




MINISTRY OF EDUCATION

Te Tāhuhu o te Mātauranga

New Zealand



**TELA: Laptops for Teachers
Evaluation**

Final Report Years 9-13

**B Cowie, A Jones, A Harlow, C McGee, B Cooper, M Forret, T Miller,
and B Gardiner**

Report to the Ministry of Education

RESEARCH DIVISION



Wāhanga Mahi Rangahau

ISBN 978-0-478-13830-6

Web Copy ISBN 978-0-478-13833-7

RMR-879

© Ministry of Education, New Zealand — 2008

Research reports are available on the Ministry of Education's website Education Counts:

www.educationcounts.govt.nz/publications.

Opinions expressed in this report are those of the authors and do not necessarily coincide with those of the Ministry of Education

TELA: LAPTOPS FOR TEACHERS EVALUATION

Final Report Years 9-13

Commissioned by the Ministry of Education

Bronwen Cowie, Alister Jones, Ann Harlow,
Clive McGee, Bev Cooper, Mike Forret,
Thelma Miller, and Ben Gardiner



THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato

The University of Waikato

Private Bag 3105
Hamilton, New Zealand
www.waikato.ac.nz

**Centre for Science &
Technology Education
Research (CSTER)**

Telephone: +64 (07)
838 4035
Fax: (07) 838 4272
Email:
cster@waikato.ac.nz

**Wilf Malcolm Institute of
Educational Research
(WMIER)
School of Education**

Telephone: +64 (07) 858
5171
Fax: +64 (07) 838 4712
Email
wmier@waikato.ac.nz



**New Zealand Council for Educational
Research**

P O Box 3237
Wellington, New Zealand
www.nzcer.org.nz

ACKNOWLEDGEMENTS

Research of the kind outlined in this report involves a considerable number of teachers in a large number of secondary schools. The evaluation team is grateful for the willingness and forbearance of so many school principals and teachers; grateful to principals who actively encouraged teachers to take part; and grateful to the hundreds of classroom teachers who have been willing to share their experiences in relation to the TELA scheme of providing laptops for teachers.

The evaluation team has appreciated the ongoing contact with the schools and teachers in this evaluation project. Teachers have had a unique opportunity to tell their stories of their emerging experiences with their laptops. This valuable information will have an important part in informing (and hopefully enhancing) future policies and practices, ultimately to the benefit of students, teachers and schools.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
1. INTRODUCTION	7
1.1 LAPTOPS FOR TEACHERS IN NEW ZEALAND.....	7
1.2 LAPTOPS FOR TEACHERS (TELA) EVALUATION.....	7
1.3 STRUCTURE OF THIS REPORT.....	8
2. INTERNATIONAL TRENDS: ICT IN EDUCATION/LAPTOPS FOR TEACHERS	9
3. LAPTOPS FOR TEACHERS (TELA) EVALUATION	13
3.1 EVALUATION FOCUS.....	13
3.2 EVALUATION FRAMEWORK.....	13
3.3 EVALUATION METHODOLOGY.....	14
3.4 PARTICIPANTS.....	14
3.5 RESEARCH REPORTS AND DISSEMINATION.....	15
4. IMPACTS ON TEACHER PROFESSIONAL PRACTICE	17
4.1 CHANGES IN PERCEPTIONS OF EXPERTISE AND COMFORT LEVELS.....	17
4.2 CHANGES IN USE FOR ADMINISTRATION.....	19
4.3 CHANGES IN USE FOR COMMUNICATION.....	21
4.4 CHANGES IN USE FOR COLLABORATION.....	24
4.5 CHANGES IN USE FOR LESSON PLANNING AND PREPARATION.....	26
4.6 CHANGES IN CLASSROOM PRACTICE.....	29
4.7 INTEGRATION OF THE LAPTOP INTO TEACHERS’ WORK.....	34
4.8 IMPACTS OF LAPTOP USE ON SCHOOLS.....	35
5. SUPPORTS FOR TEACHER LAPTOP USE: ADDRESSING CURRENT REALITIES	37
5.1 THE TELA POLICY.....	37
5.2 SCHOOL-BASED FACTORS.....	39
6. SUSTAINING CHANGES IN TEACHER LAPTOP USE	45
6.1 THE PATTERN OF CHANGE.....	45
6.2 HOW TO SUSTAIN AND ACCELERATE CHANGE.....	45
7. RECOMMENDATIONS: MAXIMISING THE TELA SCHEME	51
7.1 NATIONAL POLICY.....	51
7.2 SCHOOLS.....	52
REFERENCES	55
APPENDIX A: EVALUATION TIMETABLE	60
APPENDIX B: IMPACTS ON ADMINISTRATION	62
APPENDIX C: IMPACTS ON COMMUNICATION	63
APPENDIX D: IMPACTS ON COLLABORATION	64
APPENDIX E: IMPACTS ON LESSON PLANNING AND PREPARATION	65
APPENDIX F: IMPACTS ON CLASSROOM PRACTICE	66

EXECUTIVE SUMMARY

The purpose of this evaluation was to investigate the impacts of the Laptops for Teachers Scheme: TELA (referred to from here as the TELA scheme) on teachers' work over a period of four years (2003-2006) and to record emerging changes in laptop use. This evaluation report presents findings from three annual cycles of national focus groups, questionnaires and case studies with Year 9 to 13 teachers in New Zealand secondary schools.

In this evaluation, three methods of data collection were used: first, six focus groups of teachers in face-to-face meetings, second, a questionnaire sent to teachers in a range of schools, and third, case studies of eight schools participating in the TELA scheme. The focus groups allowed teachers to talk about their experiences and changes in their use of the laptop over the three years. Each year, teachers from twenty focus group secondary schools met in five regions. The annual questionnaire asked teachers about various aspects of their laptops' experience, including school support for laptops, professional development, their use of laptops at home and in school, and their goals for future use. In this final report, questionnaire results are presented together with the results from focus groups held over three years and case study data from three years of case studies.

Main findings

As a direct result of the TELA policy to provide teachers with laptops rather than desktop computers, teachers reported that they now had flexibility of time and place for working. Teachers also commented on the improved access to resources afforded by TELA laptop ownership, and how the laptop had helped them to become more confident in the use of ICT.

The evidence in this report demonstrates that the implementation of the Laptops for Teachers scheme (TELA) has resulted in progress towards the achievement of the goals for this initiative. It reveals:

- Modest increases in confidence and expertise with ICT in many teachers, particularly for 'beginner' users of laptops;
- Increasing use of laptops to strengthen collegial relationships;
- Efficiencies gained in lesson planning, preparation, administration and reporting; and
- Growing use of laptops for classroom practice and student learning activities.

It needs to be pointed out, however, that there was considerable variation between individual teachers – first, in terms of where they began in 2003, second, their degree of progress, and third, their competence and confidence at the end of 2005. In spite of differences in progress, a number of broad conclusions can be made.

1. Confidence with ICT

Over the three-year period, there was improved confidence and expertise with ICT, a greater proportion of teachers becoming comfortable using their laptops for a range of tasks. Nearly all teachers reported they

were comfortable with word processing and most were comfortable using email, and searching the Internet. By 2005, using graphics, locating online information, using spreadsheets and charts, and using presentation software were tasks that around half of teachers felt comfortable with. Case study teachers were very appreciative of the opportunity to access a TELA laptop. For most teachers, the laptop was now integral to their professional lives. Teachers who had appeared somewhat diffident in 2004 spoke with confidence about what they could and intended to do. Informal peer mentoring was seen as the most efficacious form of professional development and assistance because teachers accessed help in the context they would use it and they had models of effective practice that worked with their systems and students.

Since the distribution of laptops to Year 9 to 13 teachers in 2003, there has been an improved confidence, particularly for those new to laptop use, and expertise with ICT, with a growing proportion of teachers becoming comfortable using their laptops for a range of tasks.

2. More effective communication and collaboration

The laptops had enabled teachers to engage in more effective communication with colleague teachers and more easily collaborate with them. By 2005, over four fifths of teachers used their laptops for email communication with colleagues. Teachers had found that using the laptop for communication gave time and date verification of communications. By 2005 there had been an increase in use of laptops for working collaboratively, and there were fewer teachers who had ‘never’ used the laptop in collaboration with colleagues. The laptop, being portable, could be taken to meetings for collaboration purposes. When colleagues also had laptops, teachers had found that resources were easier to share and adapt for individual class/student needs.

The laptops had enabled more effective communication with a wider range of people, and ease of collaboration among teachers, strengthening collegial relations.

3. Efficiencies gained

Laptops had afforded teachers flexibility of time and place of work, with the result that administrative tasks had effectively become less onerous. Over the three years, there had been an overall increase in use of laptops for administration. There had been increased ‘routine use’ for: writing reports; checking student lists and records; checking departmental schemes and units; checking school timetable; checking school or staff notices; recording student grades and monitoring student progress; and for recording attendance. The only area where there had been no change was the use of laptops to schedule appointments. When schools had well-set-up administration systems, teachers found that using the laptop for administration saved time and was more efficient. Teachers felt that the laptops were invaluable in helping them to cope with an increased range of administrative tasks. The laptops enhanced efficiency through more up-to-date programs and were faster than school computers. Teachers in the focus groups said that laptops had accelerated school infrastructure development.

With increased connectivity and up to date specifications teachers found using the laptop to plan and prepare lessons was efficient and effective. The laptops were providing flexibility in time and place for planning and preparation for teaching. There had been a steady increase over three years in laptop use for lesson preparation and in the use of online resources for this purpose. Teachers considered that the laptops were

invaluable for lesson preparation in that they were portable, compact in size and provided a sole repository for teaching, learning and assessment materials and resources. Laptops had assisted access to multimedia materials that were easy to incorporate into lessons. There were indications from the focus groups, case studies, and written questionnaire comments that increased access to a wide range of information and people had changed the way learning resources were defined: The laptops afforded the preparation and use of multimodal materials that included images, diagrams, audio, video and web-links. They also supported access and use of real time data, simulations, animations and other interactives. An added benefit was that electronic materials could easily be searched, shared, customised and even modified during use.

When schools had well set-up administration systems, many teachers found that using the laptop for administration saved time and was more efficient.

Laptops provided flexibility in time and place for administrative tasks, and for planning and preparation for teaching.

The increased access to a wide range of information, resources and people had changed the way learning resources were defined.

4. Use of laptops for classroom practice

There was a modest increase in the use of laptops during lessons over the three years, the greatest increase in 'routine use' being for classroom presentations. Teachers had found that having a laptop with multimedia capability allowed them to make more use of visual materials. The laptop connected to the Internet allowed teachers to respond quickly and in-depth to student questions. Students in case study schools reported gains in understanding and interest consequent upon teacher use of multi-modal lesson materials. Some case study teachers noted that the patterns of interaction in their classrooms had changed with them taking a more facilitative role. There was ongoing evidence that focus group and case study teachers in different subjects were using their laptops/ICT in qualitatively different ways in the classroom for teaching and learning. Science, art and social science teachers were generally enthusiastic about the potential of greater access to images (static and dynamic), animations and simulations, and real-world data.

At the end of three years one third of teachers made use of the laptop for classroom practice.

Fewer than half of teachers had access to the Internet in every classroom they taught in. When the laptop was used in a classroom where there was Internet access, easy access to digital resources, software and peripherals, teachers had the opportunity to provide multi-modal and multi-sensory resources.

There was increased easy access to a data projector, allowing nearly three fifths of teachers to use their laptops with a data projector in the classroom. The most prevalent use of the laptop and peripherals was to present visual material – static or dynamic images, as part of instruction to the class.

Teachers' main goal for laptop use was to learn about ICT as a tool in teaching.

5. Influences on teacher laptop use

School leadership, exercised by the principal, and a small group that included senior management representation and/or expert individuals, was important for guiding and supporting school ICT/laptop developments and, consequently, individual utilisation of laptops/ICT. A high proportion of users in a school, combined with an effective infrastructure, enabled greater laptop use. The most important factors affecting teachers' effective use of the laptop, including laptop use in teaching were: time to experiment, professional development and support, a data projector in the classroom, home access to the school network, and prompt technical assistance. By the third year, teachers' main goal for laptop use was to learn about ICT as a tool in teaching.

In conclusion:

Overall, it may be said that teachers' perception of the benefits that use of a TELA laptop afforded were as follows:

- Laptops allowed flexibility in time and place of work;
- Use of laptops has led to increased knowledge and use of IT professionally and personally;
- Use of laptops had contributed to teachers being better organised, saved time through reduction in duplication and paper work leading to greater efficiency of work;
- Laptops supported the development of greater teacher production and sharing of lesson materials that were easy to customise and adapt; and
- Teachers who used their laptops during lessons had found that the opportunity to introduce multi-modal materials that were well presented motivated students to engage creatively and critically in their learning.

Implications from the findings

Implications from these findings have relevance for TELA policy, schools and teachers. The evolution in practice across the three years has highlighted the complexity of the interaction of school leadership and organisation, school technological infrastructure, professional development and teacher individual knowledge and expertise, and the ways these factors intersect to shape teacher use of the laptop for the range of tasks envisaged within the TELA scheme, suggesting that a 'nested systems' approach is required to encourage and sustain the integration of the laptops into teachers' work.

Recommendations for policymakers:

- We recommend policymakers adopt a 'systems' approach to the development of policy and practices to initiate, extend and sustain the integration of the laptops/ICT into school and teacher work.
- Support schools in improving their ICT infrastructure, schools with less developed infrastructures may also benefit from advice and guidance about the possibilities for infrastructure development.
- Information be provided to Boards of Trustees and principals about international, national and local best practice in the use of laptops/ICT in teaching and learning.

- Consider mechanisms to provide for more opportunities and time for teachers to share best practice. Teachers benefit from opportunities to share ideas and approaches with colleagues across and within the same school. Clusters of schools provide one means for this to happen.
- Teacher education providers be encouraged to include a focus on teacher professional use of ICT in their teaching programmes, particularly ICT use for teaching and learning.

Recommendations for school leaders:

- We recommend school leaders adopt a ‘systems’ approach to the development of policy and practices to initiate, extend and sustain the integration of the laptops/ICT into school and teacher work.
- Develop a vision and expectation for ICT use in the school.
- Model the active use of ICT and if this is not possible, provide suitable support for ICT use.
- Foster a collaborative culture around ICT use and innovation within departments and across the school (learning community).
- Provide opportunities and time for professional learning, particularly in the areas of teaching and learning with ICT.
- Ensure that the school infrastructure is robust, reliable and accessible, this to include ICT technical support, workroom and classroom access, home access to school network, shared drives, and a user-friendly and reliable administration system.

Recommendations for teachers:

- Peers were shown to be the most accessible source of professional development and when teachers who were proficient laptop users pooled and shared their expertise, other teachers benefited. Teachers would be advised to seek help from and share ideas and resources with colleagues, particularly those in the same subject areas.

1. INTRODUCTION

1.1 LAPTOPS FOR TEACHERS IN NEW ZEALAND

The provision of laptops to teachers began with the Laptops for Secondary Teachers [STELA] scheme which was one component of the New Zealand compulsory school sector ICT strategy: Digital Horizons: Learning through ICT¹ (Ministry of Education, 2002a). Initial information sent to schools in September 2002 was followed by implementation commencing in November 2002 (Ministry of Education, 2002b). Following the success of this, further budget announcements have extended the scheme. The original STELA scheme was replaced by the Digital Horizons: Laptops for teachers scheme (Ministry of Education, 2003). The scheme is now known as the Laptops for teachers or TELA scheme².

Schools, not individual teachers, may apply to join the TELA scheme and they gain access to laptops for their teachers on the condition they manage the integration of the laptops into the school environment; this includes providing and meeting the costs of additional ICT infrastructure, professional development and technical support. Indeed, the Ministry information package for the scheme states that school commitment to these requirements is ‘essential for an application to succeed’ (Ministry of Education, 2004, page 4). Initially, all permanent full-time teachers in state and integrated schools working with Year 9 to 13 classes for at least 0.8 FTE were eligible to apply (Ministry of Education, 2002b). Now, permanent fulltime and part-time teachers in state and integrated schools working with Year 1 to 13 classes for at least 50% FTE are eligible to apply (Ministry of Education, 2003). Approved applicants are reimbursed for approximately two thirds of the costs of leasing a laptop leaving a deficit of around \$7 per week to be paid by the applicant or the school Board of Trustees.

The scheme reflects the government’s commitment to increasing the use of ICT in schools to help improve student achievement and teaching practice.

The objective of the scheme is to encourage teachers to develop greater confidence and competence in the use of information and communication technologies (ICT), so that they increase their use of ICT for teaching and learning, class management and administration. (Ministry of Education, 2005, p.3)

1.2 LAPTOPS FOR TEACHERS (TELA) EVALUATION

The purpose of the evaluation was to investigate the impacts of TELA laptops on New Zealand secondary teachers’ work over a period of three years beginning in 2003, feeding into considerations of how the scheme might be enhanced (see evaluation timeframe in Appendix A). The particular focus of this long-term evaluation project was to explore the impacts on teachers’ confidence and proficiency with ICT, professional growth and collaboration; on their lesson planning and preparation, and administration; and on their access to and the quality production of teaching, learning and assessment resources. Information over the course of the evaluation has been gained through yearly cycles of focus group discussions, individual teacher questionnaires and case studies in schools.

¹ *Digital Horizons: Learning through ICT* is the foundation policy document for ICT in the New Zealand compulsory education sector. It outlines the government’s goals in relation to ICT as an area of knowledge relevant to all students.

² <http://www.minedu.govt.nz/goto/tela>

1.3 STRUCTURE OF THIS REPORT

This final report is a summary and synthesis of the three years of data collection (2003-2005) carried out with secondary school teachers who were participants in the TELA scheme and reported in Research Reports 1 to 7 (see Appendix A).

The report begins by providing background information on international trends in the desktop and portable computers/laptops in education. The evaluation methodology is explained in section three, and in section four, the impacts of teachers' access to a TELA laptop on their professional work are explicated. Enablers and constraints for teacher laptop use are described in section five. The report details teacher perceptions of how their laptop use has been sustained and accelerated in section six. Recommendations at national, school and teacher levels are made in section seven. The appendices contain details that may illustrate information given within the body of the report such as tables describing the changes over the three years in the different areas of teacher use.

2. INTERNATIONAL TRENDS: ICT IN EDUCATION/LAPTOPS FOR TEACHERS

Information and communication technology [ICT] has had a major impact upon many aspects of contemporary life. The use of ICT is central to the development of a knowledge society in that it has contributed to changes in how we conceptualise knowledge and what it means to know, patterns of business and economic operations, and the ways people interact and communicate with each other. Internationally, a number of governments have invested heavily in computers for schools with the goal of preparing students for this new society in anticipation that ICT can enhance student motivation, interest and achievement of the current curriculum. The impact of this investment has been the focus of a substantial research effort. In this section, we provide a brief overview of key studies and findings pertinent to the TELA evaluation.

