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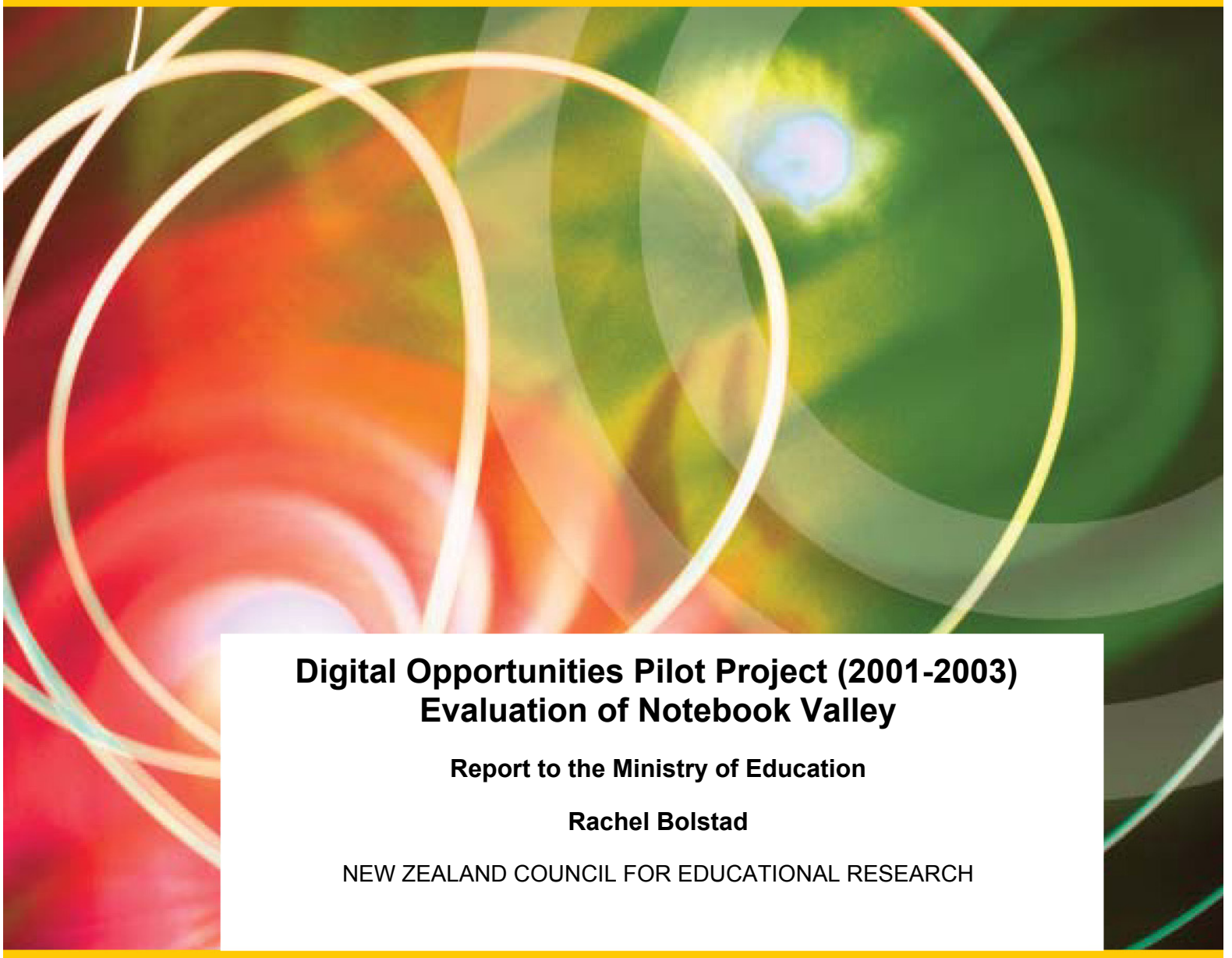

# Digital Opportunities Pilot Project (2001-2003) Evaluation of Notebook Valley

**Report to the Ministry of Education**

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# Digital Opportunities Pilot Project 2001-2003

## Evaluation of the Digital Opportunities Project: Notebook Valley

**Final Report**

Rachel Bolstad

NEW ZEALAND COUNCIL FOR EDUCATIONAL RESEARCH

TE RŪNANGA O AOTEAROA MŌ TE RANGAHAU I TE MĀTAURANGA

Wellington

2004

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# Executive summary

Notebook Valley was one of 4 Digital Opportunities projects facilitated by the Ministry of Education from 2001 to 2003. The Notebook Valley project aimed to:

> *enhance the educational achievement of the students and community particularly in mathematics and science; help overcome the barriers of access, ability, and attitude; and work in partnership with all stakeholders (Ministry of Education, 2001, p. 8).*

This education-business partnership project involved providing laptop computers, and associated information and communications technologies (ICT) networks and support, to Year 12 and 13 science and mathematics students and their teachers, in 3 low-decile secondary schools, for 2½ years.

This is the final report of the NZCER evaluation, conducted in 2002–2003, of the implementation and impact of the Notebook Valley laptop project for the students, teachers, and stakeholder partners involved. Key themes for the evaluation included:

- the initiation and implementation of the project in the 3 schools, and the role of stakeholders;
- teacher professional development;
- teachers' and students' patterns of access to and use of laptops;
- the impact of the laptops on teaching, learning, and retention;
- identification of the resources, skills, and conditions necessary to enable the effective utilisation of laptops by senior mathematics and science students and their teachers to assist learning; and
- identification of the resources, skills, and conditions necessary to enable sustainability of the project.

In 2002 and 2003, information about the use and impact of the laptops was gathered through beginning- and end-of-year student surveys and student and school staff interviews. Some observations of teacher professional development sessions and classroom laptop use were carried out in 2003. Representatives from stakeholder businesses in the project were also interviewed.

## PROJECT INITIATION AND THE ROLE OF STAKEHOLDERS

The project was rolled out to schools in 2001. Overall, schools reported satisfactory delivery of hardware and services from the business stakeholders during the technical implementation period. Principals and ICT co-ordinators were the main school staff involved in the initial implementation process, which included discussions and interactions with the Ministry of Education and various stakeholder groups.

Setting up the project within the school was more complex and took longer than external partners may have estimated. Bringing the laptops and associated systems into the schools in 2001 and 2002 required schools to make decisions about organisational management and changes to their existing technical infrastructure. In 2001 there were some delays in getting the laptops issued to teachers

and students. The number of laptops supplied to schools did not necessarily match the number of teachers and students teaching or enrolled in senior mathematics and science subjects. It took school staff some time to determine to whom the laptops would be allocated, and how the laptop project would be managed within the schools.

Most science and mathematics staff were not involved in the initiation phase of the project. Some aspects of the project and its implications for teachers and their classroom programmes were not always clear to teachers during the initial implementation period. For example, who would receive the laptops, whether there was going to be training or professional development on how to use them, and how they were expected to be used by teachers and students. Teachers thought the implementation had gone reasonably well, but some had concerns about the decisions made about how the laptops were allocated to students and teachers. There appeared to be few opportunities for school staff to make pedagogical decisions about the way the project would run in their school. For example, which subject areas or student year levels would benefit most from access to laptops, whether teachers should have laptops for several months prior to them being allocated to students, and how the laptops would contribute to or change their existing science and mathematics teaching programmes. However, one school negotiated to retain a class set of laptops within the school for use with science and mathematics classes at all year levels.

Stakeholders had varying levels of interaction with the schools. The Learning Centre Trust (LCT) Digital Opportunities staff had the most interaction with schools and teachers and had an ongoing role in support and professional development during the project.

## STAFF PROFESSIONAL DEVELOPMENT

Teachers' previous experience with computers ranged from some who were regular, confident users, to those who used computers themselves but not much in their teaching, to those who had hardly ever used computers before. Different teachers' professional development experiences during the Notebook Valley project varied considerably. In 2001/2002 teachers were involved in a range of in-school and out-of-school meetings, conferences, and training activities related to the Notebook Valley project. However, different teachers had different amounts of release time for professional development and training. Each school had some in-house professional development or training. One school brought in an external training group in 2001. Other in-house professional development involved peer-group sharing, in informal circumstances, or during departmental staff-only days after students finished school for the year. Most teachers described a lack of time or opportunities to put new skills/ideas into practice as an impediment to their use of ICT in teaching.

Throughout the project there was little collaboration or sharing of resources between schools, and limited posting of materials on the Notebook Valley website. Although some teachers discussed competition between schools as an impediment to collaboration, most felt it would be beneficial to share or collaborate with teachers from the other schools. Teachers had clear ideas for the kind of sharing and collaboration they thought would work well for them. This included meeting with other teachers in their particular subject areas to share ideas for specific units, or topics, or resources that they could use the laptops for, and having time to talk about ways of using the laptops and other ICT in class with their students. Many teachers thought they did not have these kinds of opportunities during the inter-school meetings they attended in 2001 and early 2002.

In 2002 and 2003 LCT focused primarily on working with each school individually, and arranging small-group or one-on-one sessions with teachers within those schools to provide individual support. In 2002 all 3 schools provided approximately 4 hours of release time per week to 1 or 2 teachers to work on the project. Two schools established regular or semi-regular visits from TKI's content co-ordinator to work with released teachers on resource development and some teachers were finding these sessions very productive. In 2003, the Digital Opportunities LCT team used a professional development approach which involved meeting with staff from whole science and mathematics departments to develop ICT profiles for the school, the department, and individual teachers. These profiles were used to plan programmes of teacher professional development, and to help set individual and departmental goals and plans of action to achieve these goals. However, progress in following up on these plans varied, depending on how successfully Digital Opportunities LCT and heads of department were able to co-ordinate suitable times for professional development sessions.

In 2003 Digital Opportunities LCT also helped schools purchase and learn to use science and mathematics software and equipment like *Crocodile Clips* and *Geometer's Sketchpad,* and data-logging equipment. Some developments occurred in some departments, particularly when this was supported with Digital Opportunities LCT professional development in areas that individual schools, departments, or teachers identified as need areas. However, professional development programmes were not successfully arranged and completed with all departments by the end of 2003 for a variety of reasons, including time issues and staff changes. In 2003 some staff had regular one-on-one contact with Digital Opportunities LCT staff, while others had little or no regular contact with anyone from outside their school regarding the project. Some teachers felt they had less professional development in 2003 than in 2002.

## THE IMPACT OF LAPTOPS ON TEACHING AND LEARNING

During the 2 years of the research, changes and developments which impacted on teachers' and students' experiences of the laptop project occurred in each of the 3 schools. These included: changes in schools' physical and ICT infrastructure, staff changes, changes to teachers' release time to work on the laptop project, the acquisition of new ICT science and mathematics software or equipment, changes in stakeholders' support and professional development approaches, and general changes in schools' ICT policies or systems. For teachers and students involved in the Notebook Valley project, the ramifications of these changes and developments for the use of laptops in teaching and learning could be positive, negative, neutral, or sometimes a combination.

Laptop use in science and mathematics classrooms in 2002 and 2003 was variable between different classes, teachers, and students. Reasons for this variability included:

- physical and technical barriers to laptop use in classrooms (in some cases classrooms were not networked, or were in the process of being rebuilt or refurbished);
- student laptops were fewer than the number of students taking senior science and mathematics subjects, leading to the "pepper-potting" of laptops across classes;
- a lack of clear guidance on how the laptops were expected to be used with students;
- limits on teacher knowledge, skills, or appropriate tools and resources to use laptops for teaching and learning in senior science and mathematics topics;

- insufficient teacher professional development or time to put new knowledge and skills into practice; and
- competition with other priorities, including a focus on the implementation of NCEA.

A related issue was a trend towards students not bringing their laptops to school because they were too heavy, there was nowhere to store them during the day, or there were too few opportunities to use them.

By the end of 2002, some staff felt the presence of the laptops was having an overall positive impact on each school's "ICT culture", and that students and staff were becoming accustomed to having their own laptops. One or two teachers from Schools 1 and 2 had begun working weekly with TKI and other Digital Opportunities project staff, primarily on skill development and web content development, and these teachers expressed strongly positive attitudes towards this. Some new classrooms were completed or had network access installed. In at least one school, a decision was made to "flood" some science classrooms with laptops to avoid the problems associated with "pepper-potting". However, consistent increases in the use of ICT across senior science and mathematics classrooms were difficult to detect. In general, staff who had been trying to integrate the laptops into classroom teaching and learning at the beginning of the project continued to do so where opportunities presented themselves, and staff who were not sure how to do this or did not see opportunities for doing so, did not. However, some teachers were stimulated by attendance at ICT conferences or TKI professional development sessions to develop intranets for their departments.

The laptop project continued to have mixed success in 2003. Although some teachers felt the project had gained momentum in their school since 2002, others felt it had lost momentum. All 3 Notebook Valley schools took steps towards greater ownership and self-determination of the laptop project in 2003. ICT use with junior students was a focus in 2003. At School 1, the mathematics department regularly took their junior classes to work in the school's computer lab. When senior students returned their laptops in term 4, a class of junior students with special learning needs used the laptops for the remainder of the school year. At School 2, a Digital Opportunities LCT team member was enlisted to work on a web development project with Year 9 and 10 gifted and talented students. At School 3, junior (and senior) science and mathematics students had access to a classroom set of Notebook Valley laptops housed in a "laptop lab".

There was a feeling among many of the staff interviewed that ICT developments at the Year 9 and 10 level would have a worthwhile and lasting benefit for both the students and the departments, as ICT gradually became meaningfully integrated into departmental teaching and learning programmes. The highlights for teachers in 2003 included: departments acquiring useful science and mathematics software, and installing these on laptops or the school network; developments in ICT-based teaching and learning in some Year 9 and 10 teaching programmes; and access to professional development and support from Digital Opportunities LCT that was tailored towards departmental or individual needs.

## EXPERIENCES AND IMPACT OF THE PROJECT FOR NOTEBOOK VALLEY STUDENTS

Survey findings regarding the amount and nature of students' laptop use at school were consistent with information from teacher and student interviews which indicated that laptop use was sporadic

across most classes and varied between individual students. Overall use of laptops at school appeared more frequent in 2002 than in 2003. Some students seemed to use the laptops to support their learning in a variety of ways, including using the Internet for research, creating PowerPoint presentations, and using subject-specific software and simulations in class or at home.

Students and teachers felt for the most part it was left "to the individual" (teacher or student) to find ways to use the laptop to support teaching and learning. Many students reported using laptops for word processing and spreadsheets both in science and mathematics classes, and at home. Many students used their laptops at home or at school to prepare assignments and reports for subjects other than mathematics or science. Students generally used the laptops for a wider variety of functions at home than at school. These included school-related uses (e.g. searching the Internet for information for schoolwork, writing assignments, revision and self-testing) and personal uses including games, e-mail, music, and movies.

The survey data do not show significant impacts of the laptops on students' attitudes towards science and mathematics subjects, but students' knowledge, confidence, and skills with ICT show some increases. The wide variation in laptop use between classes/students may explain why it was difficult to detect a consistent impact of the laptops on student attitudes towards their science and mathematics subjects. However, students' self-described increase in ICT knowledge, confidence, and skills does not seem to have been affected by the sporadic nature of laptop use in school.

## CONCLUSION

The Notebook Valley project provided a range of benefits for the teachers, students, and schools. These benefits included: increases in teacher and student knowledge and confidence using ICT; changes in school "ICT culture"; the acquisition of useful ICT software and peripheral ICT equipment; the development of school and departmental intranet systems; and the beginning of more ICT-based teaching schemes for some junior science and mathematics classes.

