

Wireless Writing Project

**School District No. 60
(Peace River North)**

Research Report: Phase II

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Executive Summary

In February, 2002, School District 60 (Peace River North) initiated the *Wireless Writing Project (WWP)*, a classroom-based program of technology integration designed to improve grades 6 and 7 student achievement, particularly in written expression. The *WWP* was planned as an action research project where systematic, well-supported implementation of wireless technology in five classrooms would be carefully evaluated to determine its potential for improving the achievement of grades 6 and 7 students.

Project implementation featured:

- one-to-one assignment of wireless laptop computers
- a long-term systemic implementation plan
- ongoing professional development, collegial interactions and technology support
- systematic monitoring of the *WWP* impact through assessment of student work; teacher, parent, and student surveys; classroom observations; individual teacher research projects; and formal and informal interviews.

Results are extremely positive.

- Improvements in writing achievement, as measured on controlled writing assessments and in-class assessments are strong and consistent. In May 2003, 92% of students produced writing samples that met expectations on the BC Performance Standards compared with 70% on the pretest (a gain of 22%); further, students whose writing exceeded expectations increased from 0% in September to 18% in May.
- Teachers, parents, and students are all extremely enthusiastic about the use of iBooks, and their impact on student achievement, motivation, and attitude. They believe that student writing achievement has improved, and that much of the improvement is connected to the use of iBooks.
- Teachers, parents, and students also describe positive changes in other aspects of achievement, most notably on technology skills, and on student attitudes, motivation, and work habits. Students appear to be better organized, more responsible, and more confident. Student pre-post data indicate that this aspect should be interpreted very cautiously and further examined in the coming year.
- Teachers and students want to continue using iBooks themselves, and strongly support their use for other students in grades 6-7, as well as in high school. Parents want both their own and other children to have iBooks.

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.

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1. Background and Rationale

1.1 Research Question

The *Wireless Writing Project*, developed by SD 60 (Peace Rive North), in collaboration with Apple Canada and Horizon Research & Evaluation, is designed to improve student writing achievement. Through action research, SD 60 systematically collected and interpreted data about student achievement, attitudes, and behaviours, and used these data to make decisions about the project. Research focused around the following key question:

What effect does classroom and home use of wireless technology have on student writing achievement at grades 6-7?

Specifically, what changes in achievement would occur if the district:

- provided iBooks for each student in selected grades 6 and 7 classes
- had students use the laptops at school and at home for all writing activities and assignments
- supported teachers with an ongoing inservice program integrating assessment, instruction, and the use of technology in collaboration with Apple Canada and Horizon Research & Evaluation Inc
- established and monitored common expectations about writing achievement, using the BC performance standards
- collected, interpreted, and acted on data to refine the project at key implementation points

1.2 Context

School District No. 60 has a history of commitment to improving student achievement. There has been continuing concern, however, that many students currently do not achieve the level of writing proficiency needed for success in an information age. In School District No. 60, as in other places in North America, a substantial proportion of students—often boys—enter high school without the writing skills, confidence, and commitment that they need to succeed. Research suggests that this deficit often becomes entrenched in early adolescence—by the time they finish elementary school (see, for example, *BC Ministry of Education, 1993; 2002; Barrs & Pidgeon, 2002; Epstein et al, 1999.*) Few late interventions have been successful for these students; however, research from other jurisdictions indicates that technology has the potential to improve student writing skills (see, for example, *Baker & Kinzer, 1998; Harris & Kington, 2002.*).

As part of a commitment to student success, School District No. 60 has developed strong expertise and interest in the use of technology as a tool for improving student achievement. The district has invested in developing knowledge and infrastructure with respect to best ICT practices.

Several conditions enabled SD 60 to undertake this initiative, including:

- district leadership—Ron Samborski, Superintendent, Carol Greenhalgh, Director of Instruction, and David Vandergugten, Principal of Technology, with the experience and expertise to support a project of this scope
- expertise and experience with technology integration
- commitment of SD 60 teachers to excellence in instruction.
- previous successful collaborations with potential partners, including Apple Canada and Horizon Research & Evaluation Inc.
- a commitment to long-term, systemic planning
- community and parent support for educational initiatives
- trustees who were willing to support innovation for improved achievement

The first implementation phase, January-June 2002, involved one grade 6 classroom, and one grade 5/6 classroom. Research during this phase was designed to provide direction for extended implementation. The second phase, September 2002 – June 2003 focused on developing evidence of the impact of the WWP on student achievement. The project was thus designed as an ongoing action research project, where data collected and analyzed at each phase would provide direction for the next phase. Recent publication of the BC Performance Standards for Writing provided a provincially-based resource for establishing a common set of expectations and of evaluating student achievement.

1.3 Key Decisions

1.3.1 Why Grades 6-7?

As the plan developed, grades 6 and 7 students were established as the immediate target population with expansion to grade 5 contingent on project success. Grades 6-7 were chosen for a variety of reasons including:

- Students entering high school without effective writing skills often fail to improve after grade 7; this is particularly true for boys.
- Success in high school and beyond is strongly associated with communication skills, particularly writing. Literacy/communication skills are interconnected—improvement in one area (e.g., writing) is likely to result in improvement in other areas (e.g., reading.)

- Most students establish a perception of themselves as learners – competent or not – in the elementary grades; after early adolescence this perception rarely changes in positive ways.

1.3.2 Why Wireless iBooks?

The District Leadership Team choose wireless technology, specifically Apple iBooks, for this initiative because:

- Wireless technology allowed the district to implement this initiative in current classrooms without the high cost of retro-fitting a networked environment.
- The iBooks were designed for student use, are robust (durable and compact) and have a transparent operating system.
- All wireless technology is built into the iBooks; the units are easily configured by non-technical staff.
- The iBook’s operating environment is completely compatible with other home and school computers.