Impacts

Studies of the impacts of ICT on teachers and schools have generally focused on impacts on teaching and student achievement. Despite the rhetoric, these studies have not provided unequivocal evidence of a positive impact on student learning (Cuban, 2001) although a small number of small-scale resource-rich studies have indicated that ICT can and does enhance student achievement. There is more evidence of an indirect impact with a greater number of studies reporting positive impacts on the learning environment along with changes in student interest and motivation as a consequence of, for example, the use of multi-sensory resources in classroom lessons (Becker, 2000). Cox, Abbott, Webb, Blakely, Beauchamp and Rhodes (2003) express concern about such results, saying that the nature of the learning that is promoted by the use of different ICT environments may have been overlooked. They suggest that researchers have been looking for improvements in traditional processes and knowledge, instead of new reasoning and new knowledge, which might emerge from the ICT use. On the other hand, Bebell, Russell and O'Dwyer (2004) propose that recent development in ICT supports the need for a broader conceptualisation of the potential impacts of ICT. Their survey of 2,894 teachers in the United States indicated that the teachers were making substantial use of computers out of the classroom in support of teaching for tasks such as lesson planning and preparation, administration and management, and email communication with colleagues. This line of research also highlights other impacts that might be considered. For instance, in the SITES M2 international study, Kozma (2005) proposes that ICT innovations have four dimensions: curriculum content and goals; student practices (activities, products, roles and collaborations); teacher practices (methods, roles, and collaborations); and the ways ICT is used in schools. Taking this further, Mioduser, Nachmias, Tubin and Forkosh-Baruch (2003) propose that any innovation with ICT can be evaluated in terms of impacts on the time-and-space-configurations of schools. That is, the implications of any-time-any-place opportunities for teaching and learning, and the impacts on student and teacher roles and responsibilities, particularly the ways teachers and students interact with each other and with content, and how teachers work together, is also important to analyse, along with impacts on the curriculum (content, knowledge, teaching and assessment approaches). This is a useful division for the analysis of the New Zealand situation, for it covers a range of factors from school organisation and systems to what students and teachers do in classrooms. A broad focus on impacts is consistent with the TELA goals and aims as set out in the TELA scheme specification (Ministry of Education, 2003).

This evaluation builds on research on the nature of the integration of ICT into teacher and school practices. Here research evidence is that the introduction of computers into schools has not transformed schools and

teaching. As Kerr (1991) pointed out in the early 1990s, simply acquiring technology will not bring about change in and of itself. Cultural, organisational and pedagogical issues need to be considered alongside technological issues. It seems that teachers and schools are just as likely to use technology to do the things they already do more quickly and efficiently, as they are to use it to transform what they do, or use it to do what was previously impossible, particularly with regard to pedagogical innovation. ICT can just as easily replicate and reinforce current practices as it can transform them (Cuban, 2001), and is just as likely to support traditional as innovative pedagogy (Pelgrum & Anderson, 1999). International research is replete with theories intended to explain the progression of ICT use by individual teachers. For example, Mioduser, et al. (2003) propose that teachers initially assimilate ICT into their current practice to make it more efficient and effective before moving on to translate then transform practice. Likewise, Coughlin and Lemke (1999) identify three ‘stages of instructional evolution’ based on research from the Apple Classrooms of Tomorrow program: Entry, adaptation and transformation. In this continuum teachers move from being aware of the possibility that technology holds for improving learning without changing their teaching practices; to integrating technology into current practices; to using technology as “a catalyst for significant changes in learning practice” (p. 13). Hennessy, Ruthven and Brindley (2004), working with teachers in the United Kingdom provide evidence of ‘pedagogical evolution’ over a period of three years. For the teachers in their study there was a gradual but perceptible shift in subject practice and thinking for both teachers and their students. Likewise, the year-long study of Zhao, Pugh, Sheldon and Byers (2002) of teachers attempting to carry out technology-rich projects in their classrooms concluded that teacher innovation with technology in the classroom was more likely to succeed if teachers “take small, but progressive steps towards change” (p. 512). That is, change occurred more through evolution than revolution. These findings are linked with the probability that teachers held deep-seated views about their own practice. These views are connected to habitual classroom practices that may be difficult to alter. However, in line with research on teacher and school change (Fullan, 2001; Spillane, 2004), researchers in the field of ICT innovation are increasingly turning their attention to and recommending policymakers attend to the interaction between technological innovation and school realities (Olson, 2000; Selwyn, 2002).

Accounting for variations

Researchers have explicated a number of personal and contextual factors to account for the variations in teacher adoption of ICT within and between schools. On a personal level, teacher level of confidence with using ICT can vary greatly and be related to their competence in using ICT. Added to this, perceptions about the usefulness of ICT in supporting teaching are influential (Cox, Preston & Cox, 1999; Jones, 2004; Zhao & Frank, 2003; Zhao et al., 2002), particularly perceptions about the potential of ICT use to ‘add value’ above and beyond existing practice (Hennessy, Ruthven & Brindley, 2004). The use of ICT such as the Internet can challenge teacher control and authority over knowledge and so teacher beliefs about learning, and teacher and student roles are also influential (Wallace, 2004). When considering the kind of professional development needed to enhance the use of ICT in a school, varying levels of knowledge and expertise need to be catered for, and teacher skill and pedagogical needs need to be balanced (Christensen, 2002; Jones, 2004; Cox et al., 1999). Given that successful innovation with ICT is more likely evolutionary, the distance between and alignment of any proposed technology use with current school and teacher individual practices also needs to be considered (Zhao et al., 2002).

Contextual factors include technological facilities and support, school and department-level leadership, school organisation, and school culture and ethos. Teacher use of ICT, particularly any integrated classroom

use, requires a reliable technological infrastructure that includes network systems, hardware and software (Cox et al., 1999). Teachers also need easy access to a range of ICT resources (ICT/resources/laptops) if they are to make effective use of them in the classroom (Pelgrum, 2001). Quality on-site technical support is important (Cuban, 1999; Scrimshaw, 2004) because ICT equipment can be unreliable and teachers need to be confident it will be functional when they need it (Bradley & Russell, 1997; Jones, 2004; Zhao et al., 2002). Change that involves technology has financial implications and so school leadership support is essential. Leadership vision for change and planning for action to implement this vision is crucial. All the more so because technology is a dynamic variable whose impacts at the organisational level are unpredictable and can be wide-ranging (Langer, 2005). In addition to changes in the teaching and learning process, it can lead to changes in school culture and school structures and systems (Cuban, Kilpatrick & Peck, 2001; Jewell, 1998).

Grossman, Stodolsky and Knapp (2004) make the point that “subject matter represents the crucible in which instructional reforms are enabled, as well as the direct target of many curricular reforms” (p. 3). They go on to assert that the impact of policy related to teaching is unlikely to be understood unless the interaction between policy and the sub-culture and practices associated with different subjects is taken into account. Subject departments in secondary schools provide the immediate context for pedagogical change. Recent research on teacher perspectives of the potential contribution of computers to teaching and learning supports the need to attend to subject matter as a key player in teacher use of ICT (Hennessy et al., 2004). Subject sub-cultural differences, both subject-discipline and subject-department-based, appear to influence the ways secondary teachers conceptualise and use technology to enhance teaching and learning. English teachers in a study in England by Hennessy et al., for example, placed more emphasis on student agency and face-to-face discussion as central to learning and were dubious of the role ICT could play in this. Mathematics teachers were somewhat ambivalent about the value of computers; they saw more possibilities for the use of graphic calculators. In contrast, science teachers saw ICT as being able to contribute everyday examples and illustrations of ideas. Adding to the need to consider the impact of the subject on teachers at the secondary level, Tearle (2004) and Hennessy and Deaney (2004) found that support for change and sharing of innovation from within an subject department were key factors in disseminating new pedagogical practices, but only when these were trialled and evaluated. Zhao and colleagues (Zhao & Frank, 2003; Zhao et al., 2002) found that when the prevailing school culture was one of collaboration and mutual support for change, the diffusion of technology innovations was more likely. Organisational factors and whole-school characteristics also influenced change (Hennessy & Deaney, 2004). Innovation was more likely to be widespread and sustainable in the long term when the push for ICT integration was school-wide (Forkosh-Baruch, Nachmias, Mioduser & Tubin, 2005)

Towards sustainable systemic ICT use

In recent years, researchers concerned that innovative uses of ICT have not been achieving meaningful scale or long-term integration into teacher and school everyday practices have focused their attention on the wider educational context for change. Added to this, it seems that the processes of initiating, transferring and sustaining innovative ICT practices within and across different school systems involved very different challenges and issues (Kankaanranta, 2005, p. 114). Fishman, Marx, Blumenfeld, Krajcik and Soloway (2004) noted that sustainable systemic technological reform required the participation and understanding of personnel across and at all levels of the educational system (See also Hennessy et al.). It also required attention to systemic issues such as policy change, professional development planning, and resource

production and distribution. Voogt and Pelgrum (2005) pointed out that in Finland, ICT was used as a scaffold to build connectedness for innovation, and in Hong Kong it was used as a tool to support innovation, with this difference likely to be due to broad cultural and policy differences. Kozma (2005) in her analysis of the successful integration of ICT in Singapore and Finland noted that in these two countries policies and programs target all the components of the system in a coordinated and coherent way so that any reform-based changes mutually reinforced and contributed to continuous improvement. School change was coordinated within the community and larger system and this internal consistency was then complemented by vertical consistency between the different levels of the system (Pal, 2001). Further still, the vertical consistency was complemented across different policy areas, integrating educational, economic and other social goals. Hence, the wider context of educational policy and practice is of interest in this study on laptops.

The research described so far, has concentrated on teacher use of school computers, and the extent to which teachers integrate ICT into their professional lives. Access to a personal portable computer, or laptop, can afford different opportunities for teacher use of ICT due to the portability, opportunity for teacher exclusive use, and the generally higher specifications that laptops have compared to existing school computers. At the inception of this study, research was only just beginning to explicate the impact of laptops on schools, teachers and students. Indications were that laptops could support increased communication between teachers, students and parents and greater sharing of information between teachers (Cunningham, Kerr, McEune, Smith, & Harris, 2003). Teachers have reported increases in ICT confidence and competence with perceived positive impacts in the classroom. Teachers who had formerly shared desktop computers with other teachers or students, now had a sense of ownership of the technology they were using (Sockwell & Zhang, 2003). They acknowledged the advantages of having everything in one place and liked the continual everyday availability of laptop. Teachers felt they were gaining maximum impact from their laptops when used in conjunction with peripherals. This study explicates the impacts on New Zealand secondary teachers of their access to a TELA laptop computer.

To sum up, there are a number of factors identified in the literature that are impacting upon teachers' use of ICT. Access to ICT on its own, will not necessarily result in changes for teachers or schools (Kerr, 1991). To bring about changes a number of factors must be considered that are related to school-wide opportunities and incentives for ICT use, department factors and classroom factors. Provision of professional development as needed, must take into account the reality of the considerable teacher variance in confidence and expertise and the time taken to learn new knowledge and practices in ICT. Much more needs to be known about how these identified factors impact on New Zealand schools when teachers are working to integrate technology into their professional lives.

3. LAPTOPS FOR TEACHERS (TELA) EVALUATION

3.1 EVALUATION FOCUS

The purpose of this evaluation was to monitor the impacts of teacher access to a TELA laptop. The goal was to understand the nature of the impacts on teachers' professional lives with particular emphasis on the impacts on administration and management, lesson planning and preparation and classroom teaching and learning.

3.2 EVALUATION FRAMEWORK

Research on teacher and school integration of ICT indicates that an evaluation of teacher use of laptops needs to take into account both the immediate and wider setting in which teachers find themselves to understand how and why they come to use technology in different ways over time. As indicated earlier (Section 2), research on teacher use of ICT has shifted from a focus on the personal attributes of the individual teacher to a focus on the teacher in the context of the school and wider social, economic and policy setting (Lim, 2002; Selwyn, 2002; Zhao et al., 2002; Zhao & Frank, 2003). This setting is recognised as shaping and framing teacher opportunities and incentives to use ICT and as such is of concern to an evaluation of the impact of policy. Indeed, Olson (2000) suggests that policymakers need to 'engage in conversations with teachers about their work culture, the technologies that sustain it and the implications of new approaches for those technologies' (Olson, 2000, p. 6). Policy evaluation research, which that has attended to individual teacher responses, has highlighted the multiple demands on teachers' working lives and the diversity in the ways they make sense of and accommodate these demands (Knapp, 2002). A focus on the teacher in context is consistent with research on teacher change/professional learning and with research on school change and improvement (Fullan, 2001, 2005; Senge, 1994; Spillane, Reiser, & Reimer, 2002; Wenger, McDermott, & Snyder, 2002). Teacher change/learning is now generally viewed just as much as a situated social process as it is a personal process (Putman & Borko, 2000). Institutional change as a process of organisational learning (Wenger et al., 2002) and sustainable systemic change is predicated on developing the social environment (Fullan, 2005; Spillane, 2006). Drawing together these aspects, the assumptions that underpin this evaluation of the impact of the TELA laptops are:

- Valued teacher uses of laptops include all the professional tasks associated with being a teacher: administration, management, pastoral care, professional development and collaboration, communication, lesson planning and preparation, and classroom instruction.
- Change in teacher laptop use is just as likely to be incremental and accumulative (evolutionary) as it is transformative.
- There is a need to consider the individual teacher in context.
- It is important to consider what sustains and may accelerate change as well as what enables change.

These assumptions, while they derive from consideration of research on ICT and teacher and school change, fit within a 'systems' perspective towards evaluation (Patton, 2002). In this case, changes in one part of the system are considered to lead to changes among all parts and the system as a whole. This evaluation model

seeks to identify and portray the set of inter-related factors that affect the change process. It conceptualises these factors as a system in which the whole is greater than the sum of the parts.

A system is a whole that is both greater than and different from its parts. Indeed, a system cannot be validly divided into independent parts as discrete entities of inquiry because the effects of the behaviour of the parts on the whole depend on what is happening to the other parts. The parts are so interconnected and interdependent that any simple cause-effect analysis distorts more than it illuminates. Changes in one part lead to changes among all parts and the system itself. Nor can one simply add the parts in some linear fashion and get a useful sense of the whole. (Patton, 2002, p.120)

The analysis strategy then for the evaluation had a holistic perspective where the whole phenomenon under study was understood as a complex system that was more than the sum of its parts. The focus was on the complex interdependencies and system dynamics that could not meaningfully be reduced to a few discrete variables and linear, cause-effect relationships (Patton, 2002, pp.40-41). The TELA scheme specifications suggested, and the literature as briefly reviewed in Section 2, indicated the need to focus on a breadth of teacher professional uses for the laptop and the contextual factors (school culture and infrastructure, professional learning opportunities and wider policy factors) that may constrain and enable these uses.

3.3 EVALUATION METHODOLOGY

The TELA evaluation design was to use a mixed-methods approach incorporating three yearly cycles of annual nationwide questionnaires, regional focus groups, and school-based longitudinal case studies. The surveys provided prevalence data on teacher use of the laptops and the kinds of support they had experienced for these uses. An initial focus group of teachers informed a baseline questionnaire to provide an insight into the practitioner stakeholder viewpoint. Questions were reviewed and discussed with the Ministry and central issues in the evaluation were clarified. This process of question development was ongoing. The focus group component allowed for in-depth exploration of the issues associated with teacher use of laptops in a manner that allowed participants to build on each other's ideas and introduce topics of interest to them (Morgan & Krueger, 1993). The case studies provided for a rich description and analysis of what was happening in a bounded system (Bassegy, 1999) - in this case, the schools or classrooms where teachers were utilising their laptops. An initial focus group discussion contributed to the design of the questionnaire. Subsequent focus group discussions illuminated the questionnaire data and contributed to the adaptation of the questionnaire to reflect what was happening in schools over the three-year period. Building on this, the case studies provided insights into how particular school contexts interact with teacher personal factors to shape teacher use of laptops. A timeline is provided in Appendix A.

3.4 PARTICIPANTS

3.4.1 Questionnaire respondents

In 2003, the sampling process for the questionnaires involved contacting all schools involved in the STELA scheme. Randomised sampling was used to identify 20% of the available laptop schools, but modified to ensure a range of school types (urban/rural, co-educational and single sex) and decile. Schools agreeing to take part in the questionnaire nominated a contact person who was responsible for distribution and collection of questionnaires. Teachers who responded in 2003, 2004 and 2005 were drawn from the same sample of schools, although the teacher respondent sample was not necessarily identical. The demographic constitution of the respondent group was similar sample in each of the three years.

Forty-nine secondary schools returned completed questionnaires in 2003 (48 in 2004; 50 in 2005). The number of respondents was 688 in 2003 (744 in 2004; 690 in 2005). Across the three years, the respondents were generally experienced teachers: half had been teaching at a secondary school for more than 15 years. There were roughly equal numbers of male and female teachers. Almost two thirds of teachers came from main urban centre secondary schools. Nearly all teachers had a teaching role in their school. Over a third were heads of department or faculty. Around 15% of teachers had responsibility for ICT in their schools. Each year around a fifth (2003-21%; 2004-21%; 2005-26%) of questionnaire respondents rated themselves as expert users of the laptop, two thirds as intermediate users (2003-65%; 2004-67%; 2005-65%) and around 10% as beginner users of the laptops (2003-14%; 2004-12%; 2005-9%). Nearly 80% had a computer at home and around 40% had had a computer at home for at least six years.

3.4.2 Focus group respondents

Each year six focus groups were conducted to ensure reasonable coverage of issues (Vaughan, Schumm, & Siaguh, 1996). Two groups were established in Auckland, one in the Waikato region, one in the Wellington region, one in the upper South Island, and one in the Christchurch region. Focus group schools were selected based on their reasonable proximity to a main centre with due regard given to school socio-economic status, gender, and the school roll. Each school was asked to nominate three teachers to attend, these teachers were to reflect a range of interests and abilities in their school and would not necessarily include the school ICT coordinator.

Between six and ten teachers from three or four schools attended each group, a total of around forty-eight teachers from twenty schools. Focus group discussions were held in non-school venues and lasted for up to three hours. The focus group participants held positions in their schools ranging from that of principal to first-year teacher. Some described themselves as “computer freaks” and others said the laptop was the first computer they had used. While it was not always easy to recruit teachers, due mainly to time factors, those attending commented on the positive experience of attending a focus group and on the professional development that it had given as a space to share ideas and examples of practice using ICT. Discussion was lively and positive. Teachers were keen to maintain their involvement and with the exception of two teachers who shifted schools the same teachers attended the focus groups in each of the three years.

3.4.3 Case study sample

In selecting case study schools from the list of schools involved in the laptop scheme, factors of region, decile, school size, ICT experience, school type, area, implementation and professional development strategies were taken into account. Eight case studies were undertaken in a range of schools in the Auckland, Waikato, Wellington and Christchurch areas each year. The same schools participated in each of the three years. Between eight and fourteen teachers were interviewed at each school, some individually and some in departmental groups. When they were available the same teachers were interviewed in each of the three years.

3.5 RESEARCH REPORTS AND DISSEMINATION

The evaluation findings have been documented in the form of written and oral reports to the Ministry of Education at six monthly intervals (see Appendix A). This report synthesises the three years of findings.

To ensure that the emergent findings of the evaluation have been available to a range of stakeholders formal feedback sessions have been conducted with stakeholders groups including the laptop providers and the TELA scheme school advisory group. There have been ongoing informal discussions with the TELA project manager. Research papers have been presented at national and international educational research conferences and teacher professional conferences. A paper directed towards principals has been posted on the TELA website. The following conference presentations and publications have taken place to date:

The education research community

2007

Jones, A., Cowie, B., & Harlow, A., (2007). Distributed leadership in support of teacher use of laptops in New Zealand. Paper presented at AERA conference, Chicago. 9-13 April 2007.

2006

Cowie, B., Jones, A., & Harlow, A., (2006). The Digital Horizons: Laptops for teachers policy initiative: Impacts and consequences. *New Zealand Annual Review of Education*, 15:2005, 111-132. Wellington, N.Z: Victoria University.

Jones, A., Cowie, B., & Harlow, A., (2006). *The affordance of a laptop for teaching science: The case of Josh*. Paper presented at NARST professional conference, San Francisco. 3 - 6 April 2006.

Cowie, B., Jones, A., & Harlow, A., (2006). *Infrastructure and information environments*. Paper presented at NARST professional conference, San Francisco. 3 - 6 April 2006.

Jones, A., Cowie, B., & Harlow, A., (2006). *Laptops for teachers policy initiative in New Zealand: Impacts and consequences*. Paper presented at APERA professional conference, Hong Kong. 27 November – 1 December 2006.

Cowie, B., Harlow, A. Jones, A., & Gardiner, B. (2006). *Laptops as a fulcrum or lever: Changes in secondary teacher practices over the three years subsequent to their access to TELA laptops*. Paper presented at NZARE professional conference, Rotorua. 5 - 8 December 2006.

2005

Cowie, B., Jones, A., Harlow, A., & Miller, T. (2005). *The Digital Horizons: Laptops for teachers' policy initiative: Impacts and consequences*. Paper presented at NZARE conference, Dunedin. 6 - 9 December 2005.

2004

Cowie, B., Jones, A., Harlow, A., & McPherson, M. (2004). *Teachers with laptops in New Zealand: Impacts on teachers and their practice*. Paper presented at NZARE conference, Wellington. 24 – 26 November 2004.

Teacher professional conferences and papers

2006

Cowie, B., Harlow, A., & Jones, A. (2006). *How are science teachers using their laptop?* Paper presented at SciCon professional conference, Hamilton. 2 - 6 July 2006.

Cowie, B., Jones, A., & Harlow, A. (2006). *Digital Horizons laptops for teachers: Practices and possibilities*. Paper presented at PPTA professional conference, Wellington. 19 - 21 April 2006.

2005

Cowie, B., & Jones, A. (2005). *Digital Horizons: laptops for teachers evaluation study – update on secondary teachers' experiences*. Paper prepared as a report for school leaders. September 2005. Available on <http://www.minedu.govt.nz> (Waikato University TELA Research Report)

4. IMPACTS ON TEACHER PROFESSIONAL PRACTICE

In this section we set out key findings over the period of the study in relation to the impacts of teacher access to a TELA laptop on individuals and schools, focusing on the inclusion of the laptops on the broad compass of teachers' professional work and the extent laptop access may be considered to have transformed teacher and school practices and/or to have contributed to efficiency. We begin by providing evidence of the integration of the laptop into teachers' professional lives. We next describe changes in teacher perceptions of personal expertise and detail the different uses being made of the laptop.

4.1 CHANGES IN PERCEPTIONS OF EXPERTISE AND COMFORT LEVELS

Like everything new, we need quality time to learn the new skills and to be convinced that this is a valuable teaching tool, and will enhance learning. Always difficult to find the time. (2003 comment)

It is fantastic to have been provided a laptop by MOE. My skills would not have progressed to current level without it. (2004 comment)

Greater use has led to confidence and increased ICT use within the classroom. (2005 comment)³

One of the immediate impacts of laptop access was expected to be that teachers would experience gains in ICT confidence and appropriate skills and knowledge. Table 1 shows a modest shift in teachers' rating of their ability to use the laptop in terms of their being an 'expert,' 'intermediate,' or 'beginner' user.

Table 1 Perceived ability to use a laptop (2003-2005)

	2003 %	2004 %	2005 %
Expert users	21	21	26
Intermediate users	65	67	65
Beginners	14	12	9

Table 2 shows that on the whole teachers were comfortable using their laptops over the three-year period for the three core tasks of word processing, emailing, searching the Internet.

Table 2 Teachers who felt 'comfortable' using their laptops (2003-2005)

	2003 %	2004 %	2005 %
Word processing	97	96	99
Email	94	96	98
Search Internet	96	97	99

By 2005 around half of the teachers reported that they were 'comfortable' with using their laptops for four other tasks (using graphics, locating online information, using spreadsheets or charts, and presentation

³ Where a quotation is identified by a date and 'comment', it comes from the questionnaire responses of that year. Other quotations are identified as coming from case study or focus group participants.

software). There were three tasks (creating and using a database, using movie-editing software, and creating web pages) where there was still less than a fifth of teachers feeling 'comfortable'.

The data indicate that being an expert was associated with having capability in a wider range of applications. It was the ability to locate information in a database, use graphics, presentation software and spreadsheets that distinguished those who rated themselves experts from those who rated themselves as intermediates. Over 80% of expert users reported they were comfortable with these tasks compared with between a third and a half of intermediate users. Experts were also more likely to be comfortable with creating a database, using movie-editing software and creating web pages.

The proportion of respondents who rated themselves as beginners remained relatively stable at around 10% across the three years, but the range of tasks that beginners were likely to rate themselves as being comfortable with and to be doing routinely increased, particularly between 2003 and 2004. The proportion of beginners who rated themselves as comfortable in using a word processor, searching the Internet and emailing rose from just over a third who were comfortable in 2003 to around half in 2005. The shift was greatest for searching the Internet, where there was a 41% increase in the proportion of beginners who were comfortable with this task (2003-34%; 2004-36%; 2005-48%). The proportion of beginners using the laptop to write reports rose from 51% in 2003, to 60% in 2004, and 65% in 2005. The proportion of beginners recording and checking student grades also increased with just under half of respondents using their laptops for these purposes by 2005 (33% in 2003; 40% in 2004; 51% in 2005 for recording grades; 20% in 2003; 41% in 2004; 44% in 2005 for checking student records). The proportion checking department schemes, the school timetable and notices, and recording student attendance doubled over the three years, up to 20% in 2005. Overall, this pattern of responses suggests a change in teacher norms and expectations for laptop/ICT use, which was also reflected in focus group and case study comments.

Focus group and case study teachers who, in the first year of the evaluation were somewhat deprecatory about what they could do, and who were tentative about being involved in the study, exhibited gains in confidence. Many of these teachers, along with a fifth of the questionnaire respondents, indicated the laptop was the first computer they had "owned." In the second year, most of these teachers spoke with some confidence about what they had learned to do. In the third year, all but one of the teachers in this group were positive about the range of uses to which they put their laptop, many describing it as indispensable. These teachers intimated that their having a laptop computer for their personal use had been transformative. It was important to them that the laptop computer was portable and so was available for them to explore and experiment with where and when they had the time and inclination. A technology teacher contrasted his previous resistance to computers with his current practice:

Three years ago, I resisted computers at school. I was not interested in the shared drive – I had my little life going fine and didn't need one! As you become more aware you lose the fear – the main benefit to me though, has been that the laptop has encouraged me to get to grips with the school systems. (2006 case study comment)

The impact of use of a TELA laptop was exemplified by the change in attitude and expertise of a head of department (English). Initially, she had had to fight to access a laptop because the school management had considered her as unlikely to want one: before the advent of the scheme she had had no inclination to use or own a computer. Having accessed a laptop she had proceeded to seek help from family, friends and

colleagues to develop her knowledge and skills. In 2003, she was frustrated at her inability to type. In 2004, she noted that it took 347 steps to reach the Internet connection closest to her classroom when it was dry and 513 when it was wet. At the time of the 2005 focus group she had just taken up a position of responsibility as the school senior dean. This position had, as an expectation, significant communication and organisation responsibilities within the school and with tertiary institutions. The teacher indicated that her laptop would play a key role in these duties.

4.2 CHANGES IN USE FOR ADMINISTRATION

Was excellent to be able to take my laptop on a school trip to help with daily accounts and downloading photographs from digital cameras. (2003 comment)

On the whole my laptop has been very useful for administrative purposes – makes things a lot easier. (2004 comment)

Extremely valuable and quick for administration (helps cope with a rapidly growing area). (2005 comment)

I use the laptop to access NZQA for standards in addition to sourcing revision material. (2005 comment)

One of the goals of the TELA scheme was that teachers would experience significant efficiencies in administration and reporting. Teachers were asked to indicate how frequently, if at all, they used their laptop for eight different administration tasks. Teacher commentary indicated this goal had been achieved for many of them, particularly in relation to report writing and the recording and analysis of student assessment data.

Evidence of change

The proportion of respondents making some use of their laptop in each of the listed administrative tasks increased over the three years, as can be seen in Table 3. In 2005, over two thirds of the respondents, overall, indicated that they used their laptop for administrative tasks such as writing reports for parents, recording and checking student data; routine use for checking records, in particular, had increased substantially (50% in 2003; 63% in 2004; 65% in 2005). Nearly half of the respondents were using the laptop routinely to check schemes and the timetable by 2005. With the exception of scheduling appointments, all tasks were done routinely on the laptop by over a quarter of teachers in 2005.

Table 3 Change in levels of laptop use for administrative tasks (2003-2005)

	Routine use %			Occasional use %		
	2003	2004	2005	2003	2004	2005
Write reports	72	81	79	13	9	12
Record grades	64	68	70	20	18	18
Check lists/records	50	63	65	23	21	20
Check schemes	40	42	48	28	28	31
Check timetable	32	42	45	23	24	29
Check notices	21	19	28	18	25	23
Record attendance	18	21	27	11	12	11
Schedule appointments	9	7	10	16	17	15

Discussion

Nearly all questionnaire respondents were making some use of the laptops for administrative tasks associated with their obligations for teaching and learning. In particular, a higher proportion of beginners used the laptop for writing reports for parents than any other task. In 2005, 65% of all beginners used the laptop for this purpose, 14% more than used the laptop for any other listed task. The higher involvement by beginners in just this one task suggests they were driven by more than their own goals and, indeed, the focus group and case study teachers indicated that computer-based reporting was a school requirement in all but one of their schools. This said, teachers felt that the laptops were invaluable in allowing them to complete this administrative task, and others, with greater ease and efficiency. Focus group and case study teachers reported that the laptops had eased personal stress and teacher congestion around school computers at report time. Teachers, particularly those with young families and those who lived some distance from school, appreciated being able to prepare comments at home.

By 2005, recording and checking student grades were tasks performed by nearly half of those who rated themselves as beginners, two thirds of those who rated themselves as intermediate users, and three quarters of those who rated themselves as expert users. These, too, are administrative tasks associated with teachers' obligations to monitor and report on student progress, which, perhaps, explains their prevalence. In particular, the use of the laptop for student data entry was most likely driven by the external demand for electronic NCEA⁴ results. The prevalence of these uses could also be a consequence of teacher experience of school-provided professional development: in the second and third years of the evaluation over a third of teachers reported that they had had professional development in the use of school network and administration programs. The focus groups and some case study teachers indicated that teacher laptop access through the TELA scheme had leveraged teacher and school collection, collation and analysis of student data because the school student database was now more comprehensive and up-to-date. From a senior management perspective, one associate principal noted that the laptops had turned the school's referral systems and student records into "living documents." They were being accessed and updated regularly. In some schools, teachers were also able to enter student attendance information directly via the laptop onto the school student-data management system. The benefits of this were said to be that the school, rather than the individual teacher, could follow up on any problems quickly and efficiently.

Hence, a well set-up and maintained school infrastructure is crucial for teacher use of the laptop for administrative and management functions such as reporting, student data entry, student absences and internal communication. Schools systems for teachers to transfer comments into the school student report templates varied with some still requiring teachers to cut and paste their comments but, nevertheless, the laptops were said to have made substantial contribution to this process. In 2005, teachers were reporting that some school network systems were still not fully functional.

I feel much more positive about using ICT since our network has been upgraded. The last three years have been very frustrating but I believe there is light at the end of the tunnel. God willing! (2005 comment)

Depending on their classroom or workroom access, some teachers continued to use computers that were connected to school network administration systems. Questionnaire responses indicated that teachers with

⁴ NCEA (National Certificate of Educational Achievement) is New Zealand's main national qualification for secondary school students and part of the National Qualifications Framework (NQF).

access to the school network from every classroom that they taught in made more routine use of the laptop for administrative tasks than teachers who did not have individual classroom access. Just under half of questionnaire respondents (49%) had access in every classroom and the proportion of these teachers making use of laptops for administrative tasks was around 10% higher in every task for those with laptop access in every classroom to the school network. Restrictions on teacher home access to school systems were discussed as problematic by the focus groups. They recognised the need to protect school data and systems but pointed out this reduced the ‘any time any place’ use of the laptops to conduct of some administrative tasks.

Over the three years, many of the focus group and case study teachers detailed the issues they and their school had faced with their school’s student data management system. A number of schools were looking to upgrade these.

In regards to the long-term administrative use of ICT for tasks, an assistant principal in one case study school was clear that the Ministry needed to play a role in “future thinking about the role of ICT.” At the time of the 2006 interviews, most of the schools used a combination of paper and electronic systems. The goal of most schools was to move to totally electronic systems to avoid duplication of tasks but they were not prepared to take this step without the assurance that there would be no requirement for paper-based systems.

The table in Appendix B shows all administrative uses, and any increased routine use (in brackets), of laptops for administrative tasks over the three-year period, along with the value of using a laptop for these tasks, the specific enablers and constraints for the use of laptops to undertake administrative tasks (with number of comments in brackets), and recommendations to schools.

4.3 CHANGES IN USE FOR COMMUNICATION

Email is a good way to contact busy teachers who are often hard to locate by phone. (2005 comment)

My laptop [email] is fast becoming my preferred way to communicate – it gives date and time verification. (2005 comment)

It is generally agreed that ICT provides for greater connectivity and ease communication (Ministry of Education, 2006). Teachers were asked to report on their use of email and participation in online discussion lists or forums.

Evidence of change

Most (85% or more) of the questionnaire respondents reported some use of email over the three years (see Table 4). While there was no substantial shift in use, over half reported they made ‘routine’ use of email indicating email was part of the everyday practices of these teachers. Respondents reported an increased occasional use of professional online discussion forums over the three-year period, but a small decrease in routine use.

Table 4 Change in levels of laptop use for communication (2003-2005)

	Routine use %			Occasional use %		
	2003	2004	2005	2003	2004	2005
Email colleagues	52	51	54	33	35	33
Online discussion	10	7	5	18	19	25

Each year, over two thirds of expert users, around half of intermediate users and a quarter of beginners used their laptops routinely for email communication. The use of online discussion forums appeared to be limited to those in roles outside the role of classroom teacher, for example, PPTA executive.

Discussion

The Internet and email have become more dominant over the past ten years. While only half of the questionnaire respondents were making routine use of email the focus groups and case study teachers were very enthusiastic about its use. The implication was that teacher use of email for professional and personal communication provides an engaging entry point for teacher use of ICT, one that includes obvious and immediate feedback and efficiencies. The teachers indicated email was assuming an increasing role in collegial communication both within and between schools. Indeed, teachers at one school described 2005 as “the year of email,” identifying the use of email as the main change in ICT use. The suggestion was that email had become embedded in the communication systems of some schools to the extent that email had largely superseded other methods of communication because “it [email] is a more effective and accessible means of communication.” Email was said to be of particular value when a record of what was said was needed, particularly if someone was unavailable for a face-to-face meeting. This said, a number of those interviewed were concerned that email might supersede informal and spontaneous face-to-face discussion with colleagues. In one school, the school principal was actively resisting a move to email as a way of encouraging such interaction. In another, however, the principal encouraged the use of email to collect and distribute information school-wide. As might be expected, the use of email as a means for whole school communication, both formal and informal, was not seen as viable unless all staff had a laptop or a computer, easy access to the school network and could be relied on to use this facility on a regular basis. Thus, to be credible, whole-school communication via email needed to be driven by the school leadership.

Communication with colleagues in other schools

Email played a role in communicating with colleagues in other schools and with teacher organisations for just over two fifths of the questionnaire respondents overall (predominately those who rated themselves as expert users). Teachers were now in more regular contact with a wider range of colleagues around the country to plan joint activities, including extra-curricular activities for students, and meetings and conferences for teachers. Many focus group and case study teachers recommended email for this purpose, claiming it allowed for greater flexibility of communication with those outside school than did the telephone or fax. Email played a role in subject association networking and in setting up and following up on face-to-face meetings. This was particularly important for teachers who were the only teachers of a subject in a school. For instance, the three classics teachers who participated in the case studies and focus groups all mentioned the support they had had from their subject association suggesting it had played a key role in the diffusion of new practices. This impact is all the more significant because many teachers were searching for

models of what was possible in order to be able to continue to progress their laptop and ICT use in teaching and learning.

Communication with parents

Another interesting aspect to emerge from the focus discussion groups in 2005 was that email had become a medium that was used by some teachers to communicate with parents. Two deans used email for this purpose although individual teacher-parent communication was not generally supported. The practice in one school was to email school newsletters to parents each week. In another school, this information was made available via the school website. One teacher explained:

One thing that I am doing now that I didn't used to do is when I update the web page. Our newsletter is written by our principal's secretary as a publisher document. Instead of rewriting that entirely into a HTML document to go on the web page, I just now save as a web page and use that directly. (2005 comment)

In one case study school, the use of email to communicate with parents was just beginning in 2005. The contact related mainly to student issues such as attendance and achievement, but teachers felt this allowed better management of contacts. The deputy principal in this school was positive about the widespread use of email as he felt it “adds another level of social interaction as everyone is in contact.” Some teachers still felt it was more efficient to contact parents by phone. In another case study school the head of the careers department saw improved email access as one of the major benefits of the laptop and had found email contact with parents to be useful:

Parents enjoy having email access so I give the students my email address and ask for one for their parents now. (2006 case study comment)

Communication with students

A small number of teachers described the use of email communication with students. For example, students who were reluctant to ask questions during class would sometimes email their teacher for feedback outside of class time, as the following teacher described.

At my previous school, which was a boys' school, one of the things that was really interesting was that I would get boys who looked as if they were not paying attention in class and you get home and there would be an email of the work waiting for you. It was as if they would not expose themselves in class but the work was always there. I would say I will log on at 7.30 when the kids are in bed and I would always get five or six really good pieces of work. Especially for boys that don't want to be seen as participating. (2006 case study comment)

One case study school had set up forums on the school intranet for students to communicate with each other about various issues. Some staff were using these forums to communicate with students, which they described as being “rather like a town square” where people could interact and share opinions. However, there was a caution about the value of these now that the school did not have a Webmaster:

We have forums where staff and students can have a say. We have access to the student forum and one of the things I notice about not having a Webmaster is that some of the things coming through on the student forum should not really be coming through – a kid calling herself promiscuous - and I thought he would never have let that through. (2006 case study comment)

In two other case study schools there were examples of teachers using email to contact students: to pass on information about assignments, reminders of due dates, and to pass on links to material on a departmental shared drive; and to email homework to students who were away from school for a length of time. In the latter case, the teacher intended to continue this practice as it had allowed her to stay in touch with students and families and had proven to be effective in keeping them up-to-date with the course material. Another teacher commented that students preferred to make contact using cell phones, rather than email.

The table in Appendix C shows uses for communication and any increased routine use (in brackets) of laptops for these tasks over the three-year period, the value of using a laptop for these tasks, the specific enablers and constraints for the use of laptops for communication tasks (with number of comments in brackets), and recommendations to enhance teachers' effective use of laptops in their professional lives.

4.4 CHANGES IN USE FOR COLLABORATION

We are always gathering around the laptops, it might be if a student has done some digital photography work and you have downloaded it on your laptop and I'll say, "Check out this student's work!" Everyone will gather around and offer ideas. This is so good – the immediacy of it. (2006 case study comment)

I have only recently started to realise the huge potential for collaborative, online teaching support. AWESOME!! (2005 comment)

I have created a departmental folder on the school network for shared resources and trained others in using it. (2005 comment)

One of the expected outcomes of the laptop scheme was that laptops would impact on collegial relationships and initiate professional growth opportunities supporting teachers to share their knowledge and resources with colleagues. Teachers were asked to report on the frequency of using their laptops to access the Internet for information such as research findings and subject association newsletters and for the collaborative development of units and lesson materials.

Evidence of change

Questionnaire responses indicated around two thirds of teachers were making routine use of the laptops for the collaborative development of units and lesson materials. Routine use had increased slightly for both of these tasks (20% routine and 42% occasional use in 2004; 27% routine and 41% occasional use in 2005). The proportion of teachers accessing departmental schemes also rose slightly across the three years: 40% of respondents doing this routinely in 2003 (42% in 2004; 48% in 2005).

Discussion

Laptops fit well with the collaborative culture of many schools and departments. Being portable, they can be taken to different venues for collaboration purposes. Laptops support the development of electronic resources that can be easily shared and customised.

Collaboration within departments

The focus group and case study interviews indicated that laptops have led to a significant change in the social practices associated with professional tasks such as lesson planning and preparation. In 2005/2006, teachers in each focus group and school reported that at school they sat together with same subject colleagues in the staff room and department workspaces to collaboratively develop and share lesson

materials and student work. They met up with colleagues from their own school and other schools at cafes and other venues to share and develop ideas. They described using their laptops for school work while waiting during rehearsals, at the weekends, and while away on holidays. When colleagues also had laptops, teachers had found that resources were easier to share and adapt for individual class/student needs. A majority of the focus groups and case study teachers considered that access to a laptop had supported and, in some instances led to an increase in, sharing of resources because of “an increase in our ability to find, change, edit, copy and manipulate material.” Sharing was effected through a school’s internal email system, the school intranet or the use of a flash drive or CD. Teacher commentary suggested that the more teachers within a department with laptops, the more likely departmental colleagues were to collaborate using a laptop. That is, there needed to be a critical mass of teachers with laptops who used their laptops to establish and maximise the benefits of collaborative development and sharing of electronic resources. The lack of provision of laptops to part-time teachers and support staff was raised as an issue every year although teachers in the 2006 case studies appreciated the change from the initial policy. When some teachers within a department did not have access to a laptop, this limited the ability of teachers to share resources leading to equity issues in resource preparation and distribution and subsequently to instructional equity issues in the classroom. It also constrained the use of email for communication within departments and across a school.

Departmental mentoring and leadership, either from a head of department and or ICT expert within a department, was said to be vital to encourage the development and sharing of electronic lesson materials, and the setting up of a well organised central repository for lesson materials. For example:

Rather than standing in the middle of the room and looking around everybody and saying, “Who has got something for this text or novel?” The first thing you actually do is ask for help. The system we have at our school is that of going to the Q-drive and looking in the English folder and then by year group and the topic and see what somebody else has already put there. And our HOD is trying to remind us constantly that every time you develop a new resource, put it there so others can access it and change it for their class needs. (2006 case study comment)

As is implicit in the above quote, a department workspace that was set up with space for collaboration and easy access to the Internet and school server was an important catalyst for departmental sharing. However, there was some indication that department exclusive use of this space could lead to isolation from other teachers.

Collaboration across a school

Teachers in the focus groups and case studies indicated that it was common knowledge who on the staff was proficient with the laptop and that these individuals were sought out for help. An example came from one focus group of teachers learning how to make a *PowerPoint* presentation from a teacher in another department. There was limited deliberate diffusion of ideas across a school, possibly because teacher focus for collaboration tended to be for teaching and learning within specific subject areas.

There is a hierarchy here that classroom teachers share ideas with each other within the departments. They learn a skill and then they share it with another department and it is leaked out through the school to the person who is a full time techie kind of Digital Horizons consultation facilitator. (2005 focus group comment)

The issue of whether the laptop had led to more teachers spend time within their department was raised by five teachers. This was seen as a concern as far as wider interaction was concerned.

Collaboration with other colleagues

Email was described as a useful tool for sharing and collaboratively preparing lesson materials with colleagues in different schools, particularly by teachers who were the sole subject specialist in their school (music, art, classical studies, history). In one case study school, the science department was collaboratively planning a new course with colleagues in a school around 100km away. Two focus groups felt that this collaboration and sharing of resources tended to be confined to certain geographical areas and dependent upon established personal support networks. When a teacher shifted to another region, support networks were disrupted to a degree and it was not always easy for a teacher to regain the same level of support in a new area because this took time.

Working at home

Over the three years a substantial proportion of questionnaire respondents reported they had made use of the laptop at home in the two weeks prior to completing the questionnaire for lesson planning (around two thirds of teachers), administration (around half of the teachers) and for professional email (around a third). All of the focus groups and a majority of the case study teachers, in each of the years they were interviewed, commented on the benefits of the laptop with regard to their being able to work at home, rather than stay at school, and within a family setting, rather than isolated in a separate office.

The table in Appendix D shows uses for collaboration, and any increased routine use (in brackets), of laptops for these tasks over the three-year period, the value of using a laptop for these tasks, the specific enablers and constraints for the use of laptops for collaboration tasks (with number of comments in brackets), and recommendations to enhance teachers' effective use of laptops in their professional lives.

4.5 CHANGES IN USE FOR LESSON PLANNING AND PREPARATION

Lesson plans, nothing is created on paper now. My peers are working more and more in electronic formats. Collaboration and the sharing of material and workload are increasing. (2005 focus group comment)

Having my own laptop has been an absolute bonus. All my planning is now on computer and saves me a heap of time filling in and making new templates. (2005 comment)

We did a PowerPoint presentation I've never done before and now I've developed that for the whole of the school and the whole department uses it now on bridge construction... and we imported a video off the net and assembled it all... and it was good. (2006 case study comment)

Access to a laptop was expected to help teachers experience greater efficiencies in lesson planning and preparation. Teachers were asked to indicate how frequently, if at all, they used their laptop for four tasks associated with lesson planning and preparation. In 2005, 96% of questionnaire respondents reported they made some use of their laptop for the preparation of handouts for students (this task was the most prevalent task done on the laptop of all those listed in the questionnaire).

Evidence of change

The questionnaire data indicated teacher use of the laptops to prepare student handouts and access the Internet and Te Kete Ipurangi (TKI⁵) for curriculum or assessment-related documents was widespread over each the three years of data collection: over 85% of the respondents made some use of their laptop for these purposes in each of the years with around three quarters making routine use for preparing student handouts. Routine teacher use of the laptop to access material on the Internet rose significantly between 2003 and 2004 (up to 66% in 2004 from 46% in 2003) and while occasional use dropped the overall proportion of those involved in this task increased from 85% to 92% signalling many more teachers were making active use of the opportunity to access a wider range of teaching and learning materials when preparing for teaching. Routine and overall use to review resources such as CD ROMs to be used by students, and planning to use the laptop in combination with other equipment such as a data projector or digital camera also increased, as can be seen in Table 5.

Table 5 Change in levels of laptop use for lesson planning and preparation tasks (2003-2005)

	Routine use %			Occasional use %		
	2003	2004	2005	2003	2004	2005
Prepare student handouts	73	71	78	20	24	18
Internet/assessment items	46	66	69	39	26	24
Review resources for student use	27	31	40	52	47	44
Combine use/with other equipment	22	23	28	32	39	36

Discussion

Questionnaire data indicate that many teachers are taking advantage of the possibilities offered by the laptops when planning and preparing for lessons. Teachers in interview were enthusiastic about the contribution the laptop had made to ease their workload with respect to efficiencies gained in lesson planning and preparation. They found that the laptop had facilitated collaboration and enhanced the quality of outputs.

Efficiencies gained

In 2005, over three quarters of teachers said they had used their laptops ‘routinely’ to prepare student handouts or worksheets. Teachers appreciated the functionality of the laptops for undertaking research related to units they were teaching. Teachers were positive about the benefits of greater access to multimedia resources such as educational and other websites and CD ROMs. Planning for the use of the laptop in combination with other equipment increased over the three-year period, most likely because teachers had increasing access to peripherals, such as digital cameras and data projectors, and/or that they had developed their skills of working with laptops in combination with other equipment, and digital cameras. Digital resources are easy to modify and can be readily shared. Laptops provided the flexibility of electronic resources that were easy to modify, update, and configured to meet the learning needs of specific classes and students thereby adding, as one teacher described, “a personal touch”.

⁵ TKI is a bilingual portal-plus web community, which provides quality assured educational material for New Zealand teachers, school managers, and the wider education community.

Planning is way quicker and it's so much easier to just pull up documents that you've already got and just alter or adjust them for the next class, for the next type of kid that you're teaching. (2006 case study comment)

An added benefit of electronic resources is that they can be readily catalogued and retrieved, leading to efficiencies through a reduction in paper work and the time required in its organisation and management both in and out of class time. While these aspects may not be transformative of classroom practice in themselves it could be argued, and four focus groups made this point, that they benefit teaching and learning through streamlining in-class organisation and presentation of teaching materials, leaving more time and energy for teaching and interaction with students. For instance, one focus group discussed that when teachers were confident that their lesson materials were well presented and on-hand, they were more able to focus attention on listening to and questioning students. This said, teachers in the focus groups and case studies described the laptop as a tool and emphasised the role of the teacher. They appreciated, however, having greater access to resources.

It's to do with access to resources really. It's [the laptops] made a huge myriad of resources more readily available because, in effect, the computer's only a tool and what it's done is that it's enabled them... given them access to a whole set of resources. (2006 case study comment)

Collaborative lesson planning and preparation

Laptops affording the production and sharing of digital resources fit well with the collaborative culture of many departments. Teachers appreciated the flexibility of the laptop in allowing them to design lesson materials at school in various settings in collaboration with colleagues. Departmental mentoring and leadership, either from a head of department and/or ICT expert within a department, was said to be vital to encourage the development and sharing of electronic lesson materials, and the setting up of a well organised central repository for lesson materials.

More professional quality

Three focus groups discussed that teacher access to a laptop computer for their exclusive use had increased the professional quality of lesson materials. Student expectations related to the presentation of teaching and learning materials had changed and some teachers were under pressure to meet the new standard. In 2004, the principal of one case study school described the flow-on effect of this higher standard preparation and presentation to students as contributing to the overall push by the school to a student focus on excellence in all they did.

Up-to-date, relevant lesson materials possible

The consensus across the focus groups and the case study teachers was that image-based materials stimulated and sustained student interest and enhanced understanding. The laptops were said to have led to efficiencies in lesson planning and preparation through their support for access to multimedia resources that were recent, relevant and rich in context. Lesson materials were more now more likely to include images, graphics and up-to-date real-life data or examples, thereby making links with student lives outside the classroom. Teachers commented on the benefits of being able to couple the visual (static and moving imagery, and colour) with the aural through the use of video, simulations and animations. Teachers at the focus groups and case study interviews were positive about the benefits of greater access to a range of multimedia resources,

including those on educational and other websites, CD ROMs and copies of electronic materials given to them by colleagues. Several teachers at the 2005 focus groups noted that the laptop allowed teachers to access material on the shared drive while teaching in class (an evolution from just having it as a storage area for perusal during lesson preparation). Improved server storage had made sharing easier:

The need for pedagogical development/content knowledge

In 2003, teachers commented on the time needed to develop or convert lesson materials (worksheets, audio and video) to an electronic format. Laptops allow teachers to access the Internet either from school or from home, to store preferred sites for future use and to adapt materials and store them for immediate use in class; however, teacher use of the Internet for teaching and learning was not without its challenges. Teachers need the skills to locate and adapt available resources, many of which are not designed for education. The sharing of useful sites with colleagues was important in this process. The TELA teachers raised the issue of needing to develop pedagogical content knowledge around the tailoring and use of web-based resources (see also Loveless et al., 2001). They were anticipating this effort would be rewarded in subsequent years. By 2005, there was some suggestion this was the case although the teachers interviewed had continued to extend what they were doing as they accessed new software and technologies, and new and additional resources were identified and accessed.

The table in Appendix E shows uses for lesson planning and preparation, and any increased routine use (in brackets), of laptops for these tasks over the three-year period, the value of using a laptop for these tasks, the specific enablers and constraints for the use of laptops for lesson preparation tasks (with number of comments in brackets), and recommendations to enhance teachers' effective use of laptops in their professional lives.

4.6 CHANGES IN CLASSROOM PRACTICE

The laptop has revolutionised teaching in the classroom. No more carrying around CDs (all set works are on the laptop). Revolutionised marking of compositions. All students can see written representation as their compositions are performed. Helpful for improving students' performances as these are stored on hard drives rather than individual videos or DVDs. (2005 comment – arts teacher)

I can walk around the room now, use the remote – there is no time delay now. I monitor what they are writing down better now. It stimulates more questions and they are more engaged. (2006 case study comment)

... I just think that as a tool the laptops have added to our toolbox, especially with students that are quite visually focused in their learning. (2006 case study comment)

One of the Ministry of Education's expected outcomes of the TELA scheme was that teachers would creatively use with students the learning resources they had prepared in the classroom. This evaluation did not involve classroom observations, but focus group and case study teachers, in particular, reported a range of laptop uses for teaching and learning in the classroom. Questionnaire data, however, suggested that classroom use for teaching and learning was somewhat restricted.

Evidence of change

The questionnaire results indicated that although laptop use for classroom practice had increased somewhat, teacher routine use of the laptops for the tasks listed in the questionnaire was not widespread as is shown in

Table 6. Around three fifths of respondents made some use of the laptop for each of the listed tasks, most of it occasional. The greatest shift in use was for classroom presentation; up from 44% of respondents making some use in 2003 to 59% making some use in 2005. Even when teachers had easy access to a data projector not many of them reported routine use in class. For instance, nearly three quarters (72%) of expert users in 2005, said they had easy access to a data projector in their classroom but only 34% of made routine use of the laptop for classroom presentations. Possible reasons for this are discussed below.

Table 6 Change in levels of laptop use for classroom practice (2003-2005)

	Routine use %			Occasional use %		
	2003	2004	2005	2003	2004	2005
Teacher access to Internet	11	11	15	37	44	44
Classroom presentation	10	13	17	34	36	42
Curriculum specific software	11	10	15	30	29	40

Discussion

Teacher commentary from the focus group and case study interviews painted a more active picture of teacher laptop use in the classroom for teaching and learning than was suggested by the questionnaire data, this use predicated on and underpinned by pedagogical values and practices in conjunction with practical issues such as access to a data projector. With one exception, focus group and case study teachers were very positive about the benefits of incorporating digital resources into their teaching although it needs to be remembered that these teachers were volunteers. As pointed out earlier, teachers recognised that innovation takes time. Not only time in lesson preparation but also to practice using the resources and equipment and to develop the confidence to use them with a class.

Personally I've used mine more this year... we do a Year 10 graphic assignment, which is a lifeguard lookout tower ... so I just pretty quickly put a PowerPoint together and we had them [pictures of lookout towers] up on the screen and we talked about them and the different materials that had been used and the design features and so on... And it was that much more effective. (2006 case study comment – graphics teacher)

It's certainly changing... it's one of those evolving things that it's hard to put a finger on exactly where it is because it's ... I think it's ... I'm more a co-ordinator of what's happening and how it's happening. There's still the 'up the front of the class and teaching' going on but there's a lot more behind... co-ordinating. (2006 case study comment)

I just feel like I have grown and my teaching has grown as well. I am really positive about the laptops. (2006 case study comment – art teacher)

The teachers considered their colleagues were also excited about the use of the laptops for teaching and learning.

Laptops have liberated teachers in terms of their teaching practice, and some of them are quite excited about all the new innovations and how they can help them to help their students learn better. (2006 case study comment)

Subject differences

Not surprisingly, more ICT/computing teachers reported routine use of the laptops for the tasks listed than teachers from any other subject area. Across the three listed uses, teachers of ICT/computers, science, economics and Te Reo Māori used their laptops more routinely during lessons than teachers of other subjects. There was a higher proportion of Te Reo Māori and social sciences teachers using laptops to access the Internet during a lesson occasionally; a higher proportion of economics and Te Reo Māori teachers using laptops to do a classroom presentation occasionally; and a higher proportion of science, economics and Te Reo Māori teachers using laptops occasionally with curriculum-specific software.

Schools were asked to select teachers across a range of subject areas to be involved in the focus groups and case studies. Analysis of the data from these teachers suggests that teachers from different subject areas made qualitatively different uses of their laptops and these uses might be grounded in different subject subcultures and associated pedagogy and practices rather than different levels of classroom access to the Internet/data projector and/or differences in personal knowledge and expertise. In each of the three years, science, art and technology teachers were generally very enthusiastic about the use and potential of the laptop-plus-data projector/Internet for teaching. They felt they were able to facilitate learning more effectively through the use of more varied, up-to-date visual and interactive lesson materials. They reported that the use of visual materials supported the development and discussion of ideas in their subject.

I used the laptop in conjunction with the data projector to access the local council site to examine the city's infrastructure. The students could see all the pipes, etc. that run under their houses. (2005 focus group comment – social studies teacher)

I had a neat lesson yesterday. I had a group of girls who probably will fail at maths and English - have great difficulty with the teachers. These kids were just inspired! We looked at the PowerPoint and then drew a big grid on the board and filled the columns – technically the 'bad' girls had their hands in the air, they were just so excited. Then we loaded it all into a word document with the clues in columns and printed it out – a copy for everybody. We listened to some pieces of music and they used it to work out which piece was Baroque, for example. I could not have done that before. Having the images has really engaged them. (2006 case study comment - music teacher)

One science teacher in a case study school had used his laptop in conjunction with a data projector in geology where he had found a website that showed tectonic plates moving in subduction. This animation was a more effective teaching tool for developing student understanding than textbook diagrams, or his own drawings, had been in the past. He had also found 'Google Earth' to be an excellent site for his work. Another explained:

In physics you can't give demonstrations very often but there are all these beautiful slides that have two dimensional wave patterns and students find that really difficult. I would be answering questions and helping them to move to the next level while they are referring to the PowerPoint as a guide. I would be the resource that they could use when they wanted me to be used. (2006 case study comment)

Teachers of mathematics and English were less unanimous with some enthusiastic and others ambivalent about the potential for ICT use for teaching and learning in their subject.

Applets are very useful. I use Graphmatica, which plots graphs from equations. You can do a lot more teaching with the software as it's not so labour intensive. It allows more question and answer interaction with students. (2005 focus group comment)

A concern with added value

The teachers in this study were concerned that given the time involved in the preparation of materials that incorporated ICT they only used ICT when they were convinced it would add value to teaching and learning. In 2006, one teacher explained how teachers in his department were selective about the use of technology.

It still comes back to what you are using it for and trying to think carefully about how you're going to use it in a way that actually adds to their learning that's going to give you an advantage over using some other method. (2006 case study comment)

Teacher critique of the use of *PowerPoint*, muted in 2003 but stronger in 2005/2006, revolved around the desire to use technology when it could provide something extra. Teachers were concerned that teaching did not become over reliant on *PowerPoint* presentations that tend to align with whole class teaching.

My vision of classroom use is that it is not going to be PowerPoint after PowerPoint. I find that extremely boring – it is just as boring as reading a textbook. I like interaction in my classes, and I use questioning to get student responses and that's how I get my notes. (2006 case study comment)

Teachers were debating the relative merits of interactive whiteboards and Tablets in terms of how and if they fitted with their philosophies for teaching and learning. They were keen to use ICT in dynamic and interactive ways that supported dialogue.

The kids actually get to see the effects of this disease which they've never heard of... like I'm doing bones with some of my students and they say, 'What's rickets?... I've never seen rickets. Sounds like crickets'. And you say, 'You've never seen a case of rickets?' Or 'You've never seen a picture of rickets?' And so you just... you flash it up and they're just like... 'Oh'. 'Yes'... suddenly, learning just hits them solidly between the eyes. (2006 case study comment)

Enhanced ability to respond to student interests and questions

Teachers noted that they had seen gains in student interest and understanding if they could make 'just-in-time' use of electronic media and adapt teaching materials easily during lessons. The students who were surveyed echoed this perception. Teachers valued the immediacy of being able to respond to student questions in the moment with visual resources and animations. In class, teachers considered they were providing students with a wider range of learning opportunities and that they were more selective and targeted in developing these. Focus group teachers reported that laptops were supporting communication and the sharing of work between teachers and students in and out of class time. Students were said to be seeking to engage with teachers' lesson materials in different ways and teachers were more easily able to share teaching notes and exemplary work with students via CD and email.

A shift to encourage more student ICT use

As a result of their laptop ownership, some teachers considered they had become more confident with ICT and subsequently more prepared to take more risks in its classroom use. Teachers were becoming more confident to support students to undertake and present the results of their research and other learning using ICT.

I have more confidence now since laptops. I can now allow the students to experiment with ICT. I use PowerPoint in open evenings. Four years ago, I might have known how to cut and paste, and the laptop has helped me, although I still feel very limited. (2006 case study comment)

Student voice

In 2006, case study teachers were asked to survey students in one of their classes about the impact of the laptops on their learning; ten teachers provided responses. The responses indicate that students were positive about the impact of the laptops on teacher practice. Year 10 students said of their music teacher's use of the laptop, "It has made class more interesting as there are pictures and visuals to interest you, not just a teacher dictating," and "It makes us more understanding of what we are studying." Year 11 students made the following comments on how their history teacher used the laptop – "It was a new and interesting way of learning. I paid more attention." "I think it's convenient and effective, it showed clear image of real events." and "Visuals help to remember the information." One Year 12 physics student said, "By my teacher using the laptop I got to visualise waves more clearly in my head - therefore learning more." One student commented:

Very beneficial. Allows the teacher to prepare class work quickly and set up time is minimal. Laptop facilities allow teachers to show students animations of video footage that is not easily accessible within the classroom. Wider learning opportunities and mediums. (Student comment)

A search for innovative pedagogies

While teacher descriptions of accessing the Internet in response to student questions and as part of inquiry units suggested a shift to more student-centred or student responsive teaching, overall, the uses described by teachers suggest that the laptops were being used in classrooms to enhance and supplement existing practice. The use of *PowerPoint* exemplifies this point with a number of teachers and senior managers critiquing its use and questioning whether it may influence teachers to use a more plenary lecture-style of whole class teaching; what one teacher described as 'sage on the stage'.

Teacher interview commentary and the questionnaire data on teacher goals for future development indicated a concern with developing the knowledge and skills for using ICT and laptops to support teaching and learning. In 2005, and again in 2006, a small number of teachers explicitly discussed the notion that they were just beginning to appreciate and were keen to realise the potential of the laptop for this purpose, this, consistent with the notion that innovation takes time.

The provision of a laptop has been GREAT - appreciated and used (not to its full potential yet) but I am working on it slowly. Being able to do student reports at home will relieve pressure put on us at school. The laptop is a valuable and necessary teacher tool! (2005 focus group comment)

A deputy principal in one case study school noted the use of ICT in the classroom by individual teachers was highly variable and he was unaware if there was an ICT pedagogy available for teachers to use to model practice. He spoke about the need for guidance from the Ministry. Other teachers and schools were looking to recently qualified teachers for insights in this area.

The table in Appendix F shows uses for classroom practice, and any increased routine use (in brackets), of laptops for these tasks over the three-year period, the value of using a laptop for these tasks, the specific enablers and constraints for the use of laptops for teaching tasks (with number of comments in brackets), and recommendations to enhance teachers' effective use of laptops in their professional lives.

4.7 INTEGRATION OF THE LAPTOP INTO TEACHERS' WORK

The laptop has become an essential tool. (2005 comment)

I use the laptop in all facets of my job. (2005 comment)

I use the laptop 24/7. It's the tool that underpins my job. It's always in the classroom and always on. (2005 comment)

Take away the laptop for 2 days and I'd be desperate!! (2005 comment)

I use my laptop as a mark book and for all my administration tasks, everything really. I've set up shared files for marking with templates so it makes collating data and conducting analysis easier. (2005 focus group comment)

Questionnaire data indicated that respondents were making use of the laptops for a range of tasks. The majority were using laptops for email, and over two thirds were making routine use of laptops for reporting, preparing students handouts, recording student grades, internet searches when lesson planning, and checking class lists and records. These comments suggested the laptops had been integrated into most of the tasks a teacher performs outside the classroom in support of teaching and learning. In addition, occasional use was reported for the use of the laptops in the classroom to view presentations and subject specific software. Focus group and case study teachers were very positive about the impact of the laptops. They emphasised the vital role that their laptop played in all aspects of their work indicating it was now indispensable to their day-to-day work, as the previous quotes suggest.

In the main, respondents intimated that their laptop use was evolving, particularly in relation to use for teaching and learning. Given evidence from elsewhere that change that involves ICT is often incremental and accumulative, the extent of the shifts is, perhaps, not surprising. The evaluation also examined whether laptops could be said to have significantly transformed what teachers did, and there was some evidence that access to a laptop had made a more substantial difference to those who rated themselves beginners, and to some of the social practices associated with teachers' work with regard to ease of collaboration, and to time and place of work. The portability of the laptop coupled with teacher exclusive use had led to changes in the level of self-assessed skills of those who rated themselves as beginner users (See Table 1). Teachers had also taken advantage of the flexibility the laptops offered in time and place of use. "The accessibility and portability of the laptops has made a huge difference, you don't have to stay at school to get your work done." The laptops were said to have reduced the social isolation that had previously been the norm for many teachers when they were doing schoolwork. One teacher summed up the consensus view at his focus when he described the laptop as "socially beneficial." A number of focus group and case study participants reported that they now spent more time on schoolwork, particularly at home, but that they did not mind doing this because they could work in more convivial settings and in the company of family.

4.7.1 Variation in impacts: Personal beliefs and expertise

As might be expected, teachers' knowledge and expertise in the use of ICT was varied. Many of the teachers interviewed during in the TELA evaluation study who intimated they were more skilled users indicated that while they appreciated having an up-to-date computer for their own use, access to a laptop had not substantially enhanced their knowledge and expertise, or their practice. There were exceptions to this, and some teachers were actively redesigning their teaching and learning programmes to incorporate multimodal, up-to-date and real-life materials. Those who rated themselves as less experienced users of computers self-

reported more substantial changes in their expertise and ICT use over the three years of data collection although there was not a significant shift in the proportion rating themselves as beginner laptop users. Evidence of change came not so much from a higher proportion of teachers self-reporting as expert or intermediate users but from a shift in what those who rated themselves as beginners reported they could do with the laptop. Beginners were now more likely to be feeling comfortable using their laptops for seven categories of use (word processing, using email, searching the Internet, using graphics, using a spreadsheet, locating online information and using presentation software) and to use their laptops routinely for collaborative and administrative uses. Beginners were still not using their laptops routinely for lesson preparation activities; however, their ‘occasional use’ of laptops for use as a tool for lesson preparation had almost doubled over the three years.

Commentary from those who were proactively exploring and using the laptop for teaching and learning indicated this use was consequential on teacher confidence and expertise, teacher access to models of practice and opportunities to learn, and easy access (preferably continuous access) to the requisite technological infrastructure (hardware, software and technical support). The role of these factors as interrelated aspects within the evolutionary process was most clearly illustrated by the changes in practice of one of the most ICT proficient users interviewed over the course of the three years. In 2004, this teacher was converting his lesson materials to electronic format adding in interactives, images and video clips as he did so. He was making use of one of his school’s two data projectors during most lessons. In 2005, his classroom had a ceiling-mounted data projector and an interactive whiteboard. He demonstrated how he used these tools to project and adapt lesson materials in response to student interests and needs. In 2006, he was keen to extend his knowledge of what was possible.

4.7.2 Variation in impacts: The influence of teacher subject specialist area

In the TELA evaluation study, a disproportionate number of science and technology teachers self-assessed themselves as expert users of the laptops. Science teachers from the case study schools were enthusiastic about the use of the laptop-plus-data projector/Internet for teaching science. They reported extensive use of lesson materials that integrated text, simulations, interactives and real-world data (images and video clips) to stimulate student interest and engagement. Similarly, technology teachers were enthusiastic about the laptops as a tool to access and search the Internet for information and for *PowerPoint* presentations, these often incorporating digital photographs of student work and Computer Aided Design (CAD) demonstrations. Digital photographs were useful as a record and a tool for assessment. Physical education teachers used the video capabilities of the laptops for analysis, teaching and assessment of student performance, both individual and team, curricular and extra-curricular (tennis, golf, netball). Social science teachers in one school considered their area of expertise “lends itself nicely” to the use of *PowerPoint*, virtual field trips and websites such Google Earth and Geographic Information Systems (GIS). As mentioned earlier, English and mathematics teachers were more ambivalent. These differences suggest the need for policy initiatives and associated professional development to be sensitive to subject-specific needs.

4.8 IMPACTS OF LAPTOP USE ON SCHOOLS

An interesting finding from the case studies, and to a lesser extent the focus groups, was that teachers’ acquisition of laptops had begun to have an impact on schools as they became focused on, but struggled with, managing the introduction and use of the laptops. There is evidence that, as has been found elsewhere,

laptops in and of themselves did not catalyse change at the school or department level. In schools where ICT had been a focus prior to the TELA scheme, the laptops had accelerated the pace of introduction and integration of ICT partly because money was released to, for instance, purchase data projectors, expand and upgrade the school infrastructure (network classrooms, upgrade the school student data management system) and allow the school to take advantage of school-wide professional development initiatives such as ICT PD⁶ cluster involvement. Laptops afford teacher access to web-based resources and their introduction to schools has leveraged the introduction and/or enhancement of school internet access and school intranet facilities, which, with the appropriate leadership has supported communication and collaboration at the department, school and, in some cases, student level. With senior management leadership the use of electronic communication has increased in some schools. By 2006, teachers in all schools were making more use of school data management systems, this probably driven by the NCEA and the upgrade of their systems. With all student data collected and collated in a central electronic database, one school was undertaking more in-depth data analysis. In another case study school, the laptops as a school-wide initiative was thought to have paved the way for teacher involvement in other school-wide initiatives, creating a culture of “This is OK. This is what we do.” In a school with a few laptop users, those with laptops thought they had become ‘a community within a community.’

The TELA scheme was reported to have impacted on teacher recruitment and retention. Teachers applying for jobs assess a school’s ICT infrastructure and support systems; some schools have lost staff to ICT-rich schools. Teacher expertise, particularly in relation to providing leadership in the use of ICT for teaching and learning, was an area of concern and interest in most schools.

⁶ In 1998 a national ‘ICT Strategy for Schools’ was announced which established a new, ‘national’ system of funded professional development school clusters. This programme has become known as the ICT PD School Clusters programme. The programmes focus on the integration of ICTs into a variety of teachers’ professional practices.

5. SUPPORTS FOR TEACHER LAPTOP USE: ADDRESSING CURRENT REALITIES

Several factors emerged as supports and constraints to teacher uses of the laptops. Some of these factors were derived from the conditions of the TELA scheme, others from the context of use. The contextual factors were: school leadership and organisational support, professional development and teacher opportunities for professional learning, and school ICT infrastructure. Each factor appeared as salient for each of the uses discussed in the previous section, although it manifested in different ways for different uses and for different teachers, depending on their knowledge and expertise, and even subject area (the case study interviews indicated that teachers from different subjects might use their laptops in qualitatively different ways in the classroom for instructional purposes in a manner consistent with research by Hennessy et al. (2004) in the UK, and Bebell et al. (2004) in the USA.

5.1 THE TELA POLICY

Through the TELA scheme, teachers have gained exclusive access to a laptop, rather than a desktop computer. The portability of the laptops has afforded ‘any time and any place’ use, a feature that seems to have been particularly important for beginners who were able to explore and experiment with applications in their own time. Many teachers used their TELA laptop as their sole or main repository for administration and management forms, curriculum documents and schemes of work, unit and lesson plans, and assessment tasks, including NCEA requirements, resources and student results. One teacher described the laptop as “a portable filing cabinet,” saying:

It’s my filing cabinet. When I have my laptop I can do school work at home because everything is in it. If I am doing a lesson tomorrow, I just find it; print it off ready for photocopying it. If I am doing an animation, I can make sure of what I am doing and organise my lessons. (2006 case study comment)

An additional bonus was that these materials were well organised and easily searched. A teacher explained:

With it I’m totally organised. We have all our results on it – we’re actually working towards putting... like even running a cross country where we can actually use the computer, like all the kids run the cross-country and we can actually use the computer to input the data from a stopwatch that can input times all separately. (2006 case study comment)

The high specifications meant teachers were able to use the laptop as the sole repository of the many documents and files they used for their work. This contributed to the flexibility of use by providing access to the same documentation at home and at school. They were also able to access and/or produce a range of online and multi-modal materials. Teachers valued the ongoing upgrading of laptops. One teacher who had just produced a video of a guest speaker spoke of his new laptop’s capability:

I videoed him with a normal sort of camera and I downloaded onto my laptop and it took up a huge amount of space like 10 Gig... I’ll edit it and then compress it. That sort of thing wasn’t available to me a year ago with the old machines. (2006 case study comment)

Some aspects of the policy had been experienced by teachers as constraints on their maximising the benefits of their having a laptop.

Restriction on teachers who could access a laptop

Initially, only full time teachers could access a laptop through the TELA scheme; however, this changed in 2004 when teachers with a 0.8 full time load became eligible. The focus group and case study teachers noted that some tasks were only viable when all teachers had possession of, and used, a laptop (or computer). The use of email for school-wide communication and department-based development and sharing of teaching resources were given as examples. Teacher commentary suggested that the more teachers within a department with laptops, the more likely departmental colleagues were to collaborate using a laptop. That is, there needed to be a critical mass of teachers with laptops and those who used their laptops to establish and maximise the benefits of collaborative development and sharing of electronic resources and communication within a department. For example, in a department in one case study school there were 12 full-time and 10 part-time teachers. The teachers in the department reported that they could not move to electronic lesson and unit plans and assessment because this would exclude half of the teachers in the department. In contrast, all the teachers in the art department had laptops - these teachers reported that the synergy between them contributed to the development of ICT use. In another case study school, a technology teacher explained he had accessed a laptop, even although he was reluctant, so that he could continue to collaborate and share with members of his department.

Lease payment

Under the TELA scheme, teachers or their schools paid a portion of the lease for the laptops. Teachers were asked if they were personally paying anything towards the cost of the lease. In 2005, almost half of teachers (43%) said they were paying personally (2004-46%), and 57% said their school was paying the full cost (2004-53%). In 2003, questionnaire respondents who did not have a laptop reported that the need for lease payment was the main reason they had not accessed a laptop through the TELA scheme. This issue was raised and discussed by the case study and focus group teachers in each of the three years of the evaluation. Teachers viewed the need to pay as an equity issue for teachers and students. The argument was that students were denied learning opportunities if their teachers did not have a laptop. Teachers were acutely aware of which schools in their area were paying the lease for staff, and considered they should not have to pay for a tool that was increasingly being positioned as central to their work.

Acceptable use policies

The 2003 focus group discussions indicated schools had taken qualitatively different approaches to the requirements of the scheme. Some had developed 'acceptable use' policies that restricted the use of the laptops to schoolwork; others saw learning potential in any teacher use.

You know there are enough barriers to ICT as it is and especially for people who aren't very competent and so we just didn't want any barriers. (2003 focus group comment)

Different brands of laptop

Teachers appreciated having a choice of brand, and some were avid fans of one brand and not another, which sometimes led to compatibility issues when teachers wanted to share materials and/or access school ICT-based systems. Often school technicians were only expert in one particular system.

Exclusive use

Teachers were aware that students were not supposed to use the teacher's laptop, although some focus group and case study teachers reported supervised student use. In both 2004 and 2005, three quarters of questionnaire respondents reported that they 'never' allowed students to use their laptops. Teachers making this decision were not specifically aware of a school or a TELA requirement, rather they saw the need to safeguard confidential resources held on their laptops, which acted as a sole repository of material required for their work. This concern increased over time with focus group and case study teachers as they committed more data to electronic files on their laptops.

5.2 SCHOOL-BASED FACTORS

Teacher commentary indicated that professional development, school technological infrastructure, and school organisation, in addition to school-based leadership shaped and constrained the opportunities and incentives teachers had to use their laptops. These factors influenced, in varying ways, all teacher uses of the laptops albeit they manifested in different ways for different teachers and for different uses of the laptop.

5.2.1 The value of professional development/collaborative learning

Policymakers routinely use professional development as a tool to leverage change and in the TELA scheme, schools and teachers were obliged to undertake 40 hours of professional development over the three years of the laptop lease.

Formal professional development

In 2003, teachers across the focus groups and questionnaire were largely unaware of the TELA requirement that they undertake professional development. Where they were aware of this requirement there was uncertainty as to what could count towards the 40 hours, this persisting into 2005. This said, the 2004 and 2005 questionnaire respondents reported they had had professional development on learning about the school network (2004-49%; 2005-39%) using the administration programs (2004-41%; 2005-33%) learning about specific software (2004-32%; 2005-28%), and beginner computer skills (2004-29%; 2005-24%). Only 24% had undertaken professional development in the use of the laptop with curriculum applications, and just 18-20% had received assistance with development of resources.

Focus groups and case study teachers recalled introductory sessions with the technician when they collected their laptop, slots in staff meetings in which colleagues presented ideas, and in-house workshops run before or after school or during the lunch hour. Some focus group teachers noted, and the questionnaire responses indicate, that much of the available professional development was targeted to needs of beginning users. They argued that they, too, needed opportunities to extend their knowledge and expertise. Whole-staff professional development was recommended for institutionalised activities such as reporting, absences and data entry as a means of ensuring that consistency was maintained. It was also seen as having some value for skill development. Otherwise, generic professional development was said to lack immediacy and personal relevance.

The school as a learning community

Teachers in each component of the study identified peer mentoring and collegial support as the main mechanism for enhancing their use of the laptops for teaching and learning: around two thirds (68%) of

questionnaire respondents in both 2004 and 2005 had been helped by school ICT staff and a half by other teachers. Collegial help was described by those interviewed as the preferred and most prevalent form of professional development. Teachers acknowledged that certain individuals had particular expertise in ICT and emphasised the importance of opportunities to work in a sustained way with these colleagues as mentors. The professional development provided by same-subject colleagues for ICT use in teaching and learning was seen to be especially valuable because it was ‘in context’. Colleagues as mentors provided access to models of how a laptop could be used for teaching within the setting teachers found themselves. In one case study school the ICT personnel targeted expert individuals within a department for training and then encouraged these individuals to share what they had learned within their department. Teachers from two different focus group schools reported that some departmental leaders in their schools orchestrated the development and sharing of collective expertise by sending interested staff to external courses and providing opportunities for them to share what they had learned. Case study and focus group teachers intimated that in some instances departmental cultures of sharing and learning had been catalysed by, and revolved around, exploring the possibilities available through the laptops/ICT. Overall, the indication was of a generally positive environment for learning about and using laptops. A focus group teacher described the situation in his workroom thus:

You can see learning happening [in the workroom]. People ask questions. They ask for help and others listen in. There is a learning environment happening. (2005 focus group comment)

In this case it appears that informal peer mentoring around the laptop took place in the context of a professional learning community (Senge, 1994). Indeed, the general consensus across those interviewed was that without the collaborative culture that exists amongst New Zealand teachers very little progress would have been made in the use of the laptops/ICT. One caution about informal collegial professional development, expressed forcefully by teachers in small schools and those who were the sole subject specialist in their school, was that it was dependent upon teacher access to local expertise and thus could be haphazard.

Personal exploration and experimentation

Teachers in interviews, irrespective of their self-rated level of expertise, discussed the role that personal exploration and experimentation played in their learning. Teachers, who were inexperienced, albeit they were often reluctant computer users, indicated that a personal laptop provided a safe and flexible environment to learn about and become familiar with range of computer applications. They were able to take the time they needed to develop their expertise with a particular function and could seek help at home and at school from family and friends whom they trusted to help them without denigrating them. This way they were able to consolidate their learning. Those teachers who positioned themselves as more expert were enthusiastic about having access to an up-to-date machine spending time exploring its capabilities, often searching out information via the Internet.

5.2.2 The influence of school ICT infrastructure and support

Under the TELA scheme schools are required to manage the integration of the laptops into the school environment, including the provision of additional ICT infrastructure and technical support (Ministry of Education, 2003). School technological infrastructure including hardware, software and technical support was identified as a key constraint on teacher use of the laptops across the questionnaire, focus group and case study components of the study. Data on school technological infrastructure was not collected in 2003 but in

2004/2005 around half of the questionnaire respondents reported they had access to the school network and to the Internet in all the classrooms they taught, with an additional quarter reporting access in ‘some classrooms’. Improved access to the school network was identified as an important form of support needed by 26% of teachers in both years.

In 2005, less than two thirds of teachers (57%) had access to a data projector in every classroom they taught in. Around half of the questionnaire respondents selected a ‘data projector in the classroom’ as being important to their effective use of the laptop in their teaching (2004-51%; 2005-55%). Teachers in interviews made a distinction between easy and ongoing access to a data projector. Teachers were not prepared to make a commitment to the use of electronic resources unless they had reliable, and preferably ongoing, access to a data projector. The time and effort required to access and set up a data projector often exceeded any benefits that teachers anticipated, particularly since they envisaged as ‘ideal’ the flexible use of the laptop and saw it as a tool to respond to student ideas and questions. They recounted how colleagues with reliable access used the laptop-plus-data projector as a “natural thing”.

A department workspace that was set up with space for collaboration and easy access to the Internet and school server had the potential to support departmental sharing. During 2004 and 2005 the proportion of teachers reporting access to the school network and the Internet from staff work areas rose from 60% to over 85%. In the case of two case study schools the general staff work areas were refurbished and this refurbishment had included provision for individual and collaborative use of laptops. The facilities provided included internet connections, printers, scanners and more ergonomic workspaces. Three case study teachers from one technology department outlined the benefits they had accrued since the beginning of 2005 when their workroom had been cabled. Now, they could work together more efficiently, sharing and developing lesson materials. One of the teachers had accessed a laptop through the scheme so that he would not miss out on the gains being made.

There was evidence of different histories and levels of initial familiarity with ICT in the focus group and case study schools on entry to TELA scheme, along with indication that this had consequences for the integration of the laptops into school and teacher practices. Teacher comments intimated that the nature of a school technological infrastructure was the culmination of various antecedent decisions by school leadership under the *Tomorrow’s Schools* (Ministry of Education, 1989) school self-management regime. Schools where ICT had long been a strategic focus tended to have well developed ICT systems and resources including hardware, software and personnel with the expertise required to provide advice and guidance in the development of school ICT policy and facilities. Staff from these schools indicated that in-school personnel had been able to anticipate some of the demands of the laptops and had planned to address these. For example:

We made the decision, “Were we going to avail ourselves of this opportunity like getting laptops for teachers?” We started out by costing the whole thing out. What was the cost of leasing the laptops to school? And we were going to follow that approach rather than asking the staff to pay [the lease costs] themselves. What additional infrastructure was required in the school? So we costed that. What technical support was going to be required? Because teachers can’t do this on their own. What is the additional software that was going to be required? What PD was required? So we took that overview to it and costed in all those factors. (2005 comment)

At the other end of the continuum, teachers reported their school had joined the laptops scheme to ‘kick start’ ICT developments in the school. Focus group participants indicated schools and teachers were sharply aware of the variations in ICT infrastructure development among schools. Those less well provided for saw the TELA scheme as an opportunity to develop ICT within their school. Generally, teachers from such schools construed professional development needs as less pressing; the teachers’ focus was on the need for school-wide networking. For teachers from schools with a more established infrastructure the discussion was around the need to purchase of additional ICT resources and, in some cases, ICT professional development. Increased teacher access to laptops/ICT and professional development led to increased demand for suites of computers for curriculum teaching and in-class data projectors.

5.2.3 The influence of school leadership and support

A theme that emerged is that senior management leadership in the use of the laptops/ICT was crucial, irrespective of its form. A second theme was that leadership was exercised by a range of groups and individuals including the Board of Trustees, the school principal, the deputy and/or assistant principal(s), the ICT coordinator/leader, ICT committees, head(s) of department and enthusiastic classroom teachers. The interests and decisions of these groups and individuals influenced aspects of the context in which teachers sought to use their laptop.

Board of Trustee leadership

In the initial stages, a leadership decision was required for a school to take part in the TELA scheme. Moreover, under the TELA scheme, teachers or their schools paid a portion of the lease for the laptops, the decision about who paid being one that was made by the Board of Trustees with the principal. Some teachers reported their Board of Trustees saw the laptop as a personal item and were not prepared to fund the lease. Others explained that their Board and principal were actively pursuing a vision for ICT integration and were fully behind the scheme, to the extent of paying the lease costs. Teachers were aware of the financial implications of a Board paying for teacher laptops and appreciated the Board paying some, or all, of the lease. They saw this as a sign that the Board valued teachers’ use of ICT. Three of the case studies highlight the importance of Board of Trustee commitment to ICT use and the laptops scheme. In one school the Board’s understanding of the potential for teacher laptop access to influence ICT use within the school was a crucial factor in the decision to fund teacher laptops. In another school, an outside expert played an important role in changing the Board’s vision of how and why laptops, computers and ICT might be used for teaching and learning and subsequently their willingness to seek and act on advice and support teacher use of laptops. In a third school, the Board had changed its policy to fund the laptop lease as a cost-effective strategy to promote another initiative. Within a year, all teachers had accessed a laptop and those interviewed were enthusiastic about future possibilities. The Board had also purchased a data projector for each department.

School policies and practices

Subsequent to a school entering the scheme, school policies and practices determined the incentives and opportunities teachers had to use the laptops. Focus group discussions and case study interviews indicated that school leadership to develop policy and practice was exercised by different individuals in different schools. These individuals included the principal and/or a member of the senior management (deputy principal); a small group whose membership consisted of senior management and teachers with expertise in ICT, and/or enthusiastic individuals. Teacher commentary indicated that school polices about acceptable use

reflected a meld of the TELA scheme requirements and the benefits and opportunities the school leaders envisioned for teacher access to a laptop for their exclusive use. Some schools restricted teacher acceptable use of the laptops to school-related tasks; others allowed laptop use for all but inappropriate and objectionable tasks. Schools with a more flexible approach considered all teacher use could contribute to teacher use for professional purposes.

Focus group and case study teachers noted that where the integration of ICT was part of the school strategic plan and supported by senior management and/or the Board of Trustees that the introduction of the laptops had been accompanied by careful planning for the integration of the laptops into school systems. Teachers were very appreciative of this and the implicit valuing and support for their efforts in using the laptops. In some schools, a lack of ongoing leadership to bring about successful ongoing support for laptop use had led to integration problems. For instance, in one case study school the consequence of low-level initial Board of Trustees and principal leadership support for laptops/ICT had contributed to a very small teacher uptake of laptops. Continuing low-level support for actual use was considered, by those interviewed, to have contributed to a subsequent decline in the number of teachers with laptops. Where schools did not have active senior level leadership for ICT the resulting vacuum was filled, or not, at the departmental level by the head of department and/or teachers with enthusiasm for and expertise in ICT. In these schools, ICT and laptop use was inconsistent and support for use was generally thought to be poor or inadequate by those interviewed. In sum, it would seem that leadership is important for initiating and sustaining the conditions that support teacher utilisation of laptops and for helping teachers extend their use of the laptops. Without a clear vision and senior management level leadership, school-wide development may be haphazard and ad hoc, dependent upon individual capability and interest. As has been pointed out earlier, leadership and modelling from the principal and or senior management was important for tasks such as whole-school email communication.

Departmental leadership

Departmental mentoring and leadership, either from a head of department and/or ICT expert within a department, was said to be vital to encourage the development and sharing of electronic lesson materials, and the setting up of a well organised central repository for lesson materials. In one case study school, the intensified development of school and departmental intranets had played an important role in stimulating whole school communication and intra-departmental collaboration and sharing.

5.2.4 The influence of the wider educational policy context

The impact of other policy on teacher laptop use was not an explicit focus for the evaluation, but there was some evidence that, as Spillane (2004) has pointed out, the implementation of a particular policy depends not only on teacher and school interpretation of that policy but also on previous policies as they have become embedded in school policies and priorities, teaching materials and teaching practices. Differences in case study school technological infrastructures highlight this point. There was focus group speculation that school ICT infrastructures had a flow on effect from the differential value placed on ICT by different schools under *Tomorrow's Schools*. The implication from teacher commentary was that not only did schools with a longer-term focus on ICT have a better technological infrastructure they also had greater access to on-site expertise, and thus were better able to anticipate and provide for teacher needs arising from access to personal access to a laptop.

Teachers across the questionnaires, focus groups and case studies were looking for information and ideas about how they might exploit the affordances of the laptop and ICT in teaching and learning. They were looking to colleagues, recent graduates and the Ministry for advice and guidance, or better still, to models of effective practice for teaching and learning using ICT in the subjects they taught.

Four focus groups raised the need for consistency across government requirements. In 2005, they described different interpretations of their obligations with respect to recording student absences, reporting, and the planning they could be asked to produce for Education Review Office. A small number of teachers, mainly those in management positions, discussed the prominence of ICT/e-learning (and their perception of a lack of prominence) in the current draft curriculum document (Ministry of Education, 2006). The findings of this study suggest a number of New Zealand secondary teachers and school leaders are looking to the education system as a whole when considering the potential and possibilities for ICT use. This focus is consistent with studies that have shown that any plan for ICT implementation needs to consider how technology will be coordinated with changes in curriculum, pedagogy, assessment, teacher professional development and school organisational accountability protocols (Fishman, et al., 2004). To sum up, this section has detailed aspects of the TELA policy and school context (teacher professional learning opportunities, school technological infrastructure and leadership) that the teachers involved in this study reported as influencing the opportunities and incentive they had to use their laptop. These factors impacted on different teachers in different ways depending on their expertise and interests and also on the task they wished to accomplish.

6. SUSTAINING CHANGES IN TEACHER LAPTOP USE

6.1 THE PATTERN OF CHANGE

There is some indication from the findings that the pattern of change following the introduction of TELA laptops has followed the sigmoid curve typical of most change processes. After the first year of implementation, there were modest gains in the proportion of teachers using laptops for tasks such as report writing and emailing, and greater gains for tasks such as Internet searching. Across the second and third years, gains were maintained or there was a further smaller gain. Many of the focus group and case study teachers construed the third year as a period of consolidation of their knowledge and practice. In this section we consider how change might be sustained, and perhaps accelerated, across this plateau.

6.2 HOW TO SUSTAIN AND ACCELERATE CHANGE

While clauses in the TELA scheme specifying that schools provide for school-based integration of the laptops with regard to professional development, technical support and technical infrastructure suggest that policymakers were aware of these dimensions, it seems probable that neither they, nor the schools, appreciated the full import of this requirement, or the way it was entangled with a school's longer term focus on ICT and response to previous policy initiatives. The evaluation findings resemble studies elsewhere that indicate that it is not sufficient to simply provide schools with technology. It is not sufficient to consider professional development, available ICT infrastructure, resources and support, and teacher confidence and expertise in isolation, nor teachers and schools in isolation from the wider context for change in education (Venezky, 2004).

6.2.1 Individual teachers

For individual teachers, it was the convergence of teacher confidence and expertise and perceptions of the usefulness of ICT, professional development, school leadership for laptop use and culture for change, and access to reliable ICT resources that shaped the opportunities and incentives they had to use their laptop. A combination of these contextual factors supported and constrained teacher use of their laptop for a particular task depending on their own knowledge and expertise. For beginners, help to use the laptop, including prompt technical support, is important when they are 'stuck'. With more experienced and knowledgeable users, attention turns to the development of lesson materials, the knowledge of resources to support this, and the skills to make use of these resources. Once teachers are able to prepare multi-sensory materials, it seems that the focus shifts to the need for ongoing access to a data projector and models of how to use ICT for teaching and learning. Competent teachers who have classroom access to a data projector and the Internet were eager for professional development to extend their knowledge and skills. They were interested in opportunities (and training on how to) to share their enthusiasm and expertise with colleagues. Teachers, irrespective of their self-reported ability, were very interested in developing their laptop use for teaching and learning as Table 7 shows. In all three years, at least half of the questionnaire respondents listed tasks that were related to laptop use in the classroom for teaching and learning as their main goal for further development. In 2005, finding the time to prepare resources on the laptop and the motivation to spend time learning more about laptop uses was of concern to teachers responding to the questionnaire, with 70% reporting that 'time' was the most important factor in their being able to do this.

Table 7 Teachers' goals for using their laptop in their teaching role (2004-2005)

	2004 %	2005 %
Create teaching/learning resources	23	20
Learn about ICT as a tool in teaching	22	23
Learn to use/improve skills	19	19
Use specific software programs	11	13
Learn about potential/ICT to support learning	10	7
Access student records/admin tasks	8	6
Create websites	3	5
Access assessment resources	2	2

The 2005 focus groups indicated that the shift in focus on professional development towards the use of laptops for teaching and learning had revealed new issues. Infrastructure accessibility issues (for example, access to resources such as data projectors) and environmental issues (layout of classroom, network connections) led to some teachers limiting their professional development. These teachers saw no point in spending time on professional development when they would not be able to implement what they had learned. Case study teachers from all schools raised questions about where and how to access the knowledge and information required for pedagogical innovation with ICT. Case study teachers also highlighted the need for time to explore and experiment with the programs on their laptop and what was available via the Internet and other sources. Time to explore the capabilities of the laptop was seen as particularly beneficial by teachers with less expertise. All teachers wanted the time to consolidate what they learned from others.

6.2.2 The department

The department setting provides the immediate and most salient environment for teacher learning about laptop use for teaching and learning. The value accorded to collegial support and peer mentoring for ICT use in teaching and learning by the focus group and case study teachers highlighted the role of same-subject colleagues. Evidence has been provided that teachers working in the same room shared ideas and materials, and that department-level leadership, either from the head of department or an ICT enthusiast, supported teacher learning about and use of their laptop. The case studies also provided evidence that where there was not a critical mass of laptop users, either because teachers were not able to access a laptop or they did not want to use one, collaborative developments incorporating the laptop were limited. A shift at departmental level was observed in a case study school where one of three technology teachers had accessed a laptop. His two colleagues, seeing his enthusiasm and what he was able to do, joined the scheme. They lobbied the Board of Trustees to upgrade the technology rooms. In 2005 they were interviewed as a group in the technology suite where they described and demonstrated what they were using the laptops for. In 2006, they described the development of a new technology subject that had to be supported by laptop-based research and development. Another teacher, one who had just graduated and who was proficient in ICT, had joined the department and they were looking forward to learning more about how to use ICT from him. The experience of this group of teachers illustrates the interplay of the leadership, access resources and opportunities for professional learning. One of the teachers summed up the situation thus:

We have a new teacher started. He is into laptops and there are four of us and we all share and work in the same resources room. Whenever we have a problem we ask someone else who has done it and ... I doubt very much I would be half as far as I am if I had not had collegial support. (2006 case study comment)

6.2.3 The school

School leadership, ICT technological infrastructure, and professional learning opportunities were also found to be influential at the school level, where it was found that rather than ICT catalysing whole-school reform, educational change was most likely when the school culture supported change. The importance of these factors individually, and in interaction with each other was shown most clearly by changes in one of the case study schools. In 2004, only seven teachers at the school had laptops and these teachers tended to work alone. None was making much use of the laptops and they each begrudged having to pay the lease. In 2005, a deputy principal with expertise in, and a vision for ICT was appointed. The Board of Trustees asked him to investigate the introduction of an electronic student absence system. The deputy principal and two other teachers visited another school to see how that school managed this task. They returned and recommended that the school completely upgrade its infrastructure. They argued that the TELA scheme was the most cost-effective way to provide teachers with access to a computer. The Board agreed and funded laptops for all the teachers in the school. In the event, the school became eligible for a government-funded ICT infrastructure upgrade and at the time of the 2006 interviews all of the classrooms in the school were connected. The Board's action of paying the laptop lease had a "huge impact on teacher morale." All of the teachers had laptops and ICT literacy had improved showing that a critical mass of expertise and active laptop users was crucial to support and then extend individual teacher, department and whole-school laptop use. Laptops were also proving useful in other school-wide initiatives that utilised technology. Teacher, principal and Board attitude towards teacher laptops and ICT use had completely turned around.

School-wide and departmental leaders in ICT, particularly those from smaller schools need such opportunities to meet with peers and experts from outside their own school to share problems and solutions. Once back at school, there is a need for a mechanism for these teachers to share what they learned with colleagues and for their colleagues to have time to experiment with and explore what has been learned. Principals, Boards of Trustees and school senior management need opportunities to extend their understanding of the potential and possibilities for ICT in their particular school. However, if schools rely solely on collegial help, local good practice opportunities to learn are necessarily distributed in random and ad hoc ways (Dale, Robertson & Shortis, 2004). Teacher access to someone with the pertinent expertise and a willingness and ability to share determines opportunities to learn. That all teachers will have this access cannot be assured without some form of intervention. Added to this, teacher learning may be confined to what is available locally rather than what might be needed. What is needed is a balance between opportunities to share and to grow local knowledge and expertise.

6.2.4 National policy

Differences in school technological infrastructure highlight that government policies are not self-sufficient entities. The cultural, material and knowledge/expertise setting for school/teacher response to a particular policy is shaped in part by antecedent policies and the ways in which these have played out in the local context. School ICT infrastructures reflect the intersection over time of national and local school-based policies. The flow on from the differential value placed on ICT by different schools, in part explains current differences in school organisational, technological and personnel/expertise infrastructure. Schools with better established ICT policies and practices not only had better developed technological infrastructures, but also greater access to on-site expertise, and thus were better able to anticipate and provide for teacher needs arising from access to personal access to a laptop where these needs encompassed access to facilities,

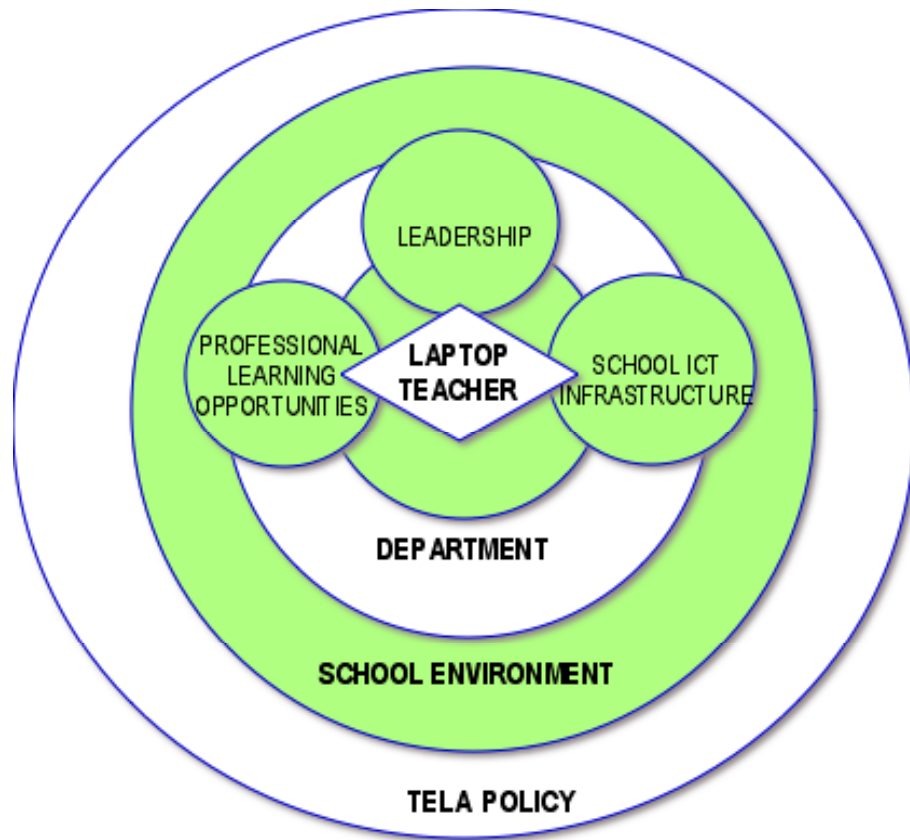
professional development, technical support and organisational and administrative systems that allowed teachers to utilise the affordances of teacher use of a TELA laptop.

Teachers across the questionnaires, focus groups and case studies were looking for information and ideas about how they might exploit the affordances of the laptop and ICT in teaching and learning. They were looking to colleagues, recent graduates and the Ministry for advice and guidance, or better still, to models of effective practice for teaching and learning using ICT in the subjects they taught. It is important that there is consistency between different government initiatives such as TELA and the interests of the Education Review Office audits, for example, and their requirement for paper-based planning, attendance and reporting. A small number of teachers, mainly those in management positions, discussed the prominence (and their perception of a lack of prominence of ICT) in the current draft curriculum document (Ministry of Education, 2006). The findings of this study suggest a number of New Zealand secondary teachers and school leaders are looking to the education system as a whole when considering the potential and possibilities for ICT use. This focus is consistent with studies that have shown that any plan for ICT implementation needs to consider how technology will be coordinated with changes in curriculum, pedagogy, assessment, teacher professional development and school organisational accountability protocols (Fishman et al., 2004). It converges with recommendations by Venezky (2004) that ICT-based policies and programs need to be consistent across all levels of the education sector and coordinated with those in other areas such as economic development and telecommunication.

6.2.5 The system for change

Fullan (2005) argues that it is only when we adopt a multilevel systems approach to change that we will be able to move past the plateau and onto into sustainable systemic innovation. School leadership and culture for change, technological infrastructure and opportunities for professional learning along with teacher personal factors appear to act to enable and constrain teacher laptops use in the classroom and at the department and whole-school level albeit in different forms. The synergy between these factors is consistent with a systems approach as set out in Section 3. Figure 1 portrays a set of inter-related factors, where the teacher is ‘nested’ within a unique school system with its own characteristics that serve to enable or constrain the teacher’s use of the laptop.

Figure 1 **The laptop teacher in context**



7. RECOMMENDATIONS: MAXIMISING THE TELA SCHEME

The evaluation showed that teachers and schools have experienced evolutionary, rather than transformative, experience of ICT integration. This is of critical significance in policy development. If the TELA scheme had been a catalyst for change, then provision of laptops to teachers would have been sufficient. Given that it has not, "...the direction of change needs to be carefully planned out and supported" (Venezky, 2004, p.11). In this regard, the findings of this evaluation are substantiated by studies elsewhere (see Section 2) that have indicated sustained growth in teachers' use of ICT, in this case laptops, especially for teaching and learning, requires a system solution. As Salomon (1993) points out, the effectiveness of a tool, in this case the laptop, "results from and contributes to the whole configuration of events, activities, contents, and interpersonal processes taking place in the context of which it is being used" (p.189). Sustained innovation is possible through the conscious, deliberate, reflective actions of policymakers, school leaders and teachers (Fullan, 2005). From the findings of this report we have identified implications or options, that may have the effect of maximising the TELA scheme and building capacity for laptop teachers' integration of ICT into their professional lives, for three levels of the New Zealand education system: national educational policymakers, schools leaders, and teachers. No consideration has been given to resource implications.

7.1 NATIONAL POLICY

The findings of this study lend support to the contention that any analysis of the impact of ICT cannot afford to decontextualise it from the wider social and political variables that shape the larger context of schools; a systems analysis is required (Selwyn, 2002). The finding the TELA scheme has more generally leveraged, rather than been a catalyst for transformative change, planned change has implications for policy (Venezky, 2004). There are four sets of findings that suggest potentially productive directions for further policy development in terms of both establishing a vision for use and of capacity building in the system and in schools to optimise the impact of teacher access to laptops. These findings relate to the role of school leadership, teacher professional learning needs (particularly those in relation to teaching and learning), school technological infrastructure, and to these three aspects as a system that can be flexibly tuned to accommodate teacher individual needs. We would make the following recommendations to policymakers:

TELA and wider policy development

We recommend that:

1. Up-to-date specifications for laptops continue to be maintained.
2. Laptop ownership/use issues are clarified for teachers who have gained scholarships, fellowships, or other service-related leave, as well as for ancillary staff, and student use of teachers' laptops.
3. Teacher education providers be encouraged to include a focus on teacher professional use of ICT in their teaching programmes, particularly ICT use for teaching and learning.

Professional learning opportunities

We recommend that strategies, in line with teacher recommendations (and the research literature), be considered to support teacher professional learning and development, including:

1. Provision be made for support and opportunities for in-school peer mentoring. Ideally this would include time for the mentee to consolidate and use what they learn, and opportunities for the mentor to enhance their own knowledge and mentoring skills. School cluster groups and subject associations may be useful in this regard.

Use of laptops for teaching and learning

We recommend that:

4. Information be provided to Boards of Trustees and principals about international, national and local best practice in the use of laptops/ICT in teaching and learning. It is suggested that this will include information on what is needed to support innovative and integrated ICT use with respect to school technological infrastructure and productive professional development and learning opportunities.
5. A programme be established for the dissemination of innovative and effective quality ICT teaching and learning ideas and practices.
6. Continued support be given to research and development into the use of ICT in subject-specific teaching and learning to provide New Zealand context-specific instances and examples of use.

The development of school technological infrastructures

We recommend that:

7. The centrally funded review and upgrade of infrastructure and network development be continued and, where possible, expanded.
8. A mechanism is put in place to ensure that schools have access to advice and guidance about infrastructure development, including the resources and systems needed to operationalise their vision.
9. Schemes such as that for a reduced purchase price for data projectors be continued and, if possible, expanded to include other peripherals and software for subject specific classroom use.

School leadership

We recommend that:

1. The exchange of information amongst principals about current and potential ICT use in administration, management, and teaching and learning be encouraged and supported.
2. Boards of Trustees and principals be supported to adopt a 'systems approach' to ICT integration, one that includes consideration of the function and impacts of leadership, technological infrastructure and professional development, individually and in interaction with each other.
3. Teacher peer mentoring and the sharing of effective practice be encouraged and, if possible, supported by the provision of time for this to happen.

7.2 SCHOOLS

School leadership was found to be crucial in providing the impetus, encouragement, and conditions for enhanced teacher expertise. Without a clear vision and senior management level leadership, school-wide development may be haphazard and ad hoc, dependent upon individual capability and interest. At one level, senior school managers provided school-wide support and incentives to use the laptop for a range of administrative and managerial tasks – school leadership initiatives such as a move to computer-based

reporting appeared to have stimulated laptop use for this purpose; at another level, departmental leadership supported teachers' day-to-day work with laptops, particularly in relation to teaching. Leadership support for these 'consequential uses' (Becker, 1994) would seem to be essential. Enhanced teacher use of the laptops would seem to require access to facilities, professional development, technical support and organisational and administrative systems that support teachers to maximise the affordances of a TELA laptop. School leaders would be advised to take a 'systems approach' to these factors. We would make the following recommendations for the integration of laptops/ICT to school leaders:

We recommend that:

1. While it is important that school principals prioritise and support ICT integration, they do not need to take the lead role for this within a school. Where possible, we recommend that principals identify and support an individual or group to take the leadership role in laptop/ICT coordination, use and integration.
2. Given the importance of leadership, and the indication that principal leadership and support are essential, we recommend that principals take up opportunities to investigate the use of new technologies and what these might contribute to their school to enhance teaching and learning. Not only are individual technologies important, but also networking, robustness and systems need to be explored.
3. A 'systems approach' be taken to increasing teacher use of the laptops for communication, collaboration, administration, and teaching and learning. This could include:
 4. Providing opportunities for department leaders to learn more about applications of ICT;
 5. Providing leadership in the use of laptops for school-wide communication, administrative and managerial tasks;
 6. Encouraging use of email communication by becoming active users; and
 7. Allowing teachers the use of appropriate curriculum-specific software.
8. The development of a culture of collaboration, sharing and professional learning around ICT integration be encouraged within a school. Processes and procedures to allow teachers who are currently using ICT in their own teaching to mentor colleagues be established. A network be cultivated amongst those within the school who are using ICT for teaching and learning.
9. An assessment of teachers' needs for technical support be undertaken, and support given is to be timely.
10. Laptop access to the Internet and the school network be made possible in all school locations.
11. Provide teaching staff with home access to the school network.
12. Schools consider the mobile nature of secondary teaching when considering further investment in infrastructure. Wireless connections, 'Computers on Wheels' (COWs), and other mobile technologies might merit consideration.
13. Staff work area ICT facilities be evaluated, including the nature of teacher access to the school network, Internet, printers, and other ICT peripherals. Staff work areas are important in supporting ICT use as they can serve as a locus for the diffusion and sharing of ideas and resources.
14. Where the intention is to increase classroom use for teaching, ongoing access to a data projector, the school network and the Internet would seem essential.
15. An ICT expert practitioner be identified and supported within each department or teacher grouping.

REFERENCES

- Bassey, M. (1999). *Case study research in educational settings*. Buckingham: Open University.
- Bebell, D., Russell, M., & O'Dwyer, L. (2004). *Measuring teachers' technology uses: Why multiple-measurers are more revealing*. Boston, MA: Technology and Assessment Study Collaborative, Boston College.
- Becker, H. (1994). How exemplary computer-using teachers differ from other teachers: Implications for realizing the potential of computers in schools. *Journal of Research on Computing in Education*, 26(3) 291-321.
- Becker, H. (2000). Findings from the teaching, learning and computer survey: Is Larry Cuban right? *Educational Policy Analysis Archives*, 8(51).
- Bradley, G. & Russell, G. (1997). Computer experience, school support and computer anxieties. *Educational Psychology*, 17(3), 22-28.
- Christensen, R. (2002). Effects of technology integration education on the attitudes of teachers and students. *Journal of Research on Technology in Education*, 34(4), 411-433.
- Coughlin, E., & Lemke, C. (1999). Professional competency continuum: Professional skills for the digital age classroom [Online document]. Santa Monica, CA.
http://www.mff.org/edtech/projects.taf?_function=detail&Content_uid1=104
- Cox, M., Abbott, C., Webb, M., Blakely, B., Beauchamp, T., & Rhodes, V. (2003). *ICT and attainment: A review of the research literature*. London: A report to the DfES. Retrieved on January 18, 2007 from: http://www.becta.org.uk/page_documents/research/ict_attainment_summary.pdf
- Cox, M., Preston, C., & Cox, K. (1999). What factors support or prevent teachers from using ICT in their classrooms? British Educational Research Association Annual Conference, University of Sussex, Brighton, September 2-5, 1999.
- Cuban, L. (1999). The technology puzzle: Why is greater access not translating into better classroom use? *Education Week*, 68, 47.
- Cuban, L. (2001). *Oversold & underused: Computers in the classroom*. Cambridge, MA: Harvard University Press.
- Cuban, L., Kilpatrick, H., & Peck, C. (2001). High access and low use of technologies in high school classrooms: Explaining an apparent paradox. *American Educational Research Journal*, 34(4), 813-834.
- Cunningham, M., Kerr, K., McEune, R., Smith, P., & Harris, S. (2003). *Laptops for Teachers: An Evaluation of the First Year of the Initiative*. (ICT in schools research and evaluation series, No.19). National Foundation for Educational Research and BECTA.

http://www.becta.org.uk/page_documents/research/lft_evaluation.pdf. (Retrieved on November 23, 2006)

- Dale, R., Robertson, S., & Shortis, T. (2004). 'You can't not go with the technological flow, can you?' Constructing 'ICT' and 'teaching and learning'. *Journal of Computer Assisted Learning*, 20, 456-470.
- Fishman, B., Marx, R., Blumenfeld, P., Krajcik, J., & Soloway, E. (2004). Creating a framework for research on systemic technology innovations. *The Journal of the Learning Sciences*, 13(1), 43-76.
- Forkosh-Baruch, A., Nachmias, R., Mioduser, D., & Tubin, D. (2005). "Islands of innovation" and "School-wide implementations": Two patterns of ICT-based pedagogical innovations in schools. *Human Technology*, 1(2), 202-215.
- Fullan, M. (2001). *Leading in a culture of change*. San Francisco: Jossey-Bass.
- Fullan, M. (2005). *Leadership & sustainability: System thinkers in action*. California: Corwin Press.
- Grossman, P., Stodolsky, S., & Knapp, M. (2004). *Making subject matter part of the equation: The interactions of policy and content. An occasional paper*. University of Washington: Centre for the Study of Teaching and Policy.
- Hennessy, S., & Deaney, R. (2004). *Sustainability and evolutions of ICT-supported classroom practice. Final Report for BECTA*. Faculty of Education, University of Cambridge.
- Hennessy, S., Ruthven, K., & Brindley, S. (2004). Teacher perspectives on integrating ICT into subject teaching: Commitment, constraints caution and change. *Journal of Curriculum Studies*, 37(2), 155-192.
- Jewell, M. (1998). The art and craft of technology leadership. *Learning and Leading with Technology*, 26(4), 46-47.
- Jones, A. (2004). *A review of the research literatures on barriers to the uptake of ICT by teachers*. www.becta.org.uk/page_documents/research/barriers.pdf
- Kankaanranta, M. (2005). International perspectives on the pedagogically innovative uses of technology. *Human Technology*, 1(2), 111-116.
- Kerr, S. (1991). Lever and fulcrum: Educational technology in teachers' thought and practice. *Teachers College Record*, 93(1), 114-134.
- Knapp, M. (2002). *Understanding how policy meets practice: Two takes on local response to a state reform initiative*. University of Washington: Centre for the Study of Teaching and Policy.
- Kozma, R. (2005). National Policies that Connect ICT-based Education Reform to Economic and Social Development. *Human Technology*, 1(2), 117-156.

- Langer, A. (2005). *IT and organizational learning: Managing change through technology and education*. New York, NY: Routledge.
- Lim, C. (2002). A theoretical framework for the study of ICT in schools: A proposal. *British Journal of Education Research*, 33(4), 411-421.
- Ministry of Education (1989). *Tomorrow's Schools*. Wellington, NZ: Learning Media.
- Ministry of Education (2002a). *Digital Horizons: Learning through ICT*. Wellington, NZ: Learning Media.
- Ministry of Education (2002b). *STELA: Laptops for secondary teachers scheme*. Information pack. Wellington, NZ: Ministry of Education.
- Ministry of Education. (2003). *The Digital Horizons: Laptops for Teachers Scheme*. Wellington, NZ: Learning Media.
- Ministry of Education (2004). *TELA Laptops for teachers scheme*. Information pack. Wellington, NZ: Ministry of Education
- Ministry of Education (2005). *TELA Infopack. July 2005*. www.minedu.govt.nz/goto/tela
- Ministry of Education (2006). *The New Zealand curriculum: Draft for consultation 2006*. Wellington, NZ: Learning Media.
- Mioduser, D., Nachmias, R., Tubin, D., & Forkosh-Baruch, A. (2003). Analysis schema for the study of domains and levels of pedagogical innovation in schools using ICT. *Education and Information Technologies*, 8(1), 23-36.
- Morgan, D., & Krueger, R. (1993). When to use focus groups and why. In D. Morgan (Ed.), *Successful focus groups: Advancing the state of the art*. Newbury Park, CA: Sage.
- Olson, J. (2000). Trojan horse or teacher's pet? Computers and the culture of the school. *Journal of Curriculum Studies*, 32(1), 1-8.
- Pal, L. (2001). *Beyond policy analysis: Public issue management in turbulent times*. Scarborough, Ontario, Canada: Nelson Thomson Learning.
- Patton, M. (2002) *Qualitative research and evaluation methods* (3rd ed.) Thousand Oaks, CA: Sage.
- Pelgrum, W. (2001). Obstacles to the integration of ICT in education: results from a worldwide educational assessment. *Computers in Education*, 37, 163-178.
- Pelgrum, W., & Anderson, R. (1999). *ICT and the emerging paradigm for life long learning: A worldwide assessment of infrastructure, goals and practices*. Amsterdam: International Association for the Evaluation of Educational Achievement.

- Putman, R., & Borko, H. (2000). What do new views of knowledge and thinking have to say about research on teacher learning? *Educational Researcher*, 29(1), 4-15.
- Salomon, G. (1993). On the nature of pedagogic computer tools: the case of the writing partner. In S. Lajoie., & S. Derry (Eds.). *Computers as Cognitive Tools*. New Jersey: Lawrence Erlbaum Association.
- Scrimshaw, P (2004). *Enabling teachers to make successful use of ICT*. BECTA.
www.becta.org.uk/page_documents/research/enablers.pdf. Retrieved on July 23, 2005.
- Selwyn, N. (2002). *Telling tales on technology: Qualitative studies of technology and education*. Aldershot, Hampshire: Ashgate Publishing.
- Senge, P. (1994). *The fifth discipline: The art and practice of the learning organization*. Milsons Point, NSW : Random House.
- Sockwell, R., & Zhang, Z. (2003). *Laptop computer pilot: Interim report 2002-2003*. December 2003. FairfaxCounty Public Schools, Department of Educational Accountability, Office of Program Evaluation.
- Spillane, J. (2004). *Standards deviation: How schools misunderstand education policy*. Cambridge, MA: Harvard University Press.
- Spillane, J., Reiser, B., & Reimer, T. (2002). Policy implementation and cognition: Reframing and refocusing implementation research. *Review of Educational Research*, 72(3), 387-431.
- Spillane, J. (2006). *Distributed leadership*. San Francisco: Jossey-Bass.
- Tearle, P. (2004). Implementation of ICT in UK secondary schools. *Final Report: February 2004*. University of Exeter.
- Vaughan, S., Schumm, J., & Siaguh, J. (1996). *Focus group interviews in education and psychology*. London: Sage.
- Venezky, R. (2004). Technology in the classroom: steps toward a new vision. *Education, Communication and Information*, 4(1), 3-21.
- Voogt, J., & Pelgrum, H. (2005). ICT and curriculum change. *Human Technology*, 1(2), 157-175.
- Wallace, R. (2004). A Framework for Understanding Teaching With the Internet. *American Educational Research Journal*, 41(2), 447-488.
- Wenger, E., McDermott, R., & Snyder, W. (2002). *Cultivating communities of practice: A guide to managing knowledge*. Boston: Harvard Business School Press.

Zhao, Y., & Frank, K. (2003). Factors affecting technology uses in schools: an ecological perspective. *American Educational Research Journal*, 40(4), 807-840.

Zhao, Y., Pugh, K., Sheldon, S., & Byers, J. (2002). Conditions for classroom technology innovations: Executive summary. *Teachers College Record*, 104(3), 482-515.

APPENDIX A: EVALUATION TIMETABLE

16 June 2003 – 30 September 2003

Planning meeting with Ministry of Education
 Ethics approval
 Pilot focus groups meeting approach
 Develop baseline questionnaire
 Design case studies
 30 September 2003 - Research Report One – progress report

01 October 2003 – 30 April 2004

Design and carry out initial focus groups (phase 1)
 Administer baseline questionnaire (phase 1)
 Analyse questionnaire responses
 Develop plan for case study schools
 Meet with Ministry of Education (May)
 30 April 2004 – Research Report Two - results focus groups (1), questionnaire (1)

01 May 2004 – 30 November 2004

Undertake case studies (phase 1)
 Develop second questionnaire
 Meet with Ministry of Education (October)
 30 November 2004 – Research Report Three – results case studies (1)

01 December 2004 – 30 April 2005

Undertake focus groups (phase 3)
 Administer second questionnaire (phase 2)
 Analyse questionnaire responses
 Plan and develop case studies (phase 2)
 Meet with Ministry of Education (April)
 30 April 2005 – Research Report Four – results focus groups (2), questionnaire (2)

01 May 2005 – 30 November 2005

Undertake case studies (phase 2)
 Undertake focus groups (phase 3)
 Develop third questionnaire
 Meet with Ministry of Education (October)
 30 November 2005 – Research Report Five – results case studies (2)

01 December 2005 – 30 April 2006

Plan and develop case studies (phase 3)
 Administer third questionnaire (phase 3)
 Analyse questionnaire responses
 Meet with Ministry of Education (April) – ‘classroom practice with laptops’ is added to evaluation goals
 30 April 2005 – Research Report Six – results focus groups (3), questionnaire (3)

01 May 2006 – 30 November 2006

Undertake case studies (phase 3)
 Meet with Ministry of Education (July)
 30 November 2006 – Research Report Seven – results case studies (3)

28 February 2007 – Final report Y 9-13

Evaluation Research Reports

- CSTER., WMIER & NZCER. (2003). *Digital Horizons: Laptops for secondary teachers evaluation. Year 9-13. Research Report One. September 2003.* Hamilton: University of Waikato.
- Cowie, B., Jones, A., Harlow, A., McPherson, M., McGee, C., & Miller, T. with Bolstad, R., Campbell, N., Cooper, B., Earl, K. & Forret, M. (2004). *Digital Horizons: Laptops for secondary teachers evaluation. Year 9-13. Research Report Two. April 2004.* Hamilton: University of Waikato.
- Cowie, B., Jones, A., Forret, M., Harlow, A., McPherson, M., Zwegelaar, J., McGee, C., Cooper, B., Earl, K., & Miller, T. with Bolstad, R & Campbell, N. (2004). *Digital Horizons: Laptops for teachers evaluation. Year 9-13. Research Report Three. October 2004.* Hamilton: University of Waikato.
- Cowie, B., Jones, A., Harlow, A., McGee, C., Miller, T., & Zwegelaar, J. (2005). *Digital Horizons: Laptops for teachers evaluation. Year 9-13. Research Report Four. April 2005.* Hamilton: University of Waikato.
- Cowie, B., Jones, A., McGee, C., Miller, T., Cooper, B., Gardiner, B., Harlow, A., & Patterson, K. (2005). *Digital Horizons: Laptops for teachers evaluation. Year 9-13. Research Report Five. November 2005.* Hamilton: University of Waikato.
- Cowie, B., Jones, A., Harlow, A., McGee, C., Miller, T., Cooper, B., & Gardiner, B., (2006). *Digital Horizons: Laptops for teachers evaluation. Year 9-13. Research Report Six. April 2006.* Hamilton: University of Waikato.
- Cowie, B., Jones, A., Cooper, B., Gardiner, B., Harlow, A., Miller, T., & McGee, C. (2006). *Digital Horizons: Laptops for teachers evaluation. Year 9-13. Research Report Seven. November 2006.* Hamilton: University of Waikato.

APPENDIX B: IMPACTS ON ADMINISTRATION

Administration - laptops afford a 'portable office', allowing teachers to collate data in one repository that can then be accessed at their convenience, affording efficiency, effectiveness, flexibility, and providing maximum support for all administration tasks.

Outputs (what teachers do)	Value (proximal outcomes)	Enablers and constraints	Recommendations
<p>Student centred tasks:</p> <p>Write reports for parents (<i>routinely used: 2003-72%, 2004-81%, 2005-79%</i>);</p> <p>Record student grades (<i>routinely used: 2003-64%, 2004-68%, 2005-70%</i>);</p> <p>Check student lists/records (<i>routinely used: 2003-50%, 2004-63%, 2005-65%</i>);</p> <p>Record absences/attendance (<i>routinely used: 2003-18%, 2004-21%, 2005-27%</i>);</p> <p>Check departmental schemes and units (<i>routinely used: 2003-40%, 2004-42%, 2005-48%</i>);</p> <p>Pastoral care information; and</p> <p>Reporting incidences.</p>	<p>Affords streamlining of administrative tasks;</p> <p>Reduces double handling of data/administrative tasks;</p> <p>Assessment data in a digital form is more easy to analyse;</p> <p>Allows use of a central repository (one-stop-shop);</p> <p>Facilitates pooling and mutual sharing of information;</p> <p>Encourages standardisation via templates; and</p> <p>Teachers with laptops do not have to wait in line to use staff computers at report time.</p>	<p>Enablers</p> <p>Central repository/school network system for school administration;</p> <p>Laptop access to network from all sites within and outside of the school;</p> <p>School requirement for computer-based administrative tasks;</p> <p>Stable and robust school Internet;</p> <p>Reliable technical support for school network;</p> <p>Wireless connections in school support teachers' mobility;</p> <p>Professional development for teachers in use of school administration systems (<i>formal PD received by between a third and a half of teachers in 2004 and 2005 on use of school network/admin</i>); and</p> <p>Production and use of templates for common administrative tasks that are readily accessible to all teachers.</p>	<p>We recommend that support be given to schools to enable their administration systems to become completely electronic.</p> <p>We recommend that principals, and other school leaders, be supported to actively lead the integration of electronic ways of administering schools.</p> <p>We recommend that schools be supported to provide wireless connections that facilitate teachers' effective use of laptops.</p> <p>We recommend that schools be supported to provide their teaching staff with home access to the school network.</p>
<p>School organisation:</p> <p>Check school timetable (<i>routinely used: 2003-32%, 2004-42%, 2005-45%</i>);</p> <p>Check school and staff notices (<i>routinely used: 2003-21%, 2004-19%, 2005-28%</i>);</p> <p>Dissemination of information to staff, parents, wider school community; and</p> <p>Use of templates for common tasks:</p> <p>Newsletters;</p> <p>Minutes of meetings; and</p> <p>Scheduling appointments.</p>		<p>Constraints</p> <p>Laptop not linked/ compatible with school system (<i>2003 n=67/154 comments</i>);</p> <p>School network unreliable/not user-friendly (<i>2003 n= 6/154 comments</i>);</p> <p>Lack of external access to school network (<i>2003 n= 3/154 comments</i>);</p> <p>Home connection too slow (<i>2005 n=7/192 comments</i>);</p> <p>No home telephone;</p> <p>No Internet connection at home;</p> <p>Other computers in school already linked to school system (easier to use) (<i>2003 n= 22/154 comments</i>).</p>	

APPENDIX C: IMPACTS ON COMMUNICATION

Communication - laptops afford e-communication in a way that supports teaching and learning.

Outputs (what teachers do)	Value (proximal outcomes)	Enablers/Constraints	Recommendations
<p>Use of laptop for communication via email:</p> <p>Within school +/-or with other schools (<i>routine use: 2003-52%, 2004-51%, 2005-54%</i>)</p> <p>With students;</p> <p>with parents;</p> <p>with community;</p> <p>throughout NZ; and</p> <p>international.</p> <p>Send and receive students' resources, assessments;</p> <p>Communicate with parents about school and student issues;</p> <p>Organise school trips, exchanges, and joint activities;</p> <p>Disseminate school information via email and/or school website;</p> <p>Advertise school events in the community; and</p> <p>Write school/class newsletters and send out to school and community.</p>	<p>Asynchronous communication that allows one-to-one or one-to-many recipients;</p> <p>Produces a personal record of communication that may be kept and accessed at any time, including immediately;</p> <p>Allows for confidential communication; and</p> <p>Laptops often 'faster' than home computers (<i>2003 n=10/92 comments</i>).</p>	<p>Enablers</p> <p>Schools have school email account;</p> <p>Teachers have a personal email account;</p> <p>Access to Internet from all locations in school and outside school;</p> <p>Leadership encourages e-communication by actively using email for communication and dissemination of information;</p> <p>School organisation processes encourage the use of email;</p> <p>A critical mass of laptop teachers in the school with the knowledge, skill and inclination to communicate electronically when appropriate.</p>	<p>We recommend that school leaders be supported to ensure that teachers have laptop access to Internet in all school locations.</p> <p>We recommend that school leaders be supported to become active users of email.</p>
		<p>Constraints</p>	
		<p>E-communication not a preferred way of communicating (<i>2003 n=3/92 comments</i>);</p> <p>Laptops not set up for email;</p> <p>Lack of awareness of possible applications for communication;</p> <p>Lack of time (<i>2004 n=5/37 comments</i>);</p> <p>Technical difficulties (<i>2004 n=4/37 comments</i>); and</p> <p>Easier to use desktop or home computer already set up for email.</p>	

APPENDIX D: IMPACTS ON COLLABORATION

Collaboration - laptops afford e-communication in a way that supports the collaboration to support teaching and learning.

Outputs (what teachers do)	Value (proximal outcomes)	Enablers/Constraints	Recommendations
Share resources with other teachers; Participate in online forums/discussion groups (<i>routine use: 2003-10%, 2004-7%; 2005-5%</i>); Undertake professional development via the Internet (<i>2003-31%, 2004-12%, 2005-10%</i>); and Undertake further qualifications via the Internet (<i>2003-10%, 2004-10%, 2005-8%</i>).	Asynchronous communication that allows one-to-one or one-to-many recipients; Efficient means of sharing of resources which are easily adapted; Produces a personal record of collaborative activities that may be kept and accessed at any time, including immediately; and A flexible and efficient means of communication for organizing joint activities.	Enablers	School leaders need to ensure that teachers have laptop access to Internet in all school locations; and School leaders support the development of learning communities within the school.
		Access to Internet from all locations in school and outside school; and A critical mass of laptop teachers in the school with the knowledge, skill and inclination to use the laptop for collaborative purposes when appropriate.	
		Constraints	
		Lack of awareness of possible applications for collaboration; Lack of time (<i>2004 n=5/37 comments</i>); and Technical difficulties (<i>2004 n=4/37 comments</i>).	

APPENDIX E: IMPACTS ON LESSON PLANNING AND PREPARATION

Lesson preparation – Laptops can become a ‘portable planning book’ with all a teacher’s planning stored in one place for easy access at any time or location. Laptops may be used together with the Internet, DVDs, and software to create high quality lesson materials suited to individual student needs.

Outputs (what teachers do)	Value (proximal outcomes)	Enablers/Constraints	Recommendations
<p>Prepare student handouts and worksheets (<i>routine use: 2003-73%, 2004-71%, 2005- 78%</i>);</p> <p>Access curriculum/assessment-related documents from Internet sites (<i>routine use 2003-46%, 2004-66%, 2005-69%</i>);</p> <p>Access Internet for lesson ideas, plans and projects (<i>2003-9%, 2004-11%, 2005-?</i>);</p> <p>Access TKI for lesson plans. Resources. (<i>2003-56%, 2004-64%, 2005-68%</i>);</p> <p>Produce lesson materials in combination with other equipment (<i>routine use 2003-32%, 2004-39%, 2005-36%</i>);</p> <p>Review resources such as DVDs, CD ROMs for in class/student use (<i>routine use 2003-27%, 2004-31%, 2005-40%</i>); and</p> <p>Access school intranet for lesson plans/resources (<i>2003-9%. 2004-11%, 2005-15%</i>).</p>	<p>Planning templates are easy to manipulate, adapt, and modify. Save time filling in and making new templates. (QF 2005);</p> <p>Reduction of the amount of paper used in planning and preparation;</p> <p>High quality lesson materials that respond to student learning needs; and</p> <p>Improved quality of presentation of resources (<i>2003 n=23/97 comments</i>).</p>	<p>Enablers</p> <p>Professional development in laptop use for lesson preparation (only around 20% had received formal PD on developing resources (2004-2005).</p> <p>Availability of other equipment such as data projector, interactive whiteboard, DVD player. (QF 2005)</p>	<p>MOE continue to update TKI as a source of lesson materials and to ensure appropriate secondary level content is available.</p> <p>Support the production of digital resources that can be modified.</p> <p>Support subject associations as a forum for the sharing and development of resources and teaching practice incorporating ICT.</p>
		<p>Constraints</p> <p>Lack of time (<i>2003 n=6/97 and 2004 n=2/27 comments</i>)</p> <p>Laptop not linked or incompatible with school system and/or Internet (<i>2003 n=10/97 comments</i>)</p> <p>Other equipment unreliable or unavailable (<i>2003 n=8/97 and 2004 n=3/27 comments</i>)</p> <p>School limiting Web use (<i>2003 n=1 comment</i>)</p> <p>Lesson preparation done by an expert in the department (<i>2003 n=1 comment</i>)</p> <p>Need for professional development (<i>2004 n=4/27 comments</i>)</p>	

APPENDIX F: IMPACTS ON CLASSROOM PRACTICE

Teaching and learning – laptops have a multimedia capability that affords teachers the opportunity to introduce multi-sensory material into their teaching which can motivate students to engage creatively and critically in their learning.

Outputs (what teachers do)	Value (proximal outcomes)	Enablers	Constraints	Recommendations
<p>To present a unit of work, introduce a new topic, support a lesson (2005 n=5/94 examples);</p> <p>Teacher access Internet during a lesson (routine use: 2003-11%, 2004-11%, 2005-15%) (2005 n=12/37 examples);</p> <p>To project information from Internet (2005 n=14/94 examples);</p> <p>PowerPoint presentation (routine use: 2003-9%, 2004-13%, 2005-17%) (2005 n=42/94 examples of use);</p> <p>Use of curriculum-specific software (routine use: 2003-11%, 2004-10%, 2005-15%) e.g., video editing, music notation, maths software;</p> <p>To show DVDs, CDs, Videos (2005 n=10/94 examples);</p> <p>Use of lesson materials including static/dynamic images and/or sound and colour;</p> <p>Use of real-world data, e.g., virtual field trips, stock market data, climate change data;</p> <p>Simulations, e.g., dangerous experiments;</p> <p>Use of lesson materials that are personalised for specific classes/individual students;</p> <p>Use for lessons outside the classroom – to record data;</p> <p>Playing music;</p> <p>Collecting class data;</p> <p>Sharing group work via the school network; and</p> <p>Responding to students' work online (The Correspondence School)</p>	<p>More professionally-orchestrated lessons;</p> <p>Multi-sensory lessons suited to students who live in an increasingly visual world;</p> <p>Supports shift from verbal to visual textual production evident in today's society;</p> <p>Links learning to the outside world;</p> <p>A valuable, portable tool that reduces double handling of information when on field trips outside the classroom;</p> <p>Makes showing edited pieces of film easier;</p> <p>Product has a professional look;</p> <p>Allows for use of multimedia in lessons; and</p> <p>Lesson delivery more effective.</p>	<p>Internet access in every room;</p> <p>Same subject mentor;</p> <p>HOD support;</p> <p>Collaborative culture in school that supports greater teacher production and sharing of easily adaptable lesson materials;</p> <p>PD in use of laptop and peripherals;</p> <p>PD in use of curriculum applications;</p> <p>Access to curriculum-specific software;</p> <p>Data projector in every classroom;</p> <p>Technical support in the school – someone who can deal with technical issues promptly;</p> <p>Easy access to digital camera and other equipment used in lessons; and</p> <p>Datalogging equipment.</p>	<p>Need to book, transport and set up data projector;</p> <p>Room configuration with respect to data projector placement, Internet access and power, blackout capability;</p> <p>Not being able to allow student use because of TELA, school or security concerns;</p> <p>The lack of time – no allowance of time to: develop skills; learn more about laptop uses; and for professional development;</p> <p>Lack of teacher confidence and understanding of how to use laptop in classroom for lessons – the need for PD;</p> <p>Poor availability, inadequacy and/or access to curriculum-specific software; Lack of, or unreliable, equipment such as data projector, printer, digital camera;</p> <p>Inconvenience of carrying laptop around the school;</p> <p>No classroom access to school network;</p> <p>No classroom access to Internet; and</p> <p>Use of another classroom computer for teaching purposes.</p>	<p>TELA could provide a means/mechanism for teachers to work in a sustained way with colleagues (provide teacher relief time);</p> <p>TELA to continue to maintain up-to-date specifications for laptops; and</p> <p>TELA could encourage the development of up-to-date curriculum-specific software for use in the classroom.</p> <p>Schools need to designate someone in the school who has the role of ICT professional development coordinator; and</p> <p>Schools need to keep up to date with the purchasing of new curriculum-specific software.</p>