However, the use of laptops in classroom teaching and learning within the Notebook Valley schools was often constrained by contextual circumstances. These included physical and technical barriers to classroom ICT use, for example, limited network connections in their classroom, the time required to log in to the system, and "pepper-potting" of laptops across classes. Non-physical barriers to classroom ICT use were also identified. These included: teachers' unfamiliarity with, or lack of access to, useful science and mathematics software or equipment; and a lack of time for teachers to explore and experiment with different ICT resources or tools, and adapt these for use in their particular teaching programmes. The time demands of covering all the curriculum content required for senior students to complete their NCEA assessments also placed constraints on ICT use in some senior classrooms. These contextual circumstances in turn created limitations on the project's potential to transform science and mathematics teaching and learning experiences and practices for Year 12 and 13 students in the schools during its 2½ years.

Some positive developments for staff and departments in the Notebook Valley schools began to occur when teachers and ICT professional development staff collaborated to develop ICT-based science or mathematics teaching units, or to discuss options for acquiring and integrating particular software or ICT peripherals which might be useful for science and mathematics teaching and learning. Teachers and professional development staff suggested these developments required a combination of ICT knowledge and expertise, and a working knowledge of the context for

secondary science and mathematics teaching. This is consistent with other research which indicates that ICT innovations in schools have the most sustainable impact on teaching and learning when educational ICT developers and teachers collaborate as co-constructors of the innovation.

To promote long-term positive changes in secondary teaching and learning through ICT innovations, it is suggested that an approach be adopted which:

a) takes into account the contextual circumstances surrounding teaching and learning in secondary schools, and identifies how and why ICT can enhance or transform these; and

b) engages teaching staff and people with expertise in the educational use of ICT in co-constructing the parameters of an ICT innovation that meets the needs of teachers and students, *and* stimulates self-sustaining change in teaching and learning practices.

A suggested strategy is to form a working group of ICT innovators, curriculum and pedagogical advisers, and seconded secondary teachers who could spend time developing teaching methodologies, tools, and resources which exploit the learning possibilities of ICT, and trial these in relation to particular teaching objectives or learning needs of students in target school(s).

# 1. Introduction

## WHAT WAS NOTEBOOK VALLEY?

Notebook Valley was one of 4 Digital Opportunities projects facilitated by the Ministry of Education from 2001 to 2003. This education-business partnership project involved providing laptop computers, and associated information and communication technologies (ICT) networks and support, to Year 12 and 13 science and mathematics students and their teachers, in 3 low-decile secondary schools, for 2½ years.

## BACKGROUND TO THE DIGITAL OPPORTUNITIES PROJECTS

The Digital Opportunities projects began in 2000, when discussions were held between senior government ministers, and ICT business leaders, to seek ways for the government and ICT businesses to "work in partnership to help bridge the digital divide and create a digital opportunity" for New Zealand (Clark and Mallard, 2001). In February 2001, the government and 15 ICT businesses entered into a 2-year commitment to develop 4 pilot projects. The partnership agreement between these groups outlined a rationale for the Digital Opportunities projects which was grounded in concerns about New Zealanders' access to, and use of, ICT. The partnership agreement stated that:

> *To be innovators, New Zealanders need access to new information and communication technologies. These technologies offer the key to a world of resources and ideas that feed innovation. They are also vital tools for analysis and information exchange. To achieve our vision, New Zealand must overcome a number of barriers such as access, ability and attitude. We need access to bandwidth, hardware and software. We need the ability to know how to use, maintain and advance technology. We also need the attitude to embrace technology and make it part of our way of life ("The Digital Opportunities Partnership Protocol: a government-business partnership", 2001).*

The agreement also explained why education was selected as the target sector for the projects:

> *Our education system offers us a starting point for working in partnership. It is an environment in which we can help young New Zealanders to contribute to growing and sustaining a knowledge economy. Through education we believe we can start to break down those barriers to innovation and improve learning outcomes ("The Digital Opportunities Partnership Protocol: a government-business partnership", 2001).*

A stated aim of all 4 projects was to use ICT to enhance students' educational achievement, particularly in the areas of mathematics, science, and technology.

### Shaping the Digital Opportunities projects

Parameters for 4 school ICT projects were developed by the Digital Opportunities partners, and different target regions were selected for the implementation of each project. Low-decile schools in these regions were identified and invited to participate in the projects. The 4 projects were:

- ICT-Boosted Study Support Centres in Christchurch and Invercargill (wickED);
- ICT Technology Training (GenXP);
- Learning Communities in the Far North (FarNet); and
- Laptops for Teachers and Senior Students in the Hutt Valley (Notebook Valley).
- The Notebook Valley Digital Opportunities project involved:
- 3 secondary schools in the Wellington region (Wainuiomata High[1], Naenae College, and Taita College);
- 4 business stakeholder partners: Compaq/Hewlett Packard, TelstraSaturn (now TelstraClear), the Learning Centre Trust (LCT), and ITAS/Renaissance; and
- the Ministry of Education.

## The Notebook Valley project

The Notebook Valley project aimed to:

> *enhance the educational achievement of the students and community particularly in mathematics and science; help overcome the barriers of access, ability, and attitude; and work in partnership with all stakeholders (Ministry of Education, 2001, p. 8).*

To effect these aims, the business stakeholders provided each school with a set of laptops and software for senior mathematics and science students and their teachers, and Internet access at school and at home. Appendix 1 shows the equipment and services supplied to the schools for the project. Schools were also granted $2000 to facilitate the installation of the ICT equipment.

The project partners were also responsible for providing a range of services to the schools, including:

- specialist training of school staff;
- assistance to explore innovative ways of using ICT in the provision of educational activities for students, teachers, and their communities; and
- assistance in developing printed and digital resources for dissemination that reflects good practice in the use of ICT in teaching and learning (Ministry of Education, 2001, p. 8).

Compaq was the nominal project leader for Notebook Valley. However, Compaq's main contribution to the project occurred during the initial implementation phase. In practice, The Learning Centre Trust (LCT) took the lead role in working with the Notebook Valley schools in 2002 and 2003. The Learning Centre Trust (LCT) had established a project team (The Digital Opportunities LCT team) to provide support and assistance in the areas listed above, and a Notebook Valley page was set up on Te Kete Ipurangi – the Online Learning Centre, (TKI).[2,3]

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1 When the project began in 2001, it involved 4 schools. In 2002, 2 of the schools, Wainuiomata College and Parkway College, merged to form Wainuiomata High.

2 http://commsuite.tki.org.nz/opportunities/notebook_valley/

### Implementation of the project

The project was rolled out to schools in 2001. The Notebook Valley principals were involved in initial negotiation and interactions with the Ministry of Education and various stakeholder groups, and principals and ICT co-ordinators were the main school staff to be involved in the implementation process. Some of the main events involved in the project implementation in 2001 and 2002 are shown in Table 1.

**Table 1 Events in the implementation of the Notebook Valley project**

| | 2001 | 2002 |
|---|---|---|
| Term 1 | • Principals, HODs, and stakeholders meet for planning and discussion<br>• Stakeholders audit schools' existing ICT infrastructure | • Wainuiomata High (new school) opens<br>• Schools re-issue laptops to teachers and students<br>• NZCER research begins |
| Term 2 | • Stakeholders facilitate recabling and infrastructure requirements in schools<br>• Official launch of Notebook Valley project<br>• Laptops arrive in schools end of term 2 | |
| Term 3 | • Professional development plans drafted in consultation with schools<br>• Schools issue laptops to students and teachers | |
| Term 4 | • Laptops returned to schools end of term 4<br>• Wainuiomata College and Parkway College close down for merger<br>• Some teachers keep laptops over school holidays | |

### The conclusion of the project

The Notebook Valley contract between schools and the Ministry of Education concluded on 10 December 2003. Towards the end of the year, it was decided that money from the Ministry's 2003/2004 Digital Opportunities budget would be used to pay out the Compaq lease for laptops, data projectors, and peripherals, and that this equipment would be gifted to the Notebook Valley schools. The contract that was drafted for this purpose stipulated that schools maintain a set of at least 40 percent of the laptop computers for the personal use of individual students during the 2004/2005 school years, although those allocations need not be restricted to senior mathematics and science students. All 3 schools chose to retain the laptops at the conclusion of the project.

## AIMS OF THE NOTEBOOK VALLEY EVALUATION RESEARCH

The aim of NZCER's research was to describe the implementation of the Notebook Valley laptop project and the impact on the students, teachers, and business partners involved. The research sought to identify the resources, skills, and conditions necessary to enable the effective utilisation of Notebook computers by senior mathematics and science students and their teachers to assist learning, and the continuation of the project. The research also aimed to highlight examples of

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[3] The Learning Centre Trust of New Zealand develops and manages TKI. In this report, the terms LCT and TKI are used interchangeably, to reflect participants' usage of these names.

good practice in the use of ICT by students and teachers and in the development of resources. The research ran from January 2002 to the end of 2003.

## RESEARCH QUESTIONS

The research questions were as follows:

- How was the delivery of services to the schools managed? What are the pros and cons of the services delivered and the models of delivery and implementation?
- What was the impact of the use of Notebook computers on teachers and on students (themes: learning and pedagogy; student and teacher access and use; student motivation, attitudes, and self-esteem; student achievement; retention; and community development[4])?
- What are some of the examples of good practice in the use of ICT by students and teachers, and in the development of resources, that stem from the project?
- What are the resources, skills, and conditions that are necessary to enable the effective utilisation of Notebook computers by senior mathematics and science students and their teachers to assist learning?
- What are the resources, skills, and conditions that are necessary to enable the continuation of the project?

## REPORTING OF THE RESEARCH

Four unpublished interim reports for the Notebook Valley research were provided to the Ministry of Education, schools, and stakeholders between 2002 and 2004 (Bolstad, 2002, 2003a, 2003b, 2004). This final report synthesises findings from the entire research project, and includes selected data from each of the interim reports.

## STRUCTURE OF THIS REPORT

Section 2 of this report outlines New Zealand and international literature on ICT initiatives in schools that share some of the key features of the Notebook Valley project. Some common outcomes, challenges, and successes of these initiatives are described. Section 3 describes the research methodology and research activities undertaken in 2002 and 2003. Section 4 discusses the project implementation and the role of stakeholders in the project. Section 5 looks at teacher professional development associated with the project. Section 6 describes key ICT developments in each of the Notebook Valley schools between 2001 and 2003. Section 7 provides findings about the experiences and impacts of the project for laptop students. Section 8 summarises the research findings and provides suggestions for consideration in future initiatives like Notebook Valley.

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[4] Community development (in terms of impacts of the laptop project on the wider community) was included in the initial evaluation plan. However, this dimension did not prove to be a significant aspect of the Notebook Valley project, and has not been covered in the research.

# 2. Notebook Valley in the context of related literature

Key features of the Notebook Valley project were that it was:

- an educational "digital divide" initiative;
- a "laptops-in-schools" initiative; and
- a partnership project involving schools, the Ministry of Education, and business stakeholders.

It aimed to:

- increase student achievement, interest, motivation, and retention, particularly in science and mathematics;
- stimulate collaboration and resource development among teachers; and
- facilitate the development of science and mathematics teaching and learning resources suitable for posting on the project website.[5]

This section outlines New Zealand and international literature on ICT initiatives in schools that share some or all of these key features and aims. Some common outcomes, challenges, and successes of these initiatives are described.

## EDUCATIONAL "DIGITAL DIVIDE" INITIATIVES

The term "digital divide" became widely used during the mid-1990s to describe a growing societal split between those with, and those without, access to computers and the Internet (Warshauer, 2003). Boyd's (2002) literature review describes how concerns about the "digital divide" in education have been addressed through various policies and initiatives in New Zealand and overseas that seek to provide ICT access to rural or low-income schools and communities. However, many digital divide projects have been criticised as being overly focused on providing access to technology, as if providing access was an end in itself. Much digital divide research appears to suffer from a similar problem as the larger body of knowledge surrounding ICT innovations, that is, it is dogged by concerns about "what" (that is, access and infrastructure) at the expense of questions concerning "how" people use the technology and "why" access can be beneficial (Boyd, 2002, p. 5).

### Transforming learning through ICT

Recent national and international vision statements on the role of ICT in education emphasise the potential of ICT to catalyse changes in the way teaching and learning happens in schools (Department for Education and Skills, 2002; Ministry of Education, 2002). Roschelle, Pea, Hoadley, Gordin, and Means (2000) assert that one of the great research advances in the twentieth century has been the development of richer understandings of processes of learning, and the features and contexts that support learning processes. Alongside this has developed the view that:

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[5] http://commsuite.tki.org.nz/opportunities/notebook_valley/

> *...technology – when used effectively – can enable ways of teaching that are much better matched to how children learn (Roschelle et al., 2000, p. 79).*

For example, cognitive research suggests that learning is most effective when 4 fundamental characteristics are present: (1) active engagement; (2) participation in groups; (3) frequent interaction and feedback; and (4) connections to real-world contexts. There are many studies which demonstrate the capacity of computer-based technologies to provide learning contexts that support the 4 characteristics described above. However, Roschelle et al. note that just because ICT *can* lead to changes and improvements in learning, does not mean that it *will* do so simply because technology is infused into the classroom. Rather:

> *...studies overwhelmingly suggest that computer-based technology is only one element in what must be a coordinated approach to improving curriculum, pedagogy, assessment, teacher development, and other aspects of school structure (Roschelle et al., 2000, p. 78).*

Thus, it is generally recognised that the introduction of ICT into schools will only bring about desired changes in teaching and learning when this occurs in the context of wider shifts in schooling practices. However, the relationship between ICT and school change is complex. According to Rudd (2001), the literature on school effectiveness and school improvement, and the literature on the impacts of ICT on teaching and learning, have both flourished in recent years, but these 2 bodies of literature essentially remain 2 discrete fields of enquiry. In other words, further research is needed to unpack the relationships (causal or otherwise) between ICT implementation, and school improvement.

