# The New Brunswick Dedicated Notebook Research Project

**Final Report**

**November 24, 2006**

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# Executive Summary

This report represents the final part of the first two phases of the New Brunswick Dedicated Notebook Computer Research Project. Phase I commenced in the fall of 2005 and it involved the distribution of notebook computers to approximately 250 students and teachers at the grade 7 level in three anglophone schools that were selected by the Department of Education. Phase II of the research project involved the movement of the notebook computers with the students in each project school as they changed from grade 7 to grade 8, plus a further 250 computers added for all new grade 7 students in the selected notebook classrooms at these same schools. In addition to the work of the teachers, administrators and school districts involved with the project coordinated by the Department of Education, the external research team, housed at Mount Allison University but including research team members from St. Francis Xavier University's School of Education, conducted the two-year research evaluation of the project.

The goal of the research project was to consider how providing middle school students and teachers with their own individual laptop computers in a 1:1, wireless, networked environment would affect the learning experiences and instructional approaches in the selected schools and classes. The research team has concluded that, overall, the dedicated notebook research project has been highly successful and has resulted in a significant level of sustained engagement between students and teachers, and that these results match or exceed results found in other jurisdictions using 1:1 laptop technology.

The research team report contains an environmental scan and review of related research initiatives and 1:1 projects across Canada and the United States, as well as some of the qualitative and quantitative results reported in each of these programs. The report also reveals the results of the work of the research team during Phase I and Phase II of the project, from January 2005 to June 2006, including a series of ongoing school visits and discussions with students, teachers and administrators, as well as parents and Department of Education officials. There were also a series of online surveys that the students participating in the project were asked to complete. The report concludes that the evidence collected in both Phase I and Phase II indicates that the dedicated notebook initiative has been highly successful, with a wide range of evidence to support the conclusion that student learning and improved teaching and pedagogy has been the direct result of the use of this new technology in the participating classes.

The research report provides detailed tabular summaries of student beliefs and overall conclusions on the role of the dedicated notebooks in their individual learning experiences at both the grade 7 and grade 8 levels, with many reporting across two years of participation. The research team has concluded that the most important factor for the success of the initiative has been the care and attention accorded to the development of a technology roll-out plan, as well as the inclusion of a high level of professional teacher development before and during the implementation phases. The in-school addition of the Teacher-Mentor program, as well as a dedicated technology assistant at each location, ensured that teachers and administrators were not expected to be the hardware and software technicians for the program. In each classroom and school within the

anglophone sector of the project, the research team found there to be the highest levels of professional development opportunities for teachers, as well as a positive, professional and engaged teaching component, and an effective communications and consultation process on the part of the Department of Education.

Briefly, the Final Report includes some of the following observations, conclusions and recommendations:

- Student interviews over the two-year period reveal a consistent, high level of interest and satisfaction with the dedicated notebook computers.
- Students and teachers, with the knowledge and overwhelming approval of parents and guardians, have experienced marked increases in their learning, including significant time and benefits within most subject areas within the curriculum, researching information on the Internet and developing 21$^{st}$ century learning skills.
- All teachers involved in the project reported a very high degree of professional satisfaction with the dedicated notebooks and they are using them in a variety of ways, such as developing instructional materials, conducting research related to instruction, and engaging in professional development opportunities with colleagues.
- Students report higher levels of engagement in their learning, including increased pride in their work, more time spent on writing and editing their work, higher levels of organization, and more interest in school and working with their peers.
- External consultants to the project have concluded that the dedicated notebooks are enhancing the delivery of the curriculum to grade 7 and grade 8 students as well as offering a greater level of effective delivery to students with special needs and individualized learning programs.
- Parents, teachers and school administrators report a very positive school environment and the development of learning communities in the notebook classrooms. The research team notes that these individuals, as well as the students themselves, are reporting a positive impact on attitudes toward learning, behaviour and attendance, as well as improved results in assessment of academic performance.

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# Detailed Summary

## Background

A variety of one-to-one computer initiatives have been implemented and studied across Canada and the United States. Although these initiatives vary widely in scope and method of implementation, some key findings emerge from a study of them. In general, these initiatives result in:

- The creation of a cadre of technologically sophisticated students
- Improved student-teacher relationships (Center for Digital Education, 2005)
- Enhanced instructional strategies
- Improved student motivation (Sivin-Kachala & Bialo, 2000)
- Improved overall academic achievement (Kulik & Kulik, 1998; Bain & Smith, 2000; Scheidt, 2003), including increased test scores in mathematics (McCabe & Skinner, 2003; Kulik, 2003) and improved writing skills (Jeroski, 2003; Rockman, et al., 2000; Herts-Lazarovitz & Bar-Natan, 2002)

In the spring of 2004, the New Brunswick Government announced its plan for the Dedicated Notebook Research Project and engaged the services of university-based research teams. The goals and objectives of this initiative included: enriching teaching and learning practices, supporting the mastery of skills required to succeed in the global knowledge economy, improving teacher and student ICT competencies, impacting positively on student motivation and achievement, and increasing parental and community involvement in education and lifelong learning (Government of New Brunswick, 2006).

The participating schools were selected, via an application process, by the Department of Education. The three anglophone schools selected were: Harry Miller Middle School, District 6, in Rothesay; Grand Manan Community School, District 10, located on Grand Manan Island in the Bay of Fundy; and Nashwaaksis Middle School, District 18, in Fredericton. The francophone schools selected for the research were: Centre d'apprentissage du Haut-Madawaska, District 3, in Clair; École Abbey-Landry, District 1, in Memramcook; and École Le Tremplin, District 9, in Tracadie-Sheila.

In Phase I of the research project, 237 grade 7 students, as well as all teachers involved with instruction of these students, received a dedicated notebook computer. Full in-class use of notebooks in Phase I did not start until January 2005 due to the late arrival of the notebooks. Phase II commenced in September of 2005 with the same students, still in the same schools but now in grade 8, keeping their notebook computers and a new cohort of 262 grade 7 students at the same six schools receiving their own notebook computers.

The Department of Education included significant technological and pedagogical support for the research project that included an extensive professional development plan for the teachers as well as the ongoing assistance of a pedagogical teacher-mentor and technical support person in each of the research schools. These individuals were put in place in the

period prior to the arrival of the notebook computers by way of the school district administrations involved.

During the first phases of the notebook initiative, participating schools were evaluated by two teams of researchers. The anglophone sector was led by researchers from Mount Allison University and St. Francis Xavier and the francophone sector was led by investigators from Université de Moncton.

The goal of the research investigation was to determine how providing New Brunswick students and teachers with their own individual portable notebook computers affects the learning experiences and instructional approaches in their classrooms.


## Research Methods

The anglophone school research team used largely qualitative research methods to collect data over the two year period of evaluation. Evaluation evidence of Phase I and II of the Dedicated Notebook Research Project included a variety of research tools, including:

- **Online surveys**, which collected data from teachers and students who were participating in the project, were conducted at the start of the project, when the notebooks were first being delivered to the classrooms (January – February 2005) as well as at the end of the school year in June of 2005 and June of 2006. The surveys allowed the research team to collect information on the initial impact of the notebooks on the teaching and learning environment across the three schools.
- **Site visits and interviews** were conducted by the research team throughout the early periods of the research project. As well, regular monthly meetings were held with teachers, students, principals, technology mentors, parents and others who were involved in the project. Each visit included interviews with these individuals and recorded site visit field notes and observations compiled by the research team members.
- **Classroom observations** were conducted on a monthly basis in each of the notebook initiative schools over the two-year life of the project. As each research team member is a trained teacher, the classroom environment and the integration and use of the notebook technology were recorded. Further, members of the research team attended several meetings with the Department of Education and participating notebook school officials, including school district officials, principals and parent groups.
- **Document analysis** was completed throughout the project. Members of the research team reviewed student work as well as related school policies, Department of Education materials and related technologies, school websites and blogs, lesson plans, and professional development plans.
- **Project summit:** Members of the research team met with all of the teachers, mentors, technology assistants, principals and school district officials involved with the Dedicated Notebook Research Project during a two-day summit on Grand Manan Island, New Brunswick, in June of 2006. Sessions were recorded and transcribed for the research report.

**Results – Student Surveys**

The June 2005 and June 2006 surveys (Appendix D) were conducted online and all participating grade 7 students (2005 and 2006) and grade eight students (2006) in the anglophone sector were asked to complete them during their last week of classes. Of the participating students, 92% and 89% submitted valid surveys in June 2005 and June 2006 respectively. The results of these surveys are summarized below.

*Overall Experience with Notebooks*

In June 2005, 97% of respondents indicated that they "enjoyed" or "really enjoyed" using the notebooks and had "positive" or "very positive" feelings about the experience. In June 2006, that number dropped slightly to 90% overall (89% for grade 8 students and 93.3% for grade 7 students).

*Subject-Specific Notebook Use*

Table DS-1 shows the results of student surveys on the use of the notebook computers for specific subject areas. Students at both grade levels made extensive use of the notebooks, particularly in the areas of language arts, social studies, French, and science. Their use in French classes increased significantly from Phase I to Phase II. The notebooks received limited use in art/music and physical education/health classes although their use for art/music increased from Phase I to Phase II. Use of the notebooks was also somewhat limited in mathematics and this is one of the few areas in which usage fell from Phase I to Phase II and from grade 7 to grade 8. It is important to note, however, that many students reported a positive impact of the tools made available by the notebooks even for subject areas that had low total usage times.

**Table DS-1: Student-reported notebook use across various subjects (in percent)**

|  |  | 2005 | 2006 | |
|---|---|---|---|---|
|  |  | **Gr. 7** | **Gr. 7** | **Gr. 8** |
| Language arts (reading/writing) | I do not take this class | 1.5 | 1.5 | 0 |
|  | 0 hours/week | 2.5 | 1.5 | 0 |
|  | 1 – 3 hours/week | 37.0 | 23 | 27 |
|  | 4 – 6 hours/week | 41.0 | 56 | 46 |
|  | 7+ hours/week | 18.0 | 18 | 27 |
| Social studies | I do not take this class | 1.0 | 0.8 | 1.0 |
|  | 0 hours/week | 4.0 | 1.5 | 1.0 |
|  | 1 – 3 hours/week | 57.0 | 77 | 56.0 |
|  | 4 – 6 hours/week | 29.0 | 20 | 30.0 |
|  | 7+ hours/week | 9.0 | 0.8 | 12.0 |

| | | | | |
|---|---|---|---|---|
| Art/music | I do not take this class | 19 | 19.0 | 19.0 |
| | 0 hours/week | 40 | 33.0 | 36.0 |
| | 1 – 3 hours/week | 32 | 43.0 | 39.0 |
| | 4 – 6 hours/week | 6 | 4.0 | 4.5 |
| | 7+ hours/week | 3 | 1.0 | 1.5 |
| Mathematics | I do not take this class | 1 | 1.5 | 4.0 |
| | 0 hours/week | 15 | 45.0 | 50.0 |
| | 1 – 3 hours/week | 65 | 33.0 | 37.0 |
| | 4 – 6 hours/week | 14 | 15.0 | 7.0 |
| | 7+ hours/week | 5 | 4.5 | 2.0 |
| French | I do not take this class | 11 | 5.0 | 4.0 |
| | 0 hours/week | 18 | 5.0 | 0.0 |
| | 1 – 3 hours/week | 27 | 46.0 | 34.0 |
| | 4 – 6 hours/week | 35 | 36.0 | 35.0 |
| | 7+ hours/week | 9 | 8.0 | 27.0 |
| Science | I do not take this class | 1 | 5.0 | 4.0 |
| | 0 hours/week | 5 | 5.0 | 0.0 |
| | 1 – 3 hours/week | 58 | 46.0 | 34.0 |
| | 4 – 6 hours/week | 31 | 36.0 | 34.5 |
| | 7+ hours/week | 5 | 8.0 | 27.5 |
| Physical education/health | I do not take this class | 2 | 10.0 | 2.0 |
| | 0 hours/week | 50 | 53.0 | 49.0 |
| | 1 – 3 hours/week | 40 | 35.0 | 45.0 |
| | 4 – 6 hours/week | 6 | 2.0 | 4.0 |
| | 7+ hours/week | 2 | 0.0 | 0.0 |

*Task-Specific Notebook Use*

Students were asked to indicate the various ways in which they use their notebook computers during a normal week and Table DS-2 summarizes these results. Students reported that they use their notebooks for a wide range of applications, with researching information on the Internet, editing their work, and organizing information being the most frequent.

Phase II surveys confirmed that students were using the notebooks to employ higher order thinking and writing and research skills as well as taking advantage of the benefits offered by the notebooks to improve efficiency in taking notes, organizing files and assignments, creating presentations and communicating with students and teachers. One of the most significant increases in notebook computer use was in the area of creation of presentations and other multimedia skills. In Phase I, 58% of grade 7 students used the notebooks, weekly, daily or several times per day to create presentations and multimedia projects. By the end of their grade 8 year in Phase II, this figure rose to 84%, and 77% of the grade 7 respondents reported using the technology for these purposes.

**Table DS-2: Student-reported notebook use for specific tasks (in percent)**

| | | 2005 | 2006 | |
|---|---|---|---|---|
| | | Gr. 7 | Gr. 7 | Gr. 8 |
| Writing first drafts of papers and projects | Never | 2.0 | 5.0 | 1.0 |
| | Less than once a week | 24.0 | 25.0 | 23.0 |
| | Once a week | 21.0 | 15.0 | 20.0 |
| | A few times a week | 33.0 | 31.0 | 35.0 |
| | Once a day | 5.0 | 14.0 | 5.0 |
| | Often during the day | 15.0 | 10.0 | 16.0 |
| Editing my work | Never | 4.0 | 4.0 | 0.0 |
| | Less than once a week | 12.0 | 6.0 | 8.0 |
| | Once a week | 12.0 | 17.0 | 13.0 |
| | A few times a week | 39.0 | 44.0 | 39.0 |
| | Once a day | 8.0 | 8.0 | 11.0 |
| | Often during the day | 25.0 | 21.0 | 29.0 |
| Taking notes | Never | 18.0 | 20.0 | 21.0 |
| | Less than once a week | 26.0 | 15.0 | 16.0 |
| | Once a week | 10.0 | 17.0 | 13.0 |
| | A few times a week | 28.0 | 29.0 | 28.0 |
| | Once a day | 7.0 | 8.0 | 8.0 |
| | Often during the day | 11.0 | 12.0 | 14.0 |
| Organizing information | Never | 7.0 | 9.0 | 3.5 |
| | Less than once a week | 12.0 | 17.0 | 16.0 |
| | Once a week | 16.0 | 23.0 | 13.0 |
| | A few times a week | 35.0 | 27.0 | 29.0 |
| | Once a day | 11.0 | 13.0 | 12.5 |
| | Often during the day | 19.0 | 11.0 | 26.0 |
| Researching information on the Internet | Never | 0.0 | 0.0 | 0.0 |
| | Less than once a week | 3.0 | 3.0 | 2.0 |
| | Once a week | 3.0 | 6.0 | 4.0 |
| | A few times a week | 26.0 | 33.0 | 27.0 |
| | Once a day | 21.0 | 21.0 | 13.0 |
| | Often during the day | 47.0 | 37.0 | 54.0 |
| Writing quizzes, tests or assignments | Never | 20.0 | 27.0 | 18.0 |
| | Less than once a week | 35.0 | 31.0 | 23.0 |
| | Once a week | 15.0 | 19.0 | 13.0 |
| | A few times a week | 21.0 | 18.0 | 32.0 |
| | Once a day | 4.0 | 2.0 | 5.0 |
| | Often during the day | 5.0 | 3.0 | 9.0 |

| Doing drills using computer simulations or games | Never | 14.0 | 15.0 | 19.0 |
| | Less than once a week | 23.0 | 42.0 | 29.0 |
| | Once a week | 19.0 | 18.0 | 14.0 |
| | A few times a week | 33.0 | 18.0 | 23.0 |
| | Once a day | 8.0 | 4.0 | 12.0 |
| | Often during the week | 3.0 | 3.0 | 3.0 |
| Creating presentations and other multimedia projects | Never | 1.0 | 0.0 | 0.0 |
| | Less than once a week | 14.0 | 9.0 | 6.0 |
| | Once a week | 27.0 | 14.0 | 10.0 |
| | A few times a week | 38.0 | 50.0 | 41.0 |
| | Once a day | 7.0 | 12.0 | 16.0 |
| | Often during the day | 13.0 | 15.0 | 27.0 |
| Working on online assignments or worksheets | Never | 8.0 | 26.0 | 8.0 |
| | Less than once a week | 35.0 | 33.0 | 28.0 |
| | Once a week | 16.0 | 17.0 | 19.0 |
| | A few times a week | 28.0 | 16.0 | 28.0 |
| | Once a day | 9.0 | 5.0 | 5.0 |
| | Often during the day | 4.0 | 3.0 | 12.0 |
| Sending and/or receiving e-mail messages | Never | 12.0 | 29.0 | 4.5 |
| | Less than once a week | 23.0 | 21.0 | 22.5 |
| | Once a week | 13.0 | 10.0 | 12.0 |
| | A few times a week | 24.0 | 19.0 | 31.0 |
| | Once a day | 12.0 | 3.0 | 10.0 |
| | Often during the day | 15.0 | 18.0 | 20.0 |
| Working on assignments in small groups | Never | 2.0 | 1.5 | 1.0 |
| | Less than once a week | 20.0 | 17.0 | 7.0 |
| | Once a week | 23.0 | 32.0 | 12.5 |
| | A few times a week | 41.0 | 35.0 | 45.0 |
| | Once a day | 2.0 | 9.0 | 14.0 |
| | Often during the day | 12.0 | 5.0 | 20.5 |

*Receiving Assistance in Using the Notebooks*

The Dedicated Notebook Research Project included a significant level of technical assistance for both students and teachers in the form of on-site teacher-mentors and technicians. Throughout both Phase I and II of the project, there were remarkably few technical or hardware problems associated with the notebooks. When students did need assistance, they most often turned to fellow students (see Table DS-3), adding to the development of shared knowledge on the part of the students.

**Table DS-3: Student-reported frequency of seeking assistance from various people (in percent) when help was needed with the notebooks**

| | | 2005 | 2006 | |
|---|---|---|---|---|
| | | Gr. 7 | Gr. 7 | Gr. 8 |
| A teacher | Never | 5.0 | 14.0 | 8.0 |
| | Not very often | 32.0 | 38.0 | 37.0 |
| | Sometimes | 49.0 | 40.0 | 39.0 |
| | This is usually the person I ask. | 14.0 | 8.0 | 16.0 |
| Another student in the class | Never | 9.0 | 10.0 | 6.0 |
| | Not very often | 31.0 | 30.0 | 32.0 |
| | Sometimes | 39.0 | 36.0 | 46.0 |
| | This is usually the person I ask. | 21.0 | 24.0 | 16.0 |
| Technology specialist or teacher-mentor | Never | 8.0 | 26.0 | 13.0 |
| | Not very often | 45.0 | 57.0 | 47.0 |
| | Sometimes | 34.0 | 12.0 | 27.0 |
| | This is usually the person I ask. | 13.0 | 5.0 | 13.0 |
| Other adult in the school | Never | 50.0 | 60.0 | 58.0 |
| | Not very often | 40.0 | 30.0 | 29.0 |
| | Sometimes | 8.0 | 8.0 | 12.0 |
| | This is usually the person I ask. | 2.0 | 2.0 | 1.0 |

*Student Attitudes and Perceptions*

In order to assess the ways in which teaching and learning were impacted by the addition of the notebooks, the students were asked to indicate their level of agreement with a series of qualitative statements regarding the use of the notebooks. As shown in Table DS-4, a large majority of students (grade 7, 2005; grade 7, 2006; and grade 8, 2006 respectively) indicated agreement with statements that using the notebooks: helps them to be better organized (94%, 92% and 98%), allows them to be more involved in the class (96%, 84% and 98%), makes them more likely to revise or edit their work (90%, 90% and 95%), allows them to get work done more quickly (95%, 95% and 97%), results in their doing more work (88%, 93%, and 97%), makes them better able to understand their work (90%, 83.5% and 92%), and makes them more interested in school (86%, 84% and 93%).

**Table DS-4: Student-reported attitudes and perceptions of using the notebooks**

| | | 2005 | 2006 | |
|---|---|---|---|---|
| | | Gr. 7 | Gr. 7 | Gr. 8 |
| Having a notebook has helped me to be better organized. | Strongly disagree | 1 | 1.5 | 0.0 |
| | Disagree | 1 | 1.5 | 0.0 |
| | Somewhat disagree | 3 | 5.0 | 2.0 |
| | Somewhat agree | 21 | 19.0 | 22.0 |
| | Agree | 35 | 46.0 | 37.0 |
| | Strongly Agree | 39 | 27.0 | 39.0 |

| I am more involved in the class when I use my notebook. | Strongly disagree | 1 | 4.0 | 1.0 |
| | Disagree | 0 | 5.0 | 3.0 |
| | Somewhat disagree | 5 | 7.0 | 2.0 |
| | Somewhat agree | 28 | 25.0 | 32.0 |
| | Agree | 39 | 37.0 | 39.0 |
| | Strongly Agree | 27 | 22.0 | 23.0 |
| I am more likely to revise or edit my work when it is done on the notebook. | Strongly disagree | 1 | 1.0 | 1.0 |
| | Disagree | 0 | 5.0 | 1.0 |
| | Somewhat disagree | 11 | 4.0 | 3.0 |
| | Somewhat agree | 12 | 17.0 | 15.0 |
| | Agree | 41 | 47.0 | 47.0 |
| | Strongly Agree | 35 | 26.0 | 33.0 |
| I get my work done more quickly now that I use a notebook. | Strongly disagree | 0 | 1.5 | 2.0 |
| | Disagree | 0 | 1.5 | 0.0 |
| | Somewhat disagree | 5 | 2.0 | 1.0 |
| | Somewhat agree | 14 | 17.0 | 13.0 |
| | Agree | 34 | 33.0 | 44.0 |
| | Strongly Agree | 47 | 45.0 | 40.0 |
| I find I do more work when I use a notebook. | Strongly disagree | 0 | 1.5 | 1.0 |
| | Disagree | 5 | 4.5 | 2.0 |
| | Somewhat disagree | 7 | 1.5 | 4.0 |
| | Somewhat agree | 21 | 14.5 | 30.0 |
| | Agree | 35 | 51.0 | 36.0 |
| | Strongly Agree | 32 | 27.0 | 27.0 |
| I am better able to understand my schoolwork when we use the notebooks. | Strongly disagree | 2 | 1.0 | 2.0 |
| | Disagree | 1 | 11.0 | 2.0 |
| | Somewhat disagree | 6 | 4.5 | 4.0 |
| | Somewhat agree | 36 | 28.0 | 27.0 |
| | Agree | 31 | 34.0 | 40.0 |
| | Strongly Agree | 24 | 21.5 | 25.0 |
| Since we received the notebooks, I am more interested in school. | Strongly disagree | 2 | 1.0 | 1.5 |
| | Disagree | 3 | 11.0 | 1.5 |
| | Somewhat disagree | 9 | 4.0 | 4.0 |
| | Somewhat agree | 23 | 27.0 | 28.0 |
| | Agree | 30 | 35.0 | 39.0 |
| | Strongly Agree | 33 | 22.0 | 26.0 |
| I find that the quality of my work has improved by using the notebook. | Strongly disagree | 0 | 1.0 | 0.0 |
| | Disagree | 1 | 4.0 | 1.0 |
| | Somewhat disagree | 2 | 2.0 | 4.0 |
| | Somewhat agree | 23 | 15.0 | 25.0 |
| | Agree | 41 | 47.0 | 36.0 |
| | Strongly Agree | 33 | 31.0 | 34.0 |

| I find that I take more pride in my work since receiving the notebook. | Strongly disagree | 2 | 1.0 | 2.5 |
| | Disagree | 0 | 2.0 | 2.0 |
| | Somewhat disagree | 6 | 4.0 | 9.0 |
| | Somewhat agree | 35 | 23.0 | 24.0 |
| | Agree | 28 | 50.0 | 35.0 |
| | Strongly Agree | 29 | 20.0 | 27.5 |
| I find that my understanding of computers and my skills using them have improved since receiving the notebook computer. | Strongly disagree | 0 | 2.0 | 2.0 |
| | Disagree | 1 | 3.0 | 0.0 |
| | Somewhat disagree | 1 | 3.0 | 4.0 |
| | Somewhat agree | 15 | 15.0 | 13.0 |
| | Agree | 39 | 35.0 | 31.0 |
| | Strongly Agree | 44 | 42.0 | 50.0 |
| Overall, I find that I have become a better student by having the notebook to complete my work. | Strongly disagree | 1 | 4.0 | 1.5 |
| | Disagree | 3 | 4.5 | 2.5 |
| | Somewhat disagree | 6 | 5.5 | 7.0 |
| | Somewhat agree | 24 | 27.0 | 20.0 |
| | Agree | 37 | 36.0 | 42.0 |
| | Strongly Agree | 29 | 23.0 | 27.0 |

*Interaction with Other Students and Teachers*

As indicated in Table DS-5, students overwhelmingly agreed that the notebooks improved relationships in the classroom. They felt that they interacted with their teachers and fellow students more and that their teachers were more effective with the notebooks.

**Table DS-5: Student-reported interaction with other students and teachers**

| | | 2005 | 2006 | |
| --- | --- | --- | --- | --- |
| | | **Gr. 7** | **Gr. 7** | **Gr. 8** |
| Now that I have my notebook, I interact with my teachers more. | Strongly disagree | 1 | 8.0 | 1.0 |
| | Disagree | 5 | 13.5 | 10.0 |
| | Somewhat disagree | 15 | 8.0 | 12.0 |
| | Somewhat agree | 43 | 40.0 | 49.0 |
| | Agree | 24 | 19.5 | 17.0 |
| | Strongly Agree | 12 | 11.0 | 11.0 |
| I find that my teacher/teachers have been more effective in teaching me when the class has been able to use the notebooks to assist our learning. | Strongly disagree | 1 | 3.0 | 1.0 |
| | Disagree | 2 | 4.0 | 1.0 |
| | Somewhat disagree | 6 | 5.0 | 6.0 |
| | Somewhat agree | 34 | 30.0 | 23.0 |
| | Agree | 35 | 44.0 | 41.0 |
| | Strongly Agree | 22 | 14.0 | 28.0 |

| Now that I have my notebook, I work with other students more. | Strongly disagree | 1.5 | 3.0 | 0.0 |
|---|---|---|---|---|
| | Disagree | 1.5 | 4.0 | 4.0 |
| | Somewhat disagree | 6 | 12.0 | 2.0 |
| | Somewhat agree | 37 | 36.0 | 37.5 |
| | Agree | 35 | 31.0 | 37.5 |
| | Strongly Agree | 19 | 14.0 | 19.0 |

*Adapting to Notebook Technology*

Results of the surveys indicate that the students adapted easily to the use of the notebooks; they did not prefer to handwrite assignments and were not overwhelmed by the amount of information available to them on the Internet (Table DS-6).

**Table DS-6:  Student-reported adaptation to the use of the notebooks**

| | | 2005 Gr. 7 | 2006 | |
|---|---|---|---|---|
| | | | Gr. 7 | Gr. 8 |
| I prefer to handwrite my assignments rather than use my notebook. | Strongly disagree | 47 | 59.0 | 37.0 |
| | Disagree | 26 | 22.0 | 37.0 |
| | Somewhat disagree | 14 | 7.0 | 9.0 |
| | Somewhat agree | 8 | 8.0 | 12.0 |
| | Agree | 4 | 3.0 | 2.5 |
| | Strongly Agree | 1 | 1.0 | 2.5 |
| All of the information available on the Internet makes it difficult for me to research and analyze the information. | Strongly disagree | 18 | 13.0 | 18.0 |
| | Disagree | 29 | 25.0 | 36.0 |
| | Somewhat disagree | 22 | 31.0 | 22.0 |
| | Somewhat agree | 22 | 18.0 | 14.0 |
| | Agree | 4 | 9.0 | 5.0 |
| | Strongly Agree | 5 | 4.0 | 5.0 |

*Taking the Notebook Home*

For a variety of reasons, the New Brunswick Department of Education decided that the notebooks were to remain at school and students were not allowed to take them home during the research period.  However, students expressed a strong desire to take the notebooks home (Table DS-7) and an environmental scan of the major 1:1 dedicated notebook projects across North America by the researchers revealed that the ultimate success of such programs is derived by 24/7, anytime access to the technology.

**Table DS-7:  Student desire to take the notebooks home**

| | | 2005 | 2006 | |
| --- | --- | --- | --- | --- |
| | | Gr. 7 | Gr. 7 | Gr. 8 |
| I would choose to take my notebook home if allowed. | Strongly disagree | 3 | 2.5 | 0.0 |
| | Disagree | 1 | 1.5 | 0.0 |
| | Somewhat disagree | 1 | 0.0 | 0.0 |
| | Somewhat agree | 4 | 9.0 | 0.0 |
| | Agree | 7 | 11.0 | 11.5 |
| | Strongly Agree | 84 | 76.0 | 88.5 |


## Results – Parent Focus Group Sessions

In May 2005 and May 2006, members of the research team met with a reasonable representation of parents and guardians of students taking part in the Dedicated Notebook Research Project.  An open discussion with orienting questions (Table DS-8 and Table DS-9) took place during each session.  The key findings are summarized here.

Most parents' feelings about the project were overwhelmingly positive.  They felt that the notebooks had a positive impact on the learning environment at school and on their children's attitude towards school and schoolwork.  Although the parents/guardians of grade 8 students in Phase II noted that some of their children were taking the computers for granted, they still felt they had a positive impact on their attitudes and were happy that they would be taking the notebooks with them to grade 9.

For the most part, parents did not notice any change in their children's marks as a result of the notebooks. Notable exceptions to this were students with fine motor skills difficulties; the use of the computers helped these students a great deal and improved their marks.

Despite no change in marks, parents/guardians did notice improvements in many areas including organizational skills, the ability to conduct independent research, and presentation and speaking skills.  They also felt that their children were doing more writing and editing.  In addition, they listed the following newly acquired technological skills:  keyboarding, preparing and giving multimedia (PowerPoint) presentations, installing software, taking and transferring digital photographs, and using a word processor's thesaurus.

There were only a few concerns expressed regarding the changes in teaching and learning since the introduction of the notebooks.  Most parents noticed a marked reduction in homework. This was attributed to the fact that the teaching and learning had become more efficient, making it unnecessary for their children to complete work at home. However, since many parents were not seeing the assignments their children were completing, it was more difficult for them to be assured that their children were doing enough work.  This lack of access to their children's assignments was partially remedied by postings on teachers' homework blogs and by having students take assignments home

using the memory keys. Since not all families had compatible computers at home, though, many were still left without adequate access to their children's work.

Some parents had a discussion on the relative costs and merits of textbooks and notebook computers. They wanted to ensure that a balance was maintained between computer research and traditional book research.

The final concern expressed was in relation to the continuation and possible expansion of the project. Parents were glad that their children had been able to participate in the project and were happy to learn that their children would continue with the notebooks into grade 9. However, they expressed concerns that not all students were given this opportunity and, in general, they wanted to see the project continue and expand so that all students in a given school (and across the province) would have the same access to technology and the opportunities it provides.

**Table DS-8: Orienting questions for the May 2005 parent focus group session**

| |
|---|
| 1. What are the effects of the notebook computers on your perceptions about the use of technology in teaching and learning? Do you feel that notebooks have positively or negatively affected the teaching and learning that your child is experiencing? |
| 2. What are the effects of the individual portable computers on your perceptions about homework? Have you notice any changes in your child's approaches and attitudes towards homework between the introduction of the notebooks and now? |
| 3. What are your needs and concerns in relation to your child's use of technology in school? Have your thoughts or concerns changed between the introduction of the notebooks and now? |
| 4. Do you have other children in the school? If so, what differences, if any, are you noticing in your children's experiences? |
| 5. Do you have recommendations about how the notebook project could be improved? |
| 6. Do you find that the nature of the work your child is doing has changed? For instance, are they doing more independent research work than they used to? Doing more writing and editing? Are you finding it necessary to help them more or less with their learning? How so? |

**Table DS-9: Orienting questions for the May 2006 parent focus group session**

| |
|---|
| 1. Has your son/daughter's attitude toward his/her studies changed since he/she began using the computers? If so, could you please describe the differences you have seen in his/her attitudes? |
| 2. What new skills do you think he/she has developed as a learner since he/she started to use the notebooks? |
| 3. Have his/her marks improved, stayed the same, or deteriorated since he/she received the computers? |
| 4. When you think about particular subjects that he/she has studied, have you noticed changes in the ways that he/she has been learning those subjects? |
| 5. Generally how do you feel as a parent and a taxpayer about the fact that your son/daughter is using a notebook computer at school? |
| 6. What is the one most interesting thing that your son/daughter has told you about how he/she has been learning? |
| 7. Is there anything else that you think I should know as a researcher about the experiences that your son/daughter ahs been having with the computers? |

## Results – Teacher Reports

The researchers met with teachers in all of the project schools. Detailed accounts of their experiences with the notebooks, particularly in specific subject areas, are provided in chapter five of this report. However, several observations and experiences emerged as being common to all of the teachers:

- Students had dedicated access to resources online. Computers were used frequently for research and word processing, and no one had to share resources.
- Students were able to present projects in a variety of ways.
- Students were more engaged with their learning, since they were comfortable with computers and felt that they got "real" results. (i.e. Their written work looked more professional. Their research was in the real world, not in a packaged textbook, and they used the same tools that working people use.)
- The computers helped students who did not use computers much at home to become more comfortable with technology.
- Teachers allowed their students more freedom to find their own way of presenting and researching. There was less need for the teacher to lecture and more need to facilitate. In other words, teachers became facilitators of learning more than the source of all information.
- Teachers learned more about technology.
- Because students were more engaged in their learning experiences, they were less likely to miss classes.
- Students' interest in learning increased.
- Struggling students produced higher quality projects and advanced students had enriched experiences because they could direct more of their learning opportunities.