1.3.3 What Implementation Timetable was Feasible?

The District Leadership Team developed a three-year plan for implementation that would begin with 2 classrooms and culminate with iBooks in all grades 6-7 classrooms in the third year. This “slow-growing” approach was chosen because:

- Pilot testing in two classrooms would allow intensive support and trouble-shooting while the project team developed plans for wider implementation
- Through the second year—still considered to be a pilot phase—a small number of classrooms would be involved to ensure that sufficient support could be provided
- Data from the second year would provide data on which subsequent decisions about project continuation and expansion could be based

1.3.4 Why focus on the BC Performance Standards?

The project team recognized the critical importance of having common expectations for writing instruction and assessment. An increasing body of research links clear, commonly held standards to increases in student achievement in a number of academic areas (see, for example, Baker, 2000; Black & William, 1998; Darling-Hammond & Falk, 1997; Marzano et al, 1993; Resnick & Harwell, 2000; Wiggins, 1993). This research suggests that clear standards contribute not only to achievement, but also to self-esteem and motivation— students who understand what is expected are more likely to feel ownership over their own progress.

Teachers and schools eligible for the project were using a variety of resources and methodologies for writing instruction. However, most of them had at least partially implemented the *BC Performance Standards for Writing* (BC Ministry of Education) and several were already using these for classroom and school assessment.

Because performance standards describe a range of expectations for student achievement, they enable teachers, students, and parents to judge whether a particular piece of student work actually meets the standard. “Any student should be able to look at a performance standard and say, ‘I understand now. I can learn how to do that’”(Tucker, 1998, p.2). Providing samples that illustrate various levels of quality, as the *BC Performance Standards* do, helps to make standards clear and concrete for teachers, students, and parents.

The *BC Performance Standards* were established as the focus for instruction, student improvement, and evaluation of results. They provide an established framework that is used throughout BC, while at the same time allowing teachers to exercise autonomy in the specific resources and methods they use. The standards also provided for self-assessment, and were the focus of feedback and discussion with students and parents.

2. Implementation and Data Collection

2.1 Phase 1. January-June 2002

Two class sets of iBooks were deployed in January 2002. Support for implementation included:

- regular teacher inservice, provided by John Maschak, Apple Canada, whose expertise is working with teachers to integrate technology into their classrooms, David Vandergugten, Principal of Technology Services for School District No. 60, and Sharon Jeroski of Horizon Research & Evaluation, whose expertise includes writing instruction and assessment, as well as program evaluation
- visits to classrooms to monitor implementation and to team teach
- parent informational and instructional meetings
- a direct phone number for technological support

2.2 Phase II. September 2002-June 2003

Three additional class sets of iBooks were deployed, for a total of 5 classes (1 grade 5/6 class; 2 grade 6/7 classes, and 2 grade 7 classes) in September 2002, in order to provide a larger data set on which to base future decisions.

Within the project, experienced classroom teachers used student work samples, journals, regular classroom assessment tools, student attitude surveys, and provincial assessments to document the changes in student writing. Students in this project wrote their grade 7 provincial writing test (Foundational Skills Assessment) electronically.

Support for implementation was expanded and refined to incorporate findings from Phase 1, and included the following activities.

- A pre-project meeting was held in June 2002, where teachers received their iBooks along with instruction in the operating system and other software. They kept their iBooks over the summer.
- A 2-day Summer Institute was conducted in late August, where teachers received additional instruction and had opportunities for discussion, questions, and planning for the year. They also designed the writing assessment they would use in September to obtain baseline data, and agreed on guiding principles for the project.

Guiding Principles of the Wireless Writing Project

1. Each laptop is dedicated to an individual student, possibly shared with a second classroom on a limited basis.
 2. This is a continuous program—Upper Intermediate Targeted.
 3. Each class participates in prewriting, surveys, writing samples, and journals.
 4. Teachers participate in pro-d with performance standards and technology.
 5. Teachers participate in action research.
 6. Students use laptops for all writing activities.
 7. Students are able to take their laptops home all of the time.
 8. All students should continue to be included throughout the project.
 9. Withholding laptops will not be used as a punitive measure.
- Classroom teachers, consultants and district staff met at monthly meetings to:
 - review progress and troubleshoot as needed
 - acquire information and skills related to teaching writing and integrating technology,
 - share teaching strategies
 - participate in action research (Each teacher developed and pursued a question of interest related to their practice and student development.)
 - Templates for student use were provided. These included abridged forms of the BC Performance Standards for various types of writing (personal, information, story, poetry) to enable self-assessment.
 - Parent informational and instructional meetings were held at each school, where parents were given the laptop contract (see Appendix A) and instructions about ways to collaborate with and support their children.
 - The District Technology Resource Centre provided consistent and timely technical support, including:
 - a laptop exchange program that guarantees that students are not without an iBook for more than one hour of instructional time
 - a direct phone number for a Help Desk that can answer most technical questions related to software and hardware issues
 - an on-line server for student file back-up
 - an on-line shared folder system so that all wireless writing participants have access to timely materials
 - a standard hard drive image with all applications needed for the project
 - tailored templates that effectively integrate the BC Performance Standards for Writing into the Microsoft Office suite

2.3 Data Collection

The following data were collected; key data collection instruments and tables are provided in Appendices A and B:

- Impromptu Writing samples (pre/post) using the BC Performance Standards for Writing (September 2002 and May 2003)
- Teacher's in-class assessment of overall student achievement (April 2003) using the BC Performance Standards for Writing
- Surveys of students' attitudes, perceptions, and self-reported behaviours related to the integration of technology and its impact on their work
- Surveys of teachers and administrators, to gather perceptions about:
 - student achievement, attitudes, and behaviours
 - successful practices
 - changes in classroom environment
- Surveys of parents' satisfaction and perceptions
- Classroom visits
- Video interviews with district leadership as well as selected students, teachers, administrators and parents
- Pre and post surveys of students' writing attitudes and strategies
- Action research results from individual teacher studies (Appendix C)
- Portfolios of writing, including representative information and literary writing assignments that students completed as part of their regular instruction, along with a cover letter from the student (Illustrative examples: Appendix D)

2.4 Dependability of Results

Because the results for the teacher surveys are based on all five teachers in the project, no error or confidence limit is reported for the teacher survey data. For student and parent data, using traditional survey statistics, we would estimate that the results are accurate, 19 times out of 20, within +/- 5 to 8 percent, depending on the specific question. Where

subgroups of students are involved (e.g., grade 5 only, or male only, the confidence limits are substantially greater.) Student surveys were completed by over 97% of participating students; approximately 70% of parents returned completed surveys.

The 95% confidence limits (i.e., confidence that results are accurate 19 times out of 20) for data on student writing vary according to the grade and reporting category being examined, for example:

- for the reported figure of 92% of all students (120), meeting/exceeding expectations in May, the confidence limit is approximately +/- 5%—that is, we are confident that 19 times out of 20, the ‘true’ result would be between 88-97%.
- for the reported figure of 18% of all students (120) exceeding expectations in May, the 95% confidence limit is approximately +/-7%. (i.e., 19 times out of 20, the ‘true’ result will be between 11-25%.)
- results that consider subgroups (e.g., one grade, gender, class) are associated with wider confidence limits. For example, very few grade 5 students are included in the pre-post writing analysis (10); therefore the 95% confidence limit associated with the 40% who exceeded expectations is +/- 30%—still large enough to indicate that *some* students exceed expectations, but sufficiently large that we cannot be certain how many.
- on the other hand, where 100% of the students fall into the same category (e.g., grade 5 students who meet/exceed combined), there is no error term, and consequently the confidence limits are 0.

Consistency of scoring for the writing samples was ensured by extensive training and calibration sessions, and having two teachers independently rate each composition. The project leader checked each students’ scores to ensure that the two teachers did not disagree by more than 1 level; where there was such disagreement (in approximately 1% of cases), the project leader reread the paper and adjudicated the score. Consistency among markers was high. Overall, two markers, independently rating the compositions assigned *exactly* the same score in 80% of cases; a further 19% disagreed by 1 level (e.g., one marker may have assigned level 2; another level 3.)

3. Results

Note: selected data tables are provided in Appendix B.

3.1 Student Writing Achievement: Pre-Post test Comparisons

The BC Performance Standards provide a provincial standard for writing at each grade, and describe 4 levels of performance:

- Not Yet Meeting Expectations
- Meeting Expectations at a Minimal to Moderate Level
- Fully Meeting Expectations
- Exceeding Expectations

The Performance Standards were used to score and compare writing samples (produced under ‘test’ conditions) from September (pre) and from May (post.) Results indicated substantial improvement.

- Student writing improved substantially between September and May, beyond what would normally be expected. In May, approximately 92% of students who wrote the posttest produced writing that met or exceeded provincial standards for their grade. This compares with 70 % in September. Further, in September, no students produced writing that exceeded provincial standards, in June, approximately 18% achieved this level.
- To provide an additional referent, in Peace River North SD, approximately 73% of students met the provincial standard for writing on the Foundation Skills Assessment (FSA) in both 2001 and 2003—that is, met or exceeded expectations; and *no* students exceeded expectations. *Note: this is offered as only a general referent—different groups of students wrote FSA and WWP, and procedures are not strictly comparable.*
- The gain, using the BC Performance Standards, averaged approximately .75 on a 4-point scale – enough to move most students a full level in terms of meeting provincial standards (e.g., from ‘not yet meeting’ to ‘meeting at a minimal to moderate level’ or from ‘fully meeting’ to ‘exceeding.’) In fact, some students moved two full levels. *Note: because the levels are very broad, it is more typical for a student to change approximately .5 level—from ‘low’ to ‘high’ within a level, or from ‘high’ at one level, to ‘low’ at another.*
- It is informative to look at FSA results for two specific schools that are participating in the WWP, and who had very different FSA profiles.

- In school A, FSA results in 2002 were somewhat higher than for the district generally; WWP results are similar for percent meeting/exceeding expectations (90% vs 93%), but are substantially higher (22% vs. 0%) for ‘exceeds expectations.’ *Caution: these are not the same students!*
 - In school B, where FSA results were somewhat lower than for the district generally, WWP results are substantially higher than FSA both for percent of grade 7s meeting/exceeding expectations (94% vs 68%) and for percent exceeding expectations (21% vs 0%) *Caution! WWP students are a small part of the grade 7 population in this school and may not be typical.*
- Gains vary somewhat by grade/teacher/class, although the pattern is similar across all five classes. This may reflect variations in implementation, in the dynamics of a particular class, or in their level of participation in Phase I.
 - Gains were relatively consistent across all aspects of writing (i.e., meaning, style, form, conventions.)

3.2 Perceptions of writing improvement

Teachers, parents, and students expressed strong beliefs that student writing has improved during the project, and further, that much of the improvement was connected to the use of iBooks.

Most grade 6 and 7 students in the WWP believe that their achievement has improved, particularly their writing skills, and see themselves as competent learners who expect to be successful. Students are enthusiastic about their writing products – their ability to produce quality work. Students describe a variety of editing strategies and practices that indicate a commitment to quality writing.

3.2.1 Teachers

- According to survey results, and summaries of in-class writing achievement, teachers strongly believe that student writing has improved and that the iBooks made an extensive/substantial contribution to this improvement.
- When teachers summarized in-class writing assessments, giving student achievement as of April 2003 (with a full 2 months of instruction remaining), results were dramatically improved from September 2003. By April, most teachers reported that only those students on *Individual Educational Plans* (IEPs) for writing were ‘not yet within expectations’ using the BC Performance Standards. (*Note:* IEPs are developed for students who are require modified learning outcomes and instructional support.) Further, on average, students had improved between .5 and 1 performance level. In

April, 14% were described as ‘exceeding expectations’ in April; in September, none fell into this category. These perceptions are remarkably consistent with the actual post test results described in a previous section.