Consequently, recent educational ICT research has focused more and more on understanding the conditions and contexts which surround ICT use, and on development of context-sensitive models that enable better planning and evaluation of ICT initiatives and programmes to enhance the quality or outcomes of teaching and learning. This is a marked shift from much early research on the impacts of introducing ICT into schools, where schooling was treated as a "black box", eliminating from the research analysis everything other than the computer itself and evidence of student learning (Culp, Honey, and Spielvogel, 2003, p. 78). Rather than trying many different kinds of ICT innovations, and seeking to identify "what works":

> *...the central evaluation question for new innovations must be 'what works when?'. That is, what are the necessary preconditions needed for the innovation to produce the desired learning outcomes? (Lesgold, 2003, p. 65)*

A central concern to researchers like Culp et al. (2003, p. 82) is that research on the impacts of ICT initiatives in schools "begins from, rather than elides, the diversity of schools – not only in the populations they serve but in their practices, constraints, priorities, and available resources." To understand the real or potential impacts of ICT for student learning, Culp et al. assert that evaluation research must focus on understanding the social context for its use. In other words:

> *...we must construct an accurate, rather than a wishful, definition of the object of our study – real, and messy, schools, teachers and students (Culp et al., 2003, p. 82).*

## WHY LAPTOPS?

Over the last 10 to 15 years there have been many overseas examples of laptops-in-schools projects. Some New Zealand schools have also experimented with giving laptops to students (Parr, 1993; Selby, Elgar, and Ryba, 2001). The key rationale for putting laptops into schools, as opposed to desktop computers, is that laptops are portable and mobile, put ICT directly into the hands of students, and enable students to access learning tools and information from school or home. Boyd (2002) traces the origins of many school laptop projects in Australia, the United States, the UK, and Canada to Microsoft's "anytime, anywhere learning" (AAL) programmes.[6] Many laptop-school programmes from the early and mid-1990s involved high-SES[7] or private schools. Extending the laptop-school concept to low-SES schools is a more recent phenomenon, corresponding with rising concerns about the digital divide from the mid- to late-1990s. New laptop initiatives continue to roll out to schools in many countries. Two large-scale examples are the state of Maine, which recently chose to give a laptop to every 7th and 8th grade[8] student and teacher,[9] and the Landes initiative in which all pupils and teachers in France are supplied with laptop computers and Internet access at school (Jaillet, 2004). However, it is worth noting that laptops are not the only form of portable computer that is being introduced into schools. There is a growing interest in assessing the value of teacher and student use of other kinds of "portables", rather than desktop or laptop computers as their main ICT device, like PDAs (personal digital assistants or "handhelds") (Bowell, France, and Redfern, 1994; Perry, 2003). The advantages of the smaller devices include lower cost, and capacity to perform specific functions that are useful in schools, for example, to connect to data-logging probes (Metcalf and Tinker, 2004), to perform calculations or produce graphs, and to record short amounts of text. Opinions about which forms of portable ICT are most useful in different school contexts vary. However, a consistent view in the literature is that positive impacts of portable ICT devices depend on the ways in which they are used, and that positive outcomes:

> *...will inevitably be reliant on the capacity of teachers and students to use ICT as an effective pedagogical tool in the pursuit of wider learning objectives (BECTA, 2004, p. 3).*

### Research on school laptop projects

Prior to the implementation of Notebook Valley, Boyd (2002) analysed research on other New Zealand and international laptops-in-schools projects. These studies provide a range of evidence about the impact and effects of laptop programmes on teaching and learning practice. Although some studies reported positive impacts or outcomes for students' achievement, attitudes, motivation, or ICT skills, in some cases little change in practice was reported beyond students using laptops as a word processor (Ainley, Bourke, Chatfield, Hillman, and Watkins, 2000; Newhouse, 1999). A synthesis of various studies helped Boyd to identify some of the key success factors for projects that *did* appear to result in positive changes in teaching and learning. These included: thorough planning (Bain, 1996; Selby et al., 2001), a shared vision concerning ICT use

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6 http://www.microsoft.com/education/default.asp?ID=AAL
7 socio-economic status
8 Students aged 12-13 years
9 http://www.state.me.us/mlte/

(Kessell, 2001), and the use of a concentrated model in which all students in the class had laptops (Rockman *et al.,* 2000).

One of the success factors for projects seemed to be that the laptop programme was part of school-wide changes in approaches to teaching and learning, rather than an isolated project. Kessell (2001) noted that one of the most important factors in the success of an initiative is undoubtedly the willingness of teachers to put in the extra work required. Related to this was adequate professional development and technical support, a shared vision for the use of ICT throughout the curriculum, and pedagogical change. Owen and Lambert (1996) suggest that these further conditions are required in order for laptop innovations to succeed:

- teachers need to have ICT skills training prior to using the laptops in the classroom;
- teachers need to be provided with professional development and time to develop an understanding of how to integrate ICT use into the classroom;
- teachers need access to support from other teachers and experts, at least at the implementation phase;
- teachers need to be able to influence the decisions concerning the implementation and on-going development of initiatives;
- school staff need to have an understanding that the laptop curriculum is different from the pre-laptop curriculum and that this has implications for practice; and
- the school needs to encourage ongoing partnerships with the community to support the laptop curriculum.

## Evaluating the outcomes of school laptop projects

Most of the studies reviewed by Boyd (2002) had a 1- to 3-year research timeframe, and most sought to identify some form of student outcomes within that timeframe. Typically a process evaluation of the implementation of the project was conducted in the first year, and then an analysis of student outcomes was conducted further into the programme (Newhouse, 1999; Ricci, 1999; Stevenson, 1999; Hill J., & Reeves T., 2000; Rockman et al., 2000; Passey et al., 2000). Several evaluators considered a 1- or 2-year timeframe inadequate to do justice to reporting the outcomes of a programme (Bain, 1996; Stevenson, 1999). An element that was rarely included in the longitudinal designs was a follow-up after more than 3 to 5 years from the initial implementation. Newhouse (1999) was one exception to this, following-up students in their seventh year of the programme—a long period of time and after the "novelty" effect of the programme had worn off. Newhouse reported that only half of the Year 12 students in his study still had their laptops and most were only using them as a word processor.

### *Measuring student learning and achievement gains from laptop projects*

The most commonly reported gains for laptop projects reviewed by Boyd (2002) included increases in students' and teachers' ICT skills, and access to and usage of ICT at school and at home. However, the often-reported improvements in students' achievement, attitudes, motivation, and information literacy skills were not necessarily clearly reflected in changes to student achievement measures (Gardner et al., 1993; Rockman et al., 2000). Positive changes to student achievement

were more likely to be reported from qualitative, rather than quantitative, data (for example, analyses of samples of students' work, or teachers' and students' perceptions). Data concerning students' achievement on standardised tests and external examinations on the whole were inconclusive. Some authors question the validity of these tests in measuring the types of gains expected from ICT innovations (Gardner et al., 1993; Rockman et al., 2000). Some studies (for example, Passey et al. (2000)) developed indicators of student achievement that were specifically tailored to the goals of an initiative, such as the ability to handle mathematics and science data. Measures like these were more useful for identifying differences between laptop and non-laptop students' learning or achievement than standardised test scores.

The international literature on ICT in education indicates that there are many unresolved theoretical and methodological questions about how to evaluate the impacts of ICT on student learning (e.g., *see* Haertel and Means, 2003; Lewin, Scrimshaw, Harrison, Somekh, and McFarlane, 2000). It is clear from the studies described above that easily-obtained quantitative achievement measures, such as examination and test scores, do not often demonstrate the impact of laptops for students' learning. Recently, research in the area of ICT and student learning has shifted focus away from simply seeking to measure student learning outcomes, towards closer investigations of the elements in the teaching and learning situation that affect *whether* and *how* ICT might impact on student learning and achievement. Boyd (2002, p. 24) suggests 2 possible reasons for the general lack of quantifiable data on improved student achievement in the laptop projects she reviewed:

> *One is that the use of laptops does not in fact have any effect on student achievement. The other, perhaps more likely, reason is that changes to student achievement are conditional on context, that is, changes are due to complex interplay of factors such as teachers changing their pedagogical approaches to support a more student-centred environment in which ICT use is integrated into the curriculum and ubiquitous. If this does not occur, and laptops are used within the traditional classroom environment simply as word-processing and presentation devices, then it is unlikely that improvements in student achievement or changes to classroom environments will be reported.*

## CLUSTER-BASED ICT DEVELOPMENT PROJECTS

In addition to being a "laptop" initiative, 2 key aspects of the Notebook Valley initiative were the involvement of 3 schools, rather than a single school; (a "cluster" approach); and the involvement of business and education stakeholders in the ICT initiative (a partnership approach).

Several other New Zealand ICT initiatives in schools share 1 or both of these characteristics. The cluster approach is strongly endorsed in *Digital Horizons,* the Ministry's ICT strategy for schools (Ministry of Education, 2003) and many other New Zealand school ICT initiatives involve school clusters. For example, the Cantatech cluster (McNicol, 1998), the Ministry of Education's *Kaupapa ara Whakawhiti Matauranga* project*,* the *Te Hiringa i te Mahara* ICT professional development programme, and the ICTPD[10] school clusters programme (Ham, 2002). School clusters and external partners also feature in non-Ministry of Education ICT projects including the North Shore Schools Net (NSSNet) and South Auckland Schools Net (SASNet)[11] partnerships (*see* Ryba, Selby, and

[10] ICT professional development
[11] http://masseynews.massey.ac.nz/2003/press_releases/27_06_03.html

Dysart, 2002), and the UNELI Project, a collaborative project involving an ICT business, UNITEC institute of technology, and 11 Auckland schools (Merrington and Halliday, 2003).

### The benefits and challenges of clustering

Ham's (2002) research on the ICTPD school clusters programme found that clustering was generally an effective strategy for teacher professional development in ICT. Among the positive effects reported were: a growing sense of purpose and self-worth as a school; the opportunity to share expertise and funding that would not otherwise be accessible; and the creation of robust inter-school networks and collaboration. However:

> *...the relative effectiveness or ineffectiveness of a particular ICT programme was an intensely situated and contextualised phenomenon, unique to each cluster (Ham, 2002, p. 43).*

Factors which created dissension within some clusters included features of the ICTPD programme (e.g. its content, or the approaches used by facilitators), and inter-school or interpersonal dynamics and politics operating within a given cluster. While Ham suggests that there is no single "recipe" for successful clustering, important ingredients included the extent to which programmes acknowledged and addressed the affective domain needs of teachers in relation to ICT, the abilities of the facilitators to support collegial development, and the extent of commitment, cooperation, and understanding shown by management, especially the principals, in participating schools.

Research by Merrington and Halliday (2003) suggests that when schools cluster together to develop online learning communities, interpersonal relationships and regular communication channels between classroom teachers are as vital as the presence of good relationships between schools at the management level. In the UNELI project, 11 primary and intermediate schools formed a group to work on collaborative ICT projects. However, some challenges arose during the first collaborative project, the development of a joint website, created by teachers and students. One difficulty was that the schools' relationships had been developed mainly at the management level, rather than at the classroom teacher level. For various reasons, staff who were involved in planning the project in 2001 (the year prior to its initiation) were not those involved in the project in 2002, and a number of the 2002 teachers had no prior knowledge of the project, nor ownership of the process. Despite inter-school discussions that occurred in 2001, in 2002 few schools or classes had built time or space into their planning to accommodate the website development venture. Time and isolation were identified as major issues for teachers who were involved in the project:.

> *They needed time to 'play' with the various technologies available to them… Lack of schoolwide involvement made most teachers interviewed feel that they had been working in isolation, as most of their colleagues were unaware of the project (Merrington and Halliday, 2003, p. 29).*

## SUMMARY

- In the 1990s, many international initiatives were established to provide computer and Internet access to rural and low-income schools and communities, in response to concerns about the "digital divide". However, these initiatives were sometimes criticised for being

overly focused on provision of ICT access, with insufficient consideration given to how people might use the technologies, and why access can be beneficial. Over time, research investigating the impacts of increased access to ICT has increasingly focused on understanding the situated contexts for use of ICT.

- The potential for ICT to transform teaching and learning in schools has been widely discussed in the literature and in educational policy and strategy documents in New Zealand and overseas. Recent ICT research in education has sought to better understand the use of ICT in real school contexts, and to identify necessary preconditions for ICT innovations to support desirable changes in teaching and learning. This represents a shift from earlier forms of ICT research where schooling was viewed as a "black box", and studies aimed to identify impacts on student learning and achievement without regard to the school and classroom contexts for ICT use.
- The concept of introducing portable computers into schools has a strong connection to notions of "anytime, anywhere learning". Early laptop projects were mostly in well-resourced, high-SES schools. Laptop projects in low-SES schools are a more recent phenomenon. There are now several international examples of teachers and students in whole states or regions being part of a laptop scheme. There is also research interest in the use of other forms of portable ICT devices in schools, and the different advantages and disadvantages of these.
- Research on laptops-in-schools projects suggests that key factors for success include: thorough planning; a shared vision concerning ICT use; the use of a concentrated model in which all students in the class had laptops; and teachers' willingness to put in the extra work required. Related to this was adequate professional development and technical support, a shared vision for the use of ICT throughout the curriculum, and pedagogical change.
- A key success factor is that the laptop programme is part of school-wide changes in approaches to teaching and learning, rather than an isolated project.
- Some laptops-in-schools projects have demonstrated positive impacts for students. However, many projects have had difficulty producing evidence of significant impacts on student learning and achievement using standardised assessments. Two possible reasons for this include: that the measures of achievement and learning used to identify the effects of laptop use are not suitable for meeting this purpose; or that the context of laptop use in the projects is such that there is little change in teacher practice, classroom activities and structure, and student learning opportunities as a result of the introduction of the laptops.
- Cluster-based and partnership approaches to school ICT development are common in New Zealand. Cluster approaches have been used for teacher ICTPD, and for the development of online learning communities. Important factors for success in cluster-based approaches include: good inter-school relationships at both the management and classroom teacher level; and the ability of facilitators to support the development of a collegial working environment. Challenges for cluster approaches include: time demands to plan and work together; co-ordination of partners; a lack of ownership of projects by staff not involved in the initial planning stages; and feelings of isolation for teachers working in projects that are not recognised school-wide.

# 3. Research activities

## METHODOLOGY

The Notebook Valley evaluation took the form of multi-method longitudinal school-based case studies with elements of formative and process evaluation, and outcome evaluation, as well as the collection of some across-school data. This framework was developed from initial interviews with the key stakeholders from some of the schools, organisations, and businesses involved in the project in 2001, and from a review of previous evaluations of "laptop schools" in New Zealand and overseas[12] (Boyd, 2002).

Some recent "laptop school" evaluations have only reported significant changes in student outcome measures after a minimum of 3 years (Bain and Smith, 2000; Newhouse, 1999; Stevenson, 1999). Previous research suggests that a 1- or 2-year timeframe is too short to adequately do justice to reporting the outcomes of a laptop programme. For this reason, many evaluators have focused on documenting the process of *implementation* in the first year of the evaluation and have waited till the second or third year to report on *outcome* data. The combination of a process and outcome evaluation is a common design employed in evaluations of laptop initiatives in school settings in New Zealand (Parr, 1993; Selby et al., 2001) and internationally (Newhouse, 1999; Passey, Steadman, Forsyth, Hutchison, and Scott, 2000; Ricci, 1999).

In 2002 the Notebook Valley research focused mainly on process and formative evaluation issues, including:

- implementation issues and professional development;
- student and teacher themes such as: learning and pedagogy; patterns of access and use of ICT by teachers and students; and student motivation, attitudes, and self-esteem; and
- collecting "baseline" student information for comparison with end-of-year student data.

In 2003, the research continued to investigate issues relating to processes, and also sought information about outcomes. This included:

- further examination of student and teacher themes, such as: implementation and continuation; learning and pedagogy; patterns of access and use of ICT by teachers and students; student motivation, attitudes, and self-esteem;
- seeking examples of teacher and student good practice; and
- collecting further information on student outcomes and retention of students in subjects/school.

## DATA SOURCES

Data collection for the project began in January/February 2002. An NZCER researcher visited each of the Notebook Valley school principals, to outline the purposes of the research and ensure that the schools were willing to participate in the research. At this stage, the Notebook Valley project

[12] Some findings of which were reported in the previous section.

had already been underway for 6 months.[13] Data for the evaluation was collected from teachers, students, and stakeholders in the project at multiple points during 2002–2003. Most of the data collected for the evaluation comprised interview and survey data. Details of these methods of data collection are given below. Other data sources that featured in the Notebook Valley evaluation plan included classroom observations, and the collection of school data on "laptop" student achievement and retention in science and mathematics subjects, and at school. However, there were some difficulties using these data sources for the research, as will be discussed later in this section.

**Table 2 Overview of research activities and reporting**

| Time-frame | Research activities | | | Reporting |
|---|---|---|---|---|
| | School and teacher data | Student data | Stakeholder data | |
| January–June 2002 | • Initial researcher visits to Notebook Valley schools<br>• Principals of Notebook Valley schools interviewed<br>• 19 science and mathematics teachers interviewed | • Laptop student questionnaire and ICT self-evaluation | • Representatives from stakeholder organisations interviewed | |
| July–December 2002 | • Principals of Notebook Valley schools interviewed<br>• 19 science and mathematics teachers interviewed | • Laptop student questionnaire and ICT self-evaluation | • Representatives from stakeholder organisations interviewed | First interim report completed |
| January–June 2003 | | • Laptop student questionnaire and ICT self-evaluation | • Meetings and discussions with Digital Opportunities LCT staff | Second interim report completed |
| July–December 2003 | • Meetings and discussions with school staff<br>• Observation of professional development sessions at 1 school<br>• Classroom observations at 1 school | • Laptop student questionnaire and ICT self-evaluation | • | Third interim report completed |
| January–June 2004 | | | | Fourth interim report completed<br><br>Final report completed |

## Data collection in 2002: the first year of research

### School staff interviews

In terms 1 and 2, 2002, the Notebook Valley principals were formally interviewed as the co-ordinators of the Notebook Valley project in their school. The ICT co-ordinators or ICT head of department in each school were also interviewed. The interviews covered these main areas:

[13] See Table 1.