## Results – Principal and Mentor-Teacher Reports

The principals and mentor-teachers involved with the project noticed marked changes in staff and student attitudes and work habits with the introduction of the notebook computers. While detailed accounts of their experiences are provided in chapter six of this report, the following observations were common across all anglophone research schools:

- An increased comfort level of teachers and students using technology
- An increased availability and use of electronic resources by students and staff
- An increased level of excitement and motivation of staff and students to use technology
- A willingness of staff and students to share ideas and knowledge
- An increased variety of learning activities and resources used with students
- An increased level of electronic communication
- Improved methods for students and teachers to present their work visually
- New ways of organizing ideas and work
- The provision of appropriate professional development was a key factor in teachers' ability to make use of the technology.
- Professional development was best delivered to teachers on an as-needed basis, with minimal time away from the classroom.

## Conclusions and Recommendations

By any measure, the changes and improvements to the learning environment in the three participating anglophone schools were dramatic and overwhelmingly positive for all involved with the project. The research team was continually impressed with the dedication of all levels of teachers and administrators in their implementation of the Dedicated Notebook Research Project and their focus on pedagogy and subject area content and outcomes.

Based on all of the observations, interviews, and surveys, as well as an analysis of the literature and many other 1:1 jurisdictions, the researchers have identified a series of general conclusions and related recommendations:

- Students reported a consistent, high level of interest and satisfaction with the dedicated notebook computers. They reported higher levels of engagement in their learning, including increased pride in their work, more time spent on writing and editing their work, higher levels of organization, and more interest in school and working with their peers.
- Students in the project experienced marked increases in their learning, including significant time and benefits within most subject areas within the curriculum. Most notably, students who used the dedicated notebooks exhibited better writing skills, were better independent researchers, gained specific technology skills, and developed 21$^{st}$ century learning skills.
- All teachers involved in the project reported a very high degree of professional satisfaction with the dedicated notebooks and they used them in a variety of ways,

- such as developing instructional materials, conducting research related to instruction, and engaging in professional development opportunities with colleagues.
- External consultants to the project concluded that the dedicated notebooks enhanced the delivery of the curriculum to all grade 7 and grade 8 students and offered a greater level of effective delivery to students with special needs and individualized learning programs.
- Parents, teachers and school administrators reported a very positive school environment and the development of learning communities in the notebook classrooms. The research team notes that these individuals, as well as the students themselves, reported a positive impact on attitudes toward learning, behaviour and attendance, as well as improved results in assessment of academic performance.
- The most important factor for the success of the initiative was the high level of technical and pedagogical support afforded to the teachers, including in-school teacher-mentors, in-school technicians and extensive professional development opportunities. One of the strongest recommendations in both maintaining the existing dedicated notebook computer program and future expansion of the program is the maintenance of a teacher-mentor and school-based technician.
- While the financing of the technologies used in Phase I and II of the project was beyond the mandate of the research team, the researchers heard a significant amount of concern about the ability of the Department of Education to sustain and enhance the use of dedicated notebooks in the schools of the province. It is the researchers' recommendation that the Dedicated Notebook Research Project be expanded at a rate that is consistent with the goals established as part of the initial project concept, as well as the central focus of meeting the goals of the school district plans and the Department of Education's mandate in the delivery of all educational programs. It is important to note that there are no 1:1 programs that have been delivered to an entire school population that are based solely on government resources. The Department of Education will have to consider a number of funding models that will ensure funding that increases student access, yet does not impose undue financial burdens on individuals and families.
- While there were enhanced performances seen across numerous subject areas, there continued to be a gap between the dedicated notebook technology and an enriched curriculum connection in the area of mathematics instruction. Key teaching personnel devoted a significant amount of time on this issue, with very positive results. The largest projects have also found that mathematics instruction and assessment are a challenge, simply because there are fewer online resources for instruction of discrete calculations as compared to broad, interactive problem-solving disciplines. The New Brunswick project is still in its infancy and, without appropriate metrics for the demonstration of knowledge using the new technologies, using math scores as an indicator of success should be resisted by government decision-makers and school officials.
- The overwhelming frustration and criticism of the New Brunswick Dedicated Notebook Research Project was the inability of the students to use the notebooks at home. It is our recommendation that the Department of Education devise a

mechanism that would allow students to take their notebook computers home during the school year.

The New Brunswick Dedicated Notebook Research Initiative allowed the researchers to conduct rigorous qualitative research on the impacts of ubiquitous technology use on teaching and learning, with an overall conclusion that the project was a highly successful model for future growth, development and best practice. At the same time, any definitive conclusions must be drawn cautiously based on the limited access to non-notebook students and classes, as well as the small sample sizes under investigation. The researchers believe that the New Brunswick model is well prepared for expansion and movement into other grade levels and new curriculum areas, yet there will be an ongoing need to continue researching and evaluating the impacts of these new technologies on student engagement and performance. Future research will need to provide better documentation on the nature of the learning environment at the middle and high school levels, the role of professional development in preparing teachers and resource personnel for the demands of 21st century students, and the new, digital resources that are flooding the marketplace today.

# Chapter 1: Introduction to the New Brunswick Dedicated Notebook Research Project

In the spring of 2004, the New Brunswick Department of Education announced that they were going to provide approximately 250 individual portable computers to middle school students and their teachers. In Canada, public school education is the responsibility of each of the 10 provincial and 3 territorial governments and New Brunswick is the only province that is officially bilingual. Therefore, the research project for the Dedicated Notebook Computer Project was divided between three anglophone schools and three francophone schools, with a research team working with each jurisdiction. This research project report outlines the specifics of the three anglophone schools that participated in the research project.

The goal of this research investigation was to consider how providing students and teachers with their own individual portable notebook computers would affect the learning experiences and instructional approaches in their classrooms. The focus of the research investigation was to advise the Department of Education on the implementation phases of the Dedicated Notebook Research Project. The research is not an evaluation of the actual notebook computers, but rather, it is an evaluation of their ability to create a more comprehensive teaching and learning environment where teachers and students have full-time, wireless, individualized (1:1) access to a tool for writing, researching, simulation, problem-solving, presenting, organizing and differentiated learning.

Phase I of the project was carried out from the fall of 2004 to June of 2005, during which the three schools received notebook computers for selected grade 7 classes. Phase II lasted from September 2005 to June 2006, during which those same grade 7 students continued with their notebook use in grade 8 and a further 250 students were added in the new grade 7 classrooms. The implementation of the New Brunswick research project is notable, in that the initial steps in the process involved a comprehensive, government-led review of current research and literature on the impact of dedicated 1:1 access on the teaching and learning environment. It is also the only jurisdiction in Canada that has taken a top-down, Ministry of Education-led approach to the implementation of ubiquitous notebook computing, highlighted this year by the decision to supply notebook computers to every one of the province's 7,500 public school teachers in the province who wished to have one.

The New Brunswick Dedicated Notebook Computer Research Project is part of a larger government initiative, known as The Quality Learning Agenda (QLA), which is highly focused on continuous improvement in teaching practices and continuing professional development. The government believed that initiating a provincial research project allowed teachers, students, parents and government to begin assessing current research findings within the schools of the province and to gain useful lessons for possible province-wide integration of new technologies in the future (Government of New Brunswick, 2006).

During the first phases of the notebook initiative, participating schools were evaluated by two teams of researchers. The anglophone sector was led by researchers from Mount Allison University and St. Francis Xavier and the francophone sector was led by investigators from Université de Moncton. The research project goals and objectives include: enriching teaching and learning practices, supporting the mastery of skills required to succeed in the global knowledge economy, improving teacher and student ICT competencies, impacting positively on student motivation and achievement, and increasing parental and community involvement in education and lifelong learning (Government of New Brunswick, 2006). The Interim Report was submitted to the Department of Education in August of 2005. This current report builds on that initial report and provides the final assessment of the complete two-year research project on the part of the research team.

### Research Evaluation Methodology: Anglophone Schools

The anglophone school research team used largely qualitative research methods to collect data over the two year period of evaluation. Evaluation evidence of Phase I and II of the Dedicated Notebook Research Project included a variety of research tools, including:

- **Online surveys**, which collected data from teachers and students who were participating in the project, were conducted at the start of the project, when the notebooks were first being delivered to the classrooms (January – February 2005) as well as at the end of the school year in June of 2005 and June of 2006. The surveys allowed the research team to collect information on the initial impact of the notebooks on the teaching and learning environment across the three schools.
- **Site visits** were conducted by the research team throughout the early periods of the research project. As well, regular monthly meetings were held with teachers, students, principals, teacher-mentors, parents and others who were involved in the project. Each visit included interviews with these individuals and recorded site visit field notes and observations compiled by the research team members.
- **Classroom observations** were conducted on a monthly basis in each of the notebook initiative schools over the two-year life of the notebook research project. As each research team member is a trained teacher, the classroom environment and the integration and use of the notebook technology was recorded. Further, members of the research team attended several meetings with the Department of Education and participating notebook school officials, including school district officials, principals and parent groups.
- **Literature review and document analysis**: Members of the research team have reviewed student work completed during Phase I of the notebook research project, as well as related school policies, Department of Education materials and related technologies, school websites and blogs, lesson plans, and professional development plans.
- **Project summit:** Members of the research team met with all of the teachers, teacher-mentors, technology assistants, principals and school district officials involved with the Dedicated Notebook Research Project during a two-day summit on Grand Manan Island, New Brunswick, in June of 2006. Sessions were

recorded and transcribed for the research report and a complete record of the summit has been used to inform this final report.

**Dedicated Notebook Computer Research Project Implementation**

The implementation of the two-year New Brunswick Dedicated Notebook Research Project began in the late fall period of 2004, with full in-class use of the notebooks commencing in January of 2005. The three anglophone schools selected by the Department of Education were Harry Miller Middle School in School District 6, located in Rothesay; Grand Manan Community School in District 10, located on Grand Manan Island in the Bay of Fundy; and Nashwaaksis Middle School in School District 18, located in Fredericton. The francophone schools selected for the research project include: Centre d'apprentissage du Haut-Madawaska in School District 3, located in Clair; École Abbey-Landry in School District 1, located in Memramcook, and École Le Tremplin in School District 9, located in Tracadie-Sheila.

In Phase I of the research project, 237 grade 7 students, as well as all teachers involved with instruction of these students, received a dedicated notebook computer. Phase II commenced in September of 2005 with the same students, still in the same schools but now in grade 8, keeping their notebook computers and a new cohort of 262 grade 7 students at the same six schools receiving their own notebook computers.

Based on an extensive environmental scan and consultation process with other jurisdictions and school divisions across North America, as well as initial discussions with members of the research teams, notebook computer suppliers, and the Canada Research Council, the Department of Education included a significant technological and pedagogical support implementation plan for the research project that included the support of a pedagogical teacher-mentor and technical support person in each of the research projects schools. These individuals were put in place in the period prior to the arrival of the notebook computers by way of the school district administrations involved.

It is important to note that, shortly after the interim reports of both the francophone and anglophone research teams were submitted, the Department of Education announced that, given the positive results of the first phase of the Dedicated Notebook Research Project, a similar project, the Notebook Initiative, would be launched. The Notebook Initiative would include more than 1,000 additional students, over and above the 500 participating in the Dedicated Notebook Research Project. While beyond the current research team's mandate for the research project, it is important to recognize that the government's decision to launch the Notebook Initiative between Phase I and Phase II of the research process certainly had an impact on student, teacher, parent and school administrators, including their attitudes and beliefs about the program, in terms of its impacts, strengths, weaknesses and concerns.

The implementation plan for the Notebook Initiative, announced in March of 2006, includes:

- All 7,500 K-12 teachers given the option of receiving a personal notebook computer for professional home and school use while employed in the New Brunswick school system, to be distributed to all interested teachers by July 1, 2006
- A comprehensive professional development implementation plan for all interested teachers and school administrators, delivered over the summer of 2006 and into the school year
- Expansion of the current Dedicated Notebook Research Project to include all grade 7 students at the existing Dedicated Notebook Research Project schools
- Continuation of 1:1 access to the notebook computers in September 2006 for the grade 8 students that were part of Phase I and II of the Dedicated Notebook Research Project and who will move to grade 9 at Grand Manan Community School, Leo Hayes High School (Fredericton), Kennebecasis Valley High School (Rothesay) and Rothesay High School
- A further round of applications for schools to apply to be part of the Notebook Initiative, with a total implementation investment of $9.4 million in notebook computers, teacher-mentors and technical assistants and related equipment in the Government of New Brunswick's 2006-2007 budget
- By September of 2006, 2,900 grades 7, 8 and 9 students at 27 New Brunswick schools will have a notebook computer.

# Chapter 2: Review of the Literature & Other One-to-One Computing Projects Across North America

Over the past fifteen years, the student-to-computer ratio has become the accepted proxy measure of students' access to computers in schools (Bebell, 2005). Believing that increased access to computers in schools will lead to increased use of computers, educational leaders have moved to reduce student to computer ratios across North America. In the United States, the ratio of students to computers has dropped dramatically from 125:1 in 1983 to 9:1 in 1995, 6:1 in 1998, and 4:1 in 2002 (Market Data Retrieval, 1999; Education Week, 2003). In Canada, studies have found that 97 percent of Canadian youth use computers at least once a year and virtually all Canadian schools are now connected to the World Wide Web (Looker & Thiessen, 2003).

While use of computers in schools has increased over this same time period, research studies have found that students are using computers in schools for a relatively small amount of time each day, and many simply do not have access to such technologies due to social, economic and familial reasons (Cuban, 2001; Russell, O'Brien, Bebell, & O'Dwyer, 2003; Looker & Thiessen, 2003). Looker and Thiessen (2003) found that students aged 15 – 16 reported a much smaller percentage of computer use while at school: just 21 percent of males and 15 percent of females reported using the computer at school "almost every day". Two explanations are often provided for why the use of computers has increased at a relatively slow rate despite the dramatic decrease in student to computer ratios. The first explanation focuses on the poor level of preparation being offered to pre-service teachers in the integration of technology and instructional practices (Milken Exchange on Education Technology, 1999; Bebell, Russell & O'Dwyer, 2004). The second explanation for the slow increase in computer use by students focuses on the mechanisms employed by schools and school districts in the distribution of computers and the limited access students have to one-to-one computers.

Despite relatively low student-to-computer ratios across North American schools today, in many middle and high schools, computers are removed from the classroom setting and are instead located in computer labs and libraries, which makes access during class time difficult. In contrast, elementary schools often place computers directly in the classroom, but at a ratio that requires teachers to rotate students on and off computers in order to provide all students with some level of access (Bebell, Russell & O'Dwyer, 2004). Despite the many government and private funding initiatives to enhance technology by distributing higher numbers of computers to students in our public schools, many observers have concluded that the rather stagnant student use results are due to the limited access to these computers as part of the normal school day learning environment. Computer use remains a rather episodic event, and student to computer ratios have not yet reached a stage at which the technology is pervasive or ubiquitous (Ungerleider & Burns, 2000; Bull, Bull, Garofolo, & Harris, 2002; Papert, 1996; Rockman, 1998).

Over the past several years, in an effort to make access to large numbers of computers more pervasive, some schools placed large numbers of portable computers on a cart

(Computers on Wheels, or "COWS"), which can be brought into classrooms to create a 1:1 environment on a temporary basis. Still other schools have fully committed to ubiquitous computing by providing each student with full-time access to a laptop computer. Many of these projects allow the student to take the laptop home with them and share it with family members (Canuel, 2005). Experiments and pilot programs to provide computers to students at a 1:1 ratio began in Australia in 1989 when the Methodist Ladies College in Melbourne required all incoming students in grades 5 through 12 to purchase a school-approved Toshiba laptop. Other Australian schools adopted similar programs and by the late 1990's over 50,000 Australian children were reported to have their own laptop computer (Bebell, 2005; Stager, 1998).

Within Canada and the United States, several schools and school districts have experimented with laptop programs during the 1990's. Typically, these programs were funded through special fundraising activities (Stevenson, 1999), local foundations and grants (Cromwell, 1999), and increases in tuition at private schools (Thompson, 2001). More recently, government education ministries have been working with partner organizations to experiment with 1:1 laptop initiatives in the public school system (Jeroski, 2003). Although much of the research on laptop programs is still ongoing, anecdotal evidence and findings from program evaluations report several positive outcomes. These outcomes include: increased student engagement (Cromwell, 1999; Rockman, 1998; MEPRI, 2003; Scheidt, 2003; Kulik, 2003; Canuel, 2005), fewer disciplinary problems (Baldwin, 1999; Sivin-Kachala & Bialo, 2000; Page, 2002; MEPRI, 2003), increased use of computers for writing, analysis and research (Cromwell, 1999; Baldwin, 1999; Guignon, 1998), a movement towards student-centred classrooms (Rockman, 1998), and an increase in standardized test scores (Stevenson, 1999). Baldwin (1999) also documented that the outcomes also affect student behaviours at home such that students reported spending less time watching television and more time on homework after they were provided with laptops.

A brief discussion of a number of the leading Canadian and U.S. one-to-one (1:1) laptop initiatives is provided here to review what is being done and how much has been achieved to date.

**State of Maine**

The aim of the Maine Learning Technology Initiative (MLTI) was to provide every seventh and eighth grade student in the state with a laptop computer. The program was based on the vision of former Governor Angus King and an initial government commitment of $37 million. Maine's public schools enrol about 207,000 students in grades K-12. In late September 2001, the Maine Department of Education issued an RFP for the MLTI and the contract was awarded to Apple Computer Incorporated. In late December 2001, the Department and Apple formally began to implement the initiative, whereby nine "Exploration Schools" were identified throughout the state (one in each Superintendent Region). A concurrent program of professional development for teachers began that introduced teachers to the laptop technology and related computer skills (Silvernail & Lane, 2004). Researchers have pointed to the success of the Maine initiative

because teacher professional development was believed to be paramount for the successful implementation of the program. The professional development network developed included the identification of Regional Integration Mentors (RIM). Beyond their regular teaching duties, RIMs helped to develop practices and procedures for laptop use within their school, as well as assisting in the development of a state-wide network of professional development activities and protocols related to technology integration at the middle school level (Silvernail & Lane, 2004, 3).

By the fall of 2002, the state had implemented a program that provided 17,000 seventh graders and their teachers in 243 middle schools with Apple iBook laptops. Each Apple iBook contained Appleworks word processing software, an Internet browser, e-mail accounts, various helper applications, and *The World Book Encyclopedia* (Garthwait & Weller, 2005). As the program expanded, so too did the network of individuals involved in professional development. In each of the 243 middle schools, both a "Teacher Leader" and a "Technology Coordinator" were nominated and received training to assist with the growth, development and acceptance of technology across the state school system. The most recent roles created within the MLTI professional development network are "Content Mentors" and "Content Leaders". These individuals are specialists and state-wide leaders in specific content areas, such as mathematics, language arts, social studies, and sciences. Content Leaders are content specialists within each of the nine superintendent school regions across the state (Silvernail & Lane, 2004).

In April of 2003, 700 iBooks were delivered to eighth grade teachers and these teachers were provided with regular professional development sessions. All eighth grade students received their laptop computers in September of 2003, equipping a total of some 34,000 middle school students and 3000 teachers with the technology. Looking ahead, the state developed a roll-out plan for students in grade 9, with 5000+ iBooks being delivered to 31 different high schools across the state during the month of October 2004. While there are now 100 to 200 laptop programs across North America, Maine remains as the only state-wide public school laptop initiative.

**Henrico County, Virginia**

The second largest North American laptop computer initiative occurred in Henrico County Schools in Virginia, which piloted a laptop program in 2001 and expanded the deployment of Apple iBooks to 23,000 middle and high school students and 2000 teachers by early 2004 (Gulek & Demirtas, 2005). Phase 1 was completed in 2001 with 12,000 iBooks provided to all middle and high school teachers (grades 6 to 12), as well as each high school student. Phase 2 began in the spring of 2003 with an additional 13,000 middle school students receiving laptops and wireless connections. Students are allowed to use their personal laptop computers at school and at home. The school district is now analyzing the feasibility of a roll-out to elementary level students. Each elementary school classroom currently has five Apple iMacs, for an additional 4,500 computers in the Henrico County schools system.

The Henrico County school system has faced increasing pressure to provide all of its teachers and administrators with sufficient professional development opportunities, as it is now a Virginia state regulation that teachers must demonstrate proficiency on specified technology standards. This has resulted in the development of an elaborate training and professional development program for teachers, students, administrators, and parents. Staff development is now fully funded by the state and includes school and district level opportunities, such as: curriculum writing institutes, summer institutes, site-based institutes, online learning interchange/portal, a full-time laptop technology and curriculum integration resource person in each middle school and high school, a full-time technical support position in each school, training CDs and videos and a student training program. The school district has also developed a Parent Resource Centre to assist parents and guardians with the emerging role of technology in the education system. Resources include information sessions and online assistance and call centres for parents looking for information on the use of the iBooks, as well as the integration of technology in the child's learning experience (Henrico County Schools, 2005).

**Eastern Townships School Board, Quebec**

Canada's largest laptop computer initiative is taking place in Quebec's Eastern Townships School Board, a large English-language school board covering a large geographic area, from just east of Montreal to the Vermont, New Hampshire and Maine borders. Based on research into the effectiveness of laptops on student learning in other school districts, as well as new educational outcomes and expectations of the Quebec Educational Program (QEP), planning for a possible laptop initiative began in May of 2002 (Canuel, 2005). Using existing practices from a number of U.S. experiences, the administration developed a 208-step activity plan focused on ensuring successful implementation.

Known as the Denis McCullough Initiative – Enhanced Learning Strategy (DMI-ELS), this program involves the deployment of laptop computers, over a three year period, to every student and teacher in the school board from grade three (Cycle Two) to grade 11, the final year of high school (Secondary Five). Three elementary schools were selected to act as the lead schools for the initiative, with these schools receiving their laptops in May of 2002. All grade five and six and graduating class (grade 11) students across the school board received their laptops in October of 2003, which meant distribution of 2,500 Apple iBooks to 20 elementary schools and 3 high schools. By the fall of 2004, all grade three and four students, as well as those in grades seven and eight and the Adult Education classes, received their laptop computers, bringing the total number of student and teacher laptops to 4,700 units. The fall of 2005 will see the final grades (secondary grades nine and ten) receiving the laptop computers, for a complete, board-wide laptop initiative covering grades 3 to graduation (grade11) (Canuel, 2005; Centre for the Study of Learning and Performance, 2005).

It is interesting to note that the Eastern Townships School Board struck out on its own in launching this initiative. While the Ministry of Education for Quebec co-signed loans for the funding of the project, the official position of the government is to "observe but not

comment" on the value of 1:1 computing in the schools of Quebec (Canuel, 2005). To date, researchers have highlighted several important phases of development in the program. These include: the rapid deployment of the laptop technology; extensive basic training for teachers in the use of technology for learning; and awareness of, and growing enthusiasm for, the use of technology for learning (Centre for the Study of Learning and Performance, 2005).

**Peace River, British Columbia**

In September 2003, Peace River North (School District Number 60) implemented the Wireless Writing Program (WWP), providing Apple iBooks on a 1:1 basis to all grades 6 and 7 students. Implementation involved 1150 students and 37 teachers in 17 schools, and followed a successful 18-month pilot project. The Wireless Writing Program (WWP) is designed to improve student achievement, motivation, and learning skills, through the integration of technology with writing instruction. The BC Performance Standards for Writing are an integral part of the program. School officials believe that the Wireless Writing Project has demonstrated that technology can be effectively integrated to improve student performance and attitudes, classroom learning environments, and parent satisfaction with schools. Analysis of survey and achievement data have also identified some key issues and provided guidance for program expansion (Vandergugten, 2005).

**New Hampshire Middle Schools**

In September of 2003, New Hampshire Governor Craig Benson announced a program to provide 1:1 laptop computing to all seventh grade students and teachers in six of the state's neediest schools. Known as the "Technology Promoting Student Excellence" strategy, TPSE sought to replicate many of the positive outcomes found in the State of Maine's laptop initiative (Bebell, 2005, 5). In January of 2004, the program was officially launched with the distribution of Apple iBook laptop computers to seventh grade students at each of the participating schools. In addition to the laptop computers, the Technology Promoting Student Excellence initiative included wireless classroom access, laptop computers for each of the participating teachers, digital cameras, printers, video cameras and a video-conferencing camera for the school (Bebell, 2005). As part of this initial phase, the Technology and Assessment Study Collaborative at Boston College was contracted to conduct a one-year external evaluation of the initial effects of the initiative on instructional practices and classroom change.

**State of Michigan**

The Freedom to Learn program is the initial phase of the State of Michigan's vision of a 1:1 wireless learning environment for all middle school students, with funding from the federal No Child Left Behind Act. It targets high-priority schools, meaning those not achieving yearly progress as defined by the Act, including schools that have poor attendance records and lag behind in standardized testing (State of Michigan, 2005). The first demonstration project of the 1:1 environment took place in 2001, with major state

funding allowing for a more extensive program commencing in 2003. To date, the program has seen the distribution of nearly 19,000 HP notebook computers to middle school students, as well as to 1,300 teachers, principals and technology coordinators. The initial funding period is for four years, with research evaluation being conducted by several university researchers.

**Other One-to-One Initiatives**

An environmental scan of Ministry of Education and school district websites uncover nearly daily reports of new 1:1 laptop initiatives. Similar to the situation in New Brunswick, there are now clearly identified steps for the introduction and evaluation of such initiatives, including external evaluation mechanisms being established to identify the possible strengths and weaknesses of such programs. Some of the larger initiatives currently announced or underway include:

- Cobb County School District, Marietta, Georgia, is now moving towards the deployment of 63,000 laptops for students and teachers. Phase 1 of the program will see all 7,100 teachers in the district receive an Apple iBook, as well as 8,500 high school students in four demonstration schools. The initial budget is $25 million, with a system-wide deployment set at just over $100 million.
- The State of Connecticut is moving forward with a government initiative to purchase $15.5 million worth of laptops to improve high school students' writing skills. Over 19,000 laptops are to be distributed to ninth and tenth grade students by the fall of 2005.
- The Ministry of Education in British Columbia has set aside $3.6 million to support 12 separate laptop pilot projects in school districts across the province. The provincial government is committed to a province-wide wireless initiative, as well as a virtual high school, yet it is allowing each school district to use funds to develop 1:1 initiatives. The province will fund 25% of the costs, with 75% being allocated by each school district.

**Evaluating 1:1 Laptop Initiatives: Research Findings**

There is growing interest and enthusiasm about the potential for using 1:1 laptop technology for learning, yet there are few research studies that fully address the impacts of such technologies on teaching and learning. While there has been a growing body of research on the general use of technology for learning, centred on what has become characterized as the "Information Age", it was the State of Maine's Learning Technology Initiative that propelled many governments, school districts and individuals into a situation where they need to pay immediate attention to the evaluation of the strengths and weaknesses of such ubiquitous computing for teaching and learning in the school system. The Maine Learning Technology Initiative provided every seventh and eighth grade student in the state with a laptop computer. Researchers from the Maine Education Policy Research Institute at the University of Southern Maine have conducted a series of mid-year and first phase evaluations of the program and have presented very promising findings in terms of the impact the initiative has had on student learning and achievement, with interpretations of qualitative and quantitative data obtained from

surveys, case studies, interviews, and focus groups with students, teachers, superintendents and principals (Gravelle, 2003; Lane, 2003; Sargent, 2003; Silvernail et al., 2003; Silvernail & Lane, 2004; Sclater, et al., 2005). The research report on the impact on middle-school teachers and students, as of February 2004, is summarized here:

- Teachers are using the laptops in a variety of ways, and most often in developing instructional materials, conducting research related to instruction, and communicating with colleagues;
- Teacher usage is 20 to 30% higher for teachers with more advanced technology skills, and higher for teachers who have participated in four or more professional development activities;
- Students report using the laptops most frequently in finding information (90%), organizing information (63%), and taking class notes (57%);
- Student usage of the laptops for completing class work is higher for students who are permitted to take the laptops home;
- Over 70% of the teachers surveyed reported that the laptops helped them to more effectively meet their curriculum goals and individualize their curriculum to meet particular student needs;
- Over 75% of the teachers reported that having the laptops helped them better meet Maine's state-wide learning standards, the Learning Results;
- More than 4 out of 5 teachers surveyed reported that students are more engaged in their learning, more actively involved in their own learning, and produce better quality work;
- More than 70% of the students surveyed reported that the laptops helped them to be better organized, to get their work done more quickly, and with better quality;
- Teachers reported that all types of students are more engaged in their learning and more motivated to learn, particularly at-risk and special needs children;
- A sample of ninth grade students who no longer have laptops reported that they get less work done without the laptops, and the quality of their work has declined without the laptops;
- Teachers and principals reported considerable anecdotal evidence that the laptops have had a very positive impact on student attendance, behaviour, and achievement although concrete evidence is still sparse;
- Teachers reported that the greatest obstacles in integrating the laptop technology more into their curriculum and instruction are the lack of technical support, the lack of more professional development opportunities, and the lack of time;
- Some teachers, students, and principals still report continuing problems with the technology, but these problems appear to have declined substantially after the first few months of the program;
- Superintendents reported some increases in costs with implementation of the laptops.

In summary, Silvernail & Lane (2005) state that "the evidence collected for this evaluation indicates that a large majority of Maine's middle schools have successfully implemented the one-to-one laptop program, and there is already substantial self-reported evidence that student learning has increased and improved. Additional research needs to

be conducted in the coming years to document and understand the long-term impacts of the laptop initiative on teachers and teaching, students and learning, and on schools."

Davies (2004) has completed a detailed evaluation of the impact of the Maine Learning Technology Initiative on one class. She has highlighted several positive changes in the ways students learn, in what ways they learn, in the context for teaching and learning, and on student willingness to engage in collaborative learning.

Similar results have been found in other laptop initiatives. "An overwhelming majority of teachers and students in six through 12th grades in the Henrico County public school district reported positive impacts of using laptop computers," according to a study released in May 2005 by SRI International and Education Development Centre. Their key findings include:

- 97 percent of mathematics and science teachers report that the computers have helped students to learn these challenging subjects.
- 59 percent report that laptops have helped "a lot" or "a great deal".
- Teachers report that laptops have had "positive" or "very positive" impacts on gifted students, students with learning disabilities, and typical students alike.
- More than 80 percent of students reported that using a computer for their schoolwork is "helpful" or "very helpful".
- Teachers report that the computers have had "positive" or "very positive" impacts on students' engagement and interest levels, the teachers' interactions with students, and on students' ability to work independently.

The SRI non-profit research institute report concluded that "the survey results and site visits we conducted in Henrico County provide strong evidence that the initiative is working to strengthen teaching and learning of mathematics and science in the district" (Center for Digital Education, 2005,13). From 2000 to 2004, the Henrico School District saw all of their high schools achieve the State of Virginia's Standards of Learning expectations and the increase has been attributed to the presence of laptop computers for teachers and students.

In Quebec's Eastern Townships School Board, officials are reporting significant improvements in academic success, behaviour, attitude, self-esteem, classroom management and pride (Canuel, 2005). An external research review of the Board's initiative has found that several key factors have been achieved to date:

- There has been rapid, effective deployment of new technologies with extensive basic training for teachers in the use of technology for learning, with increased awareness and enthusiasm for the use of new technologies in teaching and learning.
- Secondary level students using laptops demonstrated higher levels of achievement on reading tests and indicated making six times more frequent use of computer technology in their English Language Arts classes. The authors warn that these initial results must be read with caution, due to selection bias in the sample (Sclater et al., 2005).

A review of the various 1:1 laptop projects across North America, such as the ones listed above, have drawn a number of key findings from the users, as well as those who wish to measure, in a methodologically sound fashion, the longitudinal impact of intensive, pervasive and ubiquitous applications of technology for learning (Sclater, 2005). A detailed discussion of the literature and related research on technology and learning has just recently been completed by the Centre for the Study of Learning and Performance at Concordia University (Sclater et al., 2005) and presented as a preliminary study to Industry Canada's SchoolNet Program.

For the purposes of this report to the Department of Education for New Brunswick, we summarize some of the key findings of the various initiatives below:

*The Creation of a Cadre of Technologically Sophisticated Students:*

Consistent with the literature on the use of technology for learning, laptop computing initiatives are further contributions in making technology use a central element of the school curriculum. Many schools are finding much higher levels of computing skills, from keyboarding to student-led technical resource centres and help desks. The creation of a technology culture is enhanced through the development of a wireless, ubiquitous technology program.

*Impact on Relationships between Students and Teachers as well as Enhancement of Instructional Strategies:*

One of the very powerful results from the introduction of laptops in a 1:1 environment has been the demonstration of a visible and positive impact on student-teacher relations. As one teacher explained in a recent review of their school-based 1:1 initiative, the project "is more than technology. It is self-reliance, group work and teacher responsibility. What students need is mentoring and belonging. That is the answer to school reform (Center for Digital Education, 2005, 14)." Most of the research studies also provide evidence that instructional strategies and teacher use are important benefits of a laptop initiative. According to a study completed in late 1999 (Middleton & Murray, 1999), the level of technology used by the teacher significantly affected student academic achievement in specific curriculum areas when compared to that of students in a traditional classroom setting (without laptop computers). Rockman (2003) wrote that "developing the ability to learn independently, collaborate with peers to accomplish work, and communicate the conclusions for your work are the core of 21st century skills, and a highly valued set of competencies in the world outside of school."

*Impact on Overall Student Achievement:*

Numerous studies have reviewed the impact of laptop technology and have found significant gains in achievement, motivation and engagement when students are exposed to such a technology-rich environment (Schacter, 1999; Waxman, Lin & Michko, 2003; Scheidt, 2003). In terms of student academic performance, as measured by examination scores, there has been a consistent series of results that indicate that student scores are

higher for those participating in a technology-based environment with computer instruction, than those who do not have this type of environment (Kulik & Kulik, 1998; Bain & Smith, 2000; Scheidt, 2003).

### *Impact on Student Attitudes and Motivation:*

The overwhelming conclusion of research studies conducted on the impact of individualized computing on student attitudes and motivation is that these technologies increase these factors, given that computer use has the potential to support different learning needs and provide learners with greater control over their learning (McCombs, 2000). Sivin-Kachala & Bialo (2000) found a positive relationship between the use of educational technology and student motivation and attitudes towards learning. Jeroski (2003) attributes the positive changes in student motivation and attitudes toward school to a Wireless Writing Project introduced to the learning environment. Likewise, Scheidet (2003) revealed that including a computer-based learning program into a global history curriculum increased student interest and motivation. While most studies have found an immediate demonstration of higher levels of motivation and excitement with the introduction of laptop technologies, Kinnon, Nolan & Sinclair (2000) found that student attitudes towards computer use for learning became significantly less positive over time.

### *Impact on Mathematics Achievement:*

Sivin-Kachala & Bialo (2000) found that students participating in learning experiences whereby technology is used to support mathematics curricula focused on problem-solving demonstrated greater conceptual understanding. Likewise, McCabe & Skinner (2003) and Kulik (2003) found that the use of computers, and the resultant test scores in math, was shown to be higher for students using integrated technologies in their learning systems for math. Page (2002) found that students in the computer technology treatment group displayed significant differences in mathematics achievement over the control group.

### *Impact on Writing Skills:*

A recent national review of the 1:1 computing initiative made the following conclusion: "Although technology continues to change and evolve, all the research seems clear on one point: Routine access to technology will increase learning in environments where educational expectations have been communicated." In addition to the traditional "student achievement" measures, students with access to technology are particularly advantaged in their ability to improve the creative process and enhance writing skills (CEO Forum on Education and Technology, 2001). These "21st century skills" include:
- Improved basic writing skills
- Improved digital age literacy skills (technological, cultural, global awareness)
- Improved inventive thinking skills (creativity, problem solving, higher order thinking, sound reasoning)
- Improved effective communication and interpersonal skills (writing, public speaking, teamwork, collaboration)
- Improved productivity skills (creating high quality results)

Sivin-Kachala & Bialo (2000), Kulik (2003) and Goldberg, Russell & Cook (2003) published separate meta-analysis reports that found that students with access to regular word processing software and the Internet, along with traditional instruction, improve their writing significantly more than students without these tools. Several individual case studies found that students in a 1:1 wireless environment showed significant gains in writing achievement on controlled writing assessments and in-class assessments compared to students who did not use laptops in their daily learning programs (Jeroski, 2003; Rockman, et al., 2000; Herts-Lazarovitz & Bar-Natan, 2002).

*Impact on Science Achievement:*

Several studies on the use of laptop computers in the science curriculum have resulted in improved student learning. Sivin-Kachala and Bialo (2000) found that students benefited from the use of simulations, computer-based labs and videos to add higher levels of realism and deeper understanding of real-world problems in science. Siegel & Foster (2001) found that students benefited from using laptop computers in their anatomy and physiology classes. Kulik (2003) found only mixed results on the impact of computer tutorials, simulations and microcomputer-based labs on science achievement, whereas the same study found test scores in math to be higher for students using computers.

*Overall Conclusions from the Literature and Specific Laptop Initiatives:*

Our review of the literature, as well as attendance at a number of recent conference devoted to 1:1 laptop programs, indicates that laptop use not only reinforces the utilization of successful learning strategies but also enables students to transfer knowledge across disciplines. Rockman et al. (1997, 1998, 2000) believe that this occurs because laptop students:

- Are involved in highly engaged and focused activities (spending more time on their work and completing larger projects)
- Frequently apply active learning strategies
- Interact with each other about their work
- Problem solve through project-based activities, which usually involve more critical thinking
- Regularly find information, make sense of it, and communicate it

Research provides evidence that students who engage in collaborative work, participating in more project-based learning, have higher levels of motivation. When these students are motivated, they demonstrate improved achievement, they produce longer and higher quality writing samples, and they spend more time doing homework (Gulek, 2003; Gutherie & Wigfield, 2000; Gulek and Demirtas, 2005). In a similar way, teachers engaged in a laptop learning environment feel more empowered and spend less time lecturing, have fewer classroom management problems, and are much more engaged in professional development activities (Marzano et al., 2003; Canuel, 2005).

While the overwhelming majority of research studies and individual laptop initiatives provide evidence that participation in such programs has a significant impact on student achievement, they also raise a number of larger issues that governments, school leaders, families and individuals must confront. Given the cost of creating a 1:1 laptop environment, most projects have had to deal with the issue of equity. As Jameson (1999) stated, "Clearly, school systems are not technologically or financially equal." Other research studies have found that inequities also result from differences in funding, technical infrastructure, access to technology (the Digital Divide), gender differences in access and achievement using technology, instructional practices, and the role of the teacher in the innovation and diffusion of technology in our schools. Any development of a one-to-one laptop initiative also uncovers inequities that exist between schools in the same district and within classrooms in the same school, for both the student and teacher experience. Most educational leaders and researchers involved in these new initiatives argue for enhanced research and funding, since the potential benefits that may come from learning in laptop settings is so overwhelmingly positive.

# Chapter 3:  Findings after Phase I of the Dedicated Notebook Research Project, January 2005 – June 2005

Evaluation evidence of Phase I of the Dedicated Notebook Research Project included a variety of research tools, including:

- **Online surveys**, which collected data from teachers and students who were participating in the project, were conducted at the start of the project, when the notebooks were first being delivered to the classrooms (January – February 2005) as well as at the end of the school year in June of 2005. The surveys allowed the research team to collect information on the initial impact of the notebooks on the teaching and learning environment. A sample of the Initial Student Survey can be found in Appendix A.

- **Site visits** were conducted by the research team throughout the early periods of the research project. As well, regular monthly meetings were held with teachers, students, principals, teacher-mentors, parents and others who may be involved in the project in Phase II. Each visit included interviews with these individuals and recorded site visit field notes and observations compiled by the research team members.

- **Classroom observations** were conducted in each of the notebook initiative schools on a monthly basis. As each research team member is a trained teacher, the classroom environment and the integration and use of the notebook technology was recorded. Further, members of the research team attended several meetings with the Department of Education and participating notebook school officials, including school district officials, principals and parent groups.

- **Literature review and document analysis**: Members of the research team reviewed student work completed during Phase I of the notebook research project, as well as related school policies, Department of Education materials and related technologies, school websites and blogs, lesson plans, and professional development plans.

## Student Surveys and Interviews

This section of the report provides evaluation evidence on the impact of the first six months of the Dedicated Notebook Research Project on those grade 7 students who participated in the initiative. This initial set of student interviews and surveys addresses the impact of the notebook computers on student learning, how the notebooks are actually being used, and what obstacles, if any, students encountered during the initial period of using the notebooks in their classes.

The June 2005 survey was an online survey and all participating grade 7 students in the anglophone sector were asked to complete it during their last week of classes. Of the total 134 students, 127, or 95%, completed the survey.  Of the total number of respondents, 54% are female and 46% are male. The results of the survey, as well as results of the

dozens of individual student interviews conducted at the schools during that six-month period, are highlighted here.

The overall impact of the notebooks on students appears to be substantial in terms of their overall experience when using them. In response to the initial question on their individual experiences, 97% indicated that they have "enjoyed" or "really enjoyed" using the notebooks and have "positive" or "very positive" feelings about the experience.

**Table 3-1: What has been your overall experience when using the notebook computer this year?**

| | |
|---|---|
| I have not enjoyed using the notebook computer this year and have negative feelings about the experience. | 1% |
| I have neither negative nor positive feelings about using the notebook computer this year. | 2% |
| I have enjoyed using the notebook computer and have generally positive feelings about the experience. | 28% |
| I have really enjoyed using the notebook computer and have very positive feelings about the experience. | 69% |

Student interviews reveal a very high level of interest and satisfaction with the notebook computers. One student summarizes the changes she has experienced in this way:

> *Things have gotten a lot easier. I'm more organized and we don't waste time writing notes from the board or trying to copy from textbooks. I think it is easier to learn using the laptops because it cuts down on the work the teachers have to do in trying to make us understand the books or what they're trying to say. We get to work on our own; at our own pace. The teachers trust us to work out answers on our own and then they help us later –editing and creating files of our work. The teachers aren't standing up in front of the class all the time, trying to get all of us to listen and waiting for them to answer questions I have. I think I am more independent, so I am learning more.*

Table 3-2 reports the results of student surveys on the use of notebooks for specific subject areas. Across all three research project schools, students are making extensive use of the notebooks in the language arts, including use for reading and writing tasks. Over 96% of respondents are using the notebooks in their classes, with only 2.5% not using them for any length of time during the week.

**Table 3-2: Indicate how often you use your notebook for language arts (reading and writing)**:

| | |
|---|---|
| I do not take this class. | 1.5% |
| 0 hours per week | 2.5% |
| 1-3 hours per week | 37% |
| 4-6 hours per week | 41% |
| 7 hours or more per week | 18% |

Likewise, 95% of students are using the notebook computer, to some extent, each week. Most students (57%) are using their notebooks for 1 – 3 hours in their social studies classes, with a further 29% using them for 4-6 hours and 9% for 7 hours or more.

**Table 3-3: Indicate how often you use your notebook for social studies:**

| | |
|---|---|
| I do not take this class | 1% |
| 0 hours per week | 4% |
| 1 – 3 hours per week | 57% |
| 4 – 6 hours per week | 29% |
| 7 hours per week | 9% |

A smaller percentage of students use their notebooks in art or music, with over half of them (59%) either not taking these classes or not using the notebooks during these particular classes. A minority of students (41%) indicated that they are using their notebooks in either art or music. It should be noted that these particular subject areas are taught by teachers who are not the regular class instructors, so it is expected that a smaller percentage of time would be devoted to notebook use in these instances. Still, students report very positive responses to the limited use of notebooks in art to date. They report a very high level of creativity being used in the various applications being tested in the art curriculum.

**Table 3-4: Indicate how often you use your notebook for art/music.**

| | |
|---|---|
| I do not take this class. | 19% |
| 0 hours per week | 40% |
| 1 – 3 hours per week | 32% |
| 4 – 6 hours per week | 6% |
| 7 hours or more per week | 3% |

In mathematics education, 84% of students completing the survey reported using the notebook computers in their learning. Only 15% of students are not using notebook applications for this subject area. As one student observed, "We go to math games, and it will show us like if you're right or wrong. There are really fun games; some of them are really hard. And its funny because people get mad at it." Several students commented in their interviews that their math scores were improving and that they were more involved in math class because of the opportunities they had to use virtual manipulatives online.

**Table 3-5: Indicate how often you use your notebook for mathematics.**

| | |
|---|---|
| I do not take this class | 1% |
| 0 hours per week | 15% |
| 1 – 3 hours per week | 65% |
| 4 – 6 hours per week | 14% |
| 7 hours or more per week | 5% |

Student surveys indicate that the notebook computers have been used extensively in the French second language classrooms across the three schools. Initial student surveys

indicated a high number of negative comments pertaining to the French curriculum and methods of instruction. End-of-year surveys indicate that 71% of students are now using their notebooks to complete their studies in French – with resultant positive comments from students and parents. For instance, a boy talked about really enjoying using his notebook computer in French class:

> *We used it quite a bit in French. We used it just about every day for at least 20 minutes and sometimes we used it all class. We had pen pals [email partners] and we had to write them in French and they'd write us back in English because they were at a French immersion school. And they would correct our French and send it back and we would correct their English and send it back. I thought it was pretty different because we got to actually type in French. The only thing I didn't like was that it came up wrong and I would have to right click it and change it. But that's all good... [In French] we're doing a PowerPoint now on different food groups. [My project here] tells about what you should eat and why you should eat it, and what's good for you and what's bad for you is what we're writing about now.*

**Table 3-6: Indicate how often you use your notebook for French.**

| | |
|---|---|
| I do not take this class. | 11% |
| 0 hours per week | 18% |
| 1 – 3 hours per week | 27% |
| 4 – 6 hours per week | 35% |
| 7 hours or more per week | 9% |

Similar to the other core subject areas of English language arts, social studies and mathematics, 94% of student respondents reported using their notebooks in science education. Access to a wide number of interactive sites with science-based information is mentioned by students as a positive aspect of using the notebooks in this area.

In his interview a boy described his use of the notebook for a science project:

> *Yesterday I did a project on the Siberian tiger. We had to do one on an animal so I did that. I've got my project done already. [I wrote about] what they ate, and habitats, and what part they lived in. We had to draw a picture and print one off. And there's why these animals are getting killed, and how could we stop that, and all kinds of different things.*

**Table 3-7: Indicate how often you use your notebook for science.**

| | |
|---|---|
| I do not take this class. | 1% |
| 0 hours per week | 5% |
| 1 – 3 hours per week | 58% |
| 4 – 6 hours per week | 31% |
| 7 hours per week | 5% |

While the subject areas of physical education and health have been added to complete the overall coverage of the curriculum, most students do not have their regular grade 7 teacher for these subject areas, with over 50% of them reporting that notebooks are not part of their classes. However, 48% of students do report using their notebooks in completing work in either health or physical education. The use of notebooks would be expected to grow as more teachers outside of the core curriculum become involved with notebook education for their students. One girl reported in her interview that in health class she and her fellow group members were doing an Internet search and PowerPoint presentation on Fetal Alcohol Syndrome.

**Table 3-8: Indicate how often you use your notebook for physical education/health.**

| | |
|---|---|
| I do not take this class. | 2% |
| 0 hours per week | 50% |
| 1 – 3 hours per week | 40% |
| 4 – 6 hours per week | 6% |
| 7 hours or more per week | 2% |

There has been a very clear pattern of widespread notebook computer use in each of the disciplinary areas of the grade 7 curriculum. With usage rates over 94% in language arts, science and social studies, and strong results in mathematics and French, it is evident that teachers and students have been engaged in active learning using the notebook computers during the first six months of the project.

**Student Use of their Notebooks**

Students were asked to indicate the overall usage of their notebook computers over a typical week. A range of notebook activities and functions were provided, and students selected the amount of time they spend, on average, for each activity during a typical week. Students reported using the notebooks most frequently (that is, once a day or often during the day) for researching information on the Internet (67%), editing their work (33%), organizing information (30%) and sending e-mail (28%).

When the usage of the notebook is expanded to include use of the notebook at least once a week, students exhibit widespread use in: researching information on the internet (96%), creating presentations and other multimedia projects (86%), editing their work (84%), organizing information (81%), writing first drafts of papers and projects (74%), doing drills using computer simulations or games (74%), sending or receiving e-mail messages (65%), taking notes (56%), and writing quizzes, tests or assignments (45%).

The breakdown of student responses according to type of use is listed in the tables that follow.

**Table 3-9: Indicate the response that describes how often you use your notebook to do the following:**

**3-9.1 Writing first drafts of papers and projects**

| | |
|---|---|
| Never | 2% |
| Less than once a week | 24% |
| Once a week | 21% |
| A few times a week | 33% |
| Once a day | 5% |
| Often during the day | 15% |

**3-9.2 Editing my work**

| | |
|---|---|
| Never | 4% |
| Less than once a week | 12% |
| Once a week | 12% |
| A few times a week | 39% |
| Once a day | 8% |
| Often during the day | 25% |

**3-9.3 Taking notes**

| | |
|---|---|
| Never | 18% |
| Less than once a week | 26% |
| Once a week | 10% |
| A few times a week | 28% |
| Once a day | 7% |
| Often during the day | 11% |

**3-9.4 Organizing information**

| | |
|---|---|
| Never | 7% |
| Less than once a week | 12% |
| Once a week | 16% |
| A few times a week | 35% |
| Once a day | 11% |
| Often during the day | 19% |

Students appear to be using the notebooks to employ higher order thinking and writing skills, as well as enjoying the benefits offered by having the notebooks to take notes, organize their work and communicate with others. One student mentioned the increased amount of writing and editing she has seen in her work since receiving a notebook computer:

> *I think we use them much more for writing and presenting projects. I like how it organizes the classes and the teachers leave us to write and edit. I think I am writing more, although I always write a lot. I am editing my work and I love to see the spell checker work and help me.*

Another student wrote:

> *We do projects where we can use the internet to research the project. It is way better than using books or making notes. I find information right away and use it in my presentations. We did projects where the information was new and correct.*

### 3-9.5 Researching Information on the Internet

| | |
|---|---|
| Never | 0% |
| Less than once a week | 3% |
| Once a week | 3% |
| A few times a week | 26% |
| Once a day | 21% |
| Often during the day | 47% |

### 3-9.6 Writing quizzes, tests or assignments

| | |
|---|---|
| Never | 20% |
| Less than once a week | 35% |
| Once a week | 15% |
| A few times a week | 21% |
| Once a day | 4% |
| Often during the day | 5% |

### 3-9.7 Doing drills using computer simulations or games

| | |
|---|---|
| Never | 14% |
| Less than once a week | 23% |
| Once a week | 19% |
| A few times a week | 33% |
| Once a day | 8% |
| Often during the week | 3% |

### 3-9.8 Creating presentations and other multimedia projects

| | |
|---|---|
| Never | 1% |
| Less than once a week | 14% |
| Once a week | 27% |
| A few times a week | 38% |
| Once a day | 7% |
| Often during the day | 13% |

**3-9.9 Working on online assignments or worksheets**

| | |
|---|---|
| Never | 8% |
| Less than once a week | 35% |
| Once a week | 16% |
| A few times a week | 28% |
| Once a day | 9% |
| Often during the day | 4% |

**3-9.10 Sending and/or receiving e-mail messages**

| | |
|---|---|
| Never | 12% |
| Less than once a week | 23% |
| Once a week | 13% |
| A few times a week | 24% |
| Once a day | 12% |
| Often during the day | 15% |

**3-9.11 Working on assignments in small groups**

| | |
|---|---|
| Never | 2% |
| Less than once a week | 20% |
| Once a week | 23% |
| A few times a week | 41% |
| Once a day | 2% |
| Often during the day | 12% |

**Receiving Assistance in Using the Notebook Computer:**

Students taking part in the research project were asked how often they required assistance when using their notebooks, as well as to whom they went for that help. After the first six months of the project, there appears to be range of individuals available to assist students, including other students. An overall finding in Phase I of this project was that there were remarkably few technical or hardware problems associated with using the notebook computers. When problems arose, students reported that they usually sought the help of another student first (21%), followed by a teacher involved in the project (14%), closely followed by the technology specialist/teacher-mentor (13%). One concern in the implementation of a notebook program is that teachers will be seen as the primary individuals used to solve technical or hardware problems. The survey of students involved with the implementation of the notebook computers found that 38% of students rarely, if ever, seek help from the teacher when problems arise although 49% of the students reported that they will "sometimes" ask their teacher for help with their notebooks.

The development of shared student knowledge, including student help desks and group workstations, appears to have been a positive step in allowing students to seek out help from their peers should they need help with their notebooks. In fact, 39% of students

reported that they "sometimes" ask other students for help, with a further 21% having reported that they usually go to a fellow student for such help.

Pressure on teacher and student time and knowledge for assistance with the notebooks was greatly reduced by the presence of technology specialists and teacher-mentors in each of the three research project schools. A full 13% of students indicated that it was the technology specialist/teacher-mentor they usually go to for assistance with their notebooks, with a further 34% having mentioned that they "sometimes" go to this individual or individuals.

**Table 3-10: Indicate how often you ask for help from each of the following people when you need help with your notebook.**

**3-10.1 A teacher**

| Never | 5% |
|---|---|
| Not very often | 32% |
| Sometimes | 49% |
| This is usually the person I ask. | 14% |

**3-10.2 Another student in the class**

| Never | 9% |
|---|---|
| Not very often | 31% |
| Sometimes | 39% |
| This is usually the person I ask. | 21% |

**3-10.3 Technology specialist or notebook teacher-mentor**

| Never | 8% |
|---|---|
| Not very often | 45% |
| Sometimes | 34% |
| This is usually the person I ask. | 13% |

**3-10.4 Other adult in the school**

| Never | 50% |
|---|---|
| Not very often | 40% |
| Sometimes | 8% |
| This is usually the person I ask. | 2% |

**Student Attitudes and Perceptions**

A very important aspect of the research design for this initiative concerned students' attitudes and perceptions on their educational experience with the addition of a notebook computer as a tool for learning. With just six months of experience with the notebooks, the impact on student learning was substantial. The students participating in the project were asked a series of qualitative questions on the use of their notebooks, where they could indicate the degree to which they agree or disagree with a statement. The results

indicate a very high level of benefit being attached to the addition of notebooks in the classroom and their impact on students' attitudes and perceptions of their learning. As shown in the following tables, students reported very high levels of agreement to statements on the role of the notebooks in helping them be better organized (94%), allowing them to be more involved in the class when they are using their notebooks (96%), being more likely to revise or edit their work when it is done on the notebook (90%), getting their work done more quickly (95%), finding they are doing more work when they use a notebook (88%), being better able to understand their work when using a notebook 90%), and finding that they are more interested in school since the arrival of the notebooks (86%).

Students completing the end-of-year survey were extremely positive in their evaluation of the role of the notebooks in their attitudes and behaviours toward school and their own academic performance in a notebook environment. Survey results indicated that students agree that:  the quality of their work has improved by using the notebook computer (97%), they find that they take more pride in their work since receiving the notebook (92%), their understanding of computers and skills using them have improved over the last six months (98%), and overall, they believe that they have become better students by having the notebook to complete their work (90%). One student believed, for instance, that her computer made her a better organized individual.

> *I find it easier to think about things. I used to get on the computer and think where would this be and where would that be.  Now that it's my own computer no one can move anything anywhere.  I have it where I want it. I can go directly to it.  It doesn't take as long to do stuff.  I know how to save stuff now.  It's really easy.*

**Table 3-11: Having a notebook has helped me to be better organized.**

| | |
|---|---|
| Strongly disagree | 1% |
| Disagree | 1% |
| Somewhat disagree | 3% |
| Somewhat agree | 21% |
| Agree | 35% |
| Strongly agree | 39% |

**Table 3-12: I am more involved in the class when I use my notebook.**

| | |
|---|---|
| Strongly disagree | 1% |
| Disagree | 0% |
| Somewhat disagree | 5% |
| Somewhat agree | 28% |
| Agree | 39% |
| Strongly agree | 27% |

As one student pointed out in an interview, "I know that my writing makes more sense because I read it over carefully, and then, that way, I don't have to erase it all and then re-write it.  All I've got to do is go up and erase a certain part." The interviews brought out a

number of comments from students who describe themselves as having had very poor attitudes toward school in the past; the notebooks have had a significant impact on their attitude and performance. One male student stated:

> *I was probably one of the worst students at this school last year and before. I hated school and I always got in fights and was sent to the principal. I have been suspended before and I never listened to my teachers. This year has been awesome though because of the notebooks. I haven't missed a day of school and I have really learned a lot with the computers. I'm actually organized and don't lose everything. I am more involved in school because I can use the notebook to write and research. It's not boring anymore. It is something I am interested in and I can actually help others to use them. My teachers can't believe I am the same guy and I am even getting the award for making the biggest turnaround in my school this year!*

**Table 3-13: I am more likely to revise or edit my work when it is done on the notebook.**

| | |
|---|---|
| Strongly disagree | 1% |
| Disagree | 0% |
| Somewhat disagree | 11% |
| Somewhat agree | 12% |
| Agree | 41% |
| Strongly agree | 35% |

**Table 3-14: I get my work done more quickly now that I use a notebook.**

| | |
|---|---|
| Strongly disagree | 0% |
| Disagree | 0% |
| Somewhat disagree | 5% |
| Somewhat agree | 14% |
| Agree | 34% |
| Strongly agree | 47% |

**Table 3-15: I find I do more work when I use a notebook.**

| | |
|---|---|
| Strongly disagree | 0% |
| Disagree | 5% |
| Somewhat disagree | 7% |
| Somewhat agree | 21% |
| Agree | 35% |
| Strongly agree | 32% |

**Table 3-16: I am better able to understand my schoolwork when we use the notebooks.**

| | |
|---|---|
| Strongly disagree | 2% |
| Disagree | 1% |
| Somewhat disagree | 6% |
| Somewhat agree | 36% |
| Agree | 31% |
| Strongly agree | 24% |

A girl acknowledged during an interview that she really enjoys coming to school now because of the computers.

> *I think it's funner coming to school actually because pretty much every class except for the first one we take our laptops with us. I used to need help learning how to spell these words, so if someone was sitting beside me and I was writing a story I'd say, "Do you know how to spell this word?" or "Can you help me with this word?" Now I'm getting really good at spelling. I really like it now too because I'm getting better at math. I wasn't so hot at that and now I'm pulling up my marks.*

Another student commented on the overall impact the notebook is having on her attitudes and skills.

> *I really didn't know anything about computers and didn't use them too much before this class. I have learned so much about creating files, using the Internet and presentations. I have learned how to use the laptop and all of the ways it can be used...most from other kids in my class. I think the good thing is that I have learned how to use it to get information and create and organize my work. I love the laptop because it makes finding things easy and fun.*

**Table 3-17: Since we received the notebooks, I am more interested in school.**

| | |
|---|---|
| Strongly disagree | 2% |
| Disagree | 3% |
| Somewhat disagree | 9% |
| Somewhat agree | 23% |
| Agree | 30% |
| Strongly agree | 33% |

Many of the students interviewed expressed a very strong attachment to school, their peers and their teachers now that they are working in a notebook environment. According to one student:

> *I love school more than ever and I can't wait to get here and use the class time to use the laptop and get things done. I am really excited about what we will be learning and we get to use the laptop for learning every day.*

*Our teacher likes computers and we now like computers to learn. I can't imagine the school class without the laptops or our whole class being together. We really like being together.*

**Table 3-18: I find that the quality of my work has improved by using the notebook.**

| Strongly disagree | 0% |
|---|---|
| Disagree | 1% |
| Somewhat disagree | 2% |
| Somewhat agree | 23% |
| Agree | 41% |
| Strongly agree | 33% |

**Table 3-19: I find that I take more pride in my work since receiving the notebook.**

| Strongly disagree | 2% |
|---|---|
| Disagree | 0% |
| Somewhat disagree | 6% |
| Somewhat agree | 35% |
| Agree | 28% |
| Strongly agree | 29% |

One student noted his past difficulties with handwriting and how he avoided writing at all. This spilled over into his presentation skills and lack of pride in his work. He stated:

*I really hated writing because it was sloppy and people made fun of me. They said I was a baby and so I just didn't write anything. If we had projects to make, I usually didn't hand it in. Now I have PowerPoint and I can make amazing graphics and my writing doesn't look stupid. I use the presentations software and all of my work is just as good as everybody else's. I am proud of my projects and my writing assignments this year.*

**Table 3-20: I find that my understanding of computers and my skills using them have improved since receiving the notebook computer.**

| Strongly disagree | 0% |
|---|---|
| Disagree | 1% |
| Somewhat disagree | 1% |
| Somewhat agree | 15% |
| Agree | 39% |
| Strongly agree | 44% |

**Table 3-21: Overall, I find that I have become a better student by having the notebook to complete my work.**

| | |
|---|---|
| Strongly disagree | 1% |
| Disagree | 3% |
| Somewhat disagree | 6% |
| Somewhat agree | 24% |
| Agree | 37% |
| Strongly agree | 29% |

**Interaction with Other Students and Teachers**

Several survey questions addressed the role of the notebook computers in the building of relationships for learning, both between students and with their teachers. As with the other questions on student attitudes and perceptions, the response was overwhelmingly positive. A full 80% of student responses indicated that they somewhat agree, agree or strongly agree that they interact more with their teachers, now that they have the notebooks. The strength of the effectiveness of the relationship between teaching and learning was supported; 91% of student responses somewhat agree, agree or strongly agree that their teacher(s) have been more effective in teaching them when they are able to use the notebooks to assist in their learning. The relationships among students in the notebook classroom were given very strong support, with 91% of student responses in agreement with the statement that, now that they have their notebooks, they work with other students more.

A student interview brought out the following observation on the first six months of using the notebooks:

> *They have really changed life here at school. So many of the people in my class are now my friends and we are really together as a class. It has made learning more fun and easier, since our teachers are less stressed and have fun showing us how to do the laptop projects. I think we are more together as a class, even though it is big, we all respect our laptops and being able to be part of the project. I think we are really lucky to have been picked for the laptops.*

**Table 3-22: Now that I have my notebook, I interact with my teachers more.**

| | |
|---|---|
| Strongly disagree | 1% |
| Disagree | 5% |
| Somewhat disagree | 15% |
| Somewhat agree | 43% |
| Agree | 24% |
| Strongly agree | 12% |

**Table 3-23: I find that my teacher/teachers have been more effective in teaching me when the class has been able to use the notebooks to assist our learning.**

| | |
|---|---|
| Strongly disagree | 1% |
| Disagree | 2% |
| Somewhat disagree | 6% |
| Somewhat agree | 34% |
| Agree | 35% |
| Strongly agree | 22% |

In his interview, one boy described how he worked with a friend to do a project in social studies class:

> *The good thing about using the laptops is that we have [memory] keys, and I could put all my stuff that I found into [my partner's] computer, and he could put all his stuff that he's got into my computer till we both had the same amount of stuff. And he could sit across the room and I could sit across the other side of the room and we could still be working on the same exact thing together.*

In individual interviews, several students suggested that the role of their teacher(s) had changed and that they now see them as being much more effective. One student said:

> *My teachers are more relaxed and they can help individual students learn, instead of yelling at all of us to listen and pay attention. I realized that my teacher knows an incredible amount of information about math because he helps me understand and answer questions I am having problems with. He uses the laptop and the projector to show us how to do math problems and we get to practice on the laptops.*

**Table 3-24: Now that I have my notebook, I work with other students more.**

| | |
|---|---|
| Strongly disagree | 1.5% |
| Disagree | 1.5% |
| Somewhat disagree | 6% |
| Somewhat agree | 37% |
| Agree | 35% |
| Strongly agree | 19% |

**Adapting to Notebook Technology**

The researchers were interested in student reaction to the changes that notebook computers may have had in the regular classroom environment, where they now have the ability to write and create on a computer screen, learn new techniques for researching, creating and learning and be exposed to the World Wide Web and the massive amount of information it provides to them in an instant. Therefore, several questions on student attitudes and perceptions on these areas were included in the end-of-year survey.

As mentioned earlier, 83% of the notebook student group agreed or strongly agreed that their understanding of computers and skills using them had improved since receiving the notebooks. In terms of the transition to computer use from handwriting all notes and assignment, 56% of respondents use the notebooks to take notes at least once a week, and when asked if they would prefer to handwrite assignments rather than using the notebook, 87% disagreed, somewhat disagreed or strongly disagreed with the idea. When asked their level of agreement or disagreement with the statement that all of the information available on the Internet makes it difficult for them to research and analyze the information, 69% of students who responded expressed some level of disagreement. Only 9% of respondents agreed or strongly agreed to this statement. It would appear that the students have found the notebooks to be highly effective in the classroom and that they are not intimidated or overwhelmed by the technology or the volume of information available on the Internet.

**Table 3-25: I prefer to handwrite my assignments rather than use my notebook.**

| Strongly disagree | 47% |
|---|---|
| Disagree | 26% |
| Somewhat disagree | 14% |
| Somewhat agree | 8% |
| Agree | 4% |
| Strongly agree | 1% |

**Table 3-26: All of the information available on the Internet makes it difficult for me to research and analyze the information.**

| Strongly disagree | 18% |
|---|---|
| Disagree | 29% |
| Somewhat disagree | 22% |
| Somewhat agree | 22% |
| Agree | 4% |
| Strongly agree | 5% |

**Taking the Notebook Home**

From the very beginning of the Dedicated Notebook Research Project in 2004, there was a significant level of attention and concern over the possibility that students would be able to take the notebook computers home with them. For a range of reasons, including questions over liability and insurance, the Department of Education decided that, at least for this research project, the notebooks would remain in the school and students would not be allowed to transport them to their homes. As the research team visited schools, spoke with administrators, teachers, parents and students, there was an ongoing series of questions, concerns and preferences over this issue. The research team decided to ask students a question related to the issue of taking the notebooks home in the June survey of their experiences, attitudes and preferences.

When asked to indicate their level of agreement on the ability to take the notebook computers home, if they were allowed to do so, 84% of students responded that they "strongly agreed" with the statement while a further 11% either agreed or somewhat agreed with the statement. Less than 5% of student responses expressed some level of disagreement with this statement.

**Table 3-27: I would choose to take my notebook home if allowed.**

| | |
|---|---|
| Strongly disagree | 3% |
| Disagree | 1% |
| Somewhat disagree | 1% |
| Somewhat agree | 4% |
| Agree | 7% |
| Strongly agree | 84% |

**Summary of Parent Focus Group Sessions**

During the month of May 2005, members of the research team met with parents and guardians of students taking part in the dedicated notebook computer research project. Invitations were sent to parents and there was a reasonable representation of parents/guardians at each of the focus group meetings (one at each school). An open discussion with six orienting questions was employed during each focus group session. A summary of key findings, including selected quotes from parents/guardians is provided here:

1. **What are the effects of the notebook computers on your perceptions about the use of technology in teaching and learning? Do you feel that notebooks have positively or negatively affected the teaching and learning that your child is experiencing? Would you please provide examples from different subject areas?**

Virtually all parents (100%) agreed that the notebooks have had a very positive impact on their child's learning.

> *My son has really taken off in his learning. He really looked forward to the arrival of the laptops and has just loved being part of this project. His learning has definitely improved since January. He is much more on task in his work – always seems to be up-to-date on his homework and assignments. This has not always been the case, I can tell you that.*

Several parents suggested that their perceptions were rather vague or weak, as they really did not have much background information on the notebook project. Even at the late date in May, they felt they had not heard a great deal about the project. These same individuals acknowledged that they had not made any effort to contact the school about the program. Several commented that their child appeared to have much less homework, now that the notebooks had arrived.

*My daughter doesn't seem to have as much homework with the laptops. I think, and she tells me it is so, that she is more efficient during school time, where she has the laptop. Mr. Whipple tells me that he doesn't have to assign much homework because the class seems to be learning more quickly and not wasting time. I think this is really positive.*

There was a shared concern for the tentative nature of the project and, although they all support the project and see that it is a major change for their children, they worry that the skills are going to be wasted or lost once they finish grade 8.

*The only negative I can see is what will happen when they get to grade 9 (the end of the project)? What will happen to what they have learned with the laptops when they get to high school and don't have them any longer?*

Two or three parents were concerned about the teaching and learning taking place in math. They suggested that this is the only subject where there seems to be regular homework and that they are not sure about the other subjects. The concern is focused on the fact that math does not seem to use the notebook technology as much as other subjects. Other parents suggested that the approach is fairly consistent with how math has been done in other years and that a limited amount of practice and fun activities are done for math using the notebooks. Some parents concluded that it was really that their children were only asking for their help when it came to solving math problems, rather than any major changes or increased focus on math homework.

One parent stated that his son enjoyed the math teaching much more than he used to, as the teacher was able to use the projector and the notebooks to focus the class. This caused his son to try and use different mechanisms to improve his learning in math.

*My son is a special needs student and has had a computer for several years. What this project has done is make him one of the regular members of the class, rather than being different. This has changed his learning approach completely, as he now feels comfortable using the laptop, as everyone else is doing. He has become a much more confident learner in all subject areas. He used to despise social studies, but now he thinks it is "ok".  This is a huge change for a kid who did not like the school environment at all. For that, I am very thankful for this laptop experiment.*

2. **What are the effects of the individual portable computers on your perceptions about homework? Have you noticed any changes in your child's approaches and attitudes towards homework between the introduction of the notebooks and now?**

A majority of the parents in attendance at the focus group meetings agreed that there had been a marked reduction in the amount of homework being assigned. While there were a few concerns with this reduction, the overall feeling was that the teaching and learning

has become much more efficient in school, so there is no need to have work completed for homework.

> I find the class homework blog, listed on the school's homepage, as just an excellent tool for students and parents. Everything is listed there, including the math problem for the day, so I can go to that site and see what is to be completed and when. My son finds it very useful too. He comes home and gets to his homework right away. He has become much more organized with his work. There is a huge improvement in the area of homework.

> My son sees the homework as being a way of getting ahead on the work he needs to complete for class, rather than punishment or an extension of the school day. This is an important change, especially at the grade 7 level. It allows the students to use home time as part of the learning, rather than extra work that didn't get done in class because there was too much noise or wasted time.

> Before the laptop program and the homework page on the school website, I never had a clue about what homework my child had, or if it was getting done. I find that both teachers and students now know what has to be done. As parents, we can monitor the homework assignments and ask the teacher for an interview or phone conversation, if needed.

> Because the computers don't come home, I am not really sure how my son is organized or what he actually does with his laptop. He tells me that it is great and that he is much more organized and knows a great deal more about the Internet, etc. I have to believe that is true, since he can't seem to get enough of school and the sharing of projects and ideas he says they have with the large class of 60 and the individual computers.

3.  **What are your needs and concerns in relation to your child's use of technology in school? Have your thoughts or concerns changed between the introduction of the notebooks and now?**

Most parents agreed that they had not really been sure about the role the notebooks were going to play in their child's learning, so they had difficulty stating what their own needs were in terms of technology. They also suggested that there is a need for much more information going to parents on what the notebooks are for, how they work and what final products come from their use. While several acknowledged that the school and the teachers have made repeated offers to visit the class whenever they like, they suggest that this is difficult to do, so different mechanisms should be used to convey the details and working of the project. Most agreed that the teachers have been very busy with the project and so could not be expected to do any more than they are already doing. The focus has been on the students, and more attention given to the parents would certainly be nice, but it is not an essential part of this project.

One suggestion was to have the ability for parents and guardians to log into a web site and enter a password and be able to have "read only" capability on all of their child's files. This way, parents could see what their child is doing with the notebooks, see the organizational skills being employed and see the quality of the work being completed. Another suggested regular student-lead conferences with the aid of the notebooks.

Again at this point in the focus group topic discussion, the future of the notebook initiative was the major concern, especially the issue of equity and the lack of such technology at the secondary level of education:

> *My only concern is the limited availability of technology in the schools of New Brunswick. Really, how can we think of going back to paper and pen, once we have laptops, wireless and the internet in our school? My major worry is the limited number of computers in our schools. How can we get the government and parents to move more quickly on getting all schools and students set up with laptops? Really, how can we afford NOT to invest in technology?*

> *My concern is that this school is very progressive on the technology front, which is good, but our kids will soon be going off to different high schools and I don't think that any of them will have the kind of technology my son is getting here. We are asking them to learn a new way, using technology, then it will all be taken away in grade 9.*

> *I think we all need to be encouraging government and industry to come up with a much more reasonable price for this kind of technology. If all of the students from grade 7 to 12 get a laptop, then some business or company is going to come up with an affordable product.*

4. **Do you have other children in the school? If so, what differences, if any, are you noticing in your children's experiences?**

A small number of the parents/guardians had other children in the school (grades 6, 7 or 8).

> *I have a daughter in grade 6 and she is very envious of her brother. She is desperate to be in the laptop class next year and is quite worried that she won't be. I think students understand that this is an experiment, so they understand that only some grade seven students get to have laptops. At the same time, there are big issues around who gets them and who doesn't. I think we are saying that only some students will have this type of learning experience and all the others will not.*

> *I think that there are different styles of learning taking place for my kids. My son has this new technology and is moving ahead in so many new*

*areas. My daughter in grade 8 has no idea about computers or what can be done with them. She sees her brother and his new found love of learning and she gets very upset. She understands why, yet she can't help but feel that this is very unfair for her and the others who don't get laptops.*

*I worry for those who are coming up to grade 7 and you already see and hear parents pressuring the school to make sure their child is included in the laptop project for next year. The laptops are a really positive aspect of what can be offered by the school, yet it is becoming a huge problem for students, and their parents, who are not included in the project.*

**5. Do you have recommendations about how the notebook project could be improved?**

*Convince the government that laptop technology is an essential skill for our students and have them introduce computers to all students in grade 7 to 12.*

*This particular project can be improved through better communications with the parents on exactly what the project is, how the students are using their laptops and if the provincial curriculum is being met or enhanced.*

The vast majority of parents concluded that the project is extremely positive and could only be improved by expanding the number of participants in the program.

**6. Do you find that the nature of the work your child is doing has changed? For instance, are they doing more independent research work than they used to? Doing more writing and editing? Are you finding it necessary to help them more or less with their learning? How so?**

All parents/guardians (100%) at the focus group session reported that the nature and quality of their children's work has changed in a very positive way.

All parents/guardians attending the focus group sessions reported that their children are completing more independent research using the notebook computers. They report increased skill and awareness of technology, which has resulted in much greater research capabilities and independent learning.

*My son has demonstrated a huge increase in his attitude towards school and the type of work he is capable of doing. He is now very independent in his work, whereas he used to always wait for his teacher or me to give him the information he needed. I find him much more organized in his work and the assignments he is doing. He used to forget about homework and assignments that were due. Now he gets them done on his own and gets them to his teacher on time. The fact that the computer makes him*

*organize his work has been a positive result of this project. Now, he helps me find information, rather than me trying to help him using old materials.*

*I find the assignments to be much more independent and the information is much better quality. It's not outdated information from old textbooks or endless photocopies. The students have the most accurate and up-to-date information around. The ability to deal in real time is a huge change for them.*

*My son is autistic, non-verbal and has a range of learning disabilities. He has a wonderful teaching assistant (TA) and she has been able to work very well with him in this laptop environment. I can't tell you how important this project has been to his learning and feelings of being a full member of the class. The laptops have been great equalizers for the students, in that they all have access to the same information and presentation capabilities. My only worry is for the future of the laptops. My son will always be able to use one, but I don't think this environment will be maintained when these kids get to high school.*

Nearly all of the parents/guardians reported that their children are doing much more writing and editing than in the period before they had notebooks. They also reported that their presentation and speaking skills have been enhanced through use of the notebooks.

In summary, the parent/guardian focus group sessions revealed that most of the parents (approximately 90% - 95%) in attendance reported that the notebook environment has created a very positive learning environment for their children. Parents reported that their children love to come to school and never want to miss a day of school. They speak of a great affinity with their classmates and teachers.

## Chapter 4: Findings after Phase II of the Notebook Research Project, September 2005 – June 2006

Evaluation of Phase II of the Notebook Research Project included the same variety of research tools employed in Phase I, including:

- **Online surveys** were conducted, which collected data from teachers and students who participated in Phase Two of the research project, from September of 2005 until the conclusion of the research project in June of 2006. In this second phase, the surveys were conducted at the start of the school year, including a new survey of those students who had progressed from grade 7 (Phase I) into the grade 8 (start of Phase II), as well as a year-end survey in June of 2006. Those students who entered grade 7 in September of 2005 were provided the same survey that was provided to grade 7 students in the previous Phase in January of 2005. The surveys allowed the research team to collect information on the initial impact of the notebooks on the teaching and learning environment of new grade 7 students added to the research project in 2005. As well, the surveys were used to gather responses from those students who entered the project in grade 7 and continued using the notebook computers in their grade 8 year, as outlined below.
- **Site visits** were conducted by the research team throughout the second phase of the research project, from September 2005 until June of 2006. Just as was completed in Phase I, this second phase included regular monthly meetings with teachers, students, principals, teacher-mentors, parents, and others who may have been involved in the project in Phase II. Each visit included interviews with these individuals and recorded site visit field notes and observations compiled by the research team members.
- **Classroom observations** were conducted in each of the notebook initiative schools on a monthly basis. Once again in this phase of the research project, members of the research team attended several meetings with the Department of Education and participating notebook school officials, including school district officials, principals and parent groups. As well, research team members hosted visits by external research colleagues.
- **Literature review and document analysis**: Members of the research team reviewed student work completed during Phase II of the notebook research project, as well as related school policies, Department of Education materials and related technologies, school websites and blogs, lesson plans, and professional development plans. During this second phase, members of the research team were able to participate in several academic research conferences and seminars on 1:1 computing.

### Student Surveys and Interviews: Phase II

This section of the report provides evaluation evidence on the impact of the second year of the Dedicated Notebook Computer Research Project on those students new to grade 7, as well as those who would have access to dedicated notebook computers in their grade 8

year, thus participating in the project over an 18 month period. The focus of this second set of student interviews and surveys is to address the impact of the notebook computers on student learning for students in their second year of exposure to the dedicated notebook computers, as well as for a second group of students experiencing the dedicated notebooks for the first time. In this second phase, the research team was interested in determining how the dedicated notebooks were actually being used, and what obstacles, if any, students had encountered during this second phase of the project.

The June 2006 survey was an online survey and all participating grade 7 and grade 8 students in the anglophone sector were asked to complete it during their last week of classes. Of the total 278 students, 255, or 92%, completed the survey. Of the total number of respondents, 56.5% are female and 43.5% are male.

**Survey Results: Phase II**

| School | Grade 7 | | Grade 8 | | Total | |
|---|---|---|---|---|---|---|
| | # | % | # | % | # | % |
| Grand Manan | 26 | 10.53 | 22 | 8.91 | 48 | 19.4 |
| Harry Miller | 55 | 22.27 | 49 | 19.84 | 104 | 42.1 |
| Nashwaaksis | 52 | 21.05 | 43 | 17.41 | 95 | 38.5 |
| **Invalid Surveys** | | | | | | |
| Failed to identify | | | | | 6 | 2.4 |
| No responses | | | | | 2 | 0.8 |
| Total | | | | | 255 | 100 |
| **Total Valid** | | | | | 247 | 97 |

The results of the survey, as well as results of the dozens of individual student interviews conducted at the schools over the 2005-2006 academic year, are highlighted here. The overall impact of the notebooks on students appears to have been substantial in terms of their overall experience when using them. In response to the initial question on their individual experiences, 90% indicated that they "enjoyed" or "really enjoyed" using the notebooks and had "positive" or "very positive" feelings about the experience.

**Table 4-1: What has been your overall experience when using the notebook computer this year? (%)**

| | Gr. 7 | Gr. 8 |
|---|---|---|
| I have not enjoyed using the notebook computer this year and have negative feelings about the experience. | 0.7 | 5.0 |
| I have neither negative nor positive feelings about using the notebook computer this year. | 6.0 | 6.0 |
| I have enjoyed using the notebook computer and have generally positive feelings about the experience. | 25.0 | 32.0 |
| I have really enjoyed using the notebook computer and have very positive feelings about the experience. | 68.3 | 57.0 |

Grade 7 students indicated a slightly higher level of satisfaction, with 93.3% stating that they enjoyed, or really enjoyed, using the notebook computers. The grade 8 students continued to exhibit a very high level of satisfaction with the notebook computers, with 89% having reported that they enjoyed or really enjoyed using them and had generally positive or very positive feelings about the experience. Several grade 8 students suggested that, while the novelty of being involved with the project may have passed, they are still overwhelmingly positive about the notebooks as part of their overall learning experience:

> *Now that we are in our second year of the notebook project, the use of the computers seems to be second nature to us, really. We don't even have to think about using them any more. They are just there, every day, as part of our class. They really are still an amazing part of our classroom learning. We are really lucky to have them.*

Tables 4-2 to 4-8 report the results of student surveys on the use of notebook computers for specific subject areas. Once again, it appears that students at both grade levels, across all three research project schools, are making extensive use of the notebooks, particularly in the areas of language arts, social studies, French second language, and science. Most notable across the various curricular areas was the extensive use the notebook computers receive in English language arts. A full 97% of grade 7 students are using the notebooks in their classes, with close to 75% of respondents using them specifically for ELA 4 – 7 hours per week. The grade 8 classes report that 100% of them use the notebooks for at least 1 – 3 hours per week, with 73% of them using them from 4 – 7 hours.

> *We can do lots of things we never could do with just a pen and paper. It is a lot more fun and a little bit easier to learn with them as well. I find that the Internet plays a great role in our learning, such as searching for information etc. My laptop has helped me be more organized with work. There are many programs to help us make outlines for stories, speeches and more. I have actually gotten a better mark this year with my speech because I used new software on my computer to make an outline for it. I am a visual learner, so it is fun to learn while watching educational videos on a program called united streaming. I have learned a lot more by seeing things and watching them over the Internet.*

**Table 4-2: Indicate how often you use your notebook for language arts (reading/writing). (%)**

|  | Gr. 7 | Gr. 8 |
|---|---|---|
| I do not take this class. | 1.5 | 0 |
| 0 hours per week | 1.5 | 0 |
| 1 – 3 hours per week | 23.0 | 27.0 |
| 4 – 6 hours per week | 56.0 | 46.0 |
| 7 hours per week | 18.0 | 27.0 |

While the notebooks are not used quite as extensively in social studies, 98% of grade 7 and 8 students use them at least 1 – 3 hours per week, with grade 8 students indicating longer usage times. The following two students indicated that they really enjoyed using the computers to do their research and presentations about the world wars and the Northwest Passage.

> *We're learning about World War One and World War Two. And we can find pictures on it. And we just finished a pictorial dictionary for it. And you had to name two things for every letter in the alphabet that had to do with the war. And we did it on a slide show on PowerPoint.*

> *In social studies we did the Northwest Passage. And we had a bunch of questions and we had to go online and figure out the answers.*

**Table 4-3: Indicate how often you use your notebook for Social Studies: (%)**

|  | Gr. 7 | Gr. 8 |
|---|---|---|
| I do not take this class. | 0.8 | 1.0 |
| 0 hours per week | 1.5 | 1.0 |
| 1 – 3 hours per week | 77.0 | 56.0 |
| 4 – 6 hours per week | 20.0 | 30.0 |
| 7 hours per week | 0.8 | 12.0 |

As found in Phase I of the research project, a smaller percentage of students are using their computers in art or music classes, yet there certainly has been an increase over computer use since Phase I. Smaller percentages of time are devoted to these subject areas, so a smaller percentage of notebook usage can be expected. A number of new applications in both art and music were noted in Phase II and students seemed to enjoy the applications being introduced in these curricular areas.

**Table 4-4: Indicate how often you use your notebook for art/music. (%)**

|  | Gr. 7 | Gr. 8 |
|---|---|---|
| I do not take this class. | 19.0 | 19.0 |
| 0 hours per week | 33.0 | 36.0 |
| 1 – 3 hours per week | 43.0 | 39.0 |
| 4 – 6 hours per week | 4.0 | 4.5 |
| 7 hours or more per week | 1.0 | 1.5 |

As is the case in other notebook research jurisdictions, the students in this study continue to have limited exposure to mathematics foundations and applications using the notebooks. While just over 50% of grade 7 students have at least 1 – 3 hours of mathematics use on the notebooks, this falls to 46% in grade 8. While this particular area continues to develop, several students see positive impacts in their learning and comfort with mathematics concepts. More applications and visual manipulatives have been added, especially at the grade 8 level. One student noted:

*Math has never been easy for me, but I am now able to actually see the work on the board and follow how the teacher is getting the solution. It is fun to follow along this way and then have it saved to our own desktops so we can see it again later. I feel I can understand the concepts a lot better this way.*

**Table 4-5: Indicate how often you use your notebook for mathematics. (%)**

|                           | Gr. 7 | Gr. 8 |
|---------------------------|-------|-------|
| I do not take this class  | 1.5   | 4.0   |
| 0 hours per week          | 45.0  | 50.0  |
| 1 – 3 hours per week      | 33.0  | 37.0  |
| 4 – 6 hours per week      | 15.0  | 7.0   |
| 7 hours or more per week  | 4.5   | 2.0   |

One of the most notable changes from Phase I to Phase II has been the increased use of the notebook computers in the French second language classes. A much greater percentage of students reported regular use of the notebooks in completing exercises and presentations using the technology. They reported much greater levels of understanding and confidence in their second language. A significant increase in the use of the notebooks can be seen, from 71% of students using computers in French language arts in Phase I, to 90% of grade 7 students and 96% of grade 8 students reporting at least 1 – 3 hours of use in Phase II. Grade 8 students reported that 27% of them are using the notebooks for French for 7 hours or more each week, compared to just 9% when they were in grade 7.  As one student observed:

*French is a lot different now with the laptops in French.  And back in grade six when we'd do French, we'd always have to use a dictionary and that was very hard, like, you know, looking up the French words.  But now that we have a laptop they have a French-English dictionary on the laptop so all we have to do is type a word in and it pops up and we have the translation right there, tickety boom.*

**Table 4-6: Indicate how often you use your notebook for French. (%)**

|                           | Gr. 7 | Gr. 8 |
|---------------------------|-------|-------|
| I do not take this class. | 5.0   | 4.0   |
| 0 hours per week          | 5.0   | 0.0   |
| 1 – 3 hours per week      | 46.0  | 34.0  |
| 4 – 6 hours per week      | 36.0  | 35.0  |
| 7 hours or more per week  | 8.0   | 27.0  |

Perhaps reflecting the significant strength of science in the online community and rapid adoption of these new curriculum sites within the project schools, there has been a sustained usage of the notebooks in the science program across both grade 7 and grade 8. The subject area teachers have enhanced much of the science curriculum through notebook exercises, reports and projects, reflected in increased usage at both the grade 7 and grade 8 levels. In Phase I, just 5% of grade 7 students used the notebooks for science

for 7 or more hours per week. By the end of grade 8, 27.5% of these same students reported that they use the notebook for science for 7 or more hours per week. From the following comments, it is clear that the students are more interested in science now because of the engaging graphics and videos that they can see in their computers from software packages such as Encarta Encyclopedia and websites such as United Streaming.

> *Science [is most helped by computers] because [the teacher] can show all the diagrams, instead of just drawing it because she can show you the diagrams and you can understand how it works. It's a lot easier to explain it when you can see it in a picture.*

> *Science used to be boring but now it's interesting because of all the videos.*

**Table 4-7: Indicate how often you use your notebook for science. (%)**

|  | Gr. 7 | Gr. 8 |
|---|---|---|
| I do not take this class. | 5.0 | 4.0 |
| 0 hours per week | 5.0 | 0.0 |
| 1 – 3 hours per week | 46.0 | 34.0 |
| 4 – 6 hours per week | 36.0 | 34.5 |
| 7 hours per week | 8.0 | 27.5 |

The notebook research project has not expanded into the physical education or health curriculum from Phase I to Phase II. There is still the challenge of using a notebook in the actual gymnasium portion of the class. Many would argue that notebooks should be left behind for an opportunity for exercise and physical education. Phase II surveys indicate that there is still an opportunity for the completion of reports and research activities for the health curriculum, with a slight increase in those reporting use of the notebooks in this area.

**Table 4-8: Indicate how often you use your notebook for physical education/health. (%)**

|  | Gr. 7 | Gr. 8 |
|---|---|---|
| I do not take this class | 10.0 | 2.0 |
| 0 hours per week | 53.0 | 49.0 |
| 1 – 3 hours per week | 35.0 | 45.0 |
| 4 – 6 hours per week | 2.0 | 4.0 |
| 7 hours or more per week | 0.0 | 0.0 |

Phase II of the research project finds a growing awareness and enhanced role for the notebook computers in the various curriculum areas of the grade 7 and grade 8 academic programmes. Increased availability of curriculum resources for notebook use, as well as continued teacher professional development and integration of curricular materials through the use of notebooks, is seen across all schools participating in the project. Notebook use appears to be increasing in total time on task in a number of key curricular areas, such as English language arts, French second language, social studies and science.

**Student Use of their Notebooks**

Students were asked to indicate the various ways in which they use their notebook computers during a normal week. This includes in-class curriculum-based work, as well as independent work and group activities, projects and presentations. As in Phase I, a range of activities and functions were provided and students selected the range of time spent, on average, for each activity during the week. The various activities are listed below, with students reporting that they use their notebooks most frequently for researching information on the Internet, editing their work, creating presentations and other multimedia projects, and organizing information.

**Table 4-9: Indicate the response that describes how often you use your notebook to do the following:**

**4-9.1 Writing first drafts of papers and projects (%)**

|  | Gr. 7 | Gr. 8 |
|---|---|---|
| Never | 5.0 | 1.0 |
| Less than once a week | 25.0 | 23.0 |
| Once a week | 15.0 | 20.0 |
| A few times a week | 31.0 | 35.0 |
| Once a day | 14.0 | 5.0 |
| Often during the day | 10.0 | 16.0 |

**4-9.2 Editing my work (%)**

|  | Gr. 7 | Gr. 8 |
|---|---|---|
| Never | 4.0 | 0.0 |
| Less than once a week | 6.0 | 8.0 |
| Once a week | 17.0 | 13.0 |
| A few times a week | 44.0 | 39.0 |
| Once a day | 8.0 | 11.0 |
| Often during the day | 21.0 | 29.0 |

**4-9.3 Taking notes (%)**

|  | Gr. 7 | Gr. 8 |
|---|---|---|
| Never | 20.0 | 21.0 |
| Less than once a week | 15.0 | 16.0 |
| Once a week | 17.0 | 13.0 |
| A few times a week | 29.0 | 28.0 |
| Once a day | 8.0 | 8.0 |
| Often during the day | 12.0 | 14.0 |

**4-9.4 Organizing information (%)**

| | Gr. 7 | Gr. 8 |
|---|---|---|
| Never | 9.0 | 3.5 |
| Less than once a week | 17.0 | 16.0 |
| Once a week | 23.0 | 13.0 |
| A few times a week | 27.0 | 29.0 |
| Once a day | 13.0 | 12.5 |
| Often during the day | 11.0 | 26.0 |

**4-9.5 Researching information on the Internet (%)**

| | Gr. 7 | Gr. 8 |
|---|---|---|
| Never | 0.0 | 0.0 |
| Less than once a week | 3.0 | 2.0 |
| Once a week | 6.0 | 4.0 |
| A few times a week | 33.0 | 27.0 |
| Once a day | 21.0 | 13.0 |
| Often during the day | 37.0 | 54.0 |

**4-9.6 Writing quizzes, tests or assignments (%)**

| | Gr. 7 | Gr. 8 |
|---|---|---|
| Never | 27.0 | 18.0 |
| Less than once a week | 31.0 | 23.0 |
| Once a week | 19.0 | 13.0 |
| A few times a week | 18.0 | 32.0 |
| Once a day | 2.0 | 5.0 |
| Often during the day | 3.0 | 9.0 |

**4-9.7 Doing drills using computer simulations or games (%)**

| | Gr. 7 | Gr. 8 |
|---|---|---|
| Never | 15.0 | 19.0 |
| Less than once a week | 42.0 | 29.0 |
| Once a week | 18.0 | 14.0 |
| A few times a week | 18.0 | 23.0 |
| Once a day | 4.0 | 12.0 |
| Often during the week | 3.0 | 3.0 |

**4-9.8 Creating presentations and other multimedia projects (%)**

| | Gr. 7 | Gr. 8 |
|---|---|---|
| Never | 0.0 | 0.0 |
| Less than once a week | 9.0 | 6.0 |
| Once a week | 14.0 | 10.0 |
| A few times a week | 50.0 | 41.0 |
| Once a day | 12.0 | 16.0 |
| Often during the day | 15.0 | 27.0 |

**4-9.9 Working on online assignments or worksheets (%)**

| | Gr. 7 | Gr. 8 |
|---|---|---|
| Never | 26.0 | 8.0 |
| Less than once a week | 33.0 | 28.0 |
| Once a week | 17.0 | 19.0 |
| A few times a week | 16.0 | 28.0 |
| Once a day | 5.0 | 5.0 |
| Often during the day | 3.0 | 12.0 |

**4-9.10 Sending and/or receiving e-mail messages (%)**

| | Gr. 7 | Gr. 8 |
|---|---|---|
| Never | 29.0 | 4.5 |
| Less than once a week | 21.0 | 22.5 |
| Once a week | 10.0 | 12.0 |
| A few times a week | 19.0 | 31.0 |
| Once a day | 3.0 | 10.0 |
| Often during the day | 18.0 | 20.0 |

**4-9.11 Working on assignments in small groups (%)**

| | Gr. 7 | Gr. 8 |
|---|---|---|
| Never | 1.5 | 1.0 |
| Less than once a week | 17.0 | 7.0 |
| Once a week | 32.0 | 12.5 |
| A few times a week | 35.0 | 45.0 |
| Once a day | 9.0 | 14.0 |
| Often during the day | 5.0 | 20.5 |

After Phase II, student survey results indicate that they were using technology for a fairly wide variety of applications across the school day and in the core curriculum areas. Student respondents reported a high degree of comfort and confidence using the notebook computers. One of the most impressive and widely used areas for the notebooks is in the writing and revising process, as well as the retrieval and research analysis of information on the World Wide Web. Notebooks are used at all stages of the research and writing process, including background information on the Internet, preparing and inserting graphics, writing first drafts, editing/revising, and sharing information in small group sessions. Over 70% of grade 7 students and 75% of grade 8 students are using the dedicated notebook often during the week to assist in writing and revising.

Phase II surveys confirm that students are using the notebooks to employ higher order thinking and writing and research skills as well as taking advantage of the benefits offered by the notebooks to improve efficiency in taking notes, organizing files and assignments, creating presentations and communicating with students and teachers. One of the most significant increases in notebook computer use was in the area of creation of presentations and other multimedia skills. In Phase I, 58% of grade 7 students used the notebooks, weekly, daily or several times per day to create presentations and multimedia projects. By the end of their grade 8 year in Phase II, this figure rose to 84% and 77% of

the grade 7 respondents reported using the technology for these purposes. During Phase II, there was clear evidence that students and their teachers have grown accustomed to the power of multimedia information and presentation skills and they have acquired a high level of competence using the technology to express their ideas, as well as learning from, and with, one another and the various media sources approved by the teacher and the school district. The survey results indicate that an overwhelming percentage of students involved in the research project are engaged with the learning process through the addition of the technological tools provided by the dedicated notebooks.

**Receiving Assistance in Using the Notebook Computer**

The Dedicated Notebook Research Project was constructed with a fairly significant level of technical assistance for both students and teachers involved. After the completion of Phase II of the project, there were still remarkably few technical or hardware issues or problems associated with the notebook computers. The teacher-mentors and full-time technical assistants at each of the three sites maintained a high level of attention to the technical needs of the grade 7 and grade 8 classrooms involved with the project. Students in Phase II of the project reported that, while they sometimes or usually seek assistance with the notebook computer from their teachers (44% of grade 7 students and 55% of grade 8 students) or from the technology specialist (only 17% of grade 7 students and 40% of grade 8 students), the majority of respondents turn to fellow classmates for such assistance (60% of grade 7 students and 62% of grade 8 students). This adds to the development of shared knowledge on the part of the students, where they feel comfortable seeking out help when it is needed, as well as providing information and instruction to their peers, when appropriate. Other adults are rarely, if ever, asked to provide assistance for use of the notebooks.

**Table 4-10: Indicate how often you ask for help from each of the following people when you need help with your notebook.**

**4-10.1 A teacher (%)**

|  | Gr. 7 | Gr. 8 |
|---|---|---|
| Never | 14.0 | 8.0 |
| Not very often | 38.0 | 37.0 |
| Sometimes | 40.0 | 39.0 |
| This is usually the person I ask. | 8.0 | 16.0 |

**4-10.2 Another student in the class (%)**

|  | Gr. 7 | Gr. 8 |
|---|---|---|
| Never | 10.0 | 6.0 |
| Not very often | 30.0 | 32.0 |
| Sometimes | 36.0 | 46.0 |
| This is usually the person I ask. | 24.0 | 16.0 |

**4-10.3 Technology specialist or notebook teacher-mentor (%)**

|  | Gr. 7 | Gr. 8 |
|---|---|---|
| Never | 26.0 | 13.0 |
| Not very often | 57.0 | 47.0 |
| Sometimes | 12.0 | 27.0 |
| This is usually the person I ask. | 5.0 | 13.0 |

**4-10.4 Other adult in the school (%)**

|  | Gr. 7 | Gr. 8 |
|---|---|---|
| Never | 60.0 | 58.0 |
| Not very often | 30.0 | 29.0 |
| Sometimes | 8.0 | 12.0 |
| This is usually the person I ask. | 2.0 | 1.0 |

## Student Attitudes and Perceptions

One of the central objectives of the Dedicated Notebook Research Project was to complete a thorough analysis of how providing middle school students and teachers with their own individual notebook computer (1:1) in a wireless, networked environment actually affects the learning experiences and instructional approaches in the classroom and beyond. At the end of the day, it is critically important that we attempt to measure the ways and extent to which student attitudes and perceptions toward learning have been affected by their participation in a 1:1 environment. In short, does the access to a personal computer add to the individual student's growth and learning?

As reported earlier in this chapter, the high level of acceptance and adaptation of the students to the notebook computers assisted them in developing their skills in the areas of technology and information processing, which certainly makes them better equipped to address the curricular challenges that lie ahead. After this initial two-year research project, students reported that the impact of the dedicated notebooks on their attitudes, perceptions and learning has been substantial. Following Phase I of the project in 2005-2006, Phase II end-of-year survey results found high levels of agreement amongst students' qualitative measures of their attitudes and feelings about the use of the notebooks and their personal and shared experiences with them. As displayed in the following tables, students reported very high levels of agreement with the statements on the role of the dedicated notebook computers in helping them to be better organized (92% of grade 7 students and 98% of grade 8 students somewhat agreed, agreed or strongly agreed), allowing them to be more involved in the class when they are using their notebooks (84% of grade 7 and 94% of grade 8 students), being more likely to revise or edit their work when it is done on a notebook (90% of grade 7 and 95% of grade 8 students), getting their work done more quickly (95% of grade 7 and 97% of grade 8 students), finding they are doing more work when they use a notebook (92.5% of grade 7 and 93% of grade 8 students), being better able to understand their work when using the 1:1 technology (83.5% of grade 7 students and 92% of grade 8 students), and finding that they are more interested in school since they began using the notebooks (84% of grade 7

and 93% of grade 8 students somewhat agree, agree or strongly agree). As one student noted:

> *I think that the computers are one of the best things that happened to me in my school years. It is a great help to me when it comes to school work, and projects. With the notebooks, I can research things fast, and have a lot more resources at hand. My hand does not get tired because I type my notes, and because I do this, my work is oh so much neater than when I hand write my notes. All my work is organized and neat because of the notebooks; also I can find my work faster because all my work is in a computer file, not crammed into my desk.*

**Table 4-11: Having a notebook has helped me to be better organized. (%)**

|                   | Gr. 7 | Gr. 8 |
|-------------------|-------|-------|
| Strongly disagree | 1.5   | 0.0   |
| Disagree          | 1.5   | 0.0   |
| Somewhat disagree | 5.0   | 2.0   |
| Somewhat agree    | 19.0  | 22.0  |
| Agree             | 46.0  | 37.0  |
| Strongly agree    | 27.0  | 39.0  |

**Table 4-12: I am more involved in the class when I use my notebook. (%)**

|                   | Gr. 7 | Gr. 8 |
|-------------------|-------|-------|
| Strongly disagree | 4.0   | 1.0   |
| Disagree          | 5.0   | 3.0   |
| Somewhat disagree | 7.0   | 2.0   |
| Somewhat agree    | 25.0  | 32.0  |
| Agree             | 37.0  | 39.0  |
| Strongly agree    | 22.0  | 23.0  |

**Table 4-13: I am more likely to revise or edit my work when it is done on the notebook. (%)**

|                   | Gr. 7 | Gr. 8 |
|-------------------|-------|-------|
| Strongly disagree | 1.0   | 1.0   |
| Disagree          | 5.0   | 1.0   |
| Somewhat disagree | 4.0   | 3.0   |
| Somewhat agree    | 17.0  | 15.0  |
| Agree             | 47.0  | 47.0  |
| Strongly agree    | 26.0  | 33.0  |

**Table 4-14: I get my work done more quickly now that I use a notebook. (%)**

|  | Gr. 7 | Gr. 8 |
|---|---|---|
| Strongly disagree | 1.5 | 2.0 |
| Disagree | 1.5 | 0.0 |
| Somewhat disagree | 2.0 | 1.0 |
| Somewhat agree | 17.0 | 13.0 |
| Agree | 33.0 | 44.0 |
| Strongly agree | 45.0 | 40.0 |

**Table 4-15: I find I do more work when I use a notebook. (%)**

|  | Gr. 7 | Gr. 8 |
|---|---|---|
| Strongly disagree | 1.5 | 1.0 |
| Disagree | 4.5 | 2.0 |
| Somewhat disagree | 1.5 | 4.0 |
| Somewhat agree | 14.5 | 30.0 |
| Agree | 51.0 | 36.0 |
| Strongly agree | 27.0 | 27.0 |

**Table 4-16: I am better able to understand my schoolwork when we use the notebooks. (%)**

|  | Gr. 7 | Gr. 8 |
|---|---|---|
| Strongly disagree | 1.0 | 2.0 |
| Disagree | 11.0 | 2.0 |
| Somewhat disagree | 4.5 | 4.0 |
| Somewhat agree | 28.0 | 27.0 |
| Agree | 34.0 | 40.0 |
| Strongly agree | 21.5 | 25.0 |

**Table 4-17: Since we received the notebooks, I am more interested in school. (%)**

|  | Gr. 7 | Gr. 8 |
|---|---|---|
| Strongly disagree | 1.0 | 1.5 |
| Disagree | 11.0 | 1.5 |
| Somewhat disagree | 4.0 | 4.0 |
| Somewhat agree | 27.0 | 28.0 |
| Agree | 35.0 | 39.0 |
| Strongly agree | 22.0 | 26.0 |

**Table 4-18: I find that the quality of my work has improved by using the notebook. (%)**

|  | Gr. 7 | Gr. 8 |
|---|---|---|
| Strongly disagree | 1.0 | 0.0 |
| Disagree | 4.0 | 1.0 |
| Somewhat disagree | 2.0 | 4.0 |
| Somewhat agree | 15.0 | 25.0 |
| Agree | 47.0 | 36.0 |
| Strongly agree | 31.0 | 34.0 |

**Table 4-19: I find that I take more pride in my work since receiving the notebook. (%)**

|  | Gr. 7 | Gr. 8 |
|---|---|---|
| Strongly disagree | 1.0 | 2.5 |
| Disagree | 2.0 | 2.0 |
| Somewhat disagree | 4.0 | 9.0 |
| Somewhat agree | 23.0 | 24.0 |
| Agree | 50.0 | 35.0 |
| Strongly agree | 20.0 | 27.5 |

**Table 4-20: I find that my understanding of computers and my skills using them have improved since receiving the notebook computer. (%)**

|  | Gr. 7 | Gr. 8 |
|---|---|---|
| Strongly disagree | 2.0 | 2.0 |
| Disagree | 3.0 | 0.0 |
| Somewhat disagree | 3.0 | 4.0 |
| Somewhat agree | 15.0 | 13.0 |
| Agree | 35.0 | 31.0 |
| Strongly agree | 42.0 | 50.0 |

**Table 21: Overall, I find that I have become a better student by having the notebook to complete my work. (%)**

|  | Gr. 7 | Gr. 8 |
|---|---|---|
| Strongly disagree | 4.0 | 1.5 |
| Disagree | 4.5 | 2.5 |
| Somewhat disagree | 5.5 | 7.0 |
| Somewhat agree | 27.0 | 20.0 |
| Agree | 36.0 | 42.0 |
| Strongly agree | 23.0 | 27.0 |

**Interaction with Other Students and Teachers**

One of the objectives of the Dedicated Notebook Research Project was to create an effective learning community of teachers and learners. Several of the survey questions addressed the role of the notebooks in creating this type of learning community, with a role in building relationships for learning, both between students and students and their teachers. Just over 70% of grade 7 students and 77% of grade 8 students somewhat agreed, agreed or strongly agreed that they interact more with their teachers now that they are part of the notebook initiative. The students also supported the view that the notebook learning environment has allowed their teachers to be more effective in teaching and assisting in their learning (88% of grade 7 students and 92% of grade 8 students somewhat agreed, agreed or strongly agreed). The addition of dedicated notebooks to the learning environment was also given strong support by the respondents who believe that they now work with others more often. While over 80% of grade 7 students believe they work with other students more, 94% of the grade 8 students believe this to be the case. As the following brief dialogue illustrates, students like to go to each other for help:

> Student A: *If we're making a PowerPoint or something and we don't know how to do something, we'll go to our friend and it will be like, "Hey, do you know how to do this?"*
> Student B: *And they'll tell us and if they don't know then we'll ask someone else. If no one else knows you'll go ask the teacher…*
> Student A: *And then you go back and tell them after you've figured it out.*
> Student B: *Yeah, we all help each other, basically.*

**Table 4-22: Now that I have my notebook, I interact with my teachers more. (%)**

|  | Gr. 7 | Gr. 8 |
|---|---|---|
| Strongly disagree | 8.0 | 1.0 |
| Disagree | 13.5 | 10.0 |
| Somewhat disagree | 8.0 | 12.0 |
| Somewhat agree | 40.0 | 49.0 |
| Agree | 19.5 | 17.0 |
| Strongly agree | 11.0 | 11.0 |

**Table 4-23: I find that my teacher/teachers have been more effective in teaching me when the class has been able to use the notebooks to assist our learning. (%)**

|  | Gr. 7 | Gr. 8 |
|---|---|---|
| Strongly disagree | 3.0 | 1.0 |
| Disagree | 4.0 | 1.0 |
| Somewhat disagree | 5.0 | 6.0 |
| Somewhat agree | 30.0 | 23.0 |
| Agree | 44.0 | 41.0 |
| Strongly agree | 14.0 | 28.0 |

**Table 4-24: Now that I have my notebook, I work with other students more. (%)**

|  | Gr. 7 | Gr. 8 |
|---|---|---|
| Strongly disagree | 3.0 | 0.0 |
| Disagree | 4.0 | 4.0 |
| Somewhat disagree | 12.0 | 2.0 |
| Somewhat agree | 36.0 | 37.5 |
| Agree | 31.0 | 37.5 |
| Strongly agree | 14.0 | 19.0 |

**Adapting to Notebook Technology**

Over the course of the two-year Dedicated Notebook Research Project, students appear to have adapted their traditional research and writing skills to the wireless notebook environment. In terms of the use of the notebooks to write notes, 50% of grade 7 and grade 8 students reported that they use the notebooks to take notes, yet 88% of grade 7 and 83% of grade 8 students disagreed, somewhat disagreed or strongly disagreed with that statement. When asked their level of agreement or disagreement with the statement that all of the information available on the Internet makes it difficult for them to research and analyze the information, 69% of grade 7 students and 76% of grade 8 students who responded expressed some level of disagreement.

**Table 25: I prefer to handwrite my assignments rather than use my notebook. (%)**

|  | Gr. 7 | Gr. 8 |
|---|---|---|
| Strongly disagree | 59.0 | 37.0 |
| Disagree | 22.0 | 37.0 |
| Somewhat disagree | 7.0 | 9.0 |
| Somewhat agree | 8.0 | 12.0 |
| Agree | 3.0 | 2.5 |
| Strongly agree | 1.0 | 2.5 |

**Table 26: All of the information available on the Internet makes it difficult for me to research and analyze the information. (%)**

|  | Gr. 7 | Gr. 8 |
|---|---|---|
| Strongly disagree | 13.0 | 18.0 |
| Disagree | 25.0 | 36.0 |
| Somewhat disagree | 31.0 | 22.0 |
| Somewhat agree | 18.0 | 14.0 |
| Agree | 9.0 | 5.0 |
| Strongly agree | 4.0 | 5.0 |

**Taking the Notebook Home**

An environmental scan of the major 1:1 dedicated notebook projects across North America has revealed that the ultimate success of such programs is derived by 24/7,

anytime access to the technology, learning materials and communications strengths that they provide individual students. Phase I found a high level of attention and concern over the limitation on availability of the notebooks, allowing them to be used only during the school operations and not being allowed outside of the school. Phase I revealed that 95% of grade 7 students agreed or strongly agreed with the statement that they would choose to take their notebook computers home if allowed. At the conclusion of Phase II, the number of students who wished to take their notebooks home grew to 96% of grade 7 students and a full 100% of grade 8 students. As two students indicate in the following comments, they would prefer to take their computers home to work on their assignments:

> *Because if we're working on something and it's due and, say, we don't have PowerPoint at home, because lots of people don't, and you can't email it to yourself and finish it there because you don't have it and you can't take it home on your key, then you're kind of stuck and you have to stay after school. And sometimes a teacher can't stay and then you're overdue with your PowerPoint.*
>
> *I'd take it home because our computer at home just is horrible. It's slow and full of junk and it's got everything on it, and I don't have PowerPoint at home either.*

**Table 4-27: I would choose to take my notebook home if allowed. (%)**

|  | Gr. 7 | Gr. 8 |
|---|---|---|
| Strongly disagree | 2.5 | 0.0 |
| Disagree | 1.5 | 0.0 |
| Somewhat disagree | 0.0 | 0.0 |
| Somewhat agree | 9.0 | 0.0 |
| Agree | 11.0 | 11.5 |
| Strongly agree | 76.0 | 88.5 |

**Summary of Parent Focus Group Sessions**

During the month of May 2006, members of the research team met with parents and guardians of students taking part in the Dedicated Notebook Research Project. Invitations were sent to parents and there was a reasonable representation of parents/guardians at each of the focus group meetings. An open discussion with seven orienting questions took place during each focus group session. A summary of key findings, including selected quotations from parents/guardians, is provided here:

**1. Has your son/daughter's attitude toward his/her studies changed since he/she began using the computers? If so, could you please describe the differences you have seen in his/her attitudes?**

Although some of the parents of the grade 8 students suggested that their children were now taking the computers for granted more than they did during the first year of the

project, a large majority of the parents of both the grade 7 and grade 8 students still felt that their children continued to be very happy to be able to use the computers for their studies. The parents reported, for instance, that their children were glad that they were going to be able to continue to use the computers in grade 9.

As the following quotations indicate, many of the parents felt that their sons and daughters attitudes toward their schoolwork improved as a result of being given computers. In the first two quotations, parents reported that their children's levels of confidence and enthusiasm increased dramatically after they became proficient at using their computers.

> *My son didn't like writing at all and, even though they have to write on paper their ideas first, he seems a lot more enthusiastic about just writing stories or ideas, or anything that way. So I think that's been a positive improvement.*

> *My son didn't like to write at the first of the year (especially reading journals, he hated doing reading journals every week) but now he can type them at home on the computer and bring them in on his memory stick, and load them onto his laptop and he's all set. He doesn't complain any more; he's quite happy to do it. He can now type faster than he can print or write. In general, I think he is more enthusiastic, just about his work. He doesn't even seem to mind doing homework as much, which they don't get the laptops for, but he just gets it done. I definitely think there have been benefits.*

In the next set of comments, parents pointed out that their children's organizational skills improved as a result of using the computers.

> *I know when they received their blue tooth my daughter was excited about that because she could stay ahead of her projects and whatnot, at home. So that was kind of a nice enhancement. Anyway, I know she liked it very much when they received those.*

> *My son said he finds it a lot easier to stay organized. Everything has a place, right in the files. He says he can keep track of things better.*

> *I have two kids, and the first one never really did have any problem with homework. And the oldest one was like a nightmare, last year, before everybody had computers. This year he is totally changed and is doing his homework. I don't know if it is the computer again, but he is like a totally different kid with his homework. So I am just thankful.*

In the following quotations, parents reported that their children demonstrated the ability to express themselves and to be independent.

*They can use their own personality whereas before I suppose if they were given a project to do they had to do it this way. Now they get so many projects all the same, and they can really express themselves, you know, pick out different things that suit their personality.*

*My daughter is home sick today. And, before she had her homework brought to her, she went online and something had already been emailed to her. So she was able to get her homework early, before her homework actually made it to her. I'm just finding major independence, that way.*

The next remarks indicate that the parents felt that their children's attitudes were positive toward the computers because their technological skill levels have improved.

*My son has fine motor skill issues, so what might be easy for another student in class to take notes, and to do assignments, like written stories, would be more difficult for him. And with having the laptop, he is more likely to complete a lot more work in school, and whereas a lot of things before were a big fight, even getting him to write a story, he's very forthcoming with writing them now and one of the things that he really likes to do is bring home the memory card. He sees that as beneficial to him when he has to complete something. So I know that he, in particular, because he has always been interested in computers, it's made a big difference for him.*

*My son is enjoying it more. He likes working on the computer as opposed to taking notes. He can't spell worth beans. He likes working on the computer. And I find he's very excited about working with the laptops.*

*I think anytime they're enjoying more, they're learning more. Certainly they're soaking it in more.*

*I know that my daughter, before they started the computers in grade 7, had very few computer skills. We had a computer at home, but it was one finger. She had very little exposure to it because it was a business computer, so she wasn't allowed to use it. But once they got word about the program, she was really anxious, she couldn't wait, and it amazes me now, what she can do. She's far beyond me. She embarrasses me to death. I mean I'm asking her how to do things.*

2. **What new skills do you think he/she has developed as a learner since he/she started to use the notebooks?**

The parents who made the following comments identified keyboarding, preparing and giving multi-media (PowerPoint) presentations, installing software, taking and

transferring digital photographs, and using a word processor's thesaurus as some of the skills that their children have acquired as a result of being involved in the project.

*My son spends a lot of time on the computer and I have seen a significant improvement in his keyboarding.*

*Well, presentation-wise, being able to put their work into something that's presentable and then to be able to do the presentation with the work. I think that's—I mean, she's leaps beyond what I can do. When I have to do presentations to boards and, you know, corporate meetings, I'd rather send her.*

*The PowerPoint is a great thing. Sometimes they do it too much. But I think it is a great way for them to get in front of the class and to develop, you know, their verbal presentation because I know public speaking and the speeches they do, they're all scared to death of them, whereas this is giving them another opportunity to speak out.*

*They can be very creative with the PowerPoint. They can do different graphics, and add different things. It enables them to do their research on the Internet. But I am amazed at what she can do. She has her own website. She's got two or three that she works on at home and she finds it fun. She's constantly at them, adding pictures, deleting, changing, putting in text, and everything.*

*I know mine knows where to go more than I do. We installed XP and our daughter knew how to put a new user on there. She knew how to add all these different things, things that I had no idea. I just thought she knew her way around the computer a lot better than I did, and I work on one every day.*

*This activity that they did the other day, you need to have a picture. If you've got one on your page, you can download it. If not, you can use a digital camera. They were just whipping around and the digital cameras were going and it was just amazing.*

*My son, I know, always uses it [the Microsoft Word thesaurus]. He always used to get out a dictionary or something like that. He would much rather use a dictionary on a computer, a translation for French things, looking up synonyms, antonyms, all that kind of stuff. Much rather do it on the computer than open up a book of them.*

**3. Have his/her marks improved, stayed the same, or deteriorated since he/she received the computers?**

While the parents generally did not feel that their children's marks had changed significantly as a result of using the computers, they did not feel that this was an issue for them. A few parents noted that their children had enjoyed a definite improvement in the grades specifically because they had fine motor skills difficulties before they were given the computers.

> *Well, as I say, the marks are where they always were and the tests are coming home the same and everything's getting done so, obviously, it's working. So it's just a new way for them to learn, what we just, we're not used to.*

> *She has a fine motor skills problem and she said it was just an absolute godsend to her. All her issues were writing notes in class. Trying to get the message from what the teacher was saying on to the paper, trying to get it from the board to the paper. And her marks have jumped, like, significantly, from straight Cs to mostly As. And just because of the laptop.*

> *For my son, I think his, on a couple of subjects are a little higher because of the fine motor skill issue. And, I think, also, because he can do more in class. But some subjects, like math, for example, I don't think a laptop would impact that as much. But things like, you know, language arts, I think it has helped.*

**4. When you think about particular subjects that he/she has studied, have you noticed changes in the ways that he/she has been learning those subjects?**

Several parents were unable to answer this question because they felt that they had not seen enough of their children's assignments to be able to judge. While there were mixed opinions about whether or not they wanted their children to be allowed to bring home their computers, most parents did wish to see more of their sons' and daughters' assignments. Not all parents had computers at home that were compatible with the notebooks, so, even when their children brought home their memory sticks, the parents did not always have the opportunity to view their major projects.

> *With the PowerPoint and the projects, I really don't know what my kids are doing for projects, because they don't bring them home, so maybe that's a little bit of a drawback.*

Nevertheless, as in the first year of the Dedicated Notebook Research Project, many parents felt that their children had made definite gains in understanding in specific subjects because of the computers.

*My son's biggest change is probably French. He is a kid who has not liked French. It has been his battle since about grade two. He has gradually been getting better at it. But this year we have not had a lot of complaints about it. They've done a lot of project work, PowerPoints about different things. He's been looking up online and translating things, so it has really changed his attitude about it.*

*Story writing, there was actually, I think, a story which my son wrote which I think was his big breakthrough story this year. He went from not being able to write something to writing something funny. After he was done reading it to the class, he asked if anybody wanted a copy. He printed off some copies because it was on the computer.*

*Our son was saying he put together a science PowerPoint. They were taking the digital pictures of simple machines that the class had to find.*

**5.  Generally how do you feel as a parent and a taxpayer about the fact that your son/daughter is using a notebook computer at school?**

The responses to this question were very positive. Clearly, the parents were happy with the government's decision to extend the project to grade 9.

*I would be heartbroken as a taxpayer for them to shelve the whole project, after this much of an investment. As a matter of fact, I would be downright upset as a taxpayer if it went this far and then it was canned altogether. That, to me, would be the ultimate heartbreaker.*

*I think it would be foolish to just give them a little taste and then withdraw it.*

*I think it's great, to be honest, because, especially if you do have some kids who maybe, for whatever reason, they don't have a computer at home, they're going to get the exposure, they're going to get used to them and learn to use them. And the reality is that you have to know how to use the computer. So I think it's something the province really has to do. You know, you have to keep up with the times. We're supposed to be educating our kids.*

*I think it enables some kids to be on a better playing field, or a level playing field because some families really might not have computers. And if their kids don't get that opportunity at school, then it's going to be much more difficult for them.  So I see that as a very positive thing overall.*

The parents in one focus group, however, did have a serious discussion about the relative merits of textbooks and notebook computers. Some of them wondered if the students should be given more opportunities to do regular library research, for

instance, and they also wondered whether computers or textbooks were the more cost efficient way to provide children with information. In the end, they concluded that their children needed a balance between book research and computer research activities.

> *The textbook curriculum is extremely expensive, and I don't know if that cost comparison has been done yet. But there should be some numbers put to what is the cost over a period of twelve years to provide textbooks for children and what does it cost over twelve years to provide that same curriculum on a laptop.*

### 6. What is the one most interesting thing that your son/daughter has told you about how he/she has been learning?

The following two responses were indicative of the kinds of answers that parents offered to this question. In general, parents felt that their children were engaged in interesting computer activities, because they claimed to enjoy doing them. But they were not very well aware of what specific types of activities their children were doing, except in those instances where they were able to see their children's assignments on the teachers' homework blogs.

> *One thing that my son talked about first was emailing between him and the teacher. I kind of liked that; I thought it was kind of neat. And he hadn't really done any emailing before so that was a new computer use that he discovered this year.*

> *The presentations that the students did, the social studies one, they had to advertise coming to the New World from Britain. I thought that was kind of a funny one.*

### 7. Is there anything else that you think I should know as a researcher about the experience that your son/daughter has been having with the computers?

In this final set of answers, some of the parents' appreciation and concerns are evident. For instance, in the first quotation, the parent is happy that his son has had an opportunity to experience a very different type of learning in grade 7 than he had encountered in his first six years of school.

> *I'd just think, personally, my son comes home and he comments that he enjoys it. You know, having the experience of doing his whole year in a completely different way than he has for the first six years.*

In this second quotation, a parent shared the view of many, that it was still possible for children to waste time on the computers even though the computers do not have MSN or other chat room software installed.

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> *I know my children, well, they've had the issue that some of the kids, when they're supposed to be doing their research and working on something, as soon as they're behind that screen they're emailing.*

Finally, in the following comment, a parent argues against those who are concerned about notebooks being stolen or lost. She points out that there will always be some loss of equipment and materials and that this is not a justification for denying children the opportunity to bring their computers home with them at night.

> *And as far as losing things goes...You always heard of kids getting their books stolen at exam time or would lose notes too. Kids lose their books. My daughter had her book bag stolen right off the school steps, so… You know, those things happen too, with the old-fashioned ways, if you want to use that, so the risk is there regardless.*

While all of the parents were happy that their children were able to use the computers to do presentations, some nevertheless expressed a concern that their children did not seem to be doing as much homework or as many essay assignments as they used to do. The students explained this phenomenon by pointing out that they are able to do much more work now and do it more quickly on the computers during class time at school. Thus they have less homework, but are getting more work accomplished. The researchers have observed a great many writing assignments in all three schools, and believe that the parents who are concerned about this have simply not had the opportunity to see the work that is housed on their children's computers at school. This situation could be remedied by having some of their assignments printed out each semester and sent home to the parents to keep them better informed about their children's progress.

In summary, just as at the end of Phase I of the project, parents at the end of Phase II generally spoke very highly of their children's experiences with the notebook computers. In particular, it is important to note that the grade 8 parents who had now been involved in the project for a year and a half, had developed a strong feeling that their children were fortunate to be able to take the computers with them to grade 9.

# Chapter 5:  Teachers' Views

## Introduction

In this chapter, the teachers involved in the project express their views about their experiences during the time that they have been involved in the project. First, individual teachers of different subject areas share their thoughts about how the computers influenced their teaching practices and their students' learning experiences. Then, several of the project's teachers provide their final thoughts on what they have achieved to date and what recommendations they have for other teachers who will be using wireless notebook computers in their classrooms in the future. Some common points raised by these teachers include the following:

- Students had dedicated access to resources online. Computers were used frequently for research and word processing, and no one had to share resources.
- Students were able to present projects in a variety of ways.
- Students were more engaged with their learning, since they were comfortable with computers and felt that they got "real" results. (i.e. Their written work looked more professional. Their research was in the real world, not in a packaged text book, and they used the same tools that working people use.)
- The computers helped students who did not use computers much at home to become more comfortable with technology.
- Teachers allowed their students more freedom to find their own way of presenting and researching. There was less need for the teacher to lecture and more need to facilitate. In other words, teachers became facilitators of learning more than the source of all information.
- Teachers learned more about technology.
- Because students were more engaged in their learning experiences, they were less likely to miss classes.
- Students' interest in learning increased.
- Struggling students produced higher quality projects and advanced students had enriched experiences because they could direct more of their learning opportunities.

## A Math Teacher's Experiences

One of the math teachers in the project pointed out that traditional methods of teaching mathematics have involved lesson delivery followed by practice questions. The introduction of technology into his classroom, however, enhanced these traditions through the efficiencies created by more dynamic and effective presentation of material, hands-on access to student-controlled materials and a focus on creating independent, student-centred learning activities.

*Lesson Presentation*

The technology resources in his classroom permitted the accurate and efficient presentation of curricular concepts. While traditional chalkboards or whiteboards limited his ability to develop math concepts, by using technology, he could present content in a logical and dynamic manner that engaged his students' attention.

He observed that there are many effective presentation tools available for teachers and students alike. The development of a set of dynamic PowerPoint presentations, complete with animations that help build students' understanding, one piece of the puzzle at a time, has proven to be a great use of technology and a valuable teaching aid in the classroom. In class, he used presentation tools to develop the students' knowledge. His lessons could then be easily reviewed and annotated, and the annotations were saved, placed in the shared drive or posted on the class blog.

The WACOM tablet proved to be an inexpensive, yet powerful, tool in this endeavour. It permitted him and his students to transform the projector screen into a virtual chalkboard, complete with drawing tools and writing instruments. Through the transformation of documents into jpeg images and the use of simple programs such MS Paint, the screen was brought to life, allowing his students to share their work, which could then be saved and posted. In addition, he created simple templates for graphing and used them to teach concepts such as coordinate grids. These were then shared and used by students.

He also used SmartBoard technology in his math class. The free SmartBoard tools software package proved valuable as an enhancement to his instruction. The use of this software was limited during the first two years of the project, but he expects that its usage will expand in the future. Excel was another powerful program that he used to teach his students ideas such as basic graph construction and selection. The graphs he and his students created were cut and pasted into simple word processor or presentation software to allow for comparison activities.

The math teacher was able to utilize SmartBoard software, utilizing the projectors and the WACOM tablet, in a variety of ways to demonstrate some basic concepts to the class as a whole. The powerful graphics and ability to manipulate objects allowed for ease of demonstration. SmartBoard tools even allowed him to capture a picture or video of an activity, which he could then save and share later with absent students, or students who were just in need of a review, through the shared file drive (or maybe even the blog).

Future students' computers will have the SmartBoard tools software loaded on-board. This will allow students to have the same ability as the teacher to manipulate a vast array of graphics and tools. Possibilities exist to have students use these graphics for both learning and assessment purposes, with graphic images or even short videos of their manipulations and work-in-progress being shared with fellow students and teachers.

The use of video also proved to be effective in delivering mathematics instruction. Either as a whole group or in individual learning centres, there were a vast number of short,

interesting videos that were available through United Streaming that reinforce student learning of a wide variety of concepts.

*Lesson Review for Absent Students*

According to this teacher, one of the more difficult challenges for many of his colleagues is meeting the needs of students who are absent for a day or more and who need to catch up on concepts. In the past, this would have required the teacher to supply the student with notes and remedial instruction. When this happens for several students over several days, it can cause teachers to be in a continual state of catch up. Additionally, students who are unsure of a previously taught concept may place unnecessary demands on the teachers' time.

By using the shared data drives that are available to each student, he argues, students have greater responsibility for their own learning. All of his lessons, complete with in-class annotations, were maintained on the shared drive. If a student missed a lesson, or needed clarification of a concept, their first stop was to use their notebook computer to access the shared drive where they were then able to review or copy the lesson. This allowed them to walk independently through the lesson, step-by-step, at their own pace and on their own time (e.g. noon, before school, etc.).

He believed that students were not being abandoned to a cyber-teacher. They still needed to make their first effort on their own to capture the concept. If they continued to falter and needed assistance, then they sought assistance from a teacher. However, his experience was that, for many students, a simple review of the lesson with the possible assistance of a peer often enabled his students to build understandings without his intervention.

*Assessment Review*

The New Brunswick Department of Education mandates a provincial mathematics assessment at the end of grade 8. There is also a district-wide assessment at the end of grade 7. One of the challenges that are therefore faced by teachers is to prepare students for these assessments. This is traditionally done through the assignment and review of a number of general questions supplied by the Department of Education Assessment Branch and other questions compiled by teachers. This math teacher pointed out that there are a couple of technology advantages available in this process. First, the gathering of all the years' lessons, complete with annotations, on the shared drive provides students with immediate and efficient access to whatever concepts they might need to review during this preparation period. In addition, the posting of these review collections on the homework blog and the subsequent posting of the annotated answers permit efficient and on-demand access by students to review questions and answers. This is especially important for students who have been absent. Experience has also shown that email has been beneficial to share questions and generate dialogue between students and teachers outside of school time.

*Mental Math*

One of the three sections of the Middle Level Mathematics Assessment is Non-Calculator Math, a series of timed questions designed to test students' ability to utilize various strategies to solve common math computations, which is critical in doing mental arithmetic and estimation.  The mental math skills of most students across the province tend to be poor.

The Middle Level Mathematics Assessment has 12 questions that students have two minutes to complete, or more commonly, not complete. In preparation for the assessment activity, a six question template has been developed that can be used to review various questions and strategies. A PowerPoint template can be loaded with common questions from review sheets. Reviews are quick and efficient, without additional paper other than a math notebook. Students have one minute to answer six questions followed by a class review and self-assessment.

*Virtual Manipulatives*

Manipulatives play a significant role in developing understandings of mathematical concepts for many learners. Managing algebra tiles, dice, blocks and other physical pieces promotes the building of connections between mathematical representations and corresponding physical reality. Acquiring and managing standard manipulatives can be a challenge in many schools. Small schools often lack the resources to purchase class sets of manipulatives, while larger schools face the task of sharing what they have among many classes.

One-to-one technology permits individual students the advantage of having a large assortment of manipulatives on demand.  Many web-based manipulatives are available for a variety of mathematical concepts and grade levels.  The most complete set is located at the *National Library of Virtual Manipulatives*, but many other websites support a variety of different virtual manipulatives. Virtual manipulatives have all the benefits of standard manipulatives. Students are able to control objects, but these manipulatives have the added value of being immediately available on demand (in a variety of settings). They are easily managed and do not need to be replenished. As web-based education sites continue to flourish, the availability of concrete and realistic virtual manipulatives should become even more abundant.

*Blogs*

The transition from traditional methods of home-school communication (journals, telephone hotlines, etc.) to web-based "blogs" has been one of the tremendous successes in the project. Besides homework reminders, blogs supported the delivery of the math curriculum in three ways. Firstly, graphics could be posted on the blog for students and parents to review at home. This might include an important part of the day's lessons (work on the screens can be captured as a jpeg graphic and posted), review sheets (complete with annotated answers) or other support material.

Secondly, many websites have valuable review and reference material and interactive worksheets that students might use outside of school. Links to these sites can be posted for parents and students to access.

Lastly, an independent work ethic has been encouraged by posting a "Problem of the Week" on the blog. Generally posted on Monday and due one week later, its exclusive availability on the blog serves two purposes: to create an ethos of student responsibility for their own success and to build visibility of the blog as an important venue for information.

*Math Tools for Special Needs Students*

One of the issues that many teachers struggle with is the differentiation of lessons to meet the needs of students who possess various ability and knowledge levels. Technology can be a powerful tool in enabling teachers to achieve this objective. Whether their students just need some extra time or a completely individualized plan, the access to technology and resources can make planning for various levels much more efficient.

Because of a medical condition, one of the girls in this teacher's class functioned in math at a grade 3-4 level, so his challenge was to find instruction time to assist her on an individual basis. Fortunately, a teaching assistant was assigned to help this girl on a half-time basis, and this teaching assistant was able to use individual web-based resources that are available online to assist the student to manipulate, self assess and demonstrate her understanding in these areas. With the help of these web-based resources, the girl was also able to grasp some of the basic concepts that formed the foundation for the work the rest of the students were doing in the class. Through the introductory lessons and online generated self-assessment sheets, she was able to participate and to receive feedback without being a huge burden on the teacher. Thus the girl succeeded at her objectives and felt that she was a part of the class too.

Without one-to-one technology, one of the boys in the class would have had very limited participation in class activities because his ability to follow and review lessons and to build concepts were delayed due to his severe visual impairment. Without one-to-one computing, the burden placed on this student and his teacher would have been onerous. Traditionally, he struggled to see classroom demonstrations or to copy down notes off the board. But, because he had his own notebook computer, he was able to follow lessons, his materials were self-manipulated giving him a sense of independence, and he became a more efficient learner.

Technology in this math teacher's classroom proved to be a natural differentiation tool. The many web or computer based resources that he had at his disposal allowed his special needs students to start at primary concept levels and to then grow in understanding to the point where some of them were able to challenge students who were working at higher levels.

At first glance, many educators deem mathematics to be outside the influence of one-to-one technology. However, after two short years of experience, this math teacher found that the impact of notebook computers on both teaching and learning proved to be significant. The technologically rich environment gave him the ability to create dynamic lessons using a variety of media, supported by student-centred resources and efficient communication of ideas so that through a variety of approaches he could develop his students' mathematical understandings.

**An English Teacher's Experiences**

When a grade 7 English teacher described some of the lessons she had enjoyed teaching in the past and that she felt worked well before she used computers, it was clear that she was experienced at attempting innovative approaches to teaching. She remarked that when she first taught grades 6 and 7, she used many learning centres.

> *I had a really good pilot program on teaching enrichment at all levels, and so I really got into project based learning. I've always done a lot of group discussions and co-op groups and things like that. So I've tried different things and tried to keep up on new approaches. I've gone to workshops and in-services. I don't mind trying new things, new programs.*

She observed that she had experienced a lot of technology opportunities in her school, and that this predisposed her and her students to adjust quickly to the notebooks. "The kids have been exposed to a lot of this stuff, and that has helped. But the mentors are really great. The technology mentor asks, 'Well, what are you going to do this week?' And then he finds things for me and emails them and lets me check them out… It's been a big help."

One of the problems that she encountered was that some of the students did not have computers at home, and so they were not able to take homework home on their memory sticks. Another problem was that some of the students lacked strong keyboarding skills.

When she was asked how her teaching approach had changed as a result of having notebooks in her classroom, she said that as far as her teaching approach was concerned, she had certainly made greater use of the technology. She was now more inclined to go to a site and project something for the whole class to view. As she remarked, "It's not really a different teaching approach, but I certainly have used more of the technology than I ever have before."

Prior to this year her students used computers mostly for writing stories. She felt that in the past she made a lot of mistakes in helping them to do their research online. "I would say, 'Let's go on the Internet and find something.' I realize now that I have to find sites and give them some choices and say now this is where you can go." She felt that online research in the past was a waste of time because the resulting reports that students wrote often did not make sense.

Although she had been using computers with students as early as 1995, she said, "I have learned more and used more things [in this project] than I had in all that time." She really tried to use the notebooks in every period. "It doesn't always work out that way, but I really try and do something." She felt that she had not changed her teaching style. Nevertheless, at first she was nervous and this was not just because she was trying something new. She was also worried about potential political problems. "I just know sometimes what politics are like and what expectations are like." But to her relief, her worries proved unfounded. Instead, the computers became a very comfortable part of daily classroom life both for her and her students.

She found that she and her students used the computers in a very natural way. As she observed, "Correcting [writing] is so much easier. The mentor showed me how when they've finished writing their paragraphs they can email them to me to correct and I can highlight them and send them back. That is so much easier. That's been quite neat."

When she was asked how her students were progressing so far with the computers, she replied that most were doing very well but that two were running into some difficulties. She was not sure with one of her weaker students if he really did not remember, or if he just needed somebody to tell him what to do all the time. "But as far as using it and logging on and getting to where I want them to be, generally everybody's doing very well." She said that some other students were really helpful with her weaker students.

> *This little girl helps one of them all the time. I'd say there are two or three who are slower, but the rest are motoring right along. And one even got the computer to talk one day and they were all doing it, and I didn't know that a computer could do that. No, they're doing well. I can see progress.*

When she was asked if she noticed the students writing more than they used to do, she said, "I don't know if they write more, but they will edit more, which is usually something that is hard to get them to do." She could not really say that they were writing more, but she believed that they liked to write more. She said that when they wrote their reports, they still had to have an outline first. "They could type the outline if they wanted to, but they still had to have a plan."

This English teacher felt that for her, personally and professionally, the project was definitely pushing her to achieve what she had been planning to achieve for a long time, to become more technologically literate. Concerning her students, she said:

> *Just by the way my kids have reacted this year I see more focus on task than usual. I really try to plan different activities anyway, but I think I can see the activities really capturing them more. I think they will become more skilled in writing and editing because I think we will be able to do more.*

She hoped that the project would eventually improve her students' literacy skills and that it would enable her to differentiate their learning more easily for them as well.

Concerning the professional development opportunities that she had experienced so far, she believed that they had adequately prepared her for the work that she was doing. She was really happy that she went to Maine to see how the teachers worked at that site. "I'm glad about that and I'm glad that I've got the support that I've got, but I really don't want to be given too much professional development either. I really don't." Because she did not like to be away from her students too often, this English teacher had sometimes asked the teacher-mentor to provide in-service for her at the same time as he was working with her students. "If I need something, I'll say, 'I really don't get this.' For instance, he came in last week for an afternoon and we learned PowerPoint… I think it's been fine." In terms of time commitments, she found her workload to be quite manageable. When asked, "How has your workload changed now that the computers have arrived?" she replied:

> *I really haven't found the workload terribly bad. I really haven't. Some of the sites are just so neat. One of the guys on the notebook project showed us about this video site… You can go to a movie and take a clip out of it. You know if you are doing waves it might just be ocean waves. And so it might be a three-minute clip. I've spent ages just looking through these but it doesn't seem like a heavy workload because it's fascinating. I think as a teacher you say 'Oh, my gosh! Look at the resources that are right here,' whereas you used to have to order all this stuff you know. So I probably put in more hours than I really notice I do, but sometimes it's fun to just look.*

The only apprehension that the English teacher had about the project was that her teaching style might have been in danger of becoming a bit stilted because of the demands of the material that needed to be covered. She was not sure how it would work, and was worried about that. "For example, they want to do a collaborative project, which I think is a great idea, but I think it's something that the teachers should hash out maybe through the fall or as a summer project." She also found herself interacting with other teachers about the use of computers, and she expected to be sharing more ideas with them in the future. "I do talk computers more with the teachers and have been able to email sites to the teachers and say, 'Why don't you try this?' than I have done before." Generally, she was very happy with the changes that she and her students experienced in her classroom as a result of the project. She believed that the notebooks have been very effective in improving the skills and attitudes of the students in her classroom.

**A Science Teacher's Experiences**

One grade 8 science teacher was pleased to see that her independent learners did well with their computers right from the beginning. "If I asked them to research something, they did, and they were great at it." In September she found that some students were

afraid to do presentations. They didn't want to get up and actually present their work to the class. But eventually the computer and the projector became a safety net for them. "Now they all get up and they are not as timid to present their work." They had a sense of pride in what they had done.

Before she became a grade 8 teacher she had taught high school. Compared to the work her former high school students were able to do without computers, she felt that her current grade 8 students were now much better off, for instance, in terms of being able to do a PowerPoint presentation or knowing how to use Excel. Where, in the past, her students would draw pictures on a piece of Bristol board, now her science students were able to use a Flash program to create animated simulations. She found that their ability to present their work has improved dramatically.

She also found that her students have discovered that not all of the Internet sites they can go to contain the same information, and there are discrepancies in the information that they find in each site. "They are learning to sort out what is actual information, as opposed to something that's not true." As well as the computers, she likes to use other technology such as the Mimeo board, which works much like a Smart board but is less expensive. She also uses virtual manipulatives and software that enable the students to draw objects and then measure perimeter and area.

Some of her students can type using a keyboard more quickly than they can write with a pen. So she finds that their work is finished much faster and it is done much better than before. They have also learned how to use Microsoft Word's thesaurus function to figure out the meanings of words that are unfamiliar to them. As the teacher points out, "If I email them an assignment and they don't understand what one of the words means, they can just right-click and Word will find a synonym or an antonym for it."

For one of her science projects, she has the students make a PowerPoint for a simple machine, but they are not allowed to find images of these machines on the Internet. They have to go with a camera and take an actual digital picture of the machine. The students roamed the school and playground looking for objects to photograph while they said to each other, "We need to find a third-class lever," and "Where is the fulcrum and where would the load have to be?" They used the digital camera to capture and download images of simple machines into their PowerPoint presentations. She said that their presentations were wonderful and that this activity taught them how to find objects and then download the photographs that they had taken onto their computers.

> *Some of my science kids built models that were like the Rube Goldberg model, and they used the digital camera to videotape them. They made very quick clips that showed the whole process. Then, when they presented their projects, they explained what happened and they didn't have to continuously be using the machine. Instead, they used their video that they had taken.*

She has found that there are many excellent science sites on, for example, how to dissect a frog. "Sometimes it's just a spur-of-the-moment thing and you say, 'Oh, well, let's look that up,' or 'Let's go on Google,' or 'Let's go there.'" She felt that it would be extremely hard to go back to having to book a regular computer lab and to be forced to fit an activity like this one into a specific time frame.

**A Technology Teacher's Observations**

A technology teacher in one of the schools taught 11 to 15 different modules that integrate technology in a variety of ways. Her students were also involved in Grassroots projects and the SEVEC Exchange through Industry Canada (both of these involve using technology to create a variety of projects from word processing to designing Power Point presentations, web pages, newspapers, T-shirts, calendars, story books, movies, e-mailing, etc.) and they have worked on collaborative projects nationally and internationally (e.g. Saskatchewan, Jordan, Netherlands, Slovakia, etc).

When she was asked what the benefits of having notebooks in her school were, she responded that teachers used their notebooks every day. Many used them for management tasks (marks, lesson plans, making tests, etc), communication (e-mail), classroom and school presentation work (PowerPoint). Teachers were also exchanging lessons and sharing information across teams. She felt that teachers enjoyed the flexibility, mobility and accessibility notebooks provided. "Our teachers have shown a keen interest and willingness to learn. This has been shown through their willingness to stay after school (as well as their summer holidays) for workshops."

Because time is an important factor with teachers as they successfully implement technology and learning, she felt that notebooks gave her and her colleagues opportunities to explore software and applications at home rather than spending extended hours and weekends at school. They allowed teachers the opportunity to take their work with them wherever they went; from classroom to classroom within the school as well as when they left the building. Having a notebook allowed her a more constructive approach to teaching. She felt empowered in her classroom.

> *I had a greater sense of control over my responsibilities for instruction and managing student learning. I changed my methods of teaching to student centred/project-based learning. I gained greater confidence working as a facilitator. I enjoyed the flexibility and versatility of bringing the computer from class to class, to meetings and workshops. It helped me cut down on the long hours I spent at school. It allowed me to collaborate and build lessons with other teachers online and in my school. It gave me a greater range of resources for use in lesson planning and preparation and in teaching. I have had more freedom to access the Internet more rapidly and to make use of electronic resources and to create my own resources more easily. It gave me easier manageability of recording marks and tracking students' progress. It has improved communication*

*between me and my colleagues, students and parents.*

When she was asked what effect the notebook computers have had on her teaching, she said that they have caused her to rethink not only what she can accomplish within her school but also what she can do globally through collaborative projects with teachers in other places.

> *I have a greater range of resources from which to prepare lessons for all levels of students. I have become familiar with software packages before having to introduce them to the students. I have become more confident and competent in my ICT use. I have chosen what I want to work on at home and what I will do at school (flexibility/portability). I have chosen to facilitate more than to lecture (project based learning, hands-on, student-centred projects and activities). I am now able to produce higher quality teaching materials and to develop better classroom management skills.*

She felt that the notebooks improved her ability to communicate with colleagues, students and parents. By teaming with colleagues she found that she could use the computers to cut down on the amount of time it took to prepare teaching resources. As teachers build resources, they are easily sharable. Generally, she felt that it was easier now for teachers to be mentored by those teachers who are more skilled in using ICT.

In terms of her interactions with her students, she felt that the notebook computers enhanced their motivation to learn. Her students were more focused and they required less external motivation from her in order to stay on task. Her student-centred learning or project based learning allowed more interaction between her as a facilitator and her students as independent learners. Also her students interacted more with each other and were willing to help and instruct each other and to attempt higher level learning activities. Her students were more excited to learn and they had an increased ability to work in groups. The computers provided more opportunities for students to pursue their own interests and questions, and to make decisions about how they found answers and solved problems. They also provided opportunities for interdisciplinary learning. Thus she was able to become more of a coach and facilitator and the students were able to be more self-directed learners. She felt that she and her colleagues were shifting away from the classroom practices of short, isolated, teacher-centred lessons and instead were emphasizing learning activities that are long-term, interdisciplinary, student-centred, and integrated with real world issues and practices.

## Observations of Teachers of Students with Special Needs

One of the regular classroom teachers who had several special needs students in his classroom found that, because these students each had their own dedicated notebook computer, there was a great deal that he and the teaching assistant and resource teacher were able to do to help these children follow their specialized programs within an inclusive classroom environment. He pointed out that his teaching assistant has become

more of a facilitator than she used to be, and that she has "taken on more of a teaching role than before." At first, the teaching assistant was hesitant to use the computer, but then the teacher-mentor gave her some lessons. "Now that they're more comfortable with how the machines work, I find they are starting to troubleshoot problems for me with my modified students."

One student the teacher worked with was well below grade level in terms of his reading, writing, and numeracy skills. To help him with his base ten blocks, the teacher found him a program that used virtual manipulatives and gave the student immediate feedback when he attempted to select an answer.

> *Just seeing problems in a variety of different ways, because we've loaded a couple of different programs that present the same information in several different ways, has helped him to tune right in to math. If you can get his attention on something, you're doing well. Our school technician put on the e-tools program that she had that showed him how to use money as a manipulative. It uses Canadian money, so he has recently started using that, and now he can figure out his change and how much money he needs to buy his lunch.*

When this particular boy was initially given his computer, the teaching assistant and the teacher were concerned because they did not know how he would react to it. At first, he just pounded on the keys repeatedly; he could not figure out that he needed to allow the machine to complete its operations before proceeding. But he eventually learned to overcome his impatience, and now he knows how to make a PowerPoint presentation all on his own. He can write a journal entry in a word processor and save it on his network drive, and email it to the teacher. So this grade 7 student, who reads at a grade 3 level and has ADHD has "learned a lot of skills that aren't measured anywhere in the curriculum guide." The teacher felt that, without the help of the teaching assistant, the computer would have been of little assistance to this particular student.

> *I was getting nowhere. Until the teaching assistant was on board, I was just spinning my wheels. The laptop had just become more of a problem because, when students like this young fellow had received a notebook, they had no skills to use it. And he was just fouling the thing up, pressing every button. I think the teaching assistant really enjoyed gaining the knowledge of how to use the computer as much as the boy has... The machine has really taken a lot of the housework out of trying to teach a student with such a modified curriculum. It's nice that he, with the help of the teaching assistant, can put on a set of headphones, and can watch the manipulatives move across the screen, because he wouldn't use regular manipulatives before. They frustrated him, and so, for him to watch the computer move them around as it said everything that it is doing through the earphones, was very helpful.*

Before the student received his computer, it was a big challenge for the teacher and the teaching assistant to interest him in writing. This problem soon disappeared when he was able to write on the computer. However, the new problem which then emerged was that he became obsessed with changing the fonts on the work he was writing. So, the teacher wrote on post-it notes which font the student was to use for each assignment he worked on. "I taped them right to the base of the notebook, what font I want it in, what size of font, and what program and where I want it saved." The boy became an avid writer and was happy that his teacher and classmates could read what he had written. "It's nice when he has stood up in front of the class and presented a PowerPoint presentation, just as everyone else in the class had to, for a particular topic, and his writing didn't look any different than anybody else's, because he typed it in, and had it spell checked, and made the slides."

As well as the teaching assistant, this teacher also had the help of the school's resource teacher to reach this boy. When the resource teacher was asked about his own role in helping this boy to be a more effective student, he commented on how the team of the teacher, teaching assistant, and himself was able to use the boy's computer and their own computers to keep up-to-date records on the boy's progress and on the adaptations they were each making to his particular curriculum. "This is what we call a living document. It isn't fixed, paper, like the old type. You see for this boy, now I go in, and because I am an administrator of this record, a resource type, I can, for instance, fill out a lot of information. In the past, the resource teacher's paper files on the boy were not very accessible to the boy's teacher and teaching assistant, and they would be revised infrequently. Now all three professionals can make notes on the boy's files immediately while they are working with him.

> *From an administrative point of view as a resource teacher, it's like I've cut the umbilical cord, and I'm able to have mobility. I'm able to take the computer home and work on it whenever I like. I can work on an SEP when I am on duty in the cafeteria. I never had that flexibility before.*

When the resource teacher assisted three special needs students in his office who were all studying the movie and novel, *The Outsiders*, they used their own word processors and DVD players to work through their assignments at their own pace. "That's a big plus for technology because, ten years ago, some of these kids wouldn't even have been in school."

When the computers first arrived at the school, it was the resource teacher's job to find appropriate materials in math, social studies, and English for the special needs students. The team of the resource teacher, the teaching assistant, and the teacher gradually began to work together in a new way. The teaching assistant started asking the resource teacher to help her find specific websites for her special needs students to use. The teacher became increasingly involved with the special needs students and was able to include them in more class activities. The computer occupies these students for periods of time so that the teaching team can worked together in class to revise the students' programs. Or if the team is unable to get together at the same time, they can write notes to each other via

their computers as they all work on the student's common SEP document. For instance, the teacher has the capability of writing into the SEP a new accommodation that he finds to be effective, and he can then write in comments about why he has made these changes, which the resource teacher and teaching assistant can read later when they are working with the student. "So it gives the teacher flexibility to go in and make notes, to make changes that they see appropriate, to review it, to print it—unbelievable. I think New Brunswick is, without a doubt, one of the leading provinces in Canada, in terms of resource and where it's going."

**Final Observations of the Teachers**

During the final month of the project, in June 2006, the key project teachers from all three schools gathered together to discuss their impressions of their work over the past two years. At that meeting they offered many important observations and suggestions. The conversation began with their views about the successes that they felt they had experienced with their students. They all agreed that the computers motivated the weaker students to get to work and to stay on task. Where, in the past, these students were reluctant to put pen to paper, the teachers observed that they were now some of the first to open their notebooks each day. The teachers also felt that the computers were an "equalizer" in helping all students to be proud of the appearance of their work. As one of them observed, "When I was in school I would have been the messy one with stuff all over the place, and everything scratched out. Now, if they actually put the work into it, everyone can come up with pretty much the same quality of work." Their students were no longer as intimidated about writing assignments as they used to be. They were more willing to make an attempt and were better independent learners. "They are becoming very responsible, and their confidence is unbelievable."

*Successes*

The teachers observed that their students were more open to helping one another. If the teacher was busy, the students could go to the four or five students in the class who knew how to handle most technical problems and could receive help. They noticed that their students generally looked happy and prepared to help one another. "I find that there's none of that, 'Don't do that,' or 'Give me mine back.' They seem to really like learning from each other, a lot more than they used to."

According to the teachers, their students' assignments are much more interesting than they used to be. "They're really into it, perhaps because their work is being projected on the wall." The teachers believed that their students are living in a digital world and so having notebook computers to work with has brought more relevance to their education.

As their students have become used to the technology, they have become more sophisticated users of programs such as PowerPoint. Where, initially, they wanted to use as much animation as possible in their presentations, with more experience, the students have become more concerned about clearly communicating their ideas and less infatuated

with the superficial aesthetic features of the technology. They have become more visually literate, thinking about how their message and the form of that message need to be matched.

*Concerns*

When the teachers were asked to think of moments when things had not gone particularly well for them, they offered a number of examples. For instance, several of them identified a type of student they referred to as "flippers" because these children have a bad habit of flipping through sites instead of staying focused on the site they are supposed to be viewing.  As one teacher explained the problem:

> *We've had to actually take the computers away from them and say, "I'm putting that here until I'm done explaining what I'm doing, and then you can have them back."  I don't like doing that but at the same time, "The computer is nice but what I'm teaching you is more important right now. And, you know, I need to get you to focus on what I am saying."*

On occasions when the teachers were unable to get everyone's attention, they used the command, "Close and focus," to regain control of the class. This was sometimes the only way the teachers could be certain that everyone had understood their instructions. Another way that some of the teachers improved their ability to communicate with their students was to employ a listening enhancement device which involved the teacher talking through a microphone so that her voice was transmitted through speakers in the four corners of the room. One teacher described its use as follows:

> *It's a little like surround sound in a movie theatre. For the first couple days some of the children thought it was really loud. I had to adjust my voice because my teacher voice was too loud. When I spoke into the microphone I had to adjust to hearing my voice a lot more. But, after the first few days, the students became used to it and they could actually hear what was going on much better. When I turned myself to the side or had my back to them for a second and they could still hear exactly what I was saying.*

This technology, combined with the projector, made it much easier to capture and hold the attention of students, who had been raised on television and videogames. One of the occupational hazards of teaching is voice burnout. So the teachers felt that this device, when combined with the rest of the rich IT environment provided in this project, helped a great deal to keep their voices in good condition and to keep their students focused on their lessons.

Another concern that the teachers had about their students' love of the computers was that some children seemed to forget that they needed to socialize during recess and lunch breaks. They noticed in the mornings, for instance, that students would come into their classrooms and make a dash for the computers. Some teachers felt that they had to restrict

their students' access to the computers because, socially, it was interfering with the children's learning how to talk with each other.

> *Essentially, if you have kids who don't mix socially, that's what they do. So every once in a while we would just say, "No computers." They weren't socializing, especially the loners. They were becoming totally immersed in the computers all day. And we had to watch that.*

At the same time as the teachers were concerned about some students' antisocial behaviour because of their infatuation with computers, they also agreed that in other ways the computers actually improve the students' social interaction skills. In one school, for example, the grade 8 and the grade 4/5 classes did a project together. So, when the teachers were asked for more details about how social interactions had changed now that they had computers in their classes, they pointed out that some children who might normally be unskilled at interacting with other students gained some self-confidence when they were able to show other students how to do certain technical operations on their computers.

> *I've got a child in my class whose social skills are not great. But he loves computer games. Sometimes he'll bring in kids from the other grade 8 class during recess, and he'll show them things on the computer. So he gets to be an expert and show off.*

Another teacher believed that social interactions may have improved somewhat because the students were really anxious to show each other their work and they were proud of what they had produced. "You see kids walking around, sharing their work. Whereas before, without the laptops, they were more likely to just keep their papers to themselves." The teachers encouraged their students to do many projects, and they felt that these gave their students excellent confidence. They have heard students say to each other in the halls, "I love your project." They found that in the home periods in the morning and afternoon, their students used their time wisely by working on their projects.

The fact that the students were not allowed to take their computers home at night remained a concern for some teachers, although the use of memory sticks in Phase II of the project helped at least some of the students to be able to continue to work on their assignments if they had computers with compatible software at home. As one teacher stated, "To me, this program will not be a complete success until the computers go home. I still feel that strongly. Half our kids don't have the right software at home. They don't have Microsoft Office, so they can't do their work." The teachers believed that this software incompatibility has created a real divide between those students who can take their work home and those who must finish it all at school. For those who cannot take their work home, their parents are not able to see what their children are doing.

> *We really need to look at these computers as we do textbooks, as we do notebooks and pencils. These are the tools they need to work with. And just like I couldn't imagine not taking my computer home to prepare for*

*the next day's lessons, I think we're handicapping our children if they cannot take their computers home to do their homework... Where, before, for instance, posters went home, now parents just do not have any idea what's going on.*

*Communicating with Parents*

To solve the problem in the short term, the teachers make sure that the students accomplish as much as possible during the school day. Some teachers had an open house and the parents were invited to drop in at any time they wanted to watch their children at work. They saw how much work their children were doing and they understood why they did not have much homework. As one teacher pointed out:

> *Sometimes on a blog I'll say, "This is what we did today," and if there is no homework I'll say, "In math we did this and in English we're working on that." And then the parents can at least see what we're doing in the classroom. But the ones who came in, they thought, "They are working more than I have ever seen them work. Now I know why they don't have homework."*

*Changing Teaching Approaches*

When the teachers were asked if their teaching methodologies and student learning approaches had changed as a result of using the notebooks, they were quite certain that they had. One teacher said, "My biggest fear when I was chosen for this project (because I really didn't want it) was I didn't want to change my teaching style. But I think I'm a better teacher today because of the tools." Another teacher observed, "I find my presentations are so much more interesting. I love making up lesson plans now because I'm able to bring all this stuff in." The difficulty for some of the teachers became figuring out how to limit what materials they would use because there were now so many resources from which to choose.

As a teacher thought about a typical project that his students had done for years, called a biographical timeline, he realized that, because they were using computers, his students' work had become much richer and more detailed. Where, in the past, his students would have simply drawn a line and written one fact about each date on the line, now under each date they typed a number of facts about themselves, and then added a picture and three or four events that occurred in that particular year.

> *You know, like what song came out, what book came out, what movie was popular, maybe a world event. So that, all of a sudden, it was this timeline that was incredible because not only was it personal for them but it took them out into the world as well. It became an amazing assignment... I barely got out of my mouth what I wanted. I flashed up an example and they were all gone. And there they were and I thought, "Yes, this is it!"*

When the teachers were asked if they used textbooks any more, they said that most of the time they did not use them. For instance, instead of reading a chapter in a social studies or math textbook, the students are given a series of questions to consider, and are sent to various Internet sites to research their answers.

> *It makes Canadian history so much more exciting and fun... Now it's not about how to get the information. It's about being critical about the information they have. And I think about math, you know, it's so neat at the end of a lesson, when, instead of asking me, "Am I doing this right?" they are on a website that's telling them about it and they're putting in the answer and it's telling them whether or not they have figured it out.*

The teachers all agreed that the pedagogical paradigm had changed to the extent that textbooks were becoming obsolete. A teacher remarked, "I could easily do math and science without the textbook." In science, for instance, there are web-based and video-based resources.  As a French immersion teacher argued:

> *We're getting textbooks for francophones and, I mean, I hate that French science book. They don't understand it. They don't want to read it. Instead, now I teach my lessons using PowerPoint and video streaming. Then they go to Encarta en français and do some more research on the circulatory system. And they're reading more that way than they ever did with textbooks.*

Instead of paying fifty or sixty dollars for each textbook, the teachers suggested that the government should design a series of PowerPoint presentations and notes that they could distribute to the school districts. Then, when people are teaching about rocks and minerals, they can go to the Department of Education's Portal and download a whole geology unit. An English teacher remarked that most of the stories he uses in the textbook, *Responding to Reading*, are now available online. They all agreed that the provincial curriculum guides were the best sources from which to structure their teaching, and that the Internet and some software packages provided them, in most cases, with all the content they needed for their units. But they also felt that Department of Education curriculum coordinators should put in the curriculum guides lists of good websites and print sources to use when teaching various topics.

*The Need for Technological Competence*

Concerning the issue of what constitutes technological competence in their classrooms, the teachers believed that their students needed to be able to keyboard well, to use the functions of a word processor such as double-spacing and spell checking effectively, and to be able to organize their electronic file folders carefully. For some teachers, technological competence also included developing their students' media literacy so that they would be able to identify sites that contained faulty information. For other teachers, it includes mastering cooperative, project-based learning skills. To illustrate how students

demonstrate their technological competence, one of the teachers described the following project:

> *They did their own kind of economics project where they budgeted on their own in order to shop for a house or a car. I said, "Go buy all the things you want to play with, like, your iPods and everything like that." Then I said, "You might want to try Future Shop." But they went onto Future Shop to get a price and they said, "It's so expensive, so much a month. I'm going to see what else I can find." And, you know, they were organizing and trying to figure out the best deal. I never told them how to do that. I just said, "Try Future Shop." They were comparing prices and trying to get financing and everything like that. Wow!*

*Words of Advice for the Next Teachers who Teach with Wireless Notebook Computers*

Finally the teachers were asked what the Department of Education and the school districts should be doing in the future as this project is extended to more students and teachers. To encourage the kinds of creative pedagogical approaches and active student learning that they were able to accomplish over the past two years, the teachers recommended that a high level of technical support and professional development continue to be offered to the next group of teachers who are to use notebook computers in their classrooms. The teachers also felt that technicians in the project were busy all day long. As the project expands, they were concerned that, if there are not enough technicians, then students may be without computers for several days before their machines are serviced. Several teachers also pointed out that if the teachers are not given the opportunities to develop professionally, to take the time to learn skills, then their abilities to work with their students in the classroom will be hampered. Now there are not only a few seasoned teacher-mentors but also a core group of teachers who can help out staff in other schools as the project expands. One teacher offered the following observation about professional development:

> *I'm thinking that without proper professional development we've got some teachers on staff who are really petrified about the laptops that they're getting, whether they like it or not, and I'm thinking that, if they don't have some professional development to show them how to use the computers effectively, then what we're going to end up with is, "Open up your laptop, type down these notes that I'm putting, save it, close your laptop." They're not going to be successful because they won't have that know-how, and they're not going to have that confidence to move forward.*

When the teachers were asked what advice they have for other teachers about connecting with their students' parents, they said that electronic portfolios were very useful to show to parents when they came in to the school for parent/teacher meetings. They said, "Parents need to see what their kids are doing. Once they see, once they're part of it, they're fine." Referring to an open house when grade 4 and grade 8 students were asked

to come with their parents to the meeting, the grade 8 teacher who helped to organize the evening said that she made it mandatory for her students to be there.

> *We knew that all thirty of the grade 4 kids and their parents and grandparents, aunts, uncles, brothers and sisters, were all going to be there because this was the big thing: they were learning how to do PowerPoint presentations about the local fishing industry. So my students knew that the younger students were depending on them because they had to be there to get their computers up and running, to get the PowerPoint out for these parents to see. And when the parents of my students arrived, they were amazed at what the children had accomplished. There may not have been the detail that a grade eight student would have done because these were the grade 4 students' projects. Their role in the project was for my students to teach the younger ones a little bit about keyboarding, to teach them how to save a presentation, and to teach them how to use a digital camera and download the pictures onto their presentation. So it was about pride and it was about, you know, "Wow! My child taught this other child how to do this." After that night it became easier to ask the parents to come in.*

## Conclusion

Clearly, these teachers who have worked on the project over the past two years have made an important contribution to the education of their students through their creativity and hard work. As more teachers have the same opportunity that these teachers have described, it is likely that, with sufficient support from teacher-mentors and technicians, and through careful communication with parents, there is every reason to believe that many more children in New Brunswick will enjoy the kinds of rich and rewarding learning opportunities that the first groups of students have experienced in the Dedicated Notebook Research Project. Considered individually as math, or science, or English teachers, or listened to as a group, these educators who were the pioneers in this notebook project have shown convincingly that, because they were open to rethinking their teaching practices, they were successful in reshaping their curricula to help their students to become more technologically competent. At the same time, these teachers empowered their students generally to become more literate writers, researchers, and thinkers in an age where knowing how to find and use information electronically have become required ways of learning.

# Chapter 6:  Teacher-Mentors' and Principals' Views

The teacher-mentors and principals in all three schools observed a substantial change process as a result of the Dedicated Notebook Research Project. They felt that there was a new culture developing in the schools in which teachers and students were becoming interested in technology and everyone was seeing the benefits of using technology for administration, communication, lesson planning, lesson presentation and engaging students in active learning. When they first wrote their proposals to participate in the notebook research, the teacher-mentors and principals had no idea of the potential of wireless, one-to-one computers and that there would be so many technology tools and resources available. Since then, they have tried many new techniques for technology integration.

Some of the observable changes in staff and student attitudes and work habits observed by the principals and teacher-mentors included the following:
- An increased comfort level of teachers and students using technology
- An increased availability and use of electronic resources by students and staff
- An increased level of excitement and motivation of staff and students to use technology
- A willingness of staff and students to share ideas and knowledge
- An increased variety of learning activities and resources used with students
- An increased level of electronic communication
- Improved methods for students and teachers to present their work visually
- New ways of organizing ideas and work

In this chapter, we consider first the three teacher-mentors' and then the three principals' views about the introduction of the wireless notebook computers into their schools. Both the mentors and the principals reveal in the following pages their enthusiasm for the changes that they observed in the classrooms of their schools.

## The Teacher-Mentors' Observations

At the beginning of the research project, in the fall of 2004, the role of the teacher-mentors and the technicians was perhaps underestimated by the government. According to the comments of principals and teachers, however, the teacher-mentors and technicians have clearly played a pivotal role in the success of the project. One of the strongest points to be made about this research project is that where other jurisdictions and governments have decided to carry out similar projects without sufficient professional development and technical support, they have run into serious difficulties.

According to the teacher-mentors, the introduction of the HP notebooks into their schools' classrooms created a change in the way that teachers teach and in the way that students learn. Teachers used electronic resources that were previously unavailable and the combination of the notebook, projector and the Internet, along with other technology

tools to help students to learn using current resources, enabled them to present material in a highly visual way. The notebooks were very popular with staff and students. All of the grade 7 and 8 teachers in each project school were given a notebook regardless of whether or not they would be teaching the grade 7 and 8 students who were given computers. This resulted in the vast majority of teachers using their computers regularly. The teacher-mentors felt that the teachers employed a good balance between traditional methods and integration of the notebooks. The teacher-mentors observed that their teachers had students employ the notebooks consistently more than 10 hours per week.

The teacher-mentors felt that most teachers in the Dedicated Notebook Research Project became more comfortable using technology in the classroom as a result of professional development, mentoring and personal experience. Most staff took part in substantial professional development in areas that were of interest to them. The professional development program identified gaps in their technology skills through a skills inventory provided at the outset of the program. Personalized professional development opportunities were offered on an individualized basis. Most teachers took advantage of the individualized professional development opportunities while some teachers preferred to take part in professional development along with their students so that everyone would benefit from the learning.

The professional development initiatives were necessary in year one of the project, and most teachers spent time out of the classroom to improve their skills. After the initial professional development efforts, they expressed some reluctance to be out of the classroom as much. The availability of trained supplied teachers was lacking, and classes do not function well, in general, without their regular teacher. With the continuity of staff, fewer professional development days were needed in year two. The teacher-mentors felt that teachers preferred to be in the classroom. As one teacher pointed out, much of the professional development and curriculum development was done informally within the classroom at the times when the teacher ran into difficulties using the technology. Also, informal discussions about project ideas and technology resources took place while the teacher-mentors visited the classrooms, during breaks and after school. Teachers were quite open to trying new ideas and new technology tools that were suggested by the teacher-mentors. They pointed out that having a teacher-mentor available and in the classroom when teachers had questions was one of the best ways of overcoming problems that might discourage teachers from trying new methods of technology integration.

Teacher development in the areas of curricula and skills took place throughout the project. For instance, during the multi-aged science rotation in one school where teachers received a new group every 35 days, the teachers involved in this rotation continually changed their lesson plans to include more dynamic lessons integrating technology, even though they were teaching the same concepts each time. Their teaching and methods of delivery constantly evolved.

The teacher-mentors observed that teachers were using a more constructivist approach in the classroom. They did more facilitating while students were able to share knowledge

with the rest of the class through presentations displayed with the notebook and the projector. They were able to use the technology resources to create authentic learning situations by finding solutions to real world problems. The students worked collaboratively in groups and chose their method of presentation based on their individual learning styles.

The teacher-mentors felt that the overall excitement to share the new way of teaching was inspirational. The teacher-mentors and the students have created short videos and saved them in their online portfolios. One video, for instance, shows one of the project teachers and her students demonstrating the notebooks to a grade 3 class. Students at every level were motivated and the learning was evident. For example, one teacher gave up her preparation period to work with the grade 3 class. There seemed to be an increased willingness to share the new ideas among staff. The teacher-mentors met regularly with the main teachers involved in the project to discuss ideas, present learning opportunities, and help with technology skills.

The different teaching and technology preferences of the teachers were quite interesting to the teacher-mentors. All teachers utilized the resources very well, but there was a difference in the types of activities that they preferred. Some teachers used the online resources (e.g. math openers, Internet research tools, and online videos) that fostered thinking and class discussion. Other teachers wanted to create their own resources (multimedia presentations and videos) and have students create more long-term projects that had a substantial finished product. Few teachers felt that they had learned all aspects of integrating technology and most expressed an interest to continue to learn more in the future.

In the first year of the project, students created some long-term projects, but there were many activities that were not attempted until year two of the project such as personal portfolios, videos, and websites. There were several factors that likely contributed to fewer long term projects in the first year, including the initial learning curve, the late arrival of notebooks (January), the limited time period that students were with each teacher and the effects of the union job action on student-teacher contact time.

Multimedia presentations were one of the most popular methods effectively employed by students to present their work. For instance, one teacher capitalized on opportunities to increase student learning retention rates by having students present their multimedia presentations to students in other classes. These opportunities were effective in making students responsible for knowing their information, and it helped them to refine their presentation skills. It was also impressive to the receiving class.

Early in Phase I, the teacher-mentors worked with the technology teachers to present students with the basic skills needed to use the technology. The students learned to make multimedia presentations and web pages, they used digital cameras, and they learned to manipulate digital photos. Teachers also taught two-handed typing techniques. Having access to digital cameras motivated students. They found many opportunities to incorporate their photos into their projects. The cameras used memory cards that fit right

into the student notebooks. This feature made them very user friendly. The cameras helped spur student creativity and the teachers provided related activities such as student of the week pictures and a project bulletin board that helped students feel proud of their work and encouraged them to display their accomplishments for others to see.

Students seemed very motivated to use technology, and using it enhanced their learning experience. The teacher-mentors felt that with technology integration in the classroom, students developed solutions to problems by choosing from a range of tools. They sought answers to questions immediately over the Internet. Teachable moments were made more effective by having the projector and notebooks immediately available (not down the hall somewhere in a lab that has to be booked ahead of time). Students also had much to contribute to the teaching in the classroom. One teacher said:

> My students enjoy using the computers and seem more motivated. They have no argument when assigned to work on their computers. They seem more involved in the tasks I assign them. Students step "outside the box" and extend their research without being asked. They are proud of the work they complete, such as PowerPoint presentations, etc.

The process of change in the way that teachers teach and the way that students learn was the most noticeable effect, according to one of the teacher-mentors, of the integration of one-to-one notebook computers in the classroom. The change process did not just occur at the outset of acquiring the technology tools; it developed and blossomed throughout the project. Teachers built on the small steps initiated while more and more possibilities became apparent with successful integration of technology to teach the curriculum. The new classroom was more constructive in nature.

The teacher-mentors believed that teachers were transformed from rarely using technology in the classroom to making it part of their daily lessons and administrative procedures. Technology provided one of their primary methods of communication with colleagues and administration. The teacher-mentors said that the notebooks eventually became as much a part of the teachers' professional lives as televisions and microwave ovens have become a part of most people's personal lives. The notebooks seemed to just fit into the classroom naturally. The flexibility that wireless notebooks provided enabled project teachers to take them anywhere in the school. There were so many new ways of doing things in the classroom as a result of the new paradigm of teaching that resulted from incorporating technology. The sharing of resources and ideas, the increase in effective communication and the initiation of collaborative projects were all representative of the process of change. One teacher characterized the change by saying:

> When I am planning my lessons for my class, I find I am thinking more and more about how I can use technology in my everyday lessons or activities. It was difficult at first because, as a teacher, you had to learn what the possibilities were and it was all brand new. But, every time I tried something with technology that worked, I would become more confident in using it and expanding its use in another way.

The excitement of non-participating teachers was also an indicator of the success of the project. One teacher-mentor sent his notebook home with another teacher for a weekend so she could work on electronic report cards from the comfort of her home. (Her classroom computer was at a child sized desk; many of the elementary teachers had to sit at these little desks in order to use technology in their classrooms.) Another teacher used the notebook and a projector to show an online video to her class. Teachers became very interested in using the technology. The teacher-mentors believed that all teachers should have their own notebook and projector to use in their classrooms. The desire to use technology in the classroom is contagious.

Electronic resources were accessed in many classrooms as part of thematic units. Teachers used various teaching tools to help illustrate concepts and engage students in learning. These tools included: online digital videos; virtual experiences; concept maps; student-created videos and claymations; digital microscopes, which project images for all to see; and virtual math manipulatives. Students submitted assignments electronically, teachers marked assignments electronically and returned them to students for editing, events were recorded and documented with digital cameras on web pages, students created electronic storybooks that illustrated important lessons, and work was presented for all students to see at assemblies. The teacher-mentors observed that before the Dedicated Notebook Research Project took place, none of these uses of technology would have been seen in most of the classrooms in the three anglophone schools that participated.

The teacher-mentors gathered videotaped interviews of some students involved with classroom technology, and they created blogs for students to write journal responses about the use of technology. Generally the teacher-mentors found it interesting to watch students as they took part in technology-integrated lessons. They each agreed that the students seemed to be very engaged in their work and confident in the work from the beginning of the project. Some of the teachers, on the other hand, were not necessarily sure at first that they would be able to make sufficient and worthwhile use of the notebook computers. As one of the teacher-mentors pointed out:

> *I guess what I noticed a lot was the teachers' anxiety at first. When some of the teachers were chosen, they said, "What am I going to do? I don't know how to do this. I don't know how to get these kids to use their laptops all the time." Today, you can talk to them, and they say, "We're going to try this." You know, they'll try anything; they're just not afraid anymore. They used to have a scared look in their eyes, and they said, "Please help us!" Now they just get up and touch a couple of buttons and then go on.*

Over the two years of the project, the teachers became comfortable with the teacher-mentors, whose work with the teachers was often very informal and natural. When the teacher-mentors came into the teachers' classrooms to show the students how to use a piece of software, if the teachers had difficulties with it, then the students would

sometimes help the teachers out. Although formal professional development sessions that the teacher-mentors offered were also very helpful in many ways, the teacher-mentors found that teachers developed their expertise most effectively when they were given assistance on a need-to-know basis. As one teacher-mentor observed, teachers can do 90% of what they need to in a classroom without knowing a great deal of technical information.

> *It's the very simple things that they need to learn, like finding the simulations on the Internet that help reinforce the math skill that they have just taught, getting students to present in some manner the lesson that they learned, and doing writing using the revision process. All of those things are very, very simple skills, and so I think, in some ways, the professional development can be minimal, if that's what the teachers want. When our teachers were picked, it was not because they were fiercely enthusiastic about technology. They really didn't have much of the technology skills.*

The teacher-mentors found that different teachers required different skills, and either because of their particular teaching styles or because of the different subjects that they taught, teachers did not all need to acquire the same technical skills at the same time. One skill that the teacher-mentors felt was particularly important for all teachers and students to learn early on, however, was keyboarding.

> *One thing that I would note that does slow a teacher down very much and what they're willing to do or share with others, is their keyboarding skills. If teachers do not have the keyboarding expertise, they can't contribute some really good stuff that they could normally pass along. I think that is true for the students as well. I mean, you can give them the laptops, but if they're typing like with two fingers it is just absolutely wasting their time. So in our school keyboarding is in the curriculum at the grade six level. I would say, whether it's students or staff, that keyboarding is the fundamental skill that they have to have.*

One of the challenges that were faced by all of the teacher-mentors, but more so by the teacher-mentor in the largest school, was to keep up with the paperwork that was required of them by their school district and Department of Education supervisors. Although the teacher-mentors understood the importance of keeping a paper trail of the various tasks they carried out, they also wanted to be able to devote as much time as possible to working with teachers, and sometimes the bureaucratic demands placed upon them made it difficult for them to also spend time in the classrooms. Another challenge that they had to overcome was the problem of equity, or the digital divide.

> *We began with a very large school, 850 kids, three grades. All of our grade seven and eight teachers received notebooks. So that meant that one-third of our staff, the grade six teachers, were without. And that's a significant number of teachers. That was twelve teachers at the time. And so we saw that in order to prevent a digital divide, we needed to provide*

*laptops for them. So we bought laptops for these teachers out of our own school budget and with help from the district. We knew that it was serious. We didn't want to create this inequity of the staff. It really showed itself in staff meetings when all the grade seven and eight teachers brought in their notebooks to the staff meetings. So when we did buy those laptops, not only did it close that divide, but it also showed those teachers that we really believed in what they were doing as well.*

Another challenge for the teacher-mentors was to run professional development days. Approximately 285 days were dedicated to professional development over a period of a year-and-a-half. These days cost over $230,000, and the three teacher-mentors felt that this money represented a significant contribution by the government. While they valued the opportunities that this money afforded them to work with teachers, they also recognized the power of peer-to-peer professional development, and so they often used the money to free up teachers to share their newly acquired knowledge with each other. As one teacher-mentor observed, "I have so many things that are on the go at a school that size. Oftentimes a team of three or four just wants to get together for a day to do the planning for social studies. I don't always have to be there for professional development."

Because the teachers were given opportunities by the teacher-mentors to share their expertise with each other, many of them felt empowered to improve the way their subjects were taught. The following story from one of the teacher-mentors illustrates how an experienced teacher rediscovered his love of teaching when he was faced with the challenge of no longer having a class set of texts for his English course.

*We had a staff meeting and the principal said to the staff, "If you're teaching language arts, you're no longer going to be getting a full class set of novels." One very vocal staff member stood up and got on the soap box and said, "This isn't right. How am I going to teach four or five novels?" The whole concept of literature circles was something that he had never really employed. I thought about that for a little while. Then I came back to him in December and said, "I think you'd be able to do literature circles with groups if you had four novels in the class and divided the groups up using technology." And he said, "Well, do you really think that would make a difference?" And I said, "Well, let me try." So I took him down and showed him how to set up blogs for literature circles and it's become a model. Teachers from other districts and literacy mentors are coming to see what he's doing. He basically taught four novels to two classes and he actually created a blog for each one. I helped him set them up. He prepared all his assignments as postings, so the kids could be invited to join the blog that is particular to a novel. This teacher really felt rejuvenated because of it. He was able to go home at night and discuss with the kids at home online. It's brought a whole new meaning to teaching for him, and I think he is now going to be on the grade seven language arts teaching team next year, which is awesome.*

When the teacher-mentors were asked what suggestions they had for other teacher-mentors as the project expands in the future, they said that it is critical that they collaborate with each other and that they schedule in collaborative professional development activities together. They felt it would be helpful, on a weekly basis, to be able to ask one another questions such as: "Where are you at?" What are you doing?" "How are things going?" and "What are some of your challenges?" The teacher-mentors also found it valuable to be able to chat with the supervisors in their districts on a regular basis. As one teacher-mentor remarked, "When I can meet with my supervisor on a face-to-face basis, like I did even walking down the hall with him this morning, we're able to achieve great stuff." The teacher-mentors explained that it is important to try to streamline reporting procedures and to keep the lines of communication open between themselves and their district supervisors as the project expands in the future. "There are people at the district office who were able to help us with any technical problems that we had in this project."

Another invaluable group of partners in the project, according to the teacher-mentors, were their technicians. When the teacher-mentors were asked how they worked with the technicians and the teachers, they said that there were some challenges at the beginning when all of the students' and teachers' technical service cases were supposed to be logged by the technicians. Eventually, however, a more reasonable record keeping approach was agreed upon, and only the key problems and issues were recorded. By the second year of the project, the teachers needed to ask for less technical help, so the teacher-mentors and technicians were able to devote more time to professionally developing the teachers and less time to fixing their technical problems. As one teacher-mentor pointed out:

> *District autonomy is key. The proper protocols for the dissemination of information, the requests for information, and so on, need to be done probably more in line with that traditional way of communicating: department, district, school, or school, district, department. I think that's probably going to relieve my some of our concerns. I've been really fortunate with the teachers that I've been directly dealing with in the notebook project. I've been almost protective of them, which I find very good, and they're really great that way, you know, because they sometimes seemed strained because of the demands, not just outside demands but internal demands, on their time and energy.*

Although, by the end of the second year of the project, the teacher-mentors felt that they had developed a smooth working relationship both with the teachers and technicians in their schools and with their partners at the school district and Department of Education offices, nevertheless, they were still cautious about what would be needed for the transition to more schools in the coming years. As one of them explained, "Always put this little stipulation at the bottom, 'This is subject to change.'"

To conclude, the teacher-mentors provided the following list of positive experiences that they wanted to emphasize:

*Effective Professional Development Experiences for the Teachers*

The provision of curriculum planning sessions for teachers, where time was given to plan units using technology as a tool of delivery and as a means of expanding student learning, proved to be the most popular, as teachers enjoyed the opportunity to collaborate with their peers through the facilitation of a teacher-mentor. A typical half day session would include a period or two of teacher-mentor directed guidance followed by teacher led exploration and planning.

The classroom visitation experience was a particularly valuable one for prospective Dedicated Notebook teachers. Teachers were afforded the opportunity to visit Notebook classes for observation and, later on, for discussion with Notebook teachers. Teachers found that "seeing things in action" was important to them.

Subject specific professional development sessions, co-led by Notebook classroom teachers and the teacher-mentor, seemed to generate a great deal of enthusiasm and confidence for teachers planning to teach in the notebook environment.

"Cool tech tools for the classroom" sessions were always popular with teachers, especially those which were easy to use and, more importantly, relevant to the curriculum. Examples of a few of these were Wacom tablets for math, TI83 Scientific Graphing Calculators, and the Vernier Science Probe Kit.

"Importing experts" were valuable resources for professional development. Whether drawing from local expertise (e.g. other teacher-mentors, classroom teachers) or bona fide specialists in various curriculum areas (special needs and technology), teachers gained practical knowledge and insight into effective technology integration.

*Effective Professional Development Experiences for the Teacher-Mentors*

Attending conferences such as the ICE Tech Conference in Chicago, Illinois, were beneficial. It was through attending these conferences that the teacher-mentors were able to gain insight into their roles and to learn, for instance, how to facilitate teacher collaboration through project based learning.

Self directed professional development related to expanding their influence as teacher-mentors was effective as well. The teacher-mentors spent many hours researching more effective ways of integrating professional development, in addition to pursuing personal interests regarding technology and education.

*Support from Department and District*

It goes without saying that this project would have been a failure had it not been for the

very supportive role that Department and district personnel played from the beginning. Obviously the financial support from these two sources was greatly appreciated by the teacher-mentors. But more importantly, the "open door policy" and accessibility to key resource personnel such as Mary-Jo MacRae and Dawn Lamb was also invaluable to the teacher-mentors and to the schools.

## The Principals' Observations

When the three principals were asked what successes they had noticed over the life of the project, they focused first upon the positive impact that the computers had made upon the learning experiences of the students in their schools. They felt that the students had become very adept at using all of the technology. The children were not afraid of it at all. They used the notebooks anywhere in their schools: the gym, cafeteria, etc. The principals appreciated the fact that the students had access to, literally, anything they required to do projects. "They don't even need to go to the library anymore; they can stay upstairs and do their research with their computers."

They felt that the students were more focused on their work and that they were not afraid to gather in groups to do their work and to share ideas. The quality of the students' work had improved because of the computers, and the technology had also helped the teachers to become more effective facilitators. The principals believed that this had directly influenced how much responsibility the students were taking for their own learning. Students were on task much more after they received the computers than they had been in the past. "You go into the room before the bell even rings and they're in there with their notebooks out and checking their emails and finishing up homework."

Concerning the issue of equity that was raised by the teacher-mentors, the principals said that their biggest concern was dealing with parents because there were some very strong-minded parents in each community. As one principal pointed out:

> At the beginning of the project, we had ten grade seven classes and only two of them were going to get the computers, and that included French immersion and Core French as well. So it was a logistical juggling act for quite a while. But after that calmed down, it seemed to work its way through. We had a list of people who, if somebody dropped out, we could substitute. It eventually became very easy to solve that way.

After the initial problem of inequity was solved, the principals experienced very few complaints from parents throughout the rest of the project. Nevertheless, they felt that in future they would like to do more to keep the parents involved by letting them know on a regular basis exactly what their children are doing. The use of memory sticks in the second year of the project enabled many of the students to take their work home with them, and that was appreciated by their parents as were the homework blogs that were established by some of the teachers.

Another concern raised by the principals was the issue of preparing the high schools to receive their grade 8 students into grade 9. As they pointed out, the high schools are not prepared to receive their students. The students may be far ahead of the high school teachers because of their two years of experience in the notebook project. The principals felt that their students and their grade 7 and grade 8 teachers had grown together in their understanding of how to make the best use of the notebooks. But, as these students enter grade 9, they are going to have to teach their teachers how this new learning environment works. Some high school teachers may not be comfortable having these students do projects the way they have been able to do them on computers in previous grades. The principals have therefore proactively attempted to resolve this issue.

> *We've had high school teachers over to our school twice and our teachers have gone over to their school. And there's a fair amount of nervousness, if you like, about what's going to happen next year and where they are on the continuum. I mean, are they going to be catching up to the kids?*

One of the difficulties that may result as the grade 8 students go on to high school is that they are going to be mixed in with students who haven't had the notebooks, and some of the students have told the principals that they are concerned about this. The students have asked, "What if I get into a group with someone who doesn't know how to do it?" But the principals feel that this will provide opportunities for students to teach one another how to use the computers, provided their teachers are comfortable allowing this peer coaching to take place.

When the principals were asked, "Have teaching methodologies and student learning approaches changed as a result of using the notebooks and, if so, how?" they responded by pointing out that they had seen a major shift from teacher-centred to facilitative teaching approaches. As one principal remarked:

> *I was in a classroom the other day and the teacher was using an audio enhancer and a Smartboard, you know, and I was just sitting there thinking, "My goodness, is this ever a change!" For the kids it was so interactive. I was looking around the room and there wasn't a student who wasn't watching everything that was going on. They were totally involved in that lesson. It was quite amazing, actually.*

Related to the paradigm shift toward a more student-centred classroom was the move that the principals had noticed away from the use of textbooks. Many of their teachers were moving away from relying upon textbook use even before the computers were introduced into their classrooms, so they all felt that the argument about the parents saying that "My son or daughter needs a textbook" has evolved.

> *It's interesting that the language arts and social sciences were working very, very well without textbooks even in the early days of the project. Lately, however, even in math we have two math teachers who have gone full-bore with it. It's just unbelievable what they are doing. The software*

*they have been able to download, the information and sites that they are able to find in the last six months have been just incredible. But, in terms of textbooks, yes, some parents have a concern, there's no doubt about it. It's a visual thing because a lot of the parents are our age and we like to see books, they really do.*

One of the problems that the principals have found with textbooks is that they take so long to come out in New Brunswick that teachers are trying to teach the current curriculum using material that is out-dated. Now that their students are able to go online, they can visit up-to-date sites and they can download movies or discover information that is much more recent and interesting for them. One principal said that he has four teachers who are in the notebook project who are teaching math without textbooks.

*They are lead teachers in math. And what they're now doing in their classes just amazes me. What I've seen in the last year with Smartboards in math classrooms is wonderful. I think that, because our textbooks are so slow to be updated, the teachers can find better teaching materials on the web.*

The principals argued that a class set of textbooks costs much more than information that can be downloaded from the Internet. They believe that when teachers are surfing or looking for sites or sharing sites with other teachers, they tend to base their teaching more on the curriculum than they do on using the textbook. In the past, if the curriculum did not match the textbook, teachers still taught from the textbook. But now the principals have observed their teachers following the curriculum guides more closely with the help of information they have found on the Internet. There is more recognition of the outcomes of biology, for instance, as the students are able to do a virtual frog dissection.

*If I go in and I grab a teacher's binder with their curriculum guide, they have the sites listed by outcomes. And they keep adding to the sites. And they keep copying me with their emails, so I know where all their sites are, too.*

When the principals were asked what advice they would give to other principals who are going to be receiving notebook computers at their schools in the future, they pointed out that these principals and their teachers may be nervous about this change at first. "I can remember when we first got the computers. I looked at them and I thought, 'Oh no. Did I sign on for this?'" There certainly are reasons for school leaders to be nervous about how to implement this kind of change in their schools. For instance the three Notebook Project principals have found that over that last two years they have learned to be careful not to take teachers out of class too often for professional development because that can cause discipline problems among the students. Another piece of advice they wished to give to other principals was to focus both on technical and pedagogical professional development of their teachers, but to let their interest develop naturally with the help of lead teachers.

*Tell them not to force-feed their teachers. Let them get their feet wet. Normally, we'll have a super-star who will take the lead and once the super-star is going, then the other teachers see what can be done and can't be done. And, it spreads like an infection. The lead teacher will say, "Do you see how I'm doing this?" And the next thing, it just keeps rolling and rolling. I think that once they have the first little bit of professional development and see the technology being used and how simple it is and how they can incorporate it, well, the fears just go. They start to become more comfortable as you introduce it gradually.*

The principals said that when they are hiring teachers they need to ask them questions about technology. They believed that their school districts need to ask these questions of new employees as well. The recognition of the importance of computer literacy needs to be integrated throughout the school system. They also felt that principals should be a little less controlling and autocratic and a little more democratic and visionary when they are freeing up teachers to work more effectively with technology.

Finally, when the principals were asked what they thought about the relationship between the use of computers and the students' behavioural patterns, they remarked that they had found, for instance, that some children continued to misbehave and to miss school, but that their teachers noticed improved attendance and behaviour in many students compared with the way these children had behaved before they received the computers. The computers are generally not sent home with the children, but in one school a student went to Denmark from September to December and so the principal gave her a notebook to take with her. When she came back after Christmas, her teachers found that she had managed to stay up with her class by taking part in activities online. As far as the principals and teacher-mentors were concerned, the Notebook Project has provided them with an excellent opportunity to rethink the way the curriculum is taught and the way students construct their own knowledge in their schools. They all agree that they are very happy that they will be able to provide all of their grade 7 and grade 8 students with notebooks in the coming year.

# Chapter 7:  Conclusions and Recommendations

*Without question, this generation truly is the media generation, devoting more than a quarter of each day to media. As media devices become increasingly portable, and as they spread even further through young people's environments – from their schools to their cars – media messages will become an even more ubiquitous presence. Anything that takes up this much space in young people's lives deserves our attention. The sheer amount of time young people spend using media – an average of 6.5 hours a day – makes it plain that the potential of media to impact virtually every aspect of young people's lives cannot be ignored.*

The above statement represents the overall conclusion of a 2005 Kaiser Foundation study that examined media use among a representative sample of more than 2000 3rd through 12th-grade students across North America (Centre for Digital Education, 2005, 2). Indeed, this conclusion is representative of the dramatic change that is taking place in the schools of New Brunswick through the Dedicated Notebook Research Project. In less than two years, there has been a transformation in the teaching and learning environment in the schools participating in this research project. The research team has been able to document this transformation through regular visits to the dedicated research project schools and classrooms, through detailed interviews with students, parents, teachers and school administrators, through a series of surveys of student attitudes, perceptions and behaviours in this new learning environment, and through an analysis of the work they have produced.

By any measure, the changes and improvements to the learning environment in the three anglophone schools participating in the implementation of dedicated notebook computers have been dramatic and overwhelmingly positive for all involved with the project. Through the actions of progressive teachers and teacher-mentors, school principals, school district administrators and the Department of Education, students at the middle-school level have been offered a learning environment with constant and immediate technologies for individual and group learning opportunities and access to the entire digital world. That being said, the entire project was implemented with the very clear caveat that the focus was to be on learning "with" technology, and not "about" technology. The research team has continually been impressed with the dedication of all levels of teaching, administration and implementation of the Dedicated Notebook Research Project and their focus on pedagogy and subject area content and outcomes, and not about the computing hardware and technology for the sake of technology.

Previous sections of this report have reported on the richness of the experiences of the students, teachers, parents and others involved with the Dedicated Notebook Research Project. The environmental scan of other jurisdictions across North America, as well as a number of international experiences, allowed the research team to address the overall educational impact of this particular project on middle school learning in the three schools participating in these initial phases of the project. Based on all of the

observations, interviews, and surveys, as well as an analysis of these many other jurisdictions and the literature on 1:1 technologies, we have identified a series of overall conclusions and related recommendations.

## 21st Century Learning Skills

While the various technologies continue to evolve and change, the current research project and all of the other major implementation projects across North America have drawn a similar conclusion: routine access to technology will increase learning in environments where educational expectations have been clearly communicated to those participating in the program. In addition to the more traditional student achievement and outcome measures developed in the public schools system, students with access to this type of learning technology develop "21st century learning skills" (Partnership for 21st Century Skills, 2004). These 21st century skills may be categorized in three areas:

- *Information and communications skills* include the ability to analyze, access, manage, integrate, evaluate and create information in a variety of forms and media and the ability to create effective oral, written, and multimedia communication in a variety of forms and contexts, all using today's real-world tools.
- *Thinking and problem solving skills* include the curiosity, creativity, and ability: to frame, analyze, and solve problems; to make complex and well-reasoned choices; to understand the interconnection among systems; and to investigate, develop, implement and communicate new ideas.
- *Interpersonal and self-directional skills* include the autonomy and ability to: monitor one's own understanding and learning needs, locate and use appropriate resources as necessary, and demonstrate teamwork and leadership in working productively with others.

It is difficult to imagine the 1:1 dedicated notebook computer environment if one has not experienced it. As most of us are "digital immigrants" in society in general, it is hard to conceive of an educational experience where students and teachers are actually working in partnership in the daily, "wired" classroom environment.

As highlighted in earlier sections of this report, the new technology assists teachers and learners in changing the instructional strategies so that the level of technology used by teachers significantly affects student achievement. The research team has concluded that one of the greatest successes of this research project has been the significant improvement in the students' abilities to enhance their 21st century skill-set. We found that the effective implementation of the Dedicated Notebook Research Project, even from its earliest days in January of 2005, was highly effective in promoting these various skills. Students, working closely with their teachers and peers, consistently demonstrated effective Internet research and related searches while they learned to communicate by writing and presenting information to their teachers and the class. They developed these skills by creating clear and vivid multimedia presentations, composing and revising written passages, conducting science experiments and online mathematics activities, and becoming effective researchers, deft at analyzing and critically evaluating information

obtained electronically. These are the types of skills that students will need to draw upon as they proceed through the education system and on into the world of work.

As one teacher remarked, a year ago some of these children would not have had the courage to stand up and read a paragraph aloud to the class. Now, as a matter of routine, students are confidently sharing multimedia presentations, sending e-mail, delivering speeches, and even teaching whole classes of students in other classes and grade levels. They are becoming independent thinkers as well by finding their own way through outline materials to draw their own conclusions about the topics that they are researching. Of course, these developments are not simply the result of placing notebook computers in front of students. The teachers, teacher-mentors, and technicians, as well as the school districts and Department of Education support staff and coordinators, have all worked very effectively throughout this project to help the students become autonomous learners with 21st century skills.


## Quantity and Quality of Research and Writing

The results of the first two phases of the Dedicated Notebook Research Project reveal that those students who were provided notebook computers when learning to write were not only more engaged and motivated in their writing, but they produced written work that was of greater length and of higher quality, as revealed through self-assessments, parental assessment and classroom-based learning outcome assessments by teachers and school officials.  As the survey results and extensive interviews indicate, students who have used the dedicated notebooks exhibit better writing skills. The results in this New Brunswick project support the research results in other 1:1 laptop projects across North America. In an in-depth analysis of student writing assessments, Rockman et al. (2000) concluded that "laptop students' writing rated stronger in all four scored areas: content, organization, language/voice/style, and mechanics."  In the New Brunswick case, there is a gap between the implementation of the Dedicated Notebook Research Project and the established measures and testing standards, so there is a need to develop appropriate evaluation strategies for all students who have access to these new learning tools. After a year or two using a dedicated notebook computer to assist in the research and writing process, it is inappropriate to ask these students to then revert to the cursive or printed word.

In order to accurately gauge the impact of 1:1 student notebook learning, the Department of Education should develop appropriate assessment tools for measuring student achievement on tests and assignments, as well as standardized tests, by allowing these assessments to be written via computer and related portfolio assessment techniques.


## Student Engagement in Subject-specific Research and Writing

While there was some variation from student to student and class to class at the three schools, the research team recorded a consistently high level of student engagement with

the learning process and the various subject areas they were exposed to in the grade 7 and grade 8 curricula. As reported earlier, we found a very high level of enjoyment and engagement with the addition of the notebook technology. Self-reported engagement in the various subject areas was one of the key advantages of the Dedicated Notebook Research Project.

One of the most convincing areas of improvement during the project has been the students' improved level of involvement in French second language classes because of the opportunities they have had to communicate using the notebook technology and to visualize French vocabulary in their multimedia presentations. Doing social sciences projects in which they can download information on gems or the Globe Theatre or the Black Death has helped them to imagine more easily what it was like to live in other times, to experience various cultural periods, and to explore various approaches to understanding complex issues. Manipulating geometric shapes on their computer screens has helped them understand mathematical problems in special terms. Writing and revising journal responses, essays and poems and then posting them in their blogs have strengthened the students' understanding of English language arts. The use of the notebook to compose music, to simulate the human heart or to write a magazine or newspaper article for the class newspaper has made a dramatic impact on student engagement in their classes and various subject areas. In almost every subject area, students have indicated that they are more aware of how to improve the quality of their work. The power of the notebooks to improve students' metacognition has been significant, as they have thought about the learning processes involved in the different subjects that they have been studying at the grade 7 and grade 8 levels.

**Student Motivation and Engagement**

Beyond the subject-specific levels of engagement witnessed in students, we find that the introduction of the notebook computers in a 1:1 learning environment has had an impact in a number of personal ways, especially individual student motivation to learn, engagement with the material, the community environment created in the classroom, and personal responsibility and attitudes toward school. In numerous survey and interview responses, as well as the triangulation of these self-assessments with teachers and parents, the students in this project have repeatedly emphasized how much they enjoyed working with the notebook computers, how their grades have improved because they like working individually and in groups with their notebooks, and how proud they are of their work and the final products that they present to the teacher and to the class.

We have noted a clear increase in the level of engagement of all of the classes involved in the notebook project. In each of the schools, one finds students who spend their lunch hours in the classroom so that they can continue to use the computers. Parents in focus groups report that they are delighted that their children are more motivated to learn, and teachers are excited about the improvements that they are seeing in the work of all their students but especially in the work and engagement of students who have special needs.

Several students and parents report that the notebook technology and the fact that everyone has a notebook is "the great equalizer" in the middle school classroom.

## Deeper and More Meaningful Student Learning

While many other school districts across the continent have experienced difficulties with the implementation of the new technology and the creation of a meaningful learning environment in schools, the Dedicated Notebook Computer Research Project has followed a very well designed technology integration plan. Such a plan started with schools that were already well on their way to being learning communities with high levels of technological ability and student-teacher engagement using computers. At the same time, the Department of Education and the school districts and principals were instrumental in ensuring that teachers and students were aware of and were using the appropriate curricular models suited to the new technology, as well as ample technical assistance and the leadership of teacher-mentors. The technology roll-out planning facilitated teacher and student proficiency and comfort in information literacy, including access and retrieval strategies, software familiarity, a healthy scepticism of online information and the Internet, and the ability to work in a cooperative learning environment.

Throughout the research project, the research team has observed that the notebook computers allowed students to take multiple approaches to a given problem or issue posed in the classroom learning environment. Use of the technology facilitates both individualized and group-based project learning. We observed a much deeper and more meaningful level of student research, analysis, writing and reporting. Teachers involved at both grade levels, as well as several of the school resource teachers, reported a greater emphasis on in-depth project research, writing and reporting. The research team analyzed hundreds of innovative and creative student projects that have been produced over the past two years.

Students, teachers and parents also reported a marked improvement in engagement and levels of learning amongst those students in their classes who are following an individualized education program (IEP). Teachers and parents report that these students have a much greater range of learning materials and individualized delivery methods by using their notebook computers. As part of the evaluation, Dr. Dave Edyburn, an internationally renowned learning technology consultant for students with special needs, was able to visit several classrooms and present professional development for teachers involved in the program. Teachers and parents reported that students on IEPs who had trouble writing and being engaged in the traditional classroom before receiving the dedicated notebooks were not only writing better, but were much more engaged in their writing and research activities. Dr. Edyburn concluded that the New Brunswick Dedicated Notebook Computer Research Project was already achieving a high level of engagement from all students, but particularly with those with special needs and IEPs. The key point was that students were gaining a great deal by having personal access to a

notebook computer as opposed to only a few special needs students having access, or worse, having to travel to a separate computer laboratory.

Based on our observations of the three research project schools' classrooms, we see very strong evidence that the dedicated notebooks are allowing these schools to move from a traditional classroom to a new type of learning environment. The International Society for Technology in Education provides a useful comparison of the traditional and new learning environments:

*Traditional Learning Environments*              *New Learning Environments*

Teacher-centred instruction              Student-centred instruction
Single-sense stimulation                 Multi-sensory stimulation
Single-path progression                  Multi-path progression
Single media                             Multimedia
Isolated work                            Collaborative work
Information delivery                      Information exchange
Passive learning                         Active/exploratory/inquiry-based learning
Factual, knowledge-based                 Critical thinking and informed decision-making
Reactive response                        Proactive/planned action
Isolated, artificial context             Authentic, real world content

(ISTE, 2002,2)


## Enhanced Professional Development and Collaboration

Perhaps the true champions of the success of the New Brunswick Dedicated Notebook Research Project have been the classroom teachers who have been early adopters of these new technologies, as well as the primary enablers for students hoping to make the best possible use of the dedicated notebook computers. The New Brunswick project is also noted for the employment of a teacher-mentor in each of the research project schools, as well as a Dedicated Notebook Project technician. Across all schools, supported by their district and school administrations, the technicians, teacher-mentors and participating grade 7 and 8 classroom and resource teachers were enthusiastic and overwhelmingly positive about the implementation process and their individual and collective professional development opportunities.

The Department of Education was generous with resources for individual and school-based professional development opportunities, as well as opportunities for technical and curricular support through a new teaching and learning technology portal for all teachers across the province. Regular contact and communication with participating teachers and teacher-mentors, as well as liaison with Department of Education officials and participants in programs in other schools, all contributed to the success of this initiative. The teacher-mentors and technicians have been very careful to strike a balance in providing neither too much, nor too little, professional development for the teachers directly involved with the project. One of the most successful early initiatives was a site visit to several schools in Maine (fall 2004), where teachers, teacher-mentors, technicians

and school administrators were able to see the progress and challenges of the already established Maine Learning Technology Initiative (MLTI), also implemented at the grade 7 and grade 8 levels. Any government or educational organization investigating a possible 1:1 computing initiative should work with teachers in developing an early and continued relationship and resource commitment for professional development and technical support, including exposure to other jurisdictions where a 1:1 project has been developed.

It is clear from the current study of schools in New Brunswick, as well as the many jurisdictions where 1:1 projects are currently underway, that ubiquitous 1:1 computing is having a major impact on the ways in which teaching and learning can take place. While this report examines the early phases of a dedicated notebook research program at the middle school level, it will be critically important that governments, administrators, teachers and students maintain the time and resources for professional development that made these early phases such a success. The research team has concluded that the dedicated notebook computer appears to have enormous power in providing teachers and students with a variety of teaching and learning opportunities, as well as providing for a range of powerful skills needed in the world today. As ever, the role of the teacher will be central in the conversion of the conventional classroom to a learning space suitable for the 21$^{st}$ century.


**A Major Step Forward in Professional Development Using Technology**

The first two phases of this project saw the infusion of dedicated notebook computers into the classrooms of some 500 students and teachers in three schools, yet the Department of Education continued with the roll-out of thousands of additional units – most notably the distribution of individual notebook computers in June 2006 to all of the province's 7,500 teachers who wished to have one. The research team notes that this represents one of the single-largest implementation programs in North America and certainly the single greatest technology infusion for direct teacher professional development across the continent. Our August 2005 Interim Report recommended that the government consider an expanded technology plan for all middle school teachers and students across the province, yet with a very clear cautionary note that any further roll-out must be preceded by the provision of notebooks and a range of professional development opportunities for as many teachers as possible. The Department of Education's decision to move directly to the provision of laptops for all teachers in the public schools of the province was a well researched, clearly designed, and carefully implemented program. While this phase of the project is beyond our review mandate, it is important for the research team to note that this roll-out will certainly allow for the appropriate professional development and skill-set augmentation needed for any further dedicated notebook classroom expansion that may occur.

It is also important to note that, while Phase I and Phase II of this project have proven to be a powerful method for motivating and engaging adolescent learners, there is no doubt in the minds of the teachers who have been facilitating their students' use of these

computers that without continued professional development, they would not have been able to accomplish nearly as much as they have these past two years with their students. As the Department of Education now expands the Dedicated Notebook Research Project across other middle schools and high schools, the research team believes that the professional development component for teachers must be maintained. Otherwise, the equipment will not properly be utilized, and teachers who are not familiar with the changes needed to facilitate learning with new technologies will feel frustrated at their inability to integrate the technology into their teaching.

One of our strongest recommendations in both maintaining the existing dedicated notebook computer program and future expansion of the program is the maintenance of a teacher-mentor and school-based technician. The role of the teacher-mentor has been a critically important component of the model and is a true strength of the New Brunswick dedicated notebook research initiative. This form of in-house mentoring for professional development goes beyond the notion of having a technical person at the service of teachers and students. The teacher-mentors have been able to provide localized, "just-in-time" professional development to all teachers and resource persons in the schools where they work. While the teacher-mentors certainly assist with the technology integration of teaching and learning, they also meet the professional needs of teachers in areas such as development and integration of instructional strategies, differentiated learning techniques using the technology, and a range of methodologies for improving basic skills (math, writing), digital literacy skills (technological, cultural, research skills), inventive thinking and analysis skills, as well as effective communication and interpersonal skills and productivity skills for teachers and their students. The use of technical assistants and teacher-mentors has been a key component in the success of these initial phases of the project.

Creating sustainable professional development opportunities is an important consideration in maintaining or expanding the New Brunswick dedicated notebook model. Providing all teachers with a notebook provides a major incentive for integrating technology into their teaching repertoire. The support and in-house mentoring developed during these initial phases will ensure individual and collective staff development so that all students in the school can learn from and with their teachers. We believe that the introduction of the dedicated notebook computers is a major step in effective professional teacher development in New Brunswick. It signifies to the government and the people of New Brunswick that the schools of the province have the skills, knowledge and attitudes required in our teaching professionals, administrators and other school staff so that all students will be exposed to the 21$^{st}$ century learning environments required for our children.

## Challenges and Future Directions

The overall goal of this research project has been the consideration of how providing middle school students and teachers with their own dedicated notebook computers in a wireless, networked environment will affect the learning experiences and overall

classroom environment for grade 7 and grade 8 students. Our overall conclusion, based on evidence collected over the first two phases of the project, from January 2005 to June 2006, indicates that the overwhelming majority of the students and teachers involved in the initiative, as well as the students' parents and guardians, have successfully implemented the project in their classrooms and schools, and there is a strong range of evidence that student learning and improved teaching practice has been a direct result of the new 1:1 technology. Implementation of the project was very smooth, with all of the participating classes and schools achieving a number of educational benefits. There is no doubt that this current project has allowed for the development of an enhanced teaching and learning experience for those involved, yet the future of this project, in terms of maintenance of the infrastructure and the excellent professional development program, as well as its enhancement and roll-out to other students, teachers and grade levels, will face enormous challenges. This last section of the report highlights some of the major challenges and recommendations we see for the New Brunswick Dedicated Notebook Research Project:

*Financing, Equity and Community Support*

While the actual financing and selection of the technologies used in Phase I and II of the project were beyond the mandate of our research team, we certainly heard a significant amount of concern about the ability of the Department of Education to sustain and enhance the use of dedicated notebooks in the schools of the province. This current project represents only about two percent of the students in New Brunswick's public schools, so one of the biggest concerns people have about the project is in the area of finances.  The issue of equity among schools and students in a school system where not everyone has access to these new learning technologies was often a subject of concern during our research investigation. In particular, teachers, school officials, parents and members of the larger community questioned the selectivity of any program that favours a select minority of students and classes. The issue of annual school district and education funding will be closely tied to community support. To date, there has been a high level of provincial government support and appropriate levels of communication with schools, parents and the community. It is our recommendation that the Dedicated Notebook Research Project be expanded at a rate that is consistent with the goals established as part of the initial project concept, as well as the central focus of meeting the goals of the school district plans and the Department of Education's mandate in the delivery of all educational programs. We note that there are no 1:1 programs that have been delivered to an entire school population that are based solely on government resources. Private funding and family purchase plans or technology fees have been developed to support the various laptop initiatives. The Department of Education will have to consider a number of funding models that will ensure funding that increases student access, yet does not impose undue financial burdens on individuals and families. Ongoing maintenance and support of the hardware and software, the life expectancy of the current technology, continued professional development costs, as well as the increasing demands for more grades and larger groups of students at both the middle and secondary levels, all place significant challenges on the project. There is now a fairly sophisticated series of approaches to the financing of 1:1 initiatives across North

America. Federal government partnerships, issuance of bonds, local education funds, operational budgets, government surplus funds, direct leasing with suppliers, as well as community-based and private fundraising options have all been employed in the financing of 1:1 programs.

*Mathematics Instruction*

While there are many enhanced performances seen in the areas of English language arts, French second language, social studies and science, there continues to be a gap between the dedicated notebook technology and an enriched curriculum connection in the area of mathematics instruction. As outlined in an earlier chapter of this report, key teaching personnel involved in the project have devoted a significant amount of time on this issue, with very positive results to date. Mathematics instruction remains problematic for both teachers and students involved in similar dedicated notebook projects across North America. The largest projects have also found that mathematics instruction and assessment are a challenge, simply because there are fewer online resources for instruction of discrete calculations as compared to broad, interactive problem-solving disciplines. At the end of the day, there are no absolute rules on the use of notebooks in mathematics or any other subject area, so teachers and students must continue to adapt these new technologies only as appropriate. On the assessment front, it is always tempting for education officials and members of the community to look to math scores as an indicator of the success of any new method or technology. The New Brunswick project is still in its infancy and, without appropriate metrics for the demonstration of knowledge using the new technologies, using math scores as an indicator of success should be resisted by government decision-makers and school officials.

*Allowing Students to Take their Computers Home*

The overwhelming frustration and criticism of the New Brunswick Dedicated Notebook Research Project was the students' desire to have the opportunity to use the notebooks at home. It is our recommendation that the Department of Education devise a mechanism that would allow students to take their notebook computers home during the school year. Based on other research projects across North America, the ability to have access to the computer and the Internet after their school day, in the evenings and on weekends would result in a higher level of student and parent satisfaction and would more closely reflect the ubiquitous learning environment desired in a 1:1 learning community model. All other jurisdictions with similar laptop programs have had to deal with this issue and all have resolved the problems associated with the 24/7 model by allowing the students to take the computers home, with remarkably little loss of or damage to the machines. These other jurisdictions have found low-cost insurance policies that can provide coverage for the users in the project. Parents are required to sign release forms prior to their children taking the computers home, since most homeowner policies will provide coverage for damage or loss. Other programs require parents to pay an insurance fee for their children to take the computer home. Other types of insurance policies, school-based waiver forms, or donated computers for such uses can cover students who are not able to afford the insurance fee.

*Communications, Leadership and Future Directions*

It is our conclusion that much of the success of these first phases of the Dedicated Notebook Research Project is due to the leadership role that members of government, the Department of Education, school district administrators and school principals have played in formulating a vision and communicating it in a timely and effective manner to all of those involved in the project, as well as to members of the public. Clearly, the process has not unfolded without its share of time lags, miscommunications and implementation problems, yet the project followed a clearly defined policy that established project management, a development team and a communications strategy with schools, parents and government. The leadership also included the ability to attract those who were willing to take the initiative on developing new learning communities in their schools, assisted with the provision of training and professional development of staff associated with the project, and set up mechanisms for system security and day-to-day monitoring and consultation on the implementation of the project. As the Department of Education expands the programs this year and into the future, the challenge will be the ability to sustain the existing, high-level of support, coordination and communications that have proven so successful in these initial phases.

Dramatic changes are taking place in the schools of New Brunswick. The transformation of our classrooms from traditional places of quiet solitude, rote learning and teacher-centred, "stand and deliver" methods are being challenged by the realities of the digital world we are all exposed to beyond the walls of the classroom. There is substantial evidence across North America that using technology as an instructional and learning tool enhances student learning and educational outcomes (Bain & Smith, 2000; Hanna & de Nooy, 2003; Davies, 2004; Bebell, 2005). In particular, the innovation of the notebook computer and relatively cheap, wireless Internet technologies in our schools has led to a rapid diffusion of these technologies across a wide range of educational jurisdictions. With the introduction and rapid expansion of information and communications technologies (ICT), a number of researchers and educators have raised their concerns about the wide division between those who have access to information and new technologies and those who do not. Known generally as "the digital divide", there are significant educational issues being raised about this gap between those who have the technologies and the skills needed for the economies and societies of the 21$^{st}$ century and the "have-nots" who are denied the option to participate in new ICT educational settings and employment.

In their report on education and technology between 2000 – 2003, Underleider and Burns (2003) observed this divide in their research on student inclusion, particularly the gap between genders and urban/rural populations. Recent studies in Canada have found a further divide in the use of ICT in schools, based on socio-economic status, age, disability, aboriginal and geographic inequities (Looker & Thiessen, 2003). As schools across North America, as well as many other parts of the globe, seek ways of bridging the gap between students and using new technologies to enhance student learning, there have

been a growing number of individual, home-grown programs that we have studied in order to address the results, best practices, and lessons learned along the way.

Renowned educator and technology enthusiast Marc Prensky has added a further dimension to the challenge of bridging the digital divide, that being the gap between students of today and those who teach them. Prensky (2001) has argued that the single biggest problem facing education today is that our "digital immigrant" teachers, who speak an outdated language (that of the pre-ICT age), are struggling to teach a population of learners that speak an entirely new language (digital natives). There are now added challenges to the profession due to increased expectations for the delivery of 21st century skills using new technologies. In particular, the decision to introduce notebook technologies, often with a very short time period between decision and implementation, has left the teaching professional in the position of adding an entirely new set of skills to their teaching practice. While there is a significant amount of research focusing on the educational promise of information and communication technologies, there is very little research being conducted on the acceptance and effectiveness of these new technologies on teaching and learning.

The New Brunswick Dedicated Notebook Research Initiative has allowed us to conduct rigorous qualitative research on the impacts of ubiquitous technology use on teaching and learning, with an overall conclusion that the project has been a highly successful model for future growth, development and best practice. At the same time, we are cautious about drawing any definitive conclusions based on our limited access to non-notebook students and classes, as well as the small sample sizes under investigation during these early phases. We certainly believe that the New Brunswick model is well prepared for expansion and movement into other grade levels and new curriculum areas, yet there will be an ongoing need to continue researching and evaluating the impacts of these new technologies on student engagement and performance. Future research will need to provide better documentation on the nature of the learning environment at the middle and high school levels, the role of professional development in preparing teachers and resource personnel for the demands of 21st century students, and the new, digital resources that are flooding the marketplace today.

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# Appendices

## Appendix A:  Survey Questions for January 2005

School:

Name:

Gender:

Instructional program:

Do you have older brothers or sisters?

If you answered YES, how many? (Enter a number.)

Do you have any younger brothers or sisters?

If you answered YES, how many? (Enter a number.)

Do you have a computer at home?

Do you have access to the Internet at home?

If YES, is your Internet connection:

Are your parents regular users of your home computer?

At present, what career do you think you might like to pursue?

Do you have a personal e-mail account?

Which of these words best describes your computer skills at this time?
   a) Highly skilled at using the computer
   b) Very comfortable using the computer
   c) Able to use the computer with reasonable ease
   d) Unsure of all of the possible uses of the computer
   e) Poorly prepared/uneasy using the computer

Which specific computer skills do you think you have mastered or are comfortable with at this time? (You can choose more than one.)

What is your most favourite subject?

What is your least favourite subject?

At present, computers are used in my classes:

What effect do you think having a notebook will have on your learning?

What effect do you think that having a notebook will have on your interaction with your classmates?

What effect do you think that having a notebook will have on the role that teachers play in your learning?

What effect do you think that having a notebook will have on your attendance at school?

What effect do you think that having a notebook will have on your attitude toward school?

What effect do you think that having a notebook may have on your relationships with students in other grade 7 classes not participating in this project?

At present, we use computers in my classroom most often to (describe the activity):

What do you think will be the greatest benefit to having notebooks to use in your classroom?

# Appendix B: Interview Questions

**Teacher Interview Questions**

1. Tell me the story of how you came to be involved in this project.

2. When you have taught courses in the past to grade 7 students, what have been your approaches to teaching: project based learning, group work, independent study, full class discussions, etc? Please describe some of the lessons you have taught in the past that you enjoyed and that you felt worked well before you used computers.

3. How do you think those lessons will look now that you are using computers in the teaching process?

4. Now that you have had a chance to use these notebooks for a few weeks, what are your initial impressions of how things are going? What problems have you encountered so far? What changes to your teaching approach have you noticed?

5. How are your students progressing so far with the computers? Do you feel that some are making more progress than others? If this is the case, please explain the differences you are seeing among the students' uses of the computers.

6. What do you anticipate to be the results that will come out of this project?

7. Do you feel that the professional development opportunities that you have experienced so far have adequately prepared you for the work you are doing now, and if not, what further help do you feel that you need at this point?

8. In terms of time commitments, how have you found your workload to be to date? What do you expect to be your workload over the course of the project?

9. Do you have any entries in your journal that you would like to share with me at this time? If so, please elaborate on what you have written.

10. Do you have any apprehensions about being involved in the project?

11. Have you found yourself interacting with other teachers about the use of computers, and do you expect to be interacting with them in the future in order to share teaching ideas?

**Principal Interview Questions**

1.  Are you concerned about the haves and have-nots in the school, and if so, how are you addressing this concern?

2.  What are the challenges that you see in this project?

3.  Tell me the story of how you came to be involved in this project.

4.  In the past, what have been your teachers' approaches to teaching: project based learning, group work, independent study, full class discussions, etc? Please describe some of the lessons you have observed in the past that you enjoyed and that you felt worked well before your teachers used computers.

5.  How do you think those lessons will look now that your teachers are using computers in the teaching process?

6.  Now that your teachers have had a chance to use these notebooks for a few weeks, what are your initial impressions of how things are going? What problems have emerged so far? What changes to their teaching approach have you noticed?

7.  How are the grade 7 students progressing so far with the computers? Do you feel that some are making more progress than others? If this is the case, please explain the differences you are seeing among the students' uses of the computers.

8.  What do you anticipate to be the results that will come out of this project?

9.  Do you feel that the professional development opportunities that your teachers have experienced so far have adequately prepared you for the work you are doing now, and if not, what further help do you feel that they need at this point?

10. In terms of time commitments, how have you found your teachers' workload to be to date? What do you expect to be their workload over the course of the project?

11. Do you have any apprehensions about your school being involved in the project?

12. Do you think that the use of these computers is having an effect on the other teachers' teaching approaches?

**Student Interview Questions**

1. Please tell me a little about yourself. Who are you and how much experience did you have with computers before you received your notebook this January?

2. Please describe some of the lessons that you enjoyed before you received your computer.

3. How do you think those lessons have changed now that you are using computers to help you to learn?

4. Now that you have had a chance to use your notebook computer for a while, what are your initial impressions of how things are going? What problems have you encountered so far?

5. Do you have any particular projects that you have done so far that you would like to explain to me? If so, what are they? Please tell me what you think you have learned by doing these projects.

6. Do you have any worries or concerns about being involved in the notebook computer research project?

7. In what ways have you found yourself interacting with your classmates about how to use your computer? What kinds of things do you talk about with them?

8. What differences have you noticed in the way that your portable computer has affected your learning in different subjects?
    a. For instance, what differences have you noticed in the way you are now learning English?
    b. What differences have you noticed in the way you are now learning social studies?
    c. What differences have you noticed in the way you are now learning mathematics?
    d. What differences have you noticed in the way you are now learning sciences?
    e. Have you used the computers in other subjects such as French, and if so, what differences have you noticed in the way that you are now learning those subjects as well?

9. What are the effects of the portable computers on your general thinking skills?
    a. For instance, in what ways have you been using your computer to communicate with other people and the teacher, and have you noticed any improvements in your ability to communicate as a result?

b. Do you feel that you have gained any new technological skills and understanding as a result of using your computer so far, and if so, what new abilities and awareness have you gained?
c. Do you believe that your ability to think critically about your subjects has improved as a result of using your computer, and if so, how has your critical thinking improved? What are some of the critical thinking activities that you have done since you received the computer? How do you feel about your ability to perform these tasks?
d. What are some of the problem-solving activities that you have done since you received your computer and how has having the computer helped you in these problem solving tasks? Do you enjoy doing problem-solving activities on the computer? If so, why, and if not, why not?

10. What do you think have been some of the effects of your portable computer on your attitudes and behaviours as a learner?
a. For instance, do you think you are more motivated or excited to learn now than you used to be? If so, how, and if not, why not?
b. Do you think you are better now at learning on your own than you used to be before you had your notebook computer? If so, how have you found yourself becoming more independent as a learner?
c. Have your study habits changed since you received your computer, and if so, how? Do you feel that your marks have gone up or down or stayed the same since you received your computer? If your marks have changed, why do you think this change has taken place?

11. Is there anything else you would like to tell me about your experiences so far with your new notebook computer?

# Appendix C:  Field Note Questions

**Field Note Questions**

1. What examples are we seeing of how the notebooks are being utilized?

2. What obstacles are we seeing for teachers or students?

3. How much time on task are we seeing?

4. What norms and exceptions are we seeing in the use of the computers?

5. How is the classroom organized (rows, clusters, etc.)?

6. What kinds of interactions are taking place between teachers and students, and among the students?

7. What are the teacher-mentor's questions, concerns, and observations to date about their role as facilitators of the teachers' work?

# Appendix D: June 2005 and June 2006 Student Survey

| | |
|---|---|
| **School**: | Grand Manan |
| | Nashwaaksis Middle |
| | Harry Miller |
| **Name:** | |
| **Gender:** | Male |
| | Female |
| **What has been your overall experience when using the notebook computer this year? (Click one response only.)** | I have not enjoyed using the notebook this year and have negative feelings about the experience. |
| | I have neither negative nor positive feelings about using the notebook computers this year. |
| | I have enjoyed using the notebook computers and have generally positive feelings about the experience. |
| | I have really enjoyed using the notebook computer and have very positive feelings about the experience. |
| **Language Arts (reading/writing)** | I do not take this class. |
| | 0 hours per week |
| | 1-3 hours per week |
| | 4-6 hours per week |
| | 7 hours or more per week |
| **Social Studies** | I do not take this class. |
| | 0 hours per week |
| | 1-3 hours per week |
| | 4-6 hours per week |
| | 7 hours or more per week |
| **Art/Music** | I do not take this class. |
| | 0 hours per week |
| | 1-3 hours per week |
| | 4-6 hours per week |
| | 7 hours or more per week |
| **Mathematics** | I do not take this class. |
| | 0 hours per week |
| | 1-3 hours per week |
| | 4-6 hours per week |
| | 7 hours or more per week |
| **French** | I do not take this class. |
| | 0 hours per week |
| | 1-3 hours per week |
| | 4-6 hours per week |
| | 7 hours or more per week |

| | |
|---|---|
| **Science** | I do not take this class. |
| | 0 hours per week |
| | 1-3 hours per week |
| | 4-6 hours per week |
| | 7 hours or more per week |
| **Physical Education/Health** | I do not take this class. |
| | 0 hours per week |
| | 1-3 hours per week |
| | 4-6 hours per week |
| | 7 hours or more per week |
| **Writing first drafts of papers and projects** | Never |
| | Less than once a week |
| | Once a week |
| | A few times a week |
| | Once a day |
| | Often during the day |
| **Editing my work** | Never |
| | Less than once a week |
| | Once a week |
| | A few times a week |
| | Once a day |
| | Often during the day |
| **Taking notes** | Never |
| | Less than once a week |
| | Once a week |
| | A few times a week |
| | Once a day |
| | Often during the day |
| **Organizing information** | Never |
| | Less than once a week |
| | Once a week |
| | A few times a week |
| | Once a day |
| | Often during the day |
| **Researching information on the Internet** | Never |
| | Less than once a week |
| | Once a week |
| | A few times a week |
| | Once a day |
| | Often during the day |
| **Writing quizzes, tests or assignments** | Never |
| | Less than once a week |
| | Once a week |
| | A few times a week |
| | Once a day |
| | Often during the day |

| | |
|---|---|
| **Doing drills using computer simulations or games** | Never |
| | Less than once a week |
| | Once a week |
| | A few times a week |
| | Once a day |
| | Often during the day |
| **Creating presentations and other multimedia projects** | Never |
| | Less than once a week |
| | Once a week |
| | A few times a week |
| | Once a day |
| | Often during the day |
| **Working on online assignments or worksheets** | Never |
| | Less than once a week |
| | Once a week |
| | A few times a week |
| | Once a day |
| | Often during the day |
| **Sending and/or receiving e-mail messages** | Never |
| | Less than once a week |
| | Once a week |
| | A few times a week |
| | Once a day |
| | Often during the day |
| **Working on assignments in small groups** | Never |
| | Less than once a week |
| | Once a week |
| | A few times a week |
| | Once a day |
| | Often during the day |
| **A teacher** | Never |
| | Not very often |
| | Sometimes |
| | This is usually the person I ask |
| **Another student in the class** | Never |
| | Not very often |
| | Sometimes |
| | This is usually the person I ask |
| **Technology specialist or Notebook Teacher-Mentor** | Never |
| | Not very often |
| | Sometimes |
| | This is usually the person I ask |
| **Other adult in the school** | Never |
| | Not very often |
| | Sometimes |
| | This is usually the person I ask |

| | |
|---|---|
| **Having a notebook has helped me to be better organized.** | Strongly disagree<br>Disagree<br>Somewhat disagree<br>Somewhat agree<br>Agree<br>Strongly agree |
| **I am more involved in the class when I use my notebook.** | Strongly disagree<br>Disagree<br>Somewhat disagree<br>Somewhat agree<br>Agree<br>Strongly agree |
| **I am more likely to revise or edit my work when it is done on the notebook.** | Strongly disagree<br>Disagree<br>Somewhat disagree<br>Somewhat agree<br>Agree<br>Strongly agree |
| **I would choose to take my notebook home if allowed.** | Strongly disagree<br>Disagree<br>Somewhat disagree<br>Somewhat agree<br>Agree<br>Strongly agree |
| **Now that I have my notebook, I interact with my teachers more.** | Strongly disagree<br>Disagree<br>Somewhat disagree<br>Somewhat agree<br>Agree<br>Strongly agree |
| **Now that I have my notebook, I work with others students more.** | Strongly disagree<br>Disagree<br>Somewhat disagree<br>Somewhat agree<br>Agree<br>Strongly agree |
| **I am more likely to revise or edit my work when it is done on my notebook computer.** | Strongly disagree<br>Disagree<br>Somewhat disagree<br>Somewhat agree<br>Agree<br>Strongly agree |

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| **I get my work done more quickly now that I use a notebook.** | Strongly disagree<br>Disagree<br>Somewhat disagree<br>Somewhat agree<br>Agree<br>Strongly agree |
| **I find I do more work when I use a notebook.** | Strongly disagree<br>Disagree<br>Somewhat disagree<br>Somewhat agree<br>Agree<br>Strongly agree |
| **I am better able to understand my schoolwork when we use the notebooks.** | Strongly disagree<br>Disagree<br>Somewhat disagree<br>Somewhat agree<br>Agree<br>Strongly agree |
| **Since we received the notebooks, I am more interested in school.** | Strongly disagree<br>Disagree<br>Somewhat disagree<br>Somewhat agree<br>Agree<br>Strongly agree |
| **I prefer to handwrite my assignments rather than use my notebook.** | Strongly disagree<br>Disagree<br>Somewhat disagree<br>Somewhat agree<br>Agree<br>Strongly agree |
| **I find that the quality of my work has improved by using the notebook.** | Strongly disagree<br>Disagree<br>Somewhat disagree<br>Somewhat agree<br>Agree<br>Strongly agree |
| **I find that I take more pride in my work since receiving the notebook.** | Strongly disagree<br>Disagree<br>Somewhat disagree<br>Somewhat agree<br>Agree<br>Strongly agree |

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| **I find that my understanding of computers and skills using them have improved since receiving the notebook computer.** | Strongly disagree<br>Disagree<br>Somewhat disagree<br>Somewhat agree<br>Agree<br>Strongly agree |
| **Overall, I find that I have become a better student by having the notebook to complete my work.** | Strongly disagree<br>Disagree<br>Somewhat disagree<br>Somewhat agree<br>Agree<br>Strongly agree |
| **All of the information available on the Internet makes it difficult for me to research and analyze the information.** | Strongly disagree<br>Disagree<br>Somewhat disagree<br>Somewhat agree<br>Agree<br>Strongly agree |
| **I find that my teacher/teachers have been much more effective in teaching me when the class has been able to use the notebooks to assist our learning.** | Strongly disagree<br>Disagree<br>Somewhat disagree<br>Somewhat agree<br>Agree<br>Strongly agree |
| **What grades do you normally receive in school? (Check only one response.)** | Mostly A's<br>Mostly B's<br>Mostly C's<br>Mostly D's<br>Mostly A's and B's<br>Mostly B's and C's<br>Mostly C's and D's |
| **What is the most exciting class assignment you have been given using your notebook? Please explain.** | |
| **What do you think has been the greatest benefit to having a notebook to use in your class this year? Please explain.** | |
| **Please include any other comments you wish to make about the notebook project at this time.** | |

# Appendix E:  Grade 8 (Year 2) Student Interview Questions

**INSTRUCTIONS:  Please read through each question and type in a response below each of the numbered questions below. Be sure to save the document! Thanks for your help on this project!**

1. Now that you are into your second year of using the notebook computer, could you please explain the various ways in which you use the computer in your classes this year?

2. Was it easy for you to adjust to the notebook computer when you returned to classes in September? Were there problems or difficulties in using the computer when you started into the grade 8 year? Explain.

3. When you think about going to school and learning before you had the notebook and now that you have had a notebook computer for over a year, do you think there are many differences? Can you explain what kind of a student you were and how your learning was BEFORE vs. AFTER receiving a notebook? Feel free to give examples of these differences.

4. Now that you have been using the notebook computer for half of grade 7 and half of grade 8, what are you impressions of how things are going in the program? Have you encountered any problems with the notebooks?

5. Do you and your classmates still see the notebook computers as part of a special project, or are they just a natural part of your daily classroom experience?

6. In what ways have you found yourself interacting with your classmates and teachers about how to use the notebook computer for your learning? What kinds of things do you talk about with them?

7. What do you think have been some of the effects of having the portable notebook computer on your attitudes and feelings as a learner? For instance, do you think you are more motivated or excited to learn now than you used to be? If so, how, and if not, why not?

8. Do you think you are better now at learning on your own than you used to be before you had the notebook computer? If so, how have you found yourself becoming more independent as a learner?

9. Have your study habits changed since you received the notebook computer? Do you feel that your marks have gone up or stayed the same since you received the computer? If your marks have changed, why do you think this change has taken place?

10. Have your parents/guardians become comfortable with your use of the notebook computers? Do you think they see it as a positive part of your learning experience? Have they raised any concerns or problems with the notebook learning project?

11. Is there anything else you would like to tell me about your experiences so far with your use of the notebook or the program as it is being used in your class?