- While they indicated that all aspects of student writing had improved, they saw some aspects as improving more dramatically than others. In rank order, they saw improvements in:
 - presentation (4.8)
 - quantity of writing (4.6)
 - organization (4.0)
 - conventions (i.e., sentence structure, spelling) (4.0)
 - style (3.8)
 - meaning (3.6)
- Teachers assigned high ratings to specific ways in which the iBooks contributed to improved writing, including:
 - planning their writing (4.6)
 - drafting their writing (4.4)
 - editing and revising (4.4)

3.2.2 Parents

- Like teachers, parents are convinced that the iBooks have dramatically improved student writing. Over 93% of parents believe that iBooks have caused at least some improvement in their children’s written expression; over 70% see that improvement as extensive or substantial.
- When asked about specific ways in which the iBooks contributed to student writing, parents assigned high ratings to:
 - editing and revising (4.0)
 - presenting their work effectively (4.3)

3.2.3 Students

- Students are even more convinced than their parents that using iBooks has improved their writing. Over 50% indicated that their writing had improved ‘a lot’ this year; a further 40% said it had improved ‘quite a bit’, for an average rating of 3.4 on a 4-point scale. Results for specific aspects of their writing were as follows:
 - meaning (3.1, 83% chose ‘3’ or ‘4’)
 - style (3.3, 86% chose ‘3’ or ‘4’)
 - organization (3.4, 86%)
 - conventions (i.e., sentence structure, spelling) (3.1, 78%)

- Students answered a series of questions about *how* the iBooks helped their writing, and reported strongly positive results for virtually all the stages of writing (in rank order of results):
 - editing and revising (3.6, 91%)
 - planning (3.5, 92% chose ‘3’ or ‘4’)
 - finding information (3.5, 90%)
 - drafting (3.3, 91%)

3.3 Reported Use of Writing Strategies

Students were asked about their use of various writing strategies in a survey that was administered in September 2002, and repeated in June 2003. Results indicated:

- **Before writing.** Students reported little change in their use of traditional prewriting strategies, and indicated that they were less likely to make mental pictures or images before writing. Results were generally consistent across grade levels.
- **While writing.** Overall, students reported little change in their use of strategies while writing, with one exception: they were more likely to report changing their ideas about their topic or plan as they wrote (increase of 11%).
- **After writing.** Students generally reported higher use of editing and revising strategies in June than they had in September, however, the gains were small and most often not statistically significant. When the percent of students who chose ‘often’ or ‘most of the time’ were compared, the greatest gains were for: “Take out parts you don’t like” (increase of 10%) and “Move sentences or paragraphs” (increase of 9%.) Girls also reported a substantial increase in “Check for errors and make corrections” (increase of 13%); boys did not.
- The one area where male students showed greater gains was “Think about the person or people who will be reading your work.” While results for girls were relatively stable, there was an increase of 8-10% of boys who reported thinking about their audience ‘often’ or ‘most of the time’ as they planned, drafted, and edited their writing.
- One disappointing finding emerged in the strategy survey: in June, fewer students reported working with their family members to check or improve their writing, except at grade 5. In Phase I, this question received a much more positive result in June than in December (project initiation.) This result is at odds with information from other parent and survey students, and requires close attention as the project expands.

3.4 Opinions about the Project

Teachers, parents, and students are all extremely enthusiastic about the use of iBooks, and their impact on student achievement, motivation, and attitude. They want to continue using iBooks themselves, and strongly support their use for other students in grades 6-7, as well as in high school. Parents want both their own and other children to have iBooks.

3.4.1 Teachers

- Using a five-point scale, where ‘5’ was the most positive response, the average response to most questions was between 4-5. In most cases, all five teachers chose either ‘4’ or ‘5’ to describe their perceptions of the project.
- All teachers are overwhelmingly enthusiastic about their participation in the project and the benefits it brings to students. All five assigned the highest possible rating (5) to the following questions:
 - How important is it to you to have iBooks next year?
 - How important do you think it is for schools to provide iBooks for students in grades 6/7?

3.4.2 Parents

- The Parent Survey also used a 5 point scale. Overall, parents chose high positive ratings—‘4’ (extensively) or ‘5’ (a great deal; substantially) for most questions.
- Parents assigned their highest ratings (4.6, with 92% choosing ‘4’ or ‘5’) to the following question: “How much does your child like having an iBook?”
- They also indicated that they liked their children having iBooks (4.2, 76% rating ‘3’ or ‘4’—*note that no parent chose ‘not at all’ for this question.*)
- Further, parents strongly endorsed the use of iBooks both for their own child, and for other children, with ratings of 4.0 to 4.4 for the following questions:
 - How important is it to you that your child have an iBook next year? (4.1, 72% choosing ‘4’ or ‘5’)
 - If you have other children, how important is it that they be able to use iBooks in school? (4.1, 73%)
 - How important is it for schools to provide iBooks for students in grades 6/7? (4.0, 70%)
 - How important is it for schools to provide iBooks in high school? (4.4, 83%)

3.4.3 Students

- Students offered the most enthusiastic responses to questions about the use of iBooks. On a four-point scale, where ‘4’ was the most positive response, the average response was above 3.5 for approximately half of the questions, with over 85% choosing ‘3’ (quite a bit) or ‘4’ (a lot.)
- When asked, “How much do you like having an iBook?” over 70% chose the highest rating; the average was 3.6, and only 3 students (out of 143) said that they did not like having iBooks.
- Four other questions addressed students’ overall perceptions of the importance of iBooks to their education. All results were extremely positive, with 80-86% choosing ‘3’ or ‘4’, and average ratings of 3.3 to 3.5:
 - How important is your iBook to your success in school? (3.3, 85%)
 - How important is it to you to have an iBook next year? (3.4, 81%)
 - How important is it for all students to have iBooks in grades 6/7? (3.3, 84%)
 - How important is it for students to have iBooks in high school? (3.5, 86%)

3.5 Student Technology Skills

The WWP was designed to improve students’ writing skills. However, it is also had a major impact on a variety of other aspects of achievement, most notably on their technology skills

3.5.1 Teachers

- All teachers assigned the highest rating (5) to describe the impact of the project on students’ technology skills. They also noted strong improvements in their own skills (4.6) and confidence (4.2).

3.5.2 Parents

- In interviews, parents often emphasized that their children were developing important lifelong skills, that would be essential for success in a knowledge-based world.
- On the surveys, parents assigned high ratings to improvements in their children’s computer skills, with an overall rating of 4.6, *all* indicating their children’s skills had improved at least somewhat, and 92% seeing the improvement as ‘extensive’ or ‘substantial.’

- Most parents also reported that their children helped other family members computers, 50% ‘extensively’ or ‘substantially.’

3.5.3 Students

- Students reported a high degree of confidence in using computers, with an average rating of 3.6 on a four-point scale, and 94% choosing ‘quite a bit’ or ‘a lot.’
- Over 68% also indicated they are able to help others who are having trouble with their computers ‘quite a bit’ or ‘a lot’ (average rating 3.2)

3.6 Accessing Information

3.6.1 Teachers

- Teachers were also enthusiastic about the way in which the iBooks had helped students to access information, assigning an average rating of 4.8.

3.6.2 Parents

- Parents were not asked about the impact of the iBooks on accessing information; however, they did provide information about the extent to which children accessed the Internet for school work and leisure combined, and reported relatively low usage, with over 1/3 indicating that their children did not use the Internet at all at home (*note: 75% of parents reported having Internet access in their homes.*)

3.6.3 Students

- Students were as enthusiastic as their teachers about their ability to access information, with over 90% reporting their iBooks helped them find information ‘quite a bit’ or ‘a lot’ (average rating 3.5 on 4-point scale), and almost all (97%) indicating that this helped to improve their work ‘quite a bit’ or ‘a lot.’

3.7 Attitude, Motivation and Work Habits

According to teachers, parents, and students, the iBooks have stimulated some dramatic changes in student attitude, motivation and work habits, including increased focus and fewer incidents of disruptive off-task or inattentive behaviour.

3.7.1 Teachers

- Teachers believe that students are taking increased responsibility for their own and others' learning; often, those who previously contributed negatively to the classroom environment, are now technology 'experts' who provide assistance and instruction. Specific areas of improvement include increases in students':
 - organizing and keeping track of work (4.2)
 - working productively (on task) (4.2)
 - taking responsibility for their own work (4.0)
- They also reported that the iBooks improved student motivation, and benefited students with motivation problems (4.0), weak organization skills (3.8), and attention problems (3.6) It is interesting to note that in these three areas, one of the teachers felt the improvements were dramatic.
- Some teacher comments:
 - "The greatest success has been the amount of on-task behaviour in writing."
 - "The most pleasant surprise: on-task behaviour – students actively engaged in writing."
 - "The most pleasant surprise: The children's attitudes around the iBooks. They are very good at taking responsibility for the machine and caring for them."
 - "Several parents believe that this project has changed their children's attitude to school."

3.7.2 Parents

- Most parents see the iBooks as stimulating a profound change in their children's attitude and, with nearly 90% reporting some improvement, and over 60% indicating that improvement was 'substantial' or 'extensive' (average rating 3.9.)
- Parents also attribute changes in their children's work habits to the iBooks:
 - helps organize and keep track of work (3.8, 66% chose '4' or '5')
 - improved work habits (3.6, 57% '4' or '5')
 - increased taking responsibility for own work (3.6, 58% chose '4' or '5')

3.7.3 Students: General Survey

- Students also responded to questions about their attitudes and work habits. Over 74% indicated that their attitude to school had improved 'quite a bit' or 'a lot', due to having an iBook (average rating 3.0 on 4-point scale.)

- They reported a even stronger change in their attitudes toward writing, with nearly half indicating their attitude had improved ‘a lot’ and over 85% choosing ‘quite a bit’ or ‘a lot.’ The average rating on the four-point scale was 3.3

3.7.4 Students: Attitude toward Writing Scale

Students also completed an *Attitude toward Writing Scale*, where they responded to a series of 10 general questions about writing in both September and June. This scale has been frequently used to track general attitudes to writing; it does not focus on the use of technology, or even mention computers or word processing. Results indicated that:

- overall, students’ attitudes were relatively positive in September; they did not change appreciably over the course of the year.
- in both September and June, girls reported more positive attitudes than boys
- in September, grade 5 students – none of whom had any classroom experience with laptops – had the least positive attitudes. Over the course of the year, their attitudes improved, and at the end they reported attitudes as positive or more so than grades 6 and 7 students.
- grade 7 students, many of whom were in the project for a second year, showed a slight decline in attitude between September and June.
- the changes at grade 5 and 7 while part of an interesting pattern, are not statistically significant

3.8 Subgroups of Students

Achievement data show similar improvements at all achievement levels, and for both boys and girls. Generally, girls’ scores were substantially higher than their male counterparts in both September and May.

- Teachers were also asked to rate their views about the impact of the project on various subgroups of students (e.g., boys, girls, high-achieving.) Again, all teachers saw a positive impact on all students, although some teachers were more positive than others. Teachers were unanimous about the projects effect on:
 - both boys and girls – ratings were very similar (4.4, and 4.2)
 - high-achieving students – this received an extremely high rating (4.8)
 - First Nations students – received ratings of ‘3’ and ‘4’ from all (average 3.6)
- For other subgroups, there was more disagreement among teachers, with some reporting dramatic benefits, while others saw moderate benefits. For example:
 - for low-achieving students, two teachers assigned the highest possible rating while two indicated there had been ‘a little’ benefit. (average 3.2)

- results were similarly varied when teachers were asked about students with attention problems, although more positive (average 3.8)
 - for students with motivation (4.0) or organizational problems (3.8), as described in an earlier section, results were strongly positive, but varied from one teacher to another
- When teachers responded to open-ended questions, they often commented on students who typically have difficulties, for example:
 - “The greatest success was giving low income students a chance to use technology that they would otherwise be unable to even view.”
 - “The greatest success was opportunities for low achieving/behaviour students.”
- In interviews, parents of children who previously had been identified as having learning difficulties were particularly enthusiastic, reporting strong gains in their children’s achievement, attitude, and confidence.
 - *Note:* some of the students who made Powerpoint presentations to the School Board had a history of behaviour problems and attention deficit; Board members were unaware that these students, who presented so effectively, had any problems.
 - When pre-post surveys of student attitudes and use of writing strategies were compared, grade 5 students showed the greatest gains, particularly in:
 - thinking about the person/people who will read their work
 - making editing changes
 - working with their teacher or other students to improve their writing

It is important to note that, in most cases, grade 5 students had the lowest scores or ratings in these areas in September; by June, their results were similar to their older peers. that is, they had the greatest gains, but not the highest scores or ratings in June. One possible explanation is that these students were all genuinely new to the project; at grades 6 and 7, most students had previously had at least some experience with the WWP in 2002—they were often in ‘buddy’ classes where they used the laptops for a few hours each week. They had already demonstrated some gains in their use of strategies in 2002.

- Girls reported much higher use of various writing and editing strategies in both September and June than their male counterparts. For example, in June, 93% of girls reported that they checked their work for errors and made corrections ‘often’ or ‘most of the time,’ while for boys, the result was 69%.

Note: A related project that focuses on using iBooks with First Nations students is being conducted simultaneously, with many of the same data available. This study is not reported here, because the implementation model is substantially different, and the iBooks rotate among classes rather than being fully integrated in a 1:1 model.

3.9 Hardware and Software: Satisfaction and Use

Teachers, parents and students also responded to questions about the dependability of the hardware (iBooks) and the utility of various software and applications.

3.9.1 Teachers

- At monthly meetings, which in the first year of the project focused largely on troubleshooting, teachers by February 2003 had few/no problems to report. They frequently reported that technology was working seamlessly in their classrooms –no down time, no instances of activities interrupted or cancelled because of hardware problems. Because the technology works and is serviced quickly and smoothly, it is becoming transparent.
- Teachers indicated strong satisfaction with the reliability of the iBooks, and often mentioned (in open-ended responses), satisfaction with the level of technology support, both in terms of quality and timeliness that is available.
- Of the programs and features they were asked about, teachers indicated that most had been effective in helping student development. For example:
 - Teachers rated the word processing program very positively, in terms of helping students, (4.8)
 - Powerpoint received the second highest ratings among the software (4.6)
 - *Inspiration*, software that students use to generate, develop and organize their ideas was also seen as very helpful (4.2)
- Teachers were also positive about the effect of using the Internet (3.8)

3.9.2 Parents

- Parents were asked a slightly different set of questions about software and hardware. Rather than being asked for their impression of the impact or utility of various programs and applications, they were simply asked to indicate the extent of their children's use. Most indicated that their children spent extensive time using their iBooks at home (average rating 3.8; 64% chose '4' or '5.')
- Most reported high usage of several specific tools, both for school and leisure. Word processing tools, including editing features, received extremely high ratings.
 - editing tools (average rating, 4.2; 83% chose '4' or '5' on 5-point scale)
 - word processing (3.9; 72%)
 - *Inspiration* (3.6; 49%)

- *Powerpoint* (3.5; 50%)
- *iMovie* or *iPhoto* (2.9; 38%)

3.9.3 Students

- Most students reported a high degree of satisfaction with their iBooks with 86% percent choosing the top two ratings, and an average rating of 3.1 on the 4-point scale. Only 2 students described their iBooks as ‘not at all’ reliable.
- Students rated a variety of software and application, in terms of how helpful these had been for improving their work. They were extremely positive about most of them, reported below in rank order.
 - editing tools (average rating 3.7 on 4-point scale; 95% chose ‘3’ or ‘4’)
 - word processing (3.6, 96%)
 - features for organizing work (e.g., file folders) (3.6, 91%)
 - *Powerpoint* (3.3, 82%)
 - *Inspiration* (2.9, 73%)
 - *iMovie* or *iPhoto* (2.6, 52%)

3.10. Use of the BC Performance Standards

The BC Performance Standards for Writing were an important feature of implementation. These provincial standards were used to assess student writing, to guide instruction, and to prompt self-assessment and goal setting. Teachers, students, and parents had access to both electronic and paper forms of the Performance Standards.

3.10.1 Teachers

- All teachers felt that the BC Performance Standards had helped student writing development; some were extremely positive, others, less so (average rating 3.8.)

3.10.2 Parents

- Parents were not asked to make judgments about the value or impact of the performance standards. Rather, they were asked to report on how frequently their children used these standards at home. The results were very positive, and somewhat surprising, with 71 % reporting that their children used the standards ‘somewhat’ or more, and 37% reporting extensive or substantial use (average rating 3.1 on the 5-point scale.) This is particularly encouraging, as any use of the standards is necessarily connected to self-assessment and striving to improve writing. For example, it is possible to use word processing tools, and even Powerpoint or Inspiration for pleasure/leisure; the Performance Standards have no possible application for leisure – they are strictly an academic tool, used to focus on and improve the quality of a student’s writing.

3.10.3 Students

- Students also reported an encouraging level of use for the BC Performance Standards for Writing, with over 75% reporting that the standards had helped their writing ‘quite a bit’ or ‘a lot’ (average rating of 3.1 on 4-point scale.)

3.11 Impact on Teaching

Teachers involved in Phase II report strong satisfaction with the impact of the project on their students and classrooms, and cite few problems associated with technology integration. Classroom observations confirm that in some project classrooms, the teacher has been able to take a more facilitative role, rather than directing all student learning. This, in turn, has increased students’ engagement and responsibility for their own learning and achievement

3.11.1 Changes in teaching practice

- Teachers reported a very high level of change in their teaching practices. This is one of the most exciting results of this project, as the practices they report changing/increasing, are those which research suggests make the biggest difference to student achievement and motivation (see, for example, Black & Wiliam, . For example:
 - providing students with more choice and responsibility (4.4)
 - providing feedback to students (3.8)
 - engaging students in self-assessment (3.8)
- Teachers also indicated that they had changed the way they planned and organized for instruction, for example:

- changed planning (4.0)
 - changed managing student activities and behaviours (4.0)
 - changed organization of classroom (4.0)
 - changed designing and marking assignments (3.8)
- In interviews, teachers noted that student collaboration had increased; they share their work and the results of their research. Teachers also noted that use of the Internet has increased classroom efficiency, for example, students are able to consult reference materials or conduct research using approved sites, without leaving their desks. Some teachers have incorporated websites within their worksheets in content areas such as science.
 - One teacher commented:
 - “I am more aware of my teaching practices. I am more willing to use the performance standards and they drive my teaching of writing.”

3.11.2 Issues and Challenges

- Overall, teachers reported few issues and challenges. Those mentioned included:
 - trying to keep up with the students’ knowledge
 - monitoring Internet and chat line use
 - issues around sharing with another class
 - increased marking (because of increase in quantity and quality of student writing)
 - occasional technology problems (ensuring all iBooks are working all the time)
 - some students (1-2) who are not benefiting
 - learning to teach from a computer screen and a projector

3.12 Impact on Parental Involvement

Preliminary data from the pilot study in 2001-2002 indicated that iBooks had the potential to increase parents’ involvement in their children’s writing activities and assignments. Parents and students were asked about this involvement on the 2003 surveys.

- Approximately one-half (47%) of the parents surveyed indicated that they looked at their children’s work on the iBook ‘extensively’ or ‘a great deal’; 17% said they looked at their children’s work ‘a little’ or ‘not at all.’

- When students were asked how often their parents looked at their work or helped them, approximately 41% said ‘quite a bit’ or ‘a lot.’ while 17% chose ‘not at all.’ This result appears to be somewhat at variance with results of a similar question on the *Writing Strategies Survey* where approximately 25% reported that they ‘often’ or ‘most of the time’ worked with someone in their family to check or improve their writing; this compared to 30% who offered a similar opinion at the beginning of Phase II.
- The similarity between parent and student answers to this question give the results validity. It is difficult to determine whether the level of involvement reported by parents and students is higher or lower than what might be expected for ‘regular’ assignments.

3.13 Key Issues in Implementation

Classroom visits, project meetings, interviews, and informal discussions with teachers and students have produced the following additional insights about implementation.

3.13.1 One-to-one assignment of wireless laptop computers

- Students report strong ownership and a sense of responsibility to ‘their’ computer; this is supported by extremely low incidence of any kind of damage. Students are clearly very careful when handling their laptops.
- Students describe how important it is to have their ‘own’ computer that they can access whenever they need it, at school or at home. They are able to personalize their operating environment to suit their learning styles.
- Teachers who are accustomed to a lab or cart system for sharing computers among classes, notice a dramatic decrease in the amount of ‘maintenance’ or ‘startup’ time required each time they want to use the computers. All the iBooks are instantly available and students know where to find the software, save documents, etc. Instructional/learning time is increased. (However, there is still a small time cost involved in moving equipment back and forth from the charging cart.)
- Because students are able to take their iBooks home, parents have increased access to their day-to-day school work, as well as major assignments.
- One-to-one assignment allows for serendipitous and spontaneous use of the iBooks as opportunities naturally arise.

3.13.2 Long-term systemic implementation plan

- Perceptions that the deployment of iBooks has proceeded in a transparent, well-planned, equitable way has been critical to acceptance by district schools and staff.
- Adhering to a long-term, carefully delineated plan, has allowed School District No. 60 to effectively utilize technology grant funding and forecast teacher and technology needs.
- Feeling that they were part of a long-term plan has helped to create a collegial, collaborative climate, where teachers are partners in the development, implementation and future directions of the project.

3.13.3 Ongoing professional development, collegial interactions

- The two pre-Phase II sessions (June and August 2003) contributed to a smooth start-up.
- During the year, teachers met and participated enthusiastically in sessions that include presentations by their colleagues and discussion of their own action research.
- Teachers are taking increased responsibility for leading inservice sessions; they are willing to present, to share their students' work, and talk together about their successes and problems.
- Interactions among project teachers is not restricted to formal meetings; they often visit each other's classrooms, exchange resources electronically.
- Teachers, district staff (David Vandergugten) and consultants (Sharon Jeroski and John Maschak) exchange information and ideas during meetings, classroom visits, and informally (e.g., e-mail.)

4. Conclusions and Recommendations

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 also help to identify some key issues and provide guidance for ways to further enhance the impact of technology integration as the program expands.

4.1 Student Writing Achievement

Students who participated in the WWP improved their writing

Improvements in writing achievement, as measured on controlled writing assessments and in-class assessments are strong and consistent. In May 2003, 92% of students produced writing samples that met expectations on the BC Performance Standards compared with 70% on the pretest (a gain of 22%); further, students whose writing exceeded expectations increased from 0% in September to 18% in May. Wireless technology has the potential to improve achievement, particularly in writing, for grades 6-7 students in ways that bode well for their success in high school.

Recommendation: Expand the Intermediate project to Phase III, as initially planned, to provide similar experiences to all grades 6 and 7 students, with one-to-one deployment. See Figure 1 for this plan.

Improvements appeared consistently for all subgroups

Students at all grade levels, both boys and girls, showed similar improvement during Phase II. Girls scores were higher both at the beginning and end of Phase II. Overall, grade 5 students showed the strongest gains; however, they were a very small number, and all from one classroom; it is inappropriate to generalize beyond the specific students who participated.

Teachers had mixed views about whether some groups of students benefited more than others. They all agreed that both boys and girls benefited similarly, along with high achieving students and First Nations students. They also saw strong benefits for students who have problems with organization and work habits. Some saw the WWP as strongly benefiting low achieving students and those with behaviour or attention problems; others did not.

Recommendation: Continue to provide *all* students with opportunities to participate fully in the WWP.

4.2 Technology skills

Students' technology skills have improved.

According to teachers, parents, and students themselves, student facility with technology – both hardware and software—has improved dramatically. Most students are confident and flexible, able to ‘trouble shoot’ and help others at home or school. Teachers also report strong improvement in their technology skills and confidence.

Recommendation: Continue to provide opportunities for students to develop and apply these skills in a wide range of contexts. Consider building on these skills by focusing increasing attention on critical thinking, on collaboration, and on information management and use.

4.3 Support for the project

Teachers, parents, and students support continuation of the WWP

Teachers, parents, and students are all extremely enthusiastic about the use of iBooks, and their impact on student achievement, motivation, and attitude. They believe that student writing achievement has improved, and that much of the improvement is connected to the use of iBooks.

Teachers and students want to continue using iBooks themselves, and strongly support their use for other students in grades 6-7, as well as in high school. Parents want both their own and other children to have iBooks.

Recommendation. Ensure that the teachers, parents, and students who are involved in Phase III receive similar support, and have similar opportunities to shape the direction of the WWP as those who participated in Phase II. Continue to consult, listen, and collaborate with all groups, ensuring that the WWP is a true partnership.

Recommendation. Continue to explore ways of increasing parental involvement through activities such as a ‘family photo night’ where families can acquire or improve their skills, and through using technology to enhance home-school communication.

4.4 Student writing strategies

Students' use of writing strategies changed to a smaller degree than anticipated

Overall, most students reported similar use of prewriting and during writing strategies before and after Phase II. In fact, they reported fewer instances of some traditional

prewriting strategies (e.g., creating mental pictures) than they had at the beginning of Phase II.

On the other hand, students reported higher use of editing and revising strategies as the project developed, and boys were more likely to think about their audience after participating in the WWP.

Generally, grade 5 students showed the strongest improvements in use of writing strategies; this may be partially accounted for by the fact that they had the lowest use of strategies at the beginning of Phase II, and were the least likely to have had previous experience with laptops in their classrooms.

Recommendation: Refine data collection, and data tracking procedures to ensure that questions about student writing strategies can be satisfactorily addressed at the end of Phase III. Consider adding questions that relate specifically to the integration of technology. At the same time, emphasize for both teachers and students, the importance of the strategies and processes of writing, and how these can be enhanced by use of wireless technology.

4.5 Attitudes, motivation and work habits

Students in the WWP have developed more positive attitudes, motivation, and work habits

Teachers, parents, and students perceive positive changes in student attitudes toward school, motivation, and work habits. Students appear to be better organized, more responsible, and more confident.

At the same time, comparison data suggest that attitudes toward writing have not changed appreciably for most students. It is difficult to determine whether this is a case of reality being less positive than perceptions, whether the measure being used does not provide information about some of the changes that are occurring, and/or whether results are affected by length of time in the program (i.e., students who have participated for a longer time may not continue to show changes in their attitudes toward writing after the first year.)

Recommendation: Refine methods of collecting data related to attitude, motivation, and work habits, including a pre-measure designed to probe some of the specific changes in that Phase II parents, teachers, and students perceived.

Recommendation: Establish an ongoing data base that will allow SD 60 personnel and researchers to track students over time, to readily break out results for various subgroups of students, and to examine associations among various measures.

4.6 Impact on Teaching

The WWP has had a strong, positive impact on teaching practice

One-to-one deployment of iBooks has allowed teachers in project classrooms to take a more facilitative role, providing guidance and feedback to students, and increasing the extent of collaboration, choice, and responsibility. This, in turn, appears to have increased students' engagement and responsibility for their own learning and achievement. At the same time, teachers believe that the WWP has made their classrooms more efficient—that there is more time for active learning and practice, and that students are able to accomplish more.

The BC Performance Standards for writing became an important feature of instruction, self-assessment, and teacher evaluation. The standards provided common expectations and vocabulary for teachers, students, and parents, and were widely used by all three groups. This emphasis on the Performance Standards helped to keep the WWP focused on the improvement of various forms of writing.

There have also been a number of challenges for teacher, including: monitoring Internet and chat line use; and the increased work load associated with increases in students' productivity (i.e., there is more marking.)

Recommendation. Engage teachers who have been part of Phase II to mentor and assist those teachers who are new to the project in Phase III. Provide opportunities for them to share the knowledge, insights, and resources they have developed.

Recommendation. Continue to use the BC Performance Standards to focus the project. Formalize expectations at the outset of Phase III that teachers and students will use the Performance Standards for all types of writing, and to facilitate development of student portfolios.

4.7 Hardware and Software

The iBooks, software, and level of technical support were dependable and effective.

For the most part, technology worked seamlessly – there was little down time, few activities were interrupted because of hardware or software problems, and service was quick and efficient. Teachers and students were enthusiastic about the software they used, including editing tools; word processing; *Inspiration*, *Powerpoint*, *iMovie*, and *iPhoto*.

Teachers, based on their own experiences, suggested that minimum expectations for the introduction of various software be established for Phase III in order to reassure teachers new to the project that it would be manageable.

Recommendation. Continue to provide and support the software available in Phase II (or its updates.) Provide step-by-step information sheets to support teachers.

Recommendation. As the project expands, continue to provide hardware and software support to the same level as experienced in Phase II.

Recommendation. Establish a systematic schedule of implementation for various software and applications during Phase III. Introduce each type of software in connection with a particular type of writing, to emphasize its importance as a *tool*. Provide sufficient time and support for all teachers to become comfortable with both hardware and software.

4.8 Additional Implementation Issues

Implementation in School District No. 60 has been effective.

The strong support and satisfaction expressed by teachers, parents, and students indicate that implementation of the WWP has been effective. Evidence from the WWP supports a model of technology integration that features one-to-one assignment of wireless laptop computers, a long-term systemic implementation plan as well as short term goals and expectations, and ongoing professional development, collegial interactions and technology support.

Recommendation. All teachers who are involved in the project in Phase III should have opportunities to meet regularly, to receive inservice on the integration of technology and writing, and to participate in project development and research.

Recommendation. To help focus implementation, and make goals concrete for both teachers and students, Phase III implementation should focus around the development of individual, electronic writing portfolios that include examples of the various types of writing expected of students in grades 6 and 7. These portfolios will provide a focus, and ongoing evidence of the achievements of students in the project.

Recommendation. A long-term systemic plan for expansion to other grade levels should be established.

A final note: Students who are entering junior high school, along with their parents, frequently expressed anxiety about how they would adjust to working without their laptops. The district and the junior high schools involved should be sensitive to this issue, and make every effort to accommodate these students. Some of them may choose to provide their own laptops; they should not be discouraged from bringing these to class or using them.

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○ FIGURE 1. Implementation Plan