- the setting-up and management of the project in each school;
- information and communication with other organisations and other schools in the project;
- teacher professional development and support for teachers and students; and
- the impact of the project on teaching and learning for mathematics and science students and teachers.

A total of 19 teachers were interviewed in April–May 2002. The interviews covered these main areas:

- teachers' experiences with getting the project set up in the school;
- teachers' support and professional development;
- the effect of ICT on teaching and learning in teachers' mathematics and science classes;
- what the teachers and their students were using the laptops for in their classrooms;
- communication and contact between teachers at the 3 schools; and
- what teachers would like to be doing with ICT in their classrooms over the next 2 years.

Most of the principals and teachers were re-interviewed in term 4. The end-of-year interviews focused on:

- how they felt the project had been going since term 2;
- identifying and discussing any new developments since term 2;
- investigating whether there had been any changes in teachers' use, or perceptions of, the laptops since the beginning of the year;
- perceived highlights and low points of the project during 2002;
- reflections on what could have been done differently with the laptop project in 2002; and
- what teachers would like to see happen with the laptop project in 2003.

## Stakeholder interviews

Representatives of each of the Notebook Valley stakeholder groups were interviewed by telephone in October 2001 to give some background to the research. This background information helped guide the development of the NZCER research plan for 2002–2003. In 2002, representatives from each of the stakeholder groups were interviewed by telephone or in person. The interviews asked about the stakeholders' current role in the project, their views of how the project was going, and whether they were collecting any data that might be relevant to the research.

### *Student questionnaire and ICT skills self-evaluation*

An NZCER questionnaire was given out to Notebook Valley students when they were issued with their laptops in term 1. The purpose of the questionnaire was to collect some background information about the students, and to provide some baseline information that would be useful for

indicating the impact of the use of laptops for students over the course of the year. The questionnaire covered 5 main areas:

- students' prior skills and confidence using computers;
- students' prior access and use of computers and the Internet;
- students' views about school, science, and mathematics (and reasons for choosing science and mathematics subjects);
- students' homework patterns and some characteristics of students' homes and families; and
- students' future education and career plans.

The students also completed an ICT skills self-evaluation checklist. The checklist gave a series of functional ICT skills that students might currently or potentially use and asked students to rate themselves for each skill. A second questionnaire was given out to Notebook Valley students when they returned their laptops in term 4. Some of the term 1 survey questions were repeated in the term 4 survey to compare against the term 1 baseline information. In addition, the term 4 survey included questions about:

- any problems students had with the laptops;
- what students used laptops for at home and at school;
- students' views about school, science, and mathematics;
- perceived benefits or disappointments of the programme, and ideas for improvement; and
- which classes students often used laptops in, which classes students rarely used laptops in, and why.

### *Student focus group interviews*

Late in term 4, focus group interviews were held with 10 students (in 2 groups of 5) at 2 of the Notebook Valley schools.[14] Students were selected randomly in 1 school, and were drawn from 1 class in the other school. The focus group interviews helped to supplement the student surveys by providing some detailed insights into the experiences of some students in the laptop project.

## Reporting on the first year of research

Two interim reports documented the findings from the first year of research (Bolstad, 2002, 2003a).

### *First interim report: project implementation*

The first interim report for the Notebook Valley research was completed and sent out to schools, the Ministry of Education, LCT, and the other Digital Opportunities researchers at the end of August, with an invitation to respond with comments and feedback. The report drew mainly on interview data from principals, teachers, and stakeholders and focused on the implementation of the

[14] Due to time pressures within the school, arrangements could not be made to interview students at the third school in term 4, 2002.

project in the 3 schools. The main findings of the report were presented on 2 occasions: at a meeting of Digital Opportunities researchers and the Ministry of Education on 27 August 2002, and at a meeting for school staff, Digital Opportunities LCT, and the Ministry of Education's Digital Opportunities project co-ordinator on 10 October 2002. The executive summary for the report was also sent to all teachers interviewed in the research.

### *Second interim report: laptop students' experiences in 2002*

The second interim report for the Notebook Valley research was completed and sent out to schools, the Ministry of Education, LCT, and the other Digital Opportunities researchers in February and to other Digital Opportunities business partners in May 2003. The report focused on the impact of the laptop project for students and teachers in 2003. The report drew on principal and teacher interviews, beginning- and end-of-year student surveys, and focus group interviews with small groups of students at each school.

## Data collection in 2003: the second year of research

The data collection processes in 2003 were similar to those used in 2002. The main difference was that principals and teachers were not interviewed in term 1.[15]

### *Stakeholder interviews*

Representatives from TelstraClear and Compaq HP were interviewed by telephone between May and June 2003. The person at ITAS/Renaissance with oversight of the Notebook Valley project was on leave during this period and was not interviewed. The researcher maintained regular contact with the Digital Opportunities LCT team through visits, e-mail and telephone contact, and face-to-face meetings.

### *Teacher interviews*

A total of 19 teachers from the 3 Notebook Valley schools were interviewed in late term 4, 2003. These interviews asked teachers about:

- their involvement in the project in 2003;
- the main changes or developments in the project since 2002;
- successes, highlights, and challenges of the project;
- what positive impacts they felt had stemmed from the project;
- how the project's development measured up against its initial goals or expectations; and
- what was necessary to enable success and sustainability of the project, or another similar initiative.

### *Student questionnaire and ICT skills self-evaluation*

Questionnaires were sent to the Notebook Valley schools for Year 12 and 13 students to complete at the time that laptops were issued in term 1 or term 2, 2003. As this survey was intended to

[15] The evaluation plan called for teacher interviews only at the end of 2003.

collect baseline data, only the new cohort of students (those who did not have a laptop in 2002) were required to complete them.[16] All students who had a laptop in 2003 were asked to complete a questionnaire when they returned their laptop in term 4, 2003.

### *Student focus group interviews*

End-of-year student focus group interviews were held in November 2003 with a total of 24 students at the 3 Notebook Valley schools. Each group comprised 3 to 6 students. Teachers were asked to select a group of student volunteers to be interviewed.

## Reporting on the second year of research

The third and fourth interim reports documented the findings from the second year of research (Bolstad, 2003b, 2004). The third interim report was sent to the Ministry of Education and Digital Opportunities LCT, and the fourth interim report was sent to schools, the Ministry of Education, and Digital Opportunities LCT, for review and comment.

## Data handling and analysis

Teacher interviews and face-to-face stakeholder interviews were recorded and wholly or partially transcribed. Notes were taken during student focus group interviews and stakeholder telephone interviews. Interview data were collated and analysed against the research questions. Verbatim quotes included in the report have been chosen to be as representative as possible of the range of views expressed.

Student surveys were coded and data was entered and analysed to provide frequency counts using SAS. Associations between variables were established through the use of cross-tabulation, contingency tables, and chi-square statistics. More complex statistical analysis (for example, to investigate any differences between schools) was limited due to the small survey sample sizes from each school.

## Consent

All participants were given a letter explaining the research, and signed a consent form giving permission for their data to be used in the research. The consent form listed the following provisos regarding the use of participants' data:

- the information participants provide will only be seen by the researchers working on the project, and will be held in a secure location;
- participants can gain access to the information they provide at any time;
- participants may withdraw from participating in the research at any time;
- the information from the project will be used in interim and final reports and in an article/articles written for teachers; and

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[16] The original Notebook Valley evaluation plan indicated that both the 2002 and 2003 laptop student cohorts would be surveyed at the end of 2003. However, as it turned out this was unfeasible, because each school took a different approach to the student laptop allocations (*see* Table 3). Because there was no uniformity across the 2002 and 2003 laptop "cohorts", students were only surveyed in the year(s) that they actually had a laptop.

- participants will not be named in the reports.

Heads of department and stakeholders who contributed to the research were sent copies of the draft interim reports and were given the opportunity to comment on these sections prior to their finalisation.

## ISSUES FOR THE RESEARCH

In 2002 and 2003 a number of data collection challenges emerged for the research. The challenges can be broken down into 2 types. First, the organisational difficulties of arranging appropriate times for teacher interviews and student surveys and interviews. Second, difficulties related to the kinds of data collection that were outlined in the evaluation plan (in particular, classroom observations, and the collection of data on student achievement), and the increasing unsuitability of these given the way that the Notebook Valley project was developing within and across the 3 schools. These challenges are outlined in further detail below.

### *Identifying students and teachers who were involved in the project*

Because the number of laptops each school received was less than the number of students taking Year 12 or Year 13 science and mathematics subjects, each school had to make decisions about which students would receive a laptop, and what criteria to use to determine allocation. Schools also had to decide which science and mathematics teachers would receive a laptop—for example, should they go to all the teachers in the department, or just to those who taught Year 12 or 13 classes? The eventual allocations varied across schools, and also changed between years as some schools re assessed their initial decisions. For example, in 1 school, when laptops first arrived in the schools mid-way through 2001, they were only given to Year 13 students and teachers who taught Year 13 classes. However in 2002, laptops were given to Year 12 students, and to all teachers in the science and mathematics departments in this school, as this was felt to generate a better team ethos for staff. The allocation criteria for students also varied between schools (*see* Table 3).

**Table 3 Teacher and student laptop allocation**

| | 2002 | | 2003 | |
|---|---|---|---|---|
| | **Teacher laptop allocation** | **Student allocation** | **Teacher allocation** | **Student allocation** |
| School 1 | All science and mathematics staff | All Year 12 science and mathematics students | All science and mathematics staff | Most Year 13 science and mathematics students and some Year 12 students |
| School 2 | Only science and mathematics staff who taught Year 12 or 13 classes | Some Year 13 students and some Year 12 students, with allocation determined on the basis of subject enrolment | | Some Year 13 students and some Year 12 students, with allocation determined on the basis of subject enrolment |
| School 3 | Only science and mathematics staff who taught Year 12 or 13 classes | Some Year 12 students, with allocation determined by subject enrolment. Some laptops retained as a school set | All science and mathematics staff | Some Year 12 students, with allocation determined by subject enrolment. Some laptops retained as a school set |

In some cases, decisions about student allocation were not made until well into the first term, when student class numbers had stabilised, and staff in charge of laptop allocation had time to sit down and make decisions about how to allocate the laptops. In some schools, students were on a "standby" list to receive a laptop if another student left school, or had their laptop removed.

### *Estimating student survey response rates*

Identifying which teachers and students were involved in the project required information from whichever staff were charged with management and oversight of the laptop project in their school. For the reasons outlined above, it was often difficult to maintain an up-to-date list of which, and how many, students had laptops, and thereby to estimate the response rate for the student surveys. On several occasions an NZCER researcher administered and collected student surveys at the time that students were allocated with their laptop. However, this could not be arranged in every case, and surveys were often left with the person in charge of the laptop allocation to administer and collect at the time that laptops were issued. Survey return rates were variable. In some cases, nearly 100 percent response rates were achieved. In other cases response rates seemed low, but the reasons for this were difficult to ascertain. In 1 school, the term 1 2003 student surveys took 6 months to retrieve from the school.[17]

End-of-year student survey returns were generally lower than term 1 survey returns. Schools were asked to identify why some students did not return a survey, for example, if they had left school during the year, were absent on the day the survey was given out, had their laptop removed, or some other reason. This information was retrieved from some schools, but was more difficult to retrieve from others, and relied on the availability of key staff who could provide this information.

[17] In this case, the staff member who was in charge of the laptop project was absent for several weeks. Other staff in the school were contacted but did not know what had happened to the surveys.

### *Arranging research visits*

Arranging times for teacher and student interviews put some pressure on school staff. NZCER made teacher release time available to the schools to cover 1 period of relief time for each teacher. Despite this, all 3 schools encountered difficulties arranging times for the teacher interviews. In 2002, these difficulties included: disruptions to school days due to PPTA strike action; PPTA prohibitions on extracurricular meetings and internal teacher relief; time pressures on teachers preparing for the implementation of NCEA; and (at 1 school) shortages of quiet space to do interviews because of ongoing construction work in the school. Notwithstanding these difficulties, staff at all 3 schools indicated their willingness to contribute to the research and did their best to work around these issues.

### *School observations*

Although the original Notebook Valley evaluation plan called for classroom observations of laptop use in 2002 and 2003, identifying appropriate classrooms for observation was more complex than originally anticipated. Because the proportion of students with laptops, and use of the laptops, appeared to vary considerably between classes, it was often difficult to identify suitable classes and appropriate times for visiting them.

The classroom observations were intended to help answer these 2 research questions:

1. What are some of the examples of good practice in the use of ICT by students and teachers, and in the development of resources that stem from the project?
2. What are the resources, skills, and conditions that are necessary to enable the effective utilisation of Notebook computers by senior mathematics and science students and their teachers to assist learning?

The 2002 data suggested that teachers were just beginning to acquire skills, knowledge, and ideas for how to use the laptops as a teaching tool. Therefore it seemed premature to collect data through classroom observations of practice in 2002, and a decision was made to defer classroom observations until 2003. Some of the main findings of the 2002 research (teacher and student data) included the following (see also Section 6 of this report):

- a lack of time, and planning time, for teachers to use the laptops in their mathematics and science classes;
- some structural and organisational barriers to laptop use in class (e.g. lack of network access in some classrooms, not all students having a laptop in many classrooms);
- some students not using their laptop at school, or not bringing it to school;
- infrequent use reported in most mathematics classes and many science classes;
- most students using laptops for note-taking or writing assignments; and
- few students using laptops for purposes such as presentations, simulations, web design, data-logging, etc.

In early 2003, NZCER discussed with Digital Opportunities LCT the possibility of linking the classroom observations to the Digital Opportunities LCT professional development sessions. This

classroom observation approach required considerable time, co-ordination, and communication between the NZCER researcher, Digital Opportunities LCT, and teaching staff. Two classes of Year 10 mathematics students were observed at School 3 using a set of Notebook Valley laptops to learn statistics in August 2003. These lessons formed part of a laptop-based teaching unit which School 3's mathematics department developed with support from Digital Opportunities LCT, and which was delivered to all Year 10 mathematics classes in the school. Two departmental professional development sessions delivered to School 3's mathematics department by Digital Opportunities LCT were also observed (in May and September 2003). Because of time constraints and organisational difficulties, we were not able to organise similar observations at Schools 1 and 2. However, staff and student interviews from these schools provided much information about teachers' and students' use of laptops.

### *School data collection*

The original Notebook Valley evaluation plan indicated that school data on student achievement and retention would be collected to evaluate the impact of the project. However, during the 2 years of the research it became evident that there were difficulties with using student achievement data as an indicator of the project's impact. The first problem was identifying what sort of achievement data was appropriate to collect. To indicate whether the laptops were making a difference, laptop students' achievement would need to be compared to the achievement of a similar cohort of (non-laptop) students, taking the same subjects. Students at different schools or students at the same schools in previous years could potentially serve as a comparison group in a post-hoc experimental design. However, achievement data is prone to differ according to particular cohorts or individuals, and it can be hard to systematically link this to 1 particular variable when there may be many other differences between cohorts. Furthermore, the 2002 and 2003 student survey data suggested wide variations in students' use of the laptops within and between individuals, schools, and subjects. This suggested it would be difficult to detect relationships between the laptops and student achievement across the cohorts.

Therefore, it was decided in discussion with the Ministry of Education that it would be more useful to concentrate on teachers' and students' developing patterns of usage and attitudes/perceptions of laptop use in class, rather than seeking to directly identify impacts on student achievement using indicators not developed for this purpose.[18]

Student retention is a simpler variable to measure than achievement. The schools were asked to provide data on student enrolment and retention in school and in science and mathematics subjects. While this may give some indication of the effect of the laptops on students' motivation and interest in science and mathematics, some of the problems described above for achievement data also apply (for example, the difficulty of separating out the effects of laptop possession from the other factors that might explain student retention and enrolment patterns).

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[18] In 2003 the new cohort of Year 12 students were assessed using the new NCEA level 2. This also prevents direct comparisons of achievement between 2002 and 2003 cohorts.

# 4. Initiation of the project and the role of stakeholders 2001–2003

## INTRODUCTION

This section describes the initiation of the project in the Notebook Valley schools during 2001–2002, in terms of technical and organisational aspects, staff perceptions, and the roles of stakeholders from 2001 to 2003.

## SCHOOL ORGANISATION AND MANAGEMENT OF THE PROJECT IMPLEMENTATION (2001/2002)

In all 3 schools, the main people to be involved in the early phases of the project implementation were the principals and 1 or 2 staff (usually the person in charge of ICT, and science and mathematics HODs).

In 2001, the schools experienced some technical difficulties associated with the project's initial implementation. For example, 1 school encountered some hardware and software problems, and difficulties integrating the technical infrastructure required for Notebook Valley with the school's existing intranet system and Internet service provider (ISP). The school had to co-ordinate the activities and responsibilities of various business groups because the school was already linked to other groups not associated with the Notebook Valley partnership. In 2001 the introduction of the SmartTools intranet caused a decrease in the reliability of the school's intranet. Although the Notebook Valley contract did not provide for ITAS/Renaissance to take over the whole school's intranet system, in 2002 the school chose to merge the SmartTools system, supplied by ITAS/Renaissance, with its existing Novell administrative intranet system, at the school's own cost. The school found TelstraSaturn to be helpful in getting the school set up with cables and modems, but the school was unable to secure Internet accounts for the Notebook Valley students until late term 2, 2002. Another school, which was with a different ISP prior to the project, experienced some early difficulties getting the Notebook Valley network software to run. These problems were eventually solved and technical systems were operating smoothly by 2002. The third school was already with TelstraSaturn, but did have some issues to work through about the level of Internet usage through TelstraSaturn that would be paid for as part of the Notebook Valley project. The school also had problems with the SmartTools network system. By the beginning of 2002 most of the technical issues had been sorted out.

In 2002, principals and key staff reported some challenges with the rollout of the project. Some staff initially expected the laptops to arrive in the schools in early 2001 but they did not arrive until June or July. Once the laptops were in the schools, it took some time for decisions to be made about how the laptops would be allocated, and who would be in charge of the day-to-day management of the programme. One principal suggested that a greater lead-in time for the project, with more planning and groundwork, would have been useful. He also suggested that it would have been better for staff to be given laptops a few terms prior to their distribution to students. Principals and HODs at another school felt that stakeholders may have underestimated the amount of time and difficulty that would be involved in establishing the project in the schools, and that the schools had not been sufficiently involved in the process of determining how the project would work best at their school. School 3 negotiated a variation to the original Notebook Valley project design,

whereby a class set of laptops was retained and set up as a bookable "laptop lab". Mathematics and science teachers were able to book this room for use with Year 9–13 classes.

## TEACHERS' EXPERIENCES OF THE PROJECT IMPLEMENTATION (2002)

Nineteen mathematics and science teachers from the 3 schools were interviewed in terms 1 or 2 of 2002. Fifteen of the 19 teachers said that they had only been peripherally involved in the actual implementation and set-up of the laptops in their schools. The teachers most directly involved were heads of department or ICT lead teachers. Other teachers were aware of delays and ongoing negotiations that their principals and/or HODs were engaged in during the project set-up, but were not directly involved themselves:

> *Right at the beginning (last year) there was a meeting with the principal and science and math teachers. [The principal] was talking about the whole project and offered a trip to Melbourne. I feel really quite ignorant, left out of the loop because I really don't know much about the whole project. From my perspective there wasn't enough information. Maybe there was, but sometimes if you're given it on paper without sitting down and discussing it… At the beginning I don't think there was enough discussion. (Teacher, School 1, 2002)*

> *Well I actually didn't really have a clue what was going on. I got told about it and vaguely what the aims were. I went to a conference and that was good for me in terms of understanding what we were supposed to be doing. It gave me an opportunity to meet other people that were doing the project. But [as far as information coming] through the school, not a lot. I don't think anyone else really has an idea about what is going on, and everyone's so busy that they don't necessarily have time to communicate these issues. (Teacher, School 2, 2002)*

The lack of direct involvement of most staff in the implementation was partly the result of an effort by the project co-ordinators within each school to proceed cautiously with the project implementation to minimise impact on staff workload. Overall, most science and mathematics staff felt that the implementation process had gone "pretty well" or "as well as could be expected" but many suggested that the external expectations of them had not been entirely clear:

> *It was a bit scary that there was only vague expectations for the first couple of terms. We were getting a lot of feedback from the principal and HOD about what was going on but you could tell that everything was still just getting constructed. How were we going to be accountable for something where we didn't know exactly what we were supposed to do? It took shape but took a while to do so. It seemed like a bit too much bootstrapping. Put a lot more pressure on us than it needed to. It would have been better if it had come to us in a more completed foröm, already negotiated. (Teacher, School 3, 2002)*

> *I was on the periphery of [the project implementation]. I think it went as well as it could have, but it was really a matter of what the expectations were from the beginning, because everyone was feeling their way. Until the start of this term, I don't think that changed that much. They didn't really know what direction the teachers were supposed to be moving in. (Teacher, School 1, 2002)*

A few teachers were surprised or frustrated by decisions about the way laptops were allocated to teachers and to students:

> *I also think there shouldn't be too many people pulling the strings on who is going on training, who is getting the laptops etc…[it] creates some negative impacts on staff. There should be a very clear focus – what are these laptops intended for and who are the staff that are getting them? At the moment in our faculty 4 have got a laptop – the fifth doesn't have a laptop. I'm not really sure if it is intended for science, or science and maths, it becomes a bit blurred. (Head of department, School 2, 2002)*

> *If they are going to give out laptops it should be on the basis of who has laptops and Internet in their home and who doesn't. Some of the kids who haven't got laptops don't have access, but I talk to other kids in my class who have 3 different Internet connections at home and they're getting [laptops]. I just don't like the fact that there's 4 or 5 kids in my class who don't have them, it makes it difficult for me to use them in a teaching situation. There's a fairness aspect to it. (Teacher, School 2, 2002)*

## STAKEHOLDER ROLES IN THE PROJECT IN 2001/2002

### Digital Opportunities LCT

In 2001 Digital Opportunities LCT held several planning meetings with principals, heads of department, and science and mathematics teachers. LCT also facilitated a series of group meetings with schools in 2001, to raise teachers' awareness of the project, discuss possibilities for shared resource development and collaboration, and identify how they could support teachers to do this. Digital Opportunities LCT staff initially hoped to work with schools to identify online tools and resources that could be developed as part of the project. However, Digital Opportunities LCT found it difficult to co-ordinate with schools to follow up on these meetings, particularly because the schools were still dealing with issues of infrastructure and organisation of the laptops. Little shared or collaborative resource development occurred between the schools, or between the schools and Digital Opportunities LCT, in 2001. In March 2002, Digital Opportunities LCT and Compaq organised a mini-conference at Te Papa to re-establish the project in its second year. Science and mathematics teachers were invited to hear guest speakers on ICT and learning in schools, and to discuss ways in which they could work together with the stakeholders to develop and share resources and ideas for ICT use in science and mathematics teaching.

Throughout 2002, members of the Digital Opportunities LCT team visited the Notebook Valley schools to run staff training sessions, or to provide one-on-one support to staff with release time for the project. Some sessions aimed to familiarise staff with aspects of the TKI Notebook Valley site, or to provide support for staff to write and upload materials onto the site.

### Other stakeholders

The other business stakeholders had varying levels of interaction with the schools in 2002. Although Compaq was the nominal project leader for Notebook Valley, other than supplying the

laptops and providing technical assistance as needed[19]. Compaq took a background role in the project and the LCT Digital Opportunities team took the main responsibility for interactions and communications with the schools. Both Compaq and LCT felt that the working relationship between these 2 organisations had been successful.

In 2002, ITAS/Renaissance had relatively frequent contact with the schools to provide technical support and assistance to build and maintain the SmartTools networks. Because LCT had the major role in teacher support and professional development in this project, ITAS/Renaissance reported that it took a less active involvement with the teaching and learning aspect of Notebook Valley than in other similar school ICT projects it has been involved in. However, ITAS/Renaissance was prepared to respond to requests for further assistance and technical support from the Notebook Valley schools.

TelstraClear had minimal involvement in the project in 2002, other than the establishment and management of Internet accounts. The account manager for Notebook Valley had had little or no direct liaison with any of the stakeholder partners when interviewed in June 2002.

## STAKEHOLDER ROLES IN THE PROJECT IN 2003

As in 2002, the Learning Centre Trust (LCT) and the Ministry of Education were the most actively involved of the Notebook Valley stakeholders. TelstraClear and Compaq/HP continued to provide technical services to the schools. The professional development and support role of the Digital Opportunities LCT team is described further in Section 5 of this report.

## SUMMARY OF RESEARCH FINDINGS ABOUT THE PROJECT IMPLEMENTATION

- Implementing the laptops and associated systems into the schools in 2001 and 2002 required schools to make decisions about organisational management and changes to their existing technical infrastructure.
- School principals were involved in negotiation and interactions with the Ministry of Education and various stakeholder groups. Principals and ICT co-ordinators were the main school staff to be involved in the implementation process.
- Some principals and staff commented that setting up the project within the school was more complex and took longer than external partners may have estimated.
- In 2001 there were some delays in getting the laptops issued to teachers and students. The number of laptops supplied to schools did not necessarily match the number of teachers and students teaching or enrolled in senior mathematics and science subjects. It took the schools some time to determine to whom the laptops would be allocated, and how the laptop project would be managed within the schools. Overall, schools reported satisfactory delivery of services, although there were some problems organising student Internet accounts in 2002.
- There appeared to be few opportunities for school staff to make pedagogical decisions about the way the project would run in their school. For example, the subject areas or

[19] This included repair of damaged or malfunctioning laptops.

student year levels which would benefit from access to laptops, whether teachers should have laptops for several months prior to them being allocated to students, and how the laptops would contribute to or change their existing science and mathematics teaching programmes. However, 1 school negotiated to retain a class set of laptops within the school for use with science and mathematics classes at all year levels.

- Some aspects of the project and its implications for teachers and their classroom programmes were not always clear to teachers during the implementation period. For example, who would receive the laptops, whether there was going to be training or professional development on how to use them, and how they were expected to be used by teachers and students.
- Most science and mathematics teachers were on the periphery of the project implementation. Teachers thought the implementation had gone reasonably well, but had concerns about some of the decisions made about the laptops' allocation to students and teachers.
- Stakeholders had varying levels of interaction with the schools. Of the stakeholders, LCT had the most interaction with schools and teachers. LCT facilitated a series of group meetings with schools in 2001, to raise teachers' awareness of the project, discuss possibilities for shared resource development and collaboration, and identify how they could support teachers to do this. In 2002 and 2003 LCT concentrated on working with teachers at each school individually or in small groups. This teacher professional development and support is described further in the next section.
- Throughout the project there was little collaboration or sharing of resources between schools, and limited posting of materials on the Notebook Valley website.

# 5. Staff professional development 2001–2003

## INTRODUCTION

The Digital Opportunities professional development plan drafted in July 2001 (*see* Appendix 2) listed the following 3 aims:

Aim 1: Raise the functional skill levels in the educational use of ICT for all teachers in project schools to the point where they are confidently able to integrate ICT in their classroom teaching.

Aim 2: Curriculum applications of ICT to become a regular feature of the schools' classroom pedagogy.

Aim 3: Project and national conferences will be provided to deliver whole group information about exemplary practice and the latest ICT developments.

This section outlines the project-related professional development that occurred for staff in the Notebook Valley schools between 2001 and 2003.

## STAFF PROFESSIONAL DEVELOPMENT IN 2001/2002

By the end of term 2, 2002, most of the 19 teachers interviewed for the research had attended meetings or conferences, or had been involved in other project-related professional development or training activities within or outside their schools in relation to the project. Some of the main out-of-school or inter-school events are listed in Table 4. Activities had also occurred within each school, including training sessions for teachers or network administrators on the use of the SmartTools network, or in-house meetings and training sessions organised by teachers, heads of department, or ICT co-ordinators.

**Table 4 Notebook Valley/ICT conferences and meetings in 2001/2002**

| 2001 Conferences and meetings | | 2002 Conferences and meetings | |
|---|---|---|---|
| 7 May | NV science and mathematics teachers meet with LCT staff | 7 February | learning@school ICT cluster schools conference (Te Papa) |
| 1–3 July | Learning@school conference (Te Papa) | 22 March | Notebook Valley mini-conference (Te Papa) |
| 9–10 July | Navcon conference (Melbourne) | 9–12 July | Navcon conference (Christchurch) |
| 21 August | NV teachers and FarNet teachers meet with LCT staff | | |
| 8 October | NV teachers and principals meet with LCT staff | | |

Some teachers had been involved in the project in both 2001 and 2002, while others were new to the project in 2002. For this reason, and because different teachers had been released to go to meetings on different occasions, there was considerable variety in the combination of professional development meetings and training activities that each of the 19 teachers interviewed had participated in.

## Conferences and inter-school meetings in 2001/2002

### *Navcon conference*

All 4 schools sent teachers to the Navcon conference in Melbourne in July 2001. Four of the 19 science and mathematics teachers interviewed had gone to this conference. Most teachers said they had found the conference exciting and inspiring, but on the other hand also perceived a major gap between what they saw happening in the Melbourne schools showcased at the conference, and what they could do in their own schools:

> *That was really cool but because it was right at the beginning, I didn't really have a clue what was really happening and how I could use what I was being shown. (Science teacher, 2002)*

> *They were able to do all sorts of exciting things and all of a sudden we had some laptops, but just the time to really develop resources and get the kids to use them effectively probably didn't happen as much as I would have hoped for. (Mathematics teacher, 2002)*

> *I didn't find it all that useful. My ICT skills at that stage weren't very good. They're still not great but they are getting better. (Mathematics teacher, 2002)*

On the other hand, the Navcon conference in Melbourne had stimulated at least one ICT teacher to upgrade and develop the school's intranet on returning to the school. Only one school sent staff to the 2002 Navcon conference in Christchurch.

### *Inter-school meetings*

In 2001, LCT and other stakeholders organised several meetings which involved various groups of science, mathematics, and technology teachers and principals from the Notebook Valley schools. The TKI/Compaq mini-conference on 22 March 2002 also involved teachers from all 3 schools. However, both teachers and TKI staff indicated some disappointment with the outcomes of these meetings. The inter-school meetings were disappointing from many of the teachers' perspectives because they were taken out of class for a day and felt they did not get a useful experience:

> *It ended up that those days were very much about the philosophy of ICT in the classroom and I already agree with the philosophy, so I didn't need to be convinced. I just wanted to get into developing resources, and we didn't really get that. (Mathematics teacher, 2002)*

> *All I remember is they asked us how they could help us, and at that stage we didn't know how they could help us. It was pretty vague and it seemed pretty much like a waste of a day. It felt like them saying, 'What do you want us to do?' when at that stage we didn't know what we were supposed to do. (Science teacher, 2002)*

> *I was expecting more time to get into little groups, and searching for resources, but we only just did that in the last 15 minutes or half an hour. We had to search for science in general, and then we had only 10–15 minutes for specific topics…. Being in that meeting, to me, it didn't really do much in terms of my professional development. I wanted more time to train how to use this, and to use the resources*

*that we get from the Internet in class. But we didn't get time to do that. (Science teacher, 2002)*

The intended purpose of these meetings was to discuss what TKI staff could do to help teachers in the project, and to begin to identify resources and web resources that could be annotated and published on the Notebook Valley website for teachers to use in their classes. However, TKI staff found it hard to organise follow-up work with teachers from these initial meetings. At that time, the schools were still getting their hardware and ICT management infrastructures established. Some concerns arose on both sides about the way the meetings were going. TKI staff sensed apprehension from some teachers about providing resources and materials for TKI to put on the website, or sharing or working collaboratively across schools. Because some teachers were just beginning to use ICT, TKI staff thought they may not be ready to utilise the tools and resources that TKI was offering. Meanwhile, teachers were concerned that they were being asked to provide time and resources for the Notebook Valley site, without a clear sense that they would receive support and professional development that they felt they needed for the laptop project. In late 2001, TKI and the Ministry of Education Digital Opportunities project manager agreed that the schools would be given some time and space to settle their internal infrastructure and management issues, before stakeholders arranged to work with the schools again in 2002.

### *Teacher benefits from conferences and inter-school meetings*

Although many teachers found the inter-school meetings frustrating, several teachers said that these meetings had been "useful" insofar as it was the first time that they had a sense of the overall picture of the project, especially if they had not been involved in the laptop project from the beginning:

*Mainly they're just useful for the overall picture: where does this [project] lie? (Science teacher, 2002).*

*That's when I found out there was someone else involved. I knew there were other schools but I didn't know there was someone trying to co-ordinate. I didn't know about that before. I had no idea what everyone else was doing. (Science teacher, 2002)*

Other teachers found it interesting to find out about ICT developments happening in other New Zealand schools. However, some Notebook Valley teachers were left wondering where they fitted in the spectrum of other projects and initiatives. One teacher who had attended the learning@school conference in February 2002 commented:

*Everyone else seemed to be linked, in some stuff that we knew nothing about. Like there was something online about teachers linking together and you had a password and all that. And lots of teachers knew about that, and we knew nothing. So we were asking each other 'are we supposed to be here?' (Science teacher, 2002)*

Although this teacher had enjoyed finding out what other people were doing around the country in a practical, hands-on way, for herself and her colleagues it was "sort of like looking at wedding photos of someone you don't know".

The mini-conference in March 2002 included a presentation session about the use of ICT in education, with examples shown from the primary school level. However, at least 3 teachers questioned whether external project partners understood the particular needs of the secondary mathematics or science teaching context:

> *I think one of the other problems with them is that they don't have subject specialists. The people we meet at TKI seem to be from primary, or those from secondary aren't from maths or science. I think that makes it extremely difficult. (Mathematics teacher, 2002)*

## In-house professional development and training

The Digital Opportunities professional development plan drafted in July 2001 indicated that schools were to use in-house expertise to deliver appropriate ICT training to staff, using the weekly release time provided by the Ministry of Education. The teachers' prior experience with ICT ranged from those who were regular and confident users of ICT, to a few who had hardly ever used computers before. The way that in-house professional development/training occurred in each of the 3 schools in 2001/2002 varied. In most cases, in-house teacher professional development comprised a mixture of external training, peer-to-peer training or sharing of ideas, and a few staff from each school working individually with staff from TKI.

### *School 1*

In 2001, School 1 engaged an external group to provide staff training sessions in basic ICT skills and the use of common software:

> *We felt that to rely on anyone within the school to train the teachers was unrealistic, it wasn't going to happen. People had full-time teaching loads, they wouldn't have had time to prepare, and to train. (Deputy principal, 2002)*

Teachers who attended the externally run training sessions said that they had found parts of these sessions useful, but that some of the content had not been appropriate at the time:

> *We found that a bit of a mixed bag because it was pitched at a level that was either too low for the experts or too high for the others. Some people here and there got a bit out of it but essentially it wasn't quite right. (Science teacher, 2002)*

In 2002, School 1 established a "laptop group" comprising all teachers in the mathematics and science departments:

> *That [group] was initiated by them. The reason that emerged is they felt that they were working in their own separate ways, and were a bit unsure about what and how, and maybe by this method they were going to have a more structured way of going about things. So that's emerged from within. (Deputy principal, 2002)*

In late March 2002, the group had established a list of 10 actionable points, including an aim of meeting every 3 weeks, and a suggested training proposal that would involve peer training in

subject-based projects. However, in early May 2002, because of time issues, the group decided to dissolve formal meetings in favour of informal peer training and ideas sharing.[20]

The mathematics and science HODs had both been provided with release time for the project. TKI's content co-ordinator had done some resource development work with one HOD at School 1 in term 1. In term 2, the TKI content co-ordinator was meeting weekly with another HOD to work on resource development.

### *School 2*

The internal training at School 2 in 2002 was organised by the ICT lead teacher when time or opportunity arose. The ICT co-ordinator encouraged maths and science teachers to go to sessions with TKI and other hardware/software partners. The ICT co-ordinator had been allocated 2 release hours per week to do this. However, organising and co-ordinating staff training in the first 2 terms of 2002 proved difficult because of other things happening within the school. The ICT co-ordinator said teachers' training had been "a bit ad hoc" because it had to fit around these other things.

> *It fits in with people's timetables so it can only be that…a lot of the things we've done have been informal, we probably need to formalise. It's kind of been on a department level, with one person in a department learning a skill and then showing the others. We are trying to encourage them to use [ICT] in what they do. I am aware that some staff felt overwhelmed with the potential of [ICT], and it's taken time for confidence to build up in using it. (ICT co-ordinator, 2002)*

Of the 5 mathematics and science teachers interviewed, 2 felt there had been good formal and informal training sessions in the school but insufficient time to be able to share and practise new skills. Another teacher felt they had not been given any help despite having asked for it. All 5 teachers described time as a major barrier to their training in, and use of, the laptops, and expressed a need for further training:

> *There was no training given to anybody about how to use a laptop. I was actually learning more from the kids than from the PD. Kids were breaking their computers and would figure out how to fix it, then show me how to do it. (Science teacher, 2002)*

In 2002, 2 science teachers were given release time to work on resource development for the project. These teachers were going to be using a new science lab. In early June 2002 these labs were completed but were not yet connected to the Internet, and the 2 teachers had done very little resource development, because they felt they had not had enough time or necessary skills. In June 2002, TKI and the school's ICT co-ordinator arranged a 3-hour session for science and mathematics teachers to show them some features of the Notebook Valley website and resources, and to seek advice from teachers on specific areas where they would like assistance. Late in term 2, the TKI content co-ordinator arranged with School 2 to set up a regular weekly meeting time with the 2 science teachers who had release time for the project.

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[20] School 1 laptop meeting minutes 03/05/02.

### *School 3*

The mathematics department at School 3 organised a day near the end of 2001 during which teachers searched for and compiled an extensive list of mathematics web resources suitable for use with Year 9 and Year 10 students. Several mathematics teachers felt that this was the most significant professional development event that they had taken part in for the laptop project, and made use of these resources in their teaching in 2002. In term 1, 2002, a mathematics resource teacher was employed to do some further web development and created several annotated pages of mathematics weblinks for the school's intranet. The teacher also reviewed some mathematics and science software to advise on what would be useful to purchase. Other mathematics teachers said they had benefited from having this teacher working in the shared mathematics resource room, because it created on-the-spot opportunities to talk about what she was doing or what she had found:

> *She's developed heaps of stuff. Most of the stuff I've used I've got from her, I think more than from TKI. Maybe that's because she's right here, we've got more benefit from her that a lot of other schools probably haven't had, because she's been mainly here, we know her and she's been sitting in our office doing it. 'Oh look at this, look at this' and we all see it. (mathematics teacher, 2002)*

On the other hand, it had been almost impossible for this teacher to schedule time to sit down with colleagues and disseminate her work in a more organised way:

> *I suppose the frustrating thing there is that she's had the time and found some interesting things, but she wants to share that with me and other teachers, but when does she do that? She's tried to grab me a few times between periods, but imagine what that's like: I'm off to teach Year 9 and she's saying 'well I guess you're not interested in your 6th form!' I'd say 'well I'm really interested but I can't do it right now, I'm off to teach.' (Mathematics teacher, 2002)*

The mathematics resource teacher had also been given the responsibility of visiting and sharing this development work with teachers from the other 2 schools, but scheduling time with teachers at these schools proved too difficult, as did the opportunity to follow up on what she had shown them. One teacher from another school commented:

> *...I found it quite interesting and useful. But again, I said 'That was quite interesting,' and she left and I said I was going to have a play around with it. I just haven't had a chance to yet. (Mathematics teacher, 2002)*

## Teacher professional development and training issues in 2001/2002

Some of the issues to emerge for teachers regarding professional development and training across the 3 schools in 2001 and 2002 are as follows.

### *Teacher prior ICT experience and efforts to upskill themselves*

At all schools, the teachers' prior experience with ICT ranged from those who were regular and confident users of ICT, to a few who had hardly ever used computers before. Three of the teachers said they had regularly used computers in their teaching prior to the laptop project at previous schools they had taught in. Most teachers said they had not used computers regularly in their

teaching prior to the laptop project. At least 2 who had never been regular computer users said that the laptops had stimulated them to try to self-improve their computer skills and use:

> *What didn't go well for me was that I didn't get enough training. What went well was the fact that finally I was confronted by computers – I had no choice! And that was good. I bought a book that gives me 24-hour tutorials. I want to get stuck into that soon just to familiarise myself with the stuff I need to know. (Science teacher)*

> *For me what has gone well is that it has encouraged me to use my computer at home a lot more. Trying to get to grips with the laptop has helped me with my own computing at home. I do a fair bit of surfing the Internet for resources that I can use, it has been good for that. (Science teacher)*

Teachers rated their current confidence to use ICT reasonably highly, and their confidence to teach with ICT slightly lower (Bolstad, 2002). Several teachers said they were confident that they could learn more about how to use ICT in their teaching, but needed more time and opportunity to actually develop their knowledge and skills.

### *Constraints on time and opportunity to put skills/knowledge into practice*

Many of the teachers commented that various hardware and software training sessions had been good, but that they had often not had time to put into practice any of the knowledge, skills, or ideas gained:

> *The project's resourced really well with one exception, and that is time. And it's not time for PD or whatever, it's time for teachers to do search stuff, to do some sort of analysis on the appropriateness of stuff they pull down, getting it into a state that it can be used, time to reflect on the use and that sort of thing. That sort of ongoing day-to-day time. The resource doesn't go that far. (Principal)*

> *I did gain some ideas but because the sessions were so few and far between, I don't remember how to use them. It goes rusty, you forget how to do things. (Science teacher)*

### *Constraints on time to share ideas*

Some of the forums where teachers could share and exchange ideas and resources within each school were described in the section above, for example, in faculty "laptop group" meetings, or during informal exchanges between colleagues. However, most teachers commented that there were generally few opportunities for such peer-to-peer sharing to occur:

> *(Do you share resources you have found with other teachers in your school?) Yeah, but not all the time. Sometimes you find it the night before, and you might share it with teachers that are there. If it's what they're doing at the same time, they might be interested, but often people say well here's a good site for when you do blah blah down the road. (Mathematics teacher)*

*...the funny thing is you don't see a lot of sharing of resources in this school or in other schools in general. (Why do you think that is?) Don't know, it might be just individual workload, everyone is just so busy. (Science teacher)*

In 2002 most teachers interviewed did not use e-mail regularly to communicate within their schools, although some teachers e-mailed weblinks and resources to colleagues within their departments.

### *Barriers to collaboration across schools*

In 2002 most teachers said that their only contact with teachers at the other schools had been at the inter-school Notebook Valley meetings or "seeing their faces at a distance" at conferences. Some teachers did use these opportunities to find out what was going on in other schools, but all teachers felt they had had little or no ongoing contact with teachers at the other schools about the project. Although some principals and teachers suggested that competition for students impinged on collaboration between schools, this was seen to be more of an institutional-level than a teacher-level concern. All 3 principals, and most of the teachers, thought that it would be beneficial for teachers from the 3 schools to communicate about the use of the laptops. Teachers had clear views about the sort of collaboration that they felt would work well for them. This would involve:

- subject-based collaboration;
- focusing on the development of shared, subject-based teaching resources to "avoid re-inventing the wheel";
- talking about specific problems and issues involved in using the laptops/ICT; and
- sharing ideas for things that have "worked well" in classrooms.

When asked why they thought this kind of collaboration had not yet occurred, most teachers cited a lack of time. Several suggested that there had been a lack of opportunity or adequate facilitation to do this. A few teachers said they did not know why more collaboration and communication hadn't occurred, and supposed it was teachers' own (collective) responsibility to try to do this more.

There was a mixture of opinions about how best to facilitate the sort of collaboration that teachers would find useful. Some mentioned TKI or "whoever is in charge of the project":

*I think it requires somebody to facilitate all the organisational details. Teachers are too busy…. I suspect TKI tried to do that but I don't feel it has been very effective. Maybe we are all just learning through the process. (Principal)*

One teacher had seen successful cross-curricular, ICT-integrated approaches at Navcon in Melbourne, and in an ideal situation would like to see something similar happen in his own school:

*I'd really like to see sharing across the curriculum so that maths and science teachers have a reason to get together and share a focus, to use computers as a tool to do a thematic approach, especially at the junior level. (Mathematics teacher)*

Some teachers thought that their schools needed a teacher on site full-time to help manage the project:

*The person who has the overall responsibility for running the project, I think that is a very key position. Basically they shape the outcomes of the project. I don't know who decides who that person is, but personally I would like to see this to be a teacher. (Science teacher)*

## STAFF PROFESSIONAL DEVELOPMENT IN 2003

### 2003 Digital Opportunities LCT staff professional development approach

In 2003, the Digital Opportunities LCT team included a digital content co-ordinator and staff with expertise and experience in ICT professional development. Digital Opportunities LCT used a professional development approach and materials developed by the Edcom network, one of the partners in the Digital Opportunities LCT team. This approach involved meeting with staff from whole science and mathematics departments to develop ICT profiles for the school, the department, and individual teachers. The profiles were intended to assist in planning and monitoring appropriate programmes of teacher professional development, and to help set individual and departmental goals and plans of action to achieve these goals. Digital Opportunities LCT also assisted heads of department in purchasing specific pieces of software and equipment such as *Crocodile Clips Physics*, *Crocodile Clips Chemistry, PASCO DataStudio,* and *SchoolKit.*

The 2 Digital Opportunities LCT professional development staff who were working with the schools for the first 2 terms left the project in August. Other Digital Opportunities LCT staff took over responsibility for continuing support and professional development for the schools, and a new professional development facilitator was appointed in October 2003, for the last few months of the project.

The digital content co-ordinator was available to work one-on-one with staff and students as requested by the schools. The staff member who was digital content co-ordinator for the first half of the year left the project mid-year and was replaced by another member of Digital Opportunities LCT.

### Successes and challenges for staff professional development in 2003

#### *Successes*

In 2003 the professional development role of LCT shifted towards a more school-based whole-department approach, with lesser focus on development of the Notebook Valley website. The whole-department approach yielded some successes for some staff. In 2003 the TKI digital content co-ordinator had 2 main roles, developed in negotiation with 2 schools. The first was working weekly with 1 science HOD (described on p. 39). The second was a website development project, working with a group of Year 9 and 10 gifted and talented students from School 2 (described on p. 53).

#### *Continuity of professional development*

All science and mathematics departments worked with Digital Opportunities LCT in terms 2 and 3, 2003, to plan for support and professional development in identified areas of need. However, progress in following up these plans varied, depending on how successfully Digital Opportunities LCT and heads of department were able to co-ordinate workable professional development session

times. In several cases there were breaks in continuity due to busy school schedules, and some staff changes at Digital Opportunities LCT.

For example, at 1 school, Digital Opportunities LCT had completed the "ICT profiling" process with both the science and mathematics departments by mid-year. This information was used to plan professional development sessions with the science and mathematics HODs. In June 2003, a data-logging session was held with the science department, and a Digital Opportunities LCT staff member met with the mathematics HOD to discuss possibilities for the purchase and use of *Omnigraph*. Further professional development sessions for staff in the science department were scheduled to occur in August. However, at the beginning of August there was a changeover of staff in the Digital Opportunities LCT team. In October, the new Digital Opportunities LCT staff member organised to run a 5-day series of PD support sessions for staff in the science department in late November. These covered areas such as:

- supporting learning – planning for ICT in the classroom;
- reducing teacher workloads;
- skills development with a learning focus;
- developing literacy – science and ICT; and
- motivating low achieving students – science and ICT.

In late November, the Digital Opportunities LCT staff member also ran a 1-hour session to introduce the mathematics HOD to *Omnigraph*, and a 2-hour session with all the mathematics staff. Staff reported that the November sessions had been worthwhile, but some said it was disappointing to have had such a long delay between the June and November sessions.

At another school, the science HOD reported that when the Digital Opportunities LCT professional development facilitator came to the school in term 2 to identify staff professional development needs, the staff were "very optimistic" about the plans that were developed. However, when the professional development facilitator left the project in August, "everything sort of came to a standstill" and the HOD was not sure what was going to happen with the professional development plans. When contact was established with the new Digital Opportunities LCT professional development facilitator, some data-logging demonstration sessions were set up for the end of term 3. Some areas that particular staff had identified as professional development needs were not able to be followed up before the end of the year. The new Digital Opportunities LCT professional development facilitator offered to provide some further ICT professional development and assistance in early 2004 to members of the science and mathematics department to cover these[21].

A HOD at the third school felt that in the first half of the year the Notebook Valley project went "extremely well". The HOD attributed this largely to the Digital Opportunities LCT staff member who was working with the department in terms 1 and 2.

> *It was the first time we had someone working with us and doing professional development that was directly and usefully meeting our needs. (Mathematics HOD)*

[21] The PD facilitator reported in July 2004 that one teacher had expressed interest but had not contacted the facilitator in 2004 to arrange follow-up PD sessions.

However, after this person left the project, the HOD felt things had "been pretty downhill" in terms of building on from the progress they had made. Although the department was continuing to do the things they had begun in the first half of the year, the HOD reported a lack of progress onto new or different uses of ICT.

### *Variability in staff involvement in professional development in 2003*

The professional development experiences of individual staff during 2003 in the project varied widely, between schools, departments within schools, and individual teachers. Some staff had regular one-on-one contact with Digital Opportunities LCT staff, while others had little or no contact with anyone outside their school regarding the project. For example, the science HOD from one school worked semi-regularly with the Digital Opportunities LCT content co-ordinator to transfer digital content from the TKI website onto the school's newly developed science intranet site.[22] This HOD felt he had gained considerable skills through this process:

> *I've learnt an enormous amount this year, particularly because I have had weekly contact with [the Digital Opportunities LCT content co-ordinator]. That was my 'ICT training', to get the skills to actually transfer the stuff that was on TKI over [to our school intranet]. (Science HOD)*

Other teachers' professional development associated with the project was patchier. Some teachers felt they had less professional development in 2003 than in 2002:

> *In [2002], it was really good with [the TKI digital content co-ordinator]. We made some real progress. Then we lost all the momentum, with staff changes [in the school and in the Digital Opportunities LCT team]. (Science teacher)*

Some staff said their only professional development in 2003 had been 1 or 2 sessions to view or learn particular pieces of software such as *Omnigraph* or *PASCO* data-logging.

### *Overall views about professional development*

Many teachers felt that the small amount of professional development and release time available was an impediment to the project:

> *I'd understood at the beginning [of the project] that there was going to be quite a lot of release time. I don't think we've had much at all. (HOD)*

Although some staff involved in the project had been allocated several hours per week in 1 or both years, other teachers had little or no regular release time through the project. There was a range of ideas about how to maximise the value of release time for ICT development. The general opinion was that the most productive development occurred when staff were released for "blocks" of time, to work on a resource, and then to teach other staff in their department, or in other schools, how to

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[22] During 2002 the science HOD developed and posted a large number of pages (including worksheets and quizzes) on the TKI Notebook Valley site. Because the site used a different kind of HTML coding than the school intranet, transferring the materials from the TKI site to the school's own site required each page to be copied and remade in a format that would work on the school's site.

use it.[23] One HOD suggested that the Notebook Valley release time allocation should have been used to fund a relief teacher in the department who would be able to release other teachers for 2 or 3 weeks at a time. Having "people with the right knowledge and skills to run the professional development" was also seen as crucial. The HODs felt this required somebody with both ICT knowledge, and knowledge of the subject area (science or mathematics). Ideally, a support person would be very conversant with useful science and mathematics software, or have the time and ability to learn the software quickly.

## SUMMARY OF STAFF PROFESSIONAL DEVELOPMENT ISSUES

- In 2001/2002 teachers were involved in a range of in-school and out-of-school meetings, conferences, and training activities related to the Notebook Valley project. However, different teachers had different amounts of release time for professional development and training, and not all teachers were involved in the project from the beginning. Some aspects of the project were not clear to teachers until they attended an out-of-school meeting or conference, for example, who else was involved, and the goals, aims, and purpose of the project.
- Many teachers expressed disappointment at the inter-school meetings they attended in 2001 and early 2002. Some were hoping for more time to share ideas and talk about ways that other teachers in their subjects were using the laptops. Teachers enjoyed seeing other examples of ICT use in schools, but some felt the examples weren't relevant enough for them. Teachers who attended Navcon (Melbourne) in 2001 found the conference inspiring, but perceived a large gap between what they saw and what they felt they were able to do in their own schools.
- Teachers' previous experience with computers ranged from some who were regular, confident users, to those who used computers themselves but not much in their teaching, to those who had hardly ever used computers before. Several of these teachers were seeking to upskill themselves in computer use.
- Each school had some in-house professional development or training. One school brought in an external training group in 2001. Other in-house professional development involved peer-group sharing, in informal circumstances, or during departmental staff-only days after students finished school for the year. Most teachers described a lack of time or opportunities to put new skills/ideas into practice as an impediment to their use of ICT in teaching.
- In 2002 and 2003 LCT focused primarily on working with each school individually, and arranging small-group or one-on-one sessions with teachers within those schools to provide individual support.
- In 2002 all 3 schools provided approximately 4 hours of release time per week to 1 or 2 teachers to work on the project. Some of these teachers said their release time had mostly been taken up doing other things related to project administration and set-up in terms 1 and 2. However, 2 schools established regular or semi-regular visits from TKI's content co-

[23] This occurred for a short time in term 1, 2002, when the Ministry of Education Digital Opportunities project manager seconded a School 3 teacher to work on resource development for the Notebook Valley project. The arrangement concluded when the teacher left New Zealand in term 2, 2002.

ordinator to work with released teachers on resource development and some teachers were finding these sessions very productive.

- In 2003 the Digital Opportunities LCT team used a professional development approach which involved meeting with staff from whole science and mathematics departments to develop ICT profiles for the school, the department, and individual teachers. These profiles were used to plan programmes of teacher professional development, and to help set individual and departmental goals and plans of action to achieve these goals. However, progress in following up on these plans varied, depending on how successfully Digital Opportunities LCT and heads of department were able to co-ordinate suitable times for professional development sessions.
- In late 2002 and 2003 some interesting developments occurred in some departments, particularly when this was associated with Digital Opportunities LCT support and professional development in areas identified by the individual schools, departments, and teachers to meet their perceived needs. Digital Opportunities LCT also helped schools to purchase and learn to use science and mathematics software and equipment like *Crocodile Clips* and *Geometer's Sketchpad,* and data-logging equipment.
- Overall, the professional development experiences of individual staff in the project varied widely, between schools, departments within schools, and individual teachers. Some staff had regular one-on-one contact with Digital Opportunities LCT staff, while others had little or no contact with anyone from outside their school regarding the project. Some teachers felt they had less professional development in 2003 than in 2002. For some staff, their only professional development in 2003 was 1 or 2 sessions to view or learn particular pieces of software such as *Omnigraph* or *PASCO* data-logging.

## RELATION OF THESE ISSUES TO FINDINGS FROM OTHER RESEARCH ON ICT TEACHER PROFESSIONAL DEVELOPMENT

The Notebook Valley research findings with respect to teacher professional development share many commonalties with other studies. For example, a number of international studies cited in Boyd's (2002) review of research on laptops-in-schools projects identified a need for greater teacher professional development on how to integrate ICT use into teaching curricula (Hill and Reeves, 2000; Newhouse, 1999; Ricci, 1999; Robertson, 1997; Stevenson, 1999). Similar findings have emerged in other New Zealand studies of ICT use in schools (Boyd, 1997; Halliday, 2000). There is a broad base of research (e.g. *see* Littlejohn, 2002; Owen and Lambert, 1996; Yocam and Wilmore, 1994) which indicates that successful professional development in ICT requires an approach which:

- involves teachers in setting the professional development and training agendas;
- takes place in working classrooms;
- involves small-group collaborations between teachers;
- builds on teachers' existing knowledge about curriculum and practice;
- is based on a specific project that teachers plan to implement in their own classroom;
- includes a practical introduction to educational theory;

- involves learning ICT skills on a "need to know" basis;
- provides time and opportunities to experiment and reflect on new experiences;
- provides ongoing support to help implement change and innovation; and
- promotes incremental change.

A study by Windschitl and Sahl (2002) gives a useful framework for considering the balance of Notebook Valley teachers' project-related professional development/training experiences between 2001 and 2003. During a 2-year study of teachers who were learning to use laptop technologies in a United States middle school, Windschitl and Sahl (2002) identified 2 kinds of learning that contributed to the development of teachers' use of the laptops in their classrooms: "learning about" (LA) and "learning how" (LH). These 2 types of learning generally happened in different settings (*see* Table 5). A third kind of learning not discussed by Windschitl and Sahl, but of potential value for this research, is "learning why". That is, learning why laptops or ICT can or could contribute to developing new or different ways of thinking and practice in science and mathematics classrooms.

**Table 5 Settings for teachers "learning about" and "learning how" to use laptops**

| "Learning about" | "Learning how" |
|---|---|
| Faculty meetings<br>Regional "laptop summits" with staff from other schools<br>ICT conferences<br>Etc. | Professional development workshops<br>Informal small-group conversations in hallways and classrooms<br>Shared planning periods among teachers<br>Lunch periods<br>Etc. |

"Learning about" opportunities helped teachers learn about their school's expectations for the use of ICT, and to develop some ideas about the range of ICT uses that were possible within the context of their school and broader community. In contrast, "learning how" opportunities focused on teachers' immediate concerns about using laptops in specific classroom situations. Achieving a balanced and integrated programme of "learning about" and "learning how" appeared to be critical in the development of teachers' ideas about how to use the laptops, and their methods of integrating ICT into their classroom teaching (Windschitl and Sahl, 2002).

For teachers in the Notebook Valley project, inter-school meetings and national conferences in 2001 and 2002 presented opportunities for teachers to "learn about":

- the goals and objectives of the Notebook Valley project;
- a range of possible uses for ICT in teaching and learning;
- the hardware, software, and services that are a part of the Notebook Valley package; and
- the specific tools, resources, and assistance available from TKI, Compaq, ITAS/Renaissance and other partners in the project.

However, many teachers were still uncertain after these meetings what the project's goals and expectations meant for them, and what they or their students were expected to do with the laptops to achieve these goals.

In 2002 only a few Notebook Valley teachers had weekly release time for the project. This is the time where teachers were most likely to have sustained opportunities to "learn how" and "learn why" they could use the laptops, software, and ICT tools and resources:

- based on what they perceived as their current needs;
- for specific subject-based teaching resources;
- within the contexts of their own classrooms; and
- in a way that they saw as relevant to their subject and their students.

For some Notebook Valley teachers, the Digital Opportunities LCT professional development approach in 2003 provided these kinds of learning opportunities. For reasons including those described in this section, many other teachers never or rarely had these kinds of learning opportunities in either year of the project. In an evaluation of the ICTPD clusters programme, Ham (2002) noted that an important factor for assessing the success of ICTPD programmes was not so much the duration of time that each school was involved in an ICTPD cluster, but the length of time each individual teacher was involved. In some schools which had 3-year ICTPD programmes, the length of time individual teachers were actively involved could vary from the full 3 years, to only a few weeks or months.

# 6. ICT trends and developments in the schools 2002-2003

## INTRODUCTION

One finding to emerge during the research was that the concept of Notebook Valley as "a project", that is, a distinct initiative, with an identifiable set of goals, aims, and identifiable activities and impacts, was not always a helpful construct within which to collect the evaluation data. The 2 main reasons for this were as follows. First, not all participants in the research shared a view of Notebook Valley as a "project". As described in Section 6, during the implementation period some science and mathematics teachers were unclear what the Notebook Valley project was, what its aims where, who else was involved, and what was expected to happen as part of the project. Some teachers only learned about these aspects of the Notebook Valley project after attending a Notebook Valley meeting or a conference outside their school. Second, it was often difficult for research participants to talk about developments and issues related to the "Notebook Valley project" (that is, the laptops and associated systems, support, and professional development) in isolation from other issues within their schools or departments, particularly in relation to ICT.

During the 2 years of the research, changes and developments in each of the 3 schools occurred which impacted on teachers' and students' experiences of the laptop project. These included: changes in schools' physical and ICT infrastructure; staff changes; changes to teachers' release time to work on the laptop project; the acquisition of new ICT science and mathematics software or equipment; changes in stakeholders' support and professional development approaches; and general changes in schools' ICT policies or systems. Some of these changes and developments were directly connected to the laptop project itself, and others were related to wider contexts of change and development within the school. An additional factor for all 3 schools was the introduction of NCEA level 1, and associated PPTA strike action in 2002, and NCEA level 2 in 2003. For teachers and students involved in the Notebook Valley project, the ramifications of these changes and developments for the use of laptops in teaching and learning could be positive, negative, neutral, and sometimes a combination.

Different staff also had different perspectives about the project, what was going well, and what was not going well. Some staff tended to describe the project mainly in positive terms, and felt they and their students were gaining much from the provision of laptop computers. Often these were staff who had network connections in their classrooms, who were comfortable and committed to using computers in their teaching, who had access to ICT peripherals such as subject-related software and equipment or data projectors, and in whose classes most or all students had a laptop. Other teachers found it difficult to describe positive impacts from the project, because their own or their students' use of the laptops was restricted by factors including a lack of network access in the classroom, their lack of confidence or familiarity with using ICT in teaching, or having classes where only a handful of students had a laptop. The variability of perspectives and experiences sometimes made it difficult to draw overall conclusions about the project's progress at a department- or school-wide level.

Although it was initially conceived as such, Notebook Valley never developed into a "school cluster" project in which teachers and students at different schools worked together to share ideas, develop and exchange teaching resources, or function as an online learning community. After 2001, stakeholders' focus shifted from seeking to foster shared development across the schools, towards

working individually with schools to provide support and assistance in areas determined in discussion with each school (or each department). As the project progressed along its own trajectory in each school, the research data was used in interim reports to present an overview of the main project-related developments and events in each school (*see* Bolstad, 2003a, 2004).

This section summarises information about trends and developments within each of the Notebook Valley schools during 2002 and 2003, drawn largely from interviews with school staff. The schools are first described individually to illustrate some of the contextual factors that impacted on teachers' and students' use of the laptops in each school, and some of the main ICT-related developments occurring within each school's science and mathematics departments. The last part of this section summarises themes that emerged from across the 3 schools.

## TRENDS AND DEVELOPMENTS AT SCHOOL 1

### General trends and developments at School 1

#### *2002*

#### *ICT culture*

By November 2002, the ICT co-ordinator at School 1 felt that the school had made "steady progress" with the laptop project and that the laptops were now accepted as part of the "culture of the school". The novelty value of the laptops appeared to have worn off for students, and most teachers now generally accepted students using their laptops in the classroom. School computer labs were also being booked by teachers more regularly than in previous years.

After attending a Navcon conference in 2001, the ICT co-ordinator at School 1 began to develop a specialised intranet system. During 2002, School 1's ICT HOD visited several schools around New Zealand to look at various intranet systems and models for school-based ICT use. The development of the school intranet became a major focus for the school's ICT development during the next 2 years.

#### *2003*

#### *For staff at School 1*

Several of the staff interviewed at School 1 said that in 2003 the project had gone at least as well as, if not better than, it had gone in 2002:

> *A lot of things that just started last year have started to happen a lot more this year. The [ICT] culture's permeating. You suddenly realise how much more you're using the computer than you used to. (HOD)*

One HOD described 2003 as a "developmental year". Unlike 2002, staff had not gone to ICT conferences or been part of inter-school meetings about the project. Instead, attention had been focused on things happening "on-the-ground" within the school. Another HOD noted a range of general developments in ICT use across the school. For example, the school had purchased a second data projector, which was being used frequently, particularly in the social science department. The school had invested in a wireless intranet system, which enabled staff to log in to

the school network from various places within the school. However, students could not use the wireless system in classrooms, as the school's "Nelson block" classroom arrangement was not conducive to this.

### *Students' access at School 1*

For School 1 laptop students, 2003 was a mixed bag. In 2003, School 1 upgraded to a Windows 2000 operating system on the school network and the Notebook Valley laptops. This made it easier for the laptops to link into the school network. However, an unintended consequence of this change of system was that the school network's security settings migrated onto the laptops when the laptops were connected to the network. These settings restricted students to the role of "system users", as opposed to "system administrators" on their laptops, which essentially prevented students being able to do things such as load new software, change control panel settings, or send documents to the school printers using their laptops.[24]

In both years of the research, laptop students at School 1 were strongly encouraged by the ICT HOD and some other staff to bring their laptops to school and to use them in class:.

> *I was constantly saying 'Bring it along to school, and you will find ways of using it. If you have it you'll use it, if you don't have it you won't use it.' (ICT HOD, 2003)*

In 2003 the ICT HOD checked up on students during the year to see whether they were making appropriate use of the laptops. By August 2003, at least 13 students' laptops had been returned to the care of the ICT HOD. Reasons for this included: students leaving school; returning the laptop because they did not like carrying it back and forth from school; having the laptop confiscated by the ICT HOD because they were deemed not to be using it enough, or using it inappropriately; and returning the laptops for repair. In the last instance, laptops were returned to students once repairs were completed.

In 2003 the school arranged with a Digital Opportunities LCT staff member to hold Tuesday morning laptop student support meetings. However, these sessions were scheduled during a period 1 home-study timeslot and attendance was variable.

## Developments within School 1's science and mathematics departments 2002–2003

### *Science department*

School 1's ICT HOD felt the development of the school's intranet was one of the most successful aspects of the project. Seeing examples of ICT systems in other schools at the 2001 and 2002 Navcon conferences was felt to have been a significant motivator for this and other ICT developments in the school:

> *We did not know where we could go [with ICT], as we did not know what was actually out there, until we saw it at Navcon. And then we worked out ways of doing it. (ICT HOD, 2003)*

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[24] This problem was reversed in the second half of the year, thus restoring students' laptop administrator rights. However, some students in focus group interviews at the end of 2003 were not aware that these rights had been restored.

Through the school intranet, teachers could book rooms and equipment, and write reports and school notices from within the school, or by remote log-in.

One science teacher was inspired in 2002 by a web development training session to design and launch an intranet site for the science department's teaching schemes and topics. This teacher did not have release time for the project and had worked on the web development in his own time. This teacher also reported frequently using the laptops in 2002 and 2003 with his senior physics classes, for example, to use *Crocodile Clips* physics software, or to access sites and simulations on the Internet.

### *Mathematics department*

Intranet development was also a major focus for School 1's mathematics department in 2002 and 2003. The mathematics HOD began developing a departmental intranet in 2002 using allocated release time, and this was functional by 2003. The intranet allowed teachers and students to access a range of mathematics course materials, information, and resources.

The HOD's aim was to bring an ICT component to mathematics at all year levels, across the entire department. Therefore, access to computers was an issue. Not all Year 12 and 13 mathematics students had a laptop. Because there were not enough laptops available for all the students, in 2003 a decision was made that 1 of the 2 Year 12 mathematics classes would have laptops, and the other class would not, because that class (taught by the mathematics HOD) had access to a school computer lab.

In 2003 the Year 12 mathematics classes at School 1 used some ICT-based materials and activities that the mathematics HOD had created in 2002, when he had release time to do this. However, the laptops (or other computers) were not used all the time with these classes:

> *With Year 12 it's been a case of using technology where you didn't have to, but it made it more enjoyable…[for example] when we do trigonometry…the kids explore the look of different trig graphs, they learn how to do a spreadsheet, they learn how to create a nice little graph using a spreadsheet. (Mathematics HOD, 2003)*

The school computer labs were also used with all junior mathematics classes. The mathematics department purchased *Geometer's Sketchpad* through the Notebook Valley project, and this was used "extensively" in 2003 with Year 9 and 10 mathematics classes in the school computer labs. The department also purchased *Omnigraph* in 2003, and a Digital Opportunities LCT staff member demonstrated to the department how to use this program at the end of 2003.

School 1's mathematics HOD felt the intranet was the best achievement to have come from the project, and that the time he had spent in 2002 and 2003 developing this and other ICT teaching and learning resources for mathematics was the critical factor for making the laptop project useful:

> *When we first got the laptops, we didn't have any sort of resources to accompany them. We've been developing those. (Mathematics HOD, 2003)*

### School 1's plans for 2004 and beyond

School 1's plans for the laptops in 2004 were still not confirmed by the end of term 4 2003. However, it was expected that 20 laptops would be issued to students. The ICT HOD felt that careful thought should be given to which students should be allocated a laptop:

> *Students who are given one must have a need for one. There's no point in a laptop going to a home where there are already 3 PCs. (ICT HOD)*

The school planned to retain 20 laptops as a mobile set for use by the science and mathematics departments. For example, in Year 13 statistics, the mathematics department was looking at spending 6 to 8 weeks with students using laptops to do work for an achievement standard on time series, using spreadsheets, and developing project work which could be presented through ICT (e.g. using PowerPoint). The mathematics HOD noted that the integration of ICT was given impetus by 2 specific NCEA achievement standards in Year 13 statistics which emphasise the use of technology. He thought it was more difficult to embed ICT into Year 13 calculus, and that "it probably won't figure much [in Year 13 calculus]".

While the HODs of science, mathematics, and ICT would also get a Notebook Valley laptop, other mathematics and science teachers who wanted to continue to have a laptop would need to do so through the STELA[25] scheme.

## TRENDS AND DEVELOPMENTS AT SCHOOL 2

### General trends and developments at School 2

#### *2002*

The principal and ICT co-ordinator at School 2 felt they entered 2002 with some genuine plans and intentions for the laptop project. Overall, however, circumstances within the school had relegated the laptop project to a much lower priority than they would have liked. With hindsight, the principal's opinion was that the school should not have been involved in the project that year because staff time and attention was largely preoccupied by other significant changes and developments within the school.

#### *ICT culture at School 2*

Despite these circumstances, the principal and ICT co-ordinator felt that there had been a slow but continuous growth in the school's ICT "culture", which they attributed in part to the laptop project. The school was strongly encouraging greater staff ICT use through a variety of means, including: having greater computer access in the school; encouraging more use of the school intranet; and mandating the computerisation of administrative tasks. The ICT co-ordinator perceived a change in terms of staff attitudes towards computer use evidenced by many staff asking about booking the laptops to use over the summer holidays, and some considering purchasing their own laptops the following year.

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[25] The Ministry of Education's Laptops for Secondary Teachers scheme, now TELA (laptops for teachers). Under this scheme, the government reimburses up to two-thirds of the lease cost of a laptop for eligible teachers. The school and/or individual teachers are required to meet the balance of the lease cost.

*2003*

### *ICT infrastructure upgrade at School 2*

In 2003 School 2 underwent a major overhaul of its ICT infrastructure. In May, an ICT plan was drafted in partnership with an information technology company to supply ICT systems and services to the school. A key element of the system upgrade was for the school to operate all its ICT from a single, stable platform, replacing the previously-used dual platform system, which was felt to:

> *...fragment centralised management opportunities and reduce the ability to easily share information and technology resources across the school (School 2's ICT plan, May 2003, p. 1).*

Several new computer rooms were established in the school. The Board of Trustees also opted to support teachers who wished to lease a laptop through the STELA scheme by paying for the teachers' share of the lease cost.

One consequence of the ICT upgrade was that the Notebook Valley laptops were unable to network into the new server system. Thus, from mid-year 2003, the Notebook Valley laptops became essentially "stand-alone" machines in the school, unable to connect to the school's intranet or the Internet. The SmartTools network was never used by students at School 2, as the school experienced difficulties with this system from the beginning of the Notebook Valley project. However, by the beginning of 2003 the school had purchased several software programs (including *Crocodile Clips* physics and chemistry), and these were all installed onto the students' laptops. Science teachers and students both commented on the usefulness of these ICT resources. Students were still able to link into the Internet from home.

### *Looking at options for data-logging*

Both the science and mathematics departments at School 2 were interested in getting set up with ICT equipment for students to do automatic data-logging and data-analysis. With the involvement of Digital Opportunities LCT in the second half of the year, the school began to explore different options for purchasing equipment and software for this purpose. The science and mathematics HODs met with representatives from 2 educational technology companies to look at the benefits and disadvantages of different data-logging systems. One company, PASCO, liaised with the school through Digital Opportunities LCT. Their system offered data-loggers and software that could be used with the laptops. The other company, Texas Instruments, had established contact with the school independent of the Notebook Valley programme. Their system involved purchasing low-cost, portable, multi-purpose graphic calculators, with a range of plug-in sensors. The 2 options were still being weighed up by the HODs in December 2003, but it was expected that an investment would be made in one or the other system in 2004.

## Developments within School 2's science and mathematics departments 2002–2003

### *Science department*

During 2002 the uptake and use of the laptops within science classrooms varied significantly between teachers. The most notable progress within the science department occurred when 2

teachers worked one-on-one with TKI staff on a semi-regular basis from term 2. However, the 2 science teachers concerned had different views about how successful this development work was. Science teacher 1 had done a few sessions with TKI, but the weekly meeting times became inconvenient and thus had not progressed very far:

> *[The sessions were] good, e.g., seeing how to put stuff on TKI. But in a way it's like an extra job having to put stuff on TKI yourself. Some [teachers] are really into it. I have 2 release spells a week to do this, but to do more spills over into my personal time and time for students. (Science teacher 1)*

On the other hand, science teacher 2 felt that things had "improved immensely" for him between term 2 and term 4, 2002. His classroom had not had Internet access until partway through term 2, and getting connected had made a "big difference". This teacher had been meeting weekly for an hour with TKI staff and was learning how to publish on the Internet using TKI software, and how to navigate around the Notebook Valley website and the school site. Recently, the teacher had used these skills to publish pieces of the students' schoolwork on the school intranet. His Year 12 students had also recently worked on developing PowerPoint presentations for part of their science course. However, on balance, with the exception of teacher 2, the organised use of the laptops in other science classrooms at School 2 was still sporadic and had not changed significantly between terms 2 and 4.

### *A loss of momentum in 2003*

In 2003, staff in School 2's science department described the project as being "about the same", or perhaps less successful, than in 2002. There were a number of staffing and infrastructure changes in the department in 2003, and these were felt to have impacted on ICT development. Science teacher 1 had already left the school. There was also a feeling that support for the project from outside the school had fallen away compared to the previous year. One science teacher who was involved in the project in all 3 years felt that in 2003:

> *We've been basically left to our own devices, without any real direction or focus…it's been [a case of] schools as individuals, and teachers as individuals, working to develop their own stuff. Not working together to put something together across-the-board, or to share information. (Science teacher)*

Another teacher who was new to the project (and the school) in 2003 said of the project:

> *To me it's really vague, because when I walked in, I really didn't know what I was supposed to be doing…or what I'm expected to do from it. (Science teacher)*

### *Acquiring useful software*

On a positive note, School 2's science department had acquired some very useful science software through the project. Teachers said they had become better at using the software and resources that they did have, and were finding ways to use these in their courses. All the laptop students had *Crocodile Clips* installed on their laptops and students used these whenever they wanted. Another new development in 2003 was a shared drive on the network, where all the science schemes and assessment tools could be shared and accessed by all science staff.

### *School 2 students' use of laptops in class*

There continued to be variability of laptop use in different science classrooms, often due to different proportions of students with a laptop. However, School 2 had made a concerted effort to flood some classrooms with laptops to overcome some of the problems associated with "pepper-potting" of laptops across classes in 2002. In one Year 13 chemistry class, 10 out of 12 students had laptops. The teacher estimated that the laptops were used during class about 5 percent of the year, but used by students reasonably often outside of class time. Another teacher taught a Year 12 chemistry class where all 22 students had laptops. *Crocodile Clips* was used several times by both Year 12 and 13 chemistry students, for example, to simulate titrations and chemical reactions. Although most students in these classes had laptops, students did not always bring them to school because they were not used all the time:

> *I think a lot of the problem was the weight of the laptops. They didn't want to bring it to school every day, it was very heavy, and also for security reasons, they couldn't leave it anywhere. They had to carry it around the whole day. (Science teacher)*

However, teachers said the students brought their laptops to school when they were told they would be used in the next class.

All students in Year 12 and 13 physics had a laptop.[26] The physics teacher said students had made a lot of use of *Crocodile Clips* physics, and used the laptops for project and assessment work. Some Year 12 students presented assignments through PowerPoint, rather than as written reports. The physics teacher said that all students having a laptop at their disposal was one of the main reasons he had encouraged students to use the laptops so much:

> *If only half the class had laptops, and the other half didn't, maybe I wouldn't have gone down that path. (Science teacher)*

In a Year 12 biology class, about 15 out of 25 students had laptops. The biology teacher said laptop students always brought their laptops to class, but it was sometimes difficult to have some students with and some without laptops.

#### *Mathematics department*

During 2002, little development with the laptops occurred in mathematics at a departmental level at School 2. The mathematics HOD reported making some attempts to work with the laptops when they first arrived in 2001. However, his focus in 2002 had been on implementation of NCEA, and on coping with the other major changes occurring in the school. The HOD said because there had been no significant time allocation for the project, he had had "very marginal involvement" with the project in 2003. Students in his Year 13 class were not using their laptops in class:

> *If they thought they would be helpful, I think they would use them in class. I suppose the other reason is I haven't given them specific lessons where I've encouraged or required them to use the laptops. (Mathematics HOD)*

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[26] There were a few international students in each of these classes. These students had their own laptops. All other students had Notebook Valley laