pointless."

Getting recalcitrant team members to contribute work was an irksome task for some: "Telling him 'Ok, you need to do something.'—I felt like my mother and that's not a good thing."

There were also problems in the small groups around negotiating the proportion of work done by each group member for the symposion. Feelings got hurt and arguments ensued in some instances when a student disagreed with a low assessment made by a peer. Two respondents indicated that they were reluctant to give accurately low scores to certain team members and consequently felt that their own mark was unfairly penalized.

The two other areas mentioned as problematic by several students were the use of mind maps, which a few felt didn't contribute to learning, and the seminars and intra-team presentations.

Asked to consider what skills the project helped them develop, several cited making presentations as something that was helping them learn to speak in public. Learning to manage time, assume responsibility, and negotiate with others to get the work done were also mentioned.

Most students were not eager to use the same inquiry format in the immediate future; reasons given included the need for variety and novelty, and the fact that the same questions ("Is civilization X glorious or not? Is it worthy of study?") had been the focus for earlier units (although the format had been more traditional, employing essay work

and whole-class presentations). Jane: “We’ve done that for every civilization we’ve done.” Sue: “We did it for Japan, Egypt.” Ellen: “So it got a little repetitive.”

Various suggestions were made to improve the project in the future. Eight students felt that the project needed to be better organized and expectations and deadlines made more clear. Seven thought the amount of time devoted to the unit should be shortened, with several suggesting that research time be cut. Several noted that they worked better outside of the classroom anyway, when everyone was not trying to access the same books and computers and there were fewer “distractions”. A few suggested that the online forums should be cut out entirely, but others wanted the technical issues fixed and the number of submissions required lowered. A few students mentioned a need for more hands-on and interactive elements in the unit. One student promoted the idea of introducing debates into the unit to ensure that both of sides of the central questions got fair representation.

In their general comments about the value of the inquiry project’s approach to learning, several students remarked that they found it innovative, and that it offered a chance to develop a deeper than normal understanding of the civilization. As one student put it, “It made you think – it wasn’t about memorizing.” The relationship of the aspects of Greek culture personally studied to the “whole picture” was more clearly seen using this teaching method, according to a few respondents.

Teacher reflection

Interviewed a few days before commencing classroom work for the project, Cathy indicated that she had spent about 35 hours on the planning and development process, considerably more than the few hours she would have spent to ‘freshen up” the unit normally (she taught had it four times before) . “I never would have been able to do deal with this project if I didn’t have those two full days off thanks to the ABEL project.” She had decided in the latter stages of her development not to use the rubric part of the IO scaffolding as she was planning to base her evaluation on more of a contract basis (although that did not in fact happen for the most part). Nor did she write up the activities she planned in the “Designing a Task” section of the online template because “because I guess IO is designed for not giving the kids paper, well I already have 10 kids saying when are we getting this on paper so I knew that I would have to do this on paper”. She mentioned that she thought that inquiry learning lent itself better to the elementary level, where you were not limited to three 55 minute periods a week with your students and could thus keep “the critical mass” going. What was most valuable to her in the IO environment was the framework it provided for thinking through the project. “I didn’t even know where to start and there was a framework to start with. ”

> This worked really well for me because I am familiar with the subject material and would be hard for me to do if I wasn’t familiar with the material. What do you want the kids to know? If you haven’t been through it yourself it is hard to know what is important and what the kids really need. So it made me sift through what was crucial and it was incredible work. I think in teaching these days you tend to be practical and pragmatic and think of what is going to work and this made me start out from the basics about what is important and then it (IO) helps guide you with what you could do with the kids. It was really superb, really good.

At this point Cathy was uncertain how to proceed to make the connections needed to incorporate a videoconference into her unit:

> I have just really had to start the project without really knowing what was going to happen with a videoconference at the end. Now that I have all of the handouts and stuff is ready that's what I have to work on this week. Who do I even talk to about like sending a message…? I guess what I do is send an email to all the teachers on that list 'cause I don't know if I find ABEL has a lot going on in their home website right now. I haven't seen any kind of discussion that I can plug into. I thought that there was going to be a social science conference there but I haven't really seen that. I guess I can just send a big email to the list and explain what the project is about and see if anyone is interested in their class being on the receiving end of a final product from my kids which wouldn't actually be the final symposium but each team would have a representative that would say something.

Cathy was concerned that given the huge size of her class (36 students) it would be hard to have an authentic and interactive videoconference session with another class. She also had some hesitation in including an online forum for discussion in the unit:

> One of the criteria mentioned in the IO things said that it should replicate something that is fun. If I know teenagers they love to sit and chat on the Internet and send messages on MSN and stuff so to me this is going to be a positive part of it but you can't really tell.

The also indicated that the complexity of the project and the number of things that students were responsible for participating in could lead to some confusion, which she was trying to alleviate by producing handouts specifying activities in each part of the project and ensuring that students read them thoroughly. But her "real problem", she said, was assessment:

> It is not going to be so straightforward so I am going to have to go half toward rubrics and half towards contract thing and that's kind of boggling my mind right now. To make this work and to make this simple enough for the kids to follow, there may only be 8 of them that I need to further explain it to… can you imagine having to explain it to all of them, you saw how hard it was for me to get away today—we have a third more kids in that class, a third more people that need to talk to you at the end of every class it is just mind-boggling.

After two weeks of teaching the unit, Cathy was feeling that she was spending less time guiding her students than she would like as she had to deal with all the "administrivia" around collecting the ROM trip permissions and fees, in addition to finishing the evaluation rubrics and the ROM field assignment. She was not happy with the quality of some of the postings students were making to the forum—"they were putting things there because they had to"—but she thought some people were starting to post some interesting discussions and resources and she had heard some interesting ideas students had for their seminars. She was refining her ideas for her students' group presentations during a

videoconference, and she was still working on the assumption the conference would involve a group of high school students in Alberta, although she had heard at this point about the possibility of a session with grade six students in Calgary. It had become apparent that no-one in her class was interested in debating. Cathy indicated that in future she would take more of a proactive role in coordinating the setup of debates.

Cathy had found herself slipping behind in her marking for her other courses as she focused so much of their time on the Greek unit. "I'll be spending much of my March break marking."

In a final interview about one month after the completion of the inquiry project, Cathy reflected on its outcomes.

> I think the IO [project] was useful for independent, investigative learning. For kids that were interested in doing this I think it was very empowering for them and allowed them to become genuine enquirers and learners. I felt that this was pretty successful actually.

Asked if she perceived a shift in the nature of the work students were doing, she replied:

> Oh absolutely. What is that phrase, "to take possession of their own learning", something like that anyway. They really had some choices and could find something they were interested in and follow up on it. This differed from studying other civilizations in the course where they get kind of an overview of the main thing; it was a really different approach where they could investigate what they wanted. It was a real break in the normal classroom routine, a break for them.

She felt they were able to use deeper sources of information and knowledge: "they couldn't just use the Internet, they had to get books and actually read them, similar to a social science class in a university."

She was aware that her more advanced students pursued their topics in greater depth and made more use of the resources available to them, but nonetheless felt that all her students benefited from the experience. She thought the seminars had worked better than the whole-class presentations in the symposions:

> The seminars were great, a great experience for the kids and they were excited about this. They got into some really interesting discussions and I thought this was a real reinforcement of how fun learning can be. Now the presentations I thought were a necessity to fill in the gaps for everybody but I might try to rethink that for next year to make it more dynamic. I think that the kids who were into this in a high-level were already talking a lot and the other groups didn't really get into much. It didn't have the dynamism that the rest of the project did….I would do the presentations a different way. Standing at the front of the class with a map is difficult for others to see, regardless of how big it is. I might have them go around to groups and talk about their maps and compare. This

> might work a bit better. Just telling people what they could already see isn't that interesting.

She has was also "quite disappointed" with the level of the symposion presentations, which she thought were lacking in analysis and merely "talking about what everybody knew":

> If I was bored the kids would have been climbing the walls. This is something I need to rethink a bit. The thing is with 40 kids it is hard to work this as opposed to having a symposium of 20 kids.

She thought that by converting the symposion to a debate she could increases the amount of critical thinking it engendered.

Cathy felt the online forum had not been as successful as the seminars; she had had to spend too much time getting students signed up and even then many students had technical issues that interfered with access. She also thought that providing a more structured series of new topics for every week rather than allowing the broad, open-ended discussions that transpired would bring more depth and coherence to the dialogs. Still, she felt strongly that several students had posted thoughtful reflections that did focus on the inquiry's overarching questions.

Peer assessments had worked reasonably well but she felt that they had taken too much time, and the final student apportioning of group work responsibility had been hard to translate into individual marks.

Cathy regretted the amount of time she had spent doing paperwork during class time at the expense of guiding and supervising students, but aside from moving the deadlines up a week to tighten up the project she saw no easy resolution to this:

> I thought [more time for me to be with students] was one of the benefits of doing independent work but it took all of my time to answer questions and so on….[The only way to resolve this is] by having half the students. That is the only way. The first way through I left things vague and next time I would have a much clearer sense of what the project is about.

When asked if the professional development support provided by ABEL was sufficient for her needs, she focused her comments on a perceived lack of collegial collaboration within the school itself:

> Collegiality stinks as far as I can see. Even from the people in my own school. I really felt like nobody knows the tools. Like an online whiteboard, nobody even knows what that is. I find it amazing that the ABEL project is a bunch of pioneers and it is March and I am the only one who has this up and running. I wanted to figure out what to do and just do it and I think this has to do with the lack of support and that no one has the time. This put a huge hole in my life. If I knew what this would have been like I don't know if I would have done it….It would

> have been good if there was something or somewhere I could look up and learn how to use multimedia.

Other changes she would like to see to improve her ability to do this type of work in the future included the "serious" need for more time and for more reliable computer and data projector hookups (a few student groups had encountered difficulties when attempting PowerPoint presentations in their symposions).

Cathy thought that the videoconference provided a strong conclusion to the project for those of her students that participated:

> I think it was a good closure at the end of the unit and a wonderful experience for them to show what and how much they knew about Ancient Greece, especially individually and as a group. I think it made them internalize whether Greece really was glorious and I don't think they are going to forget this unit on Greece…. I think it went really well. It went smoothly and so it didn't feel amateurish and it felt like a priority to them. They loved it. They felt like there was a purpose in communicating with the grade 6s. My students couldn't answer everything, which is good because it was a real experience. I got great feedback from the students.

The grade six teachers also perceived the event to be a success:

> Both groups (Calgary & Toronto) seemed very excited by the conference, despite the age difference. New information was shared on both sides and good questions arose as a result of the communication…. Our students learned a lot, they worked very hard towards the goal of the videoconference, and there was a definite and motivating purpose for their learning. They had a great time participating. We were pleased that we were asked to participate in this project.

Their only suggestion for improving the event was that it could have been longer, as some of their students did not have a chance to ask their questions of the Ursula Franklin Academy students.

For her part, Cathy had several ideas on how broadband could be used more effectively in an inquiry project:

> I think if we could have virtual fieldtrips. Also, if you had another school that was doing a similar unit you could have debates rather than present. If you had a school doing a similar thing, you could do a lot with long distance partners. Maybe partners in York Region who are on ABEL. We could figure out what modifications you could make and this would change the nature of the presentations and communication.

Despite the aggravations and limitations of the current project, she still intended to deploy the unit the following year, feeling it would not nearly be so much work the second time around. She was of the view that her students had developed deeper understandings of the specialties they had studied that they might have otherwise, and

understood better how this knowledge related to the central inquiry about the glory of ancient Greece and its relevance as a subject of study. But while the specialist presentations were of some real value in giving them a broader picture of the civilization, she thought their overall vision of Greece was weaker than if she had taught it directly. Still, she greatly valued the project and felt it had enhanced her professional growth: "It is helping me see myself as a teacher in a different way - to reinvent myself."

Conclusion

Encountering a set of challenges that might have discouraged a less venturesome or talented teacher, Cathy was able to rise to the occasion and develop an inquiry-based curriculum unit that achieved a fair measure of success in facilitating students' development of a deeper, more engaged, and more reflective focus in their study of ancient Greek history. The ABEL IO tool proved critical in helping her reconceptualize and reformulate her teaching goals and strategies for the unit. But as central as it was, several other contextual supports also seemed essential to her success. Time was of paramount importance; without the two days of release time that ABEL funded the project would not have been possible, but equally important was Cathy's willingness to devote a considerable amount of her personal time to the curriculum planning and development the unit required. The expert support provided by the Galileo Centre, primarily in the person of Sharon Friesen, was also vital. In an ongoing dialogue, Centre staff provided a reflective sounding board supporting Cathy's analyses, idea generation, and decision-making by offering encouragement, a wealth of suggestions and ideas, and links to learning resources. In addition they were the key nexus in instigating and coordinating the linkage with the grade six teachers that led to the videoconference event.

As with most initial efforts at introducing new teaching strategies and technologies, the project did encounter problems and demonstrate certain limitations. Cathy felt disappointed by the lack of collaboration from her colleagues both within her school and the larger ABEL community, as demonstrated in the lack of response to her invitation to review her unit plans in IO or to participate in a videoconference event with her class. In this sense, she felt that the community-based element of the ABEL professional development process had failed her. In her words, "The problem with collaborative learning is that people have to collaborate." Ready access to useful information was often lacking; at times she found her self at a loss about how to get assistance in learning about some technology she was thinking of using, or how best to solicit participation in her project. The time required to develop all the documents and rubrics needed and to cope with "administrivia" such as sign-up sheets, combined with the large size of her class, made it difficult for her to guide and facilitate student work as closely as she would have liked, and the effect was discernible on students, who frequently lost focus in their research work. Partly as a consequence, some of the student seminars and presentations did not evince much beyond a knowledge of facts about certain dimensions of Greek society. Other speakers went beyond this, however, to engage the central questions of the inquiry in a thoughtful and cohesive manner. The assessment procedures employed were not fully satisfactory; peer review processes used were time consuming and occasionally led to dispute.

Despite the last-minute finalization of the videoconference event, and the disparity in ages and depth of knowledge about ancient Greece between the two groups participating, it proved to be a significant success. Here again the participation of Sharon played a major role, as she drafted an agenda for the event that fostered interaction and kept student interest from flagging. The thorough preparations done by the grade six classes with the support of Galileo allowed them to ask the Ursula Franklin Academy students a number of thoughtful and challenging questions that the grade 11 students could not always answer. For their part, the Ursula Franklin Academy group had carefully structured their presentations in segment lengths suitable to their audience, broken up by interactive quizzes. All of the teachers participating felt that the experience had been very involving and educationally valuable.

Can this project as implemented truly be considered an exercise in inquiry learning? Using the criteria Sharon Friesen and Pat Clifford adapted from Adria Steinberg (and which were distributed to ABEL teachers), it seems clear that overall the unit is best categorized as being at the "developing" rather than the "beginning" or "accomplished" stages of inquiry teaching. Students had limited influence in determining the scope of the project, and there was no authentic participation in it by members of the community beyond the school, except in the videoconference event. The research resources used were largely conventional, and no adult experts were consulted, but a minority of students did make use of more advanced, specialized books than are typically seen in high schools. Students had some level of meaningful choice open to them in the direction of their work, as they could determine which professional disciplines to specialize in in their study of Greece. For some students participation in the project fostered an awareness (occasionally even a critical one) of the social value of what Greece contributed to modern civilization. Project activities encouraged students to explore the relationships between the disciplines being studied through the development of mind-maps and creation of group symposion presentations. Certain problematic aspects of Greek life at the time, such as the lack of women's rights, were considered in terms of their relevance to modern societal structure. And the project structure, although well defined, did provide students with the opportunity to take initiative, to self-mange, and to collaborate in organizing, communicating, and assessing their collective work. Students could determine which technologies were most appropriate to their tasks, but except for those participating in the videoconference, the audience for their efforts remained within the classroom. On balance, the unit was a promising start to the challenging process of bringing authentic inquiry into the classroom.

10. Analysis and Recommendations

10.1. ABEL Project Progress Over the 2002-2003 School Year

After a slow start in the months following the first Summer Institute, a clear shift in the project's momentum occurred in the final quarter of the 2002-2003 school year. This was clearly demonstrated in the burst of project development and implementation that produced a sharp rise in the number of student videoconference events in April, May, and June. For a large proportion of teachers, a sense of vagueness about the project and what their involvement in it ought to be, along with a desire for a more prescriptive approach to project development, gradually gave way over the winter months to a greater willingness to investigate, experiment, and collaborate in trying out new teaching options using the ABEL tools. Part of this change has come about simply through teachers' increased knowledge of ABEL systems, which developed as they were exposed to new applications and tools through their participation in the large learning events, and especially the tools sessions. But both the survey and interview data, as well as observations of the different types of learning events, indicate that the key to understanding the rapid increase in project momentum lay in the efforts of the learning team to actively seek out feedback from participants in their events, and then quickly move to change direction when that feedback indicated that obstacles were developing or needs were not being met. Problematic issues raised by teachers relating to the quality and utility of the whole-group videoconferences, the need for a more coherent and user-friendly hub for obtaining information and seeking help, and the need for building structures and processes to facilitate teacher collaboration were addressed quickly. The actions taken were not always sufficient to fully resolve the challenge being dealt with, but problems were ameliorated to the point where they no longer presented a strong impediment to project development. The major issues confronting the project over the past school year, and the nature and impact of attempted resolutions are discussed below.

10.2. Professional Development: Participant Learning Events

In both the learning surveys they completed in the fall of 2002, and more strongly in the interviews conducted in the early winter, about one half of the teachers expressed some form of dissatisfaction with the value of the large group sessions for their own professional development. The criticisms were varied, but can roughly be categorized as being either concerns about the value of the content being delivered, or about what might be termed the "opportunity cost" of the time being devoted to them. A significant number of teachers thought that some of the presentations that site groups had to make to the whole group were either of little use in teaching them what they felt they wanted to know, involved activities that they were not comfortable with (such as critiquing other teachers' inquiry teaching efforts), lacked focus, or were rendered ineffective due to the large number of technical problems that emerged in the multi-site conferencing. In one teacher's words, "the more sites involved the more likely we are to encounter problems". Some expressed a need for a more "practical" approach that would focus on learning about the capabilities of, and the procedures for, using the various ABEL tools. Others

noted the awkwardness of collaborating using a new medium that, while appearing to offer the advantages of face-to-face communication, in fact posed a number of technical and procedural limitations on the natural flow of social exchanges when several sites were involved, which made it less than effective as a vehicle for learning. (Problems with audio intelligibility and voice delays, microphone switching, and intermittent audio feedback, as well as difficulties in discerning non-verbal cues for turn-taking and asking questions were observed to cause serious interruptions in the flow of events in many large group sessions in the first part of the year.)

Others saw the limitation of the large-group events more in terms of lost opportunities. These teachers felt that the large events provided a poor platform for making the connections they were eager to initiate with colleagues in their own subject areas, and with whom they were hoping to collaborate in developing projects. They expressed a preference for replacing them with smaller, subject-oriented sessions where these contacts could be made much more readily.

The perceived lack of value in large sessions contributed in at least one school to lowered attendance and participation rates, and to a tendency to "multitask" when not directly involved in an exchange. The low levels of interactivity often observed in these sessions (for example, when responses were solicited to a presentation by a site group, or comments requested on a suggestion) cannot be readily attributed to any one cause, but there is little doubt that the combination of limitations cited by the teachers impacted their willingness to participate and thus significantly lowered interaction levels.

The learning and management teams responded to these concerns in a variety of ways. Large group events continued on a monthly basis, but they were complemented by "ABEL tool events" which began in November. Each of these was focused on learning to use a specific ABEL tool or resource. Subject-area sessions commenced in January 2003, in five subject areas. After the first scheduled session, the teachers were given responsibility for scheduling and developing the agenda for their own subject meetings, although the learning team was available to provide any resources needed. Both of these initiatives met with teacher approval, and subject-based events received generally higher ratings in surveys than large-group events. Teachers in these events exchanged ideas for projects, began looking for curriculum matches, and in some cases forming working partnerships and starting the process of project development.

In an attempt to both improve the quality of the large-group sessions, and to educate participants in the videoconferencing setups and procedures needed to maximize the effectiveness of videoconferencing sessions used by teachers in their own projects, the large group sessions in February and March were devoted to improving videoconference production values and participation etiquette, and planning for videoconferencing events. The teacher ratings for the first of these was considerably higher than for previous large-group sessions; some teachers felt it met their needs better than the more academic and administrative content of prior events. (For the second session, which had more technical difficulties, ratings were not available).

Another innovation introduced to the large meetings in order to enhance interactivity and improve participants' ability to respond to speakers with queries and comments was the use of simultaneous parallel text-based chat sessions on the ABEL Community site. These proved effective in allowing participants to present questions or issues to speakers without breaking into the flow of their talk, as well as in queuing requests to speak to the group through the session moderator.

> *Recommendation 1.* The steps that the learning and management teams have taken to address most of the evident problems with large learning events have helped to reduce or eliminate many of the frustrations associated with them, and to enhance their value as vehicles for professional development. Nonetheless there remain limitations to the format which have in some ways become more apparent with a greater number of sites having their own videoconferencing equipment. The near-impossibility in fostering useful interaction and reflection in large-groups session with six or seven participating sites, combined with the heightened probability of technical problems, argues for a more restrained approach to session scheduling. Whole group events should be kept to an absolute minimum, and where possible sessions should be split up. One approach would be to have all Alberta sites participate in one meeting and the Ontario sites in another, which could greatly ease scheduling problems for schools. This arrangement may appear to have the disadvantage of isolating each provincial group, but as the cross-provincial subject-focused small groups are now well established and continuing their work, a large group conference split is unlikely to be a significant detriment to maintain the ABEL community of practice as a viable whole.
>
> *Recommendation 2.* As the ABEL project moves into its final phase, time pressures will increase on teachers to get projects developed quickly. To facilitate their teamwork, inform teachers that just-in-time, on-demand tool workshops can be made available at very short notice to subject groups and project teams. This should assist in accelerating the planning and deployment of projects in the final months of the ABEL initiative.

10.3. Professional Development: University and College Course Participation and Other Accreditation

In their winter interviews, many of the Ontario teachers had expressed a desire to gain Ontario specialist certification in conjunction with their participation in ABEL and (according to one insider) were disappointed when it became apparent that this was not going to happen. This concern was greatest at UFA, because of these teachers' awareness that they, unlike their colleagues, were receiving no regular course release time. By the spring, several of the UFA teachers had become interested in participating in the University of Alberta graduate course which was about to start, but the teacher strike in place at the time barred involvement in any professional development activities. ABEL management was able to arrange with the Ontario Teachers College for professional learning credits to be earned by Ontario teachers participating in the project, but due to a

conflict between the College and the teachers' unions around accreditation renewal, teachers have been asked by their union not to claim any credits for professional development activities.

For a number of reasons, the graduate course at the University of Alberta Faculty of Education (EDSE 501: ABEL Implementation and Research) did not commence until late spring of 2003, and is still in progress (it is expected to conclude in September).[4] Part of the reason for the delayed start lay in the unique timetabling sought for the course (it was to start late in the winter/spring term); the university administration felt it more appropriate to make it a summer term course. Arrangements have been made to have the fees waived for ABEL participants enrolling in the course, regardless of province of residence. Six participants have joined the course to date, two of whom are from Ontario.

Two other teachers from York Region in Ontario have enrolled in a Seneca course to date (as has Obadiah George, the Assistant Project Manager).

> *Recommendation 3.* Steps be taken over the summer to see if a fall section of the University of Alberta course can be arranged, should there be enough interest on the part of the ABEL teachers not currently enrolled.
>
> *Recommendation 4.* Greater initiative is needed on the part of the learning leads to publicize the availability of the Seneca courses and notify teachers of any applicable accreditation offered for them.

10.4. Professional Development: Education Faculty and Teacher Candidate Participation

The three York Education faculty who had agreed to participate in the learning team encountered challenges in defining their roles. The Faculty Lead, Paul Kortenaar, saw the ABEL initiative as lacking a goal when he joined the project. He remained unsure if it was primarily an inquiry learning project or a broadband infusion project, and found it was difficult for his teacher candidates to define specific projects on their own. He also found it frustrating that none of his students (all of whom he exposed to ABEL tools) were placed in ABEL schools. As for other Faculty members, Heather Miller had a few students in ABEL classrooms but never when ABEL events were taking place; Wayne Sproule had two students in ABEL classes but had very little contact with them over the year beyond checking a few times to see that they had worked in ABEL. The students had a very slow start with ABEL, but they had produced units of study incorporating it by the end of the year.

The lack of access to ABEL technologies for education faculty and their students, combined with the fact that faculty had not been involved in the project from the early days, contributed to the lack of connection between the faculty members and the project

[4] At that point a course evaluation will be completed by participants, and an interview conducted with the course instructor; these will be considered in the next report.

as a whole. But with the recent formation of a working committee, the faculty are pressing forward with plans for a process for introducing inquiry-based learning where they would use one of the tools and present ABEL as a larger concept to all of their students in September. Paul, though, indicated at the OSC event that he would not be continuing with the project in the fall as wanted to devote his time to other activities.

> *Recommendation 5.* Planning is needed to ensure that student teachers working in ABEL in the coming school year have access and exposure to the technologies in their class work, including the use of videoconferencing. This will require the setup of a CA*Net 4 drop in a Faculty classroom in the Ross or TEL buildings.
>
> *Recommendation 6.* To the extent possible, teacher candidates should be placed with ABEL teachers in their practica on a schedule that will allow them to participate in ABEL events. Only with a well-coordinated connection between faculty advisor and host teacher will students be able to fully benefit from the professional development opportunities the ABEL experience can offer them.
>
> *Recommendation 7.* Create better linkages between faculty and learning leads in order to better coordinate field activities and develop a common language and understanding around ABEL goals and strategies. Faculty should play the lead role in articulating a theoretical basis for the emerging ABEL learning model.

10.5. Improving ABEL Communication and Coordination

Survey and interview data indicate that by winter, many teachers had concerns about locating information and help in a readily accessible manner. At that point the ABEL Community web site was relatively undeveloped, and as the access data discussed earlier indicated, had not received much use. Teachers expressed a need for quick access to short tip sheets for using tools, a central nexus of links to all the associated project tools and resources, and online subject forums for asynchronous collaboration. The management team undertook to implement a communication system using the Community Zero tool. Sections were set up on the ABEL Community site for resource files, help files, a participant list, synchronous chat, and subject matter conferencing. In addition, resource links were provided to a number of ABEL tools and to various pedagogical resources, including documents on inquiry pedagogy. Minutes from subject and large-group sessions were posted, and teachers were encouraged to use the site to seek collaborators for projects and be to alerted to upcoming events via the event calendar. E-mailings were also used for critical notifications and distributions of agendas and background documents for upcoming events.

Toward the end of the year, as the pace of the teachers' project development and implementation accelerated, the need for a more standardized and universally accessible system for keeping all parties apprised of developing projects became apparent. Some teachers indicated that they were unable to elicit interest in having others join a project or event, and the management team had noted that bookings for scheduling the MCU bridge for multipoint conferences were being made very late or forgotten about, which in a few cases caused two events to be scheduled at the same time. A draft version of an online

reporting template for planned events featuring automatic MCU booking was presented at a large group event and feedback sought to improve it. It is hoped that in the fall its use will facilitate event awareness and the booking of equipment and support.

> *Recommendation 8*. A reorganization and redesign of the ABEL Community site would enhance its utility by making it easier for teachers to locate desired information. The home page should have a much cleaner and simpler design, without the "recent news and postings" on the top level, and with larger buttons linking directly to key sections. The resource files would benefit from a reordering. In the words of one teacher, "It's like going through a maze to find an individual item." At present, for example, help files are scattered throughout several resource folders, and certain ABEL tools lack any quick-use tip sheets or tutorials (these have been requested by teachers in surveys and interviews). Nor are the links to all the ABEL tools complete. Relevant software manuals should also be accessible from the site or delivered to schools. Teachers face considerable time constraints; if the Community site is not efficiently structured it may result in teachers bypassing the use of valuable resources or tools that could enhance their work.
>
> *Recommendation 9*. Implement the project/event notification procedure currently in prototype as soon as possible to ensure maximum event involvement and participation. Do not limit its use only to those projects requesting a videoconference booking. The form should be used as well to publicize potential projects that are not planning to include or have not yet planned or scheduled their videoconferencing.
>
> *Recommendation 10*. Begin to explore how the ABEL Community site can be maintained as a resource for sustaining the momentum for change in the ABEL community of practice when the formal funding for the ABEL project ends.

10.6. Technical Considerations

Over the course of the year two main technical challenges faced the project. The first, which imposed a significant impediment on implementation at several sites, was a long delay in getting some of the participant sites connected to CA*Net 4. Teachers from the York Region schools in Ontario had to come to the York University offices of the project for all videoconferencing events until the late fall of 2002; and teachers at Victoria, Centre High, and Seneca College did not gain permanent access to the network until the first months of 2003. This made it much more difficult for participants at these sites to develop a sense of ownership in the project and gain confidence in using the technologies involved. As a result, their activity development and rollout was delayed.

The second challenge remains an ongoing one—the intermittent but regularly occurring problems with low quality audio and video transmission in the videoconferences, especially when multi-site conferences were being held. The difficulties would take different forms at different times. Video would freeze temporarily or pixilate badly; audio would distort to the point where it was not understandable either due to network

congestion, to feedback interference from non-muted microphones at sites, or to VCON setups with their automatic gain control turned on. Practice and exposure to the large-group session dealing with production values led to the amelioration of the problems that were directly controllable (microphone placement, muting, gain control settings). But many communication breakdowns were beyond the control of the participants. If there were minor issues that, for example, delayed the start of a meeting by ten minutes, or caused a two-minute interruption in audio transmission from a participating site, the momentum of a meeting might be temporarily impacted, but participants normally had the patience to take these in stride. While teachers reported these as being frustrating to some extent, they were more concerned with breakdowns in student events. As one teacher noted, students expect technology to work, it is what they are used to, and if it doesn't they generally won't give it much of a second chance.

On several occasions complete failures of the videoconferencing systems made it impossible to proceed with major learning events as planned. The second videoconference discussed in the case report of the Math P2s project exemplifies the high levels of frustration and disappointment that can be experienced by both teacher and students when a carefully planned for and long-anticipated event cannot proceed due to technical failures. Other such failures are exemplified in Ursula Franklin Academy's Innovative Thinkers series. Of three events that were meant to be shared with other schools that took place in early April, the first had only one way audio functionality; students at the remote site could listen and see but not ask questions of the guest speaker as their audio output was garbled (no simultaneous chat had been set up for the event). A session on art and the environment with artists at the Banff Centre for the Arts had no video, preventing the artists from showing their work, and the audio was lost after 45 minutes. This session was also supposed to involve another school in York Region, but as earlier tests of that connection had not worked this school did not participate. The final session witnessed had far fewer problems; both J. Percy Page and Centre High classes connected successfully to UFA, although there were delays in getting the audio functioning at the first school.

Serious difficulties of this type occurred only in a minority of the videoconferences, but even one incident of this nature risks discouraging at least two teachers (not to mention their students) from wanting to participate in further events. While the teachers involved in the above incidents "recovered" from them and expressed a willingness to continue with other ABEL projects, it needs to be kept in mind that the ABEL teacher participants volunteered to be involved with the project, were open to risk-taking, typically had extensive experience and expertise in using ICT, and had the benefit of considerable psychological support from Karen, Janet, and others. It seems highly doubtful that an "average" teacher would be as patient with these types of disruptions.

Findings from earlier projects also emphasize importance of communication quality in videoconferencing applications in education. Kinnear et al. (2002: 25) found in their use of videoconferencing in teacher education that technical quality "predicts to a certain extent the overall degree of satisfaction for those involved" in videoconferencing. And poor audio quality has been shown to reduce both motivation and learning when videoconferencing is used (Roine-Taylor et al., 1998).

There were relatively fewer sessions with serious problems in May and June, which is a hopeful sign, but the number of these events for which information is available is too low to conclude that system reliability has dramatically improved.

> *Recommendation 11.* Explore the possibilities of providing better quality or additional microphones to some conferencing locations from which the audio has been consistently weak.
>
> *Recommendation 12.* Run a real-time network analysis during large-group events to determine when trouble arises exactly what the causes are and how the problems can be addressed, in the hopes of increasing the overall reliability of the connections.
>
> *Recommendation 13.* More efforts are needed to obtain finely-granulated usage data that will allow an analysis in the final evaluation report of the relative levels of use of the different components of the ABEL architecture and toolset. The technical team needs to pursue ways of collecting reporting data to the research team immediately so that a good dataset from the next term is available.

10.7. Development and Implementation of Learning Projects

The commencement of the subject-oriented sessions in January proved to be the catalyst for a rapid expansion of teacher collaboration. These sessions were an ideal venue for the joint brainstorming of project ideas and the formation of project development teams, which then continued their collaborative work between sessions via email or (in a minority of cases) the use of IO, point-to-point videoconferencing, or the forums on the ABEL Community. A further contributor to the accelerated pace of development was the completion of the CA*Net 4 connection to all sites in the winter, giving teachers from several schools more ready access to scheduled videoconferences and the ability to arrange short point-to-point sessions for collaborative work.

A handful of teachers chose to pursue solo projects, sometimes after being unable to find a suitable partnership with teachers sharing similar curriculum objectives. Cathy's experience (see case above) falls into this category; it was only after her unit was implemented that, through the mediation of Galileo staff, her connection to the grade six classes in Alberta developed, which in turn led to the videoconference. The lack of shared curricula between teachers, schools, and (especially) provinces, together with the rigid requirements imposed on teachers with respect to meeting mandated curriculum objectives, interfered with the development of some partnerships, but a few teams managed to find creative ways of cutting through these limitations. For example, in the P^2S math project, creative planning by two high school math teachers allowed them to build a project around a set of combinatorial math problems with students at different grade levels and studying different mathematics topics.

The Community site became a much more consistently used resource as a support for project work in the last few months of the year, with page hits in May and June doubling those of prior months.[5] Several student learning event sessions were documented in the Community after their occurrence, either through the posting of a presenter's PowerPoint presentation, and/or a slideshow of captioned photos from the event itself, sometimes together with student feedback about the event. But discussion forum use remained relatively low all year, considering the number of participating teachers in the project. Only two collaborations made use of it for moving their curriculum development and event planning forward—the two teachers involved in the embryology and DNA fingerprinting events, and another two teachers who worked together on an energy use project. It was also used in May by one other teacher seeking links to video field trips, and looking to start a dialog on social studies project ideas for the fall term. Most collaborators preferred to use either email or (in a few cases) IO for their discussions.

Of the ABEL tools and resources used in project deployment by teachers over the past year, videoconferencing was certainly the most popular. In virtually all cases the videoconferencing event was a one-time session, used either as part of a short-term, 'stand-alone" enrichment activity or as a culminating point in to a unit of study (as in Steven's OSC case). As far as is known, to date only the P2s math project has made use of more than one student videoconferencing session. As the case studies of the four learning events presented earlier illustrate, there was a considerable range in the nature and extent to which videoconference sessions were integrated into a teacher's curriculum. In some cases they were not tied directly to core curriculum, serving instead as secondary or enrichment activities, as with the math case study, and the majority of the Innovative Thinkers symposia at UFA. At the other end of the spectrum, a videoconferencing event was tightly integrated into a plan of studies, as in the Hana's Suitcase novel study unit and the Greek unit (although in the latter case the event was pushed back from its planned schedule due to the delay in finding a partnering school). In certain cases the event fit more closely into the curriculum of one of the participant classes than it did into others (in Steven's class, for example, students were studying DNA fingerprinting as part of their curriculum, whereas this was not the case with Jason's class).

A few projects made use of IO for development work, ANLON for development and student work, Historica resources, and/or Tutor Buddy video. The loss of ANLON LCMS as an ABEL tool, while not regretted by some who found it overly complicated and difficult to work with, created problems for those few teachers who had done significant development work using that tool and then were faced with porting that work into the WebCT environment after the introduction of WebCT and Dreamweaver in the spring. While in the end the project's technical support staff undertook the porting, teachers were still left with the need to quickly master a new tool. Overall, the use of resources other than videoconferencing in ABEL projects appears quite limited at present.

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[5] At present it is not clear which portions of the site or linked resource documents were most heavily accessed as a usage breakdown is not currently available.

A primary focus of the ABEL project as a whole is to provide the tools, professional development resources and processes, collaborative spaces, and support structures that will lead teachers to reform their pedagogy in the direction of more constructivist and inquiry-based practice. To this end, several of the whole-group sessions (and the tasks they assigned to teachers) have addressed inquiry learning theory and practice, as do many resources on the Community site. Although the ABEL project is far from complete, it seems reasonable to consider to what extent teacher projects to date have begun to embody these instructional design goals. While the variability across the limited number of cases observed and studied so far makes strong generalizations inappropriate, there are some observable trends in the projects that have taken place this year. Following the criteria for inquiry projects outlined in "Creating an Inquiry Project" (Friesen & Clifford, 2001), most of the project events have addressed authentic, real-world issues and problems that have ramifications extending well beyond the classroom, such as global energy use or international conflicts. Videoconferencing events have typically involved authentic actors in these events (e.g., peace activists, a Holocaust survivor, a genetics lawyer) who have first-hand knowledge and expertise concerning the issues being addressed. Students have been exposed in presentations and dialog to expert thinking in different disciplines, and have had opportunities not to simply learn new facts but understand patterns and interconnections on a deeper level. In certain contexts (e.g., the P^2S math event, the OSC event) they were exposed to procedural modeling and coaching from experts in novel and more powerful contexts.

But contacts of this type, while very valuable in themselves, do not embody all or even a majority of the dimensions of inquiry learning. For true inquiry learning to occur, interactions with remote experts and opportunities to collaborate and learn with others at a distance need to be embedded within a larger pedagogical enterprise that leads students to co-construct knowledge through meaningful, active inquiry using a range of strategies. Students need to be actively involved in deciding how all aspects of this process proceeds, and are responsible for creating meaningful products communicating their understandings to authentic audiences. This process was partially realized in Cathy's Greek studies unit, in which a number of her students engaged the question of the glory and relevance of ancient Greek civilization in collaborative teams in an active and personally meaningful manner that seemed (for some) to generate deeper understandings. These students had opportunities to pursue specialties of interest to them, to explore the connections between specialized knowledge in their groups, manage their own work, and to be active partners in determining assessments. (The outcomes from this project might have been more exemplary had the teacher devoted more of her time to coaching and scaffolding her students, but the novelty of the project meant that much of her class time was given over to the development and administrative aspects of the unit.) The opportunity to mentor and respond to questions from younger students in the videoconference gave Cathy's students a rich learning experience in communicating effectively and synthesizing and applying their new knowledge, but its real power lay in it being the culminating event of the project—its pedagogical value would have been far less otherwise.

In the Science Centre case, the procedural focus of the lab activities, while highly authentic in a technical sense, did not offer students opportunities for self-generative

exploration—students listened to an explanation of the test to be done and then followed the steps laid out by the instructor. The event certainly had a high level of perceived authenticity, and clearly had considerable personal meaning for the students, and by those measures it was a success. But to be part of true inquiry learning it too would need to be embedded in a larger inquiry context, as for example if students had taken on a particular inquiry challenge which led them to have a need to undertake DNA fingerprinting. In this way the lab experience would have value not simply as an authentic activity in the narrowest sense, but as one that was instrumental to a larger knowledge-building endeavor. For high school teachers faced with time limitations and curricular demands, implementing this type of project is clearly very challenging, but there were indications that a few ABEL projects had explored aspects of this bigger undertaking.

> *Recommendation 14.* The learning leads should take steps to encourage longer-term collaboration on projects incorporating ABEL tool use and videoconferencing that generate more fully developed inquiry learning experiences for students. It is suggested that the project acquire video resources that can be delivered via broadband that offer concrete exemplars of inquiry teaching methods being used in different subject areas. These clips would not necessarily need to illustrate broadband uses themselves; what is more important is the provision of a detailed but not overly long overview of the main features of the projects and the successes experienced by the participating teachers. These should not only be made available as a stand-alone resource via the Community site, but also introduced on a by-subject basis in the subject-group videoconferences.
>
> Encouraging collaboration in these endeavours is important in three ways. On a practical level it allows teachers to split up the intense workload involved in articulating new projects. It also promotes the collective professional development model that ABEL strives for, in which teaches become their own best support for their mutual growth. And at the pedagogical level, having two classes participating together in a longer-term project opens up a range of collaborative knowledge-building options not possible in one classroom.
>
> Longer projects should be encouraged to incorporate multiple videoconferencing events over the course of the project, so that extended collaboration between classes is possible in all stages of inquiry project work.
>
> *Recommendation 15*. Actively work with teachers to explore ways in which they could incorporate some of the rich media resources ABEL partners offer into their projects, and contribute their own resources to the Object Learning Repository. Most projects to date have employed videoconferencing as their primary ABEL technology. Teachers need to be made directly aware of the recent wave of new resources added to the project, and outreach in this regard by learning leads and management to both small subject groups and teams that have projects known to be in development would seem worth the effort.

Recommendation 16. Offer models and encouragement for more interactive and synergistic student videoconference events. Short term events still have a place, but they could in many instances be more effective if there were greater reciprocity in communication at the participating sites. The current model of the expert(s) who answer questions from one site does not lend itself so well to the active formation of new knowledge, which could more readily develop if, for example, two adults with complimentary expertise or even divergent views were participating from different sites. On another level, a jigsaw approach across classes could be brought into play, with each class bringing to the communal session different aspects of the knowledge needed to address an inquiry problem.

Recommendation 17. The learning team needs to actively monitor the progress of participating teachers on a week-to-week basis, and where potential failure to establish collaboration and project-building is apparent, work with the teacher to facilitate their planning and contact potential partners whom the teacher might work with. (Obviously this would have to be done with considerable tact to avoid offending the teacher involved.)

Recommendation 18. The loss of ANLON in the spring caused some disruption in a few projects. It is recommended that a final toolkit and set of resources be "locked in" prior to the start of the Summer Institute to enhance the comfort level and facilitate the planning of teachers as they work towards their fall projects.

Recommendation 19. In schools where teachers do not have a reduced teaching load but rely on release time and the use of substitute teachers to free up time for ABEL work, the project management and learning leads should work with the principal and teachers concerned to proactively plan for and schedule such release time so that teachers are regularly freed up to focus on ABEL project development. As the experience on the LearnCanada project proved, "If you want participation you have to create time." Simply waiting for teachers to request release time may create barriers to project development. Several teachers to date have made very little use of available release time. Teachers may feel that they must have a clear rationale such as a well articulated project plan before requesting time for project work. A proactive approach would allow teachers the time they need to begin serious reflection and planning, building up an essential initial momentum to accelerate project development.

10.8. Conclusion

After a somewhat slow and difficult start, the ABEL project has made significant progress over the past school year in developing a collective learning community amongst the members of its diverse learning team. Despite considerable technical, logistical, and organizational challenges ranging from connectivity failures to a teacher strike, teachers have collaborated in planning and implementing a flurry of projects over the past few months. The learning leadership in the project has gone to considerable lengths to ensure that it receives rapid and regular feedback from teachers about its professional development programs and resources, and has responded flexibly to requests

for new approaches and forms of support. Teachers have begun implementing broadband technologies in their practice in ways that are breaking through the bounds of traditional pedagogies, offering their students more authentic and engaging learning experiences. Collaboration and sharing across institutional and provincial barriers has become increasingly commonplace in a relatively short period of time. Challenges remain; not all participants have undertaken projects yet, and most that have been implemented only partially meet the criteria for inquiry-based learning. The network (both human and technological) is not yet as cohesive as it could be. But the momentum is definitely moving in the right direction, and if the recommendations suggested here are implemented, the coming school year should see tremendous progress in ABEL's efforts to advance teacher professional development through collaborative project work and community building.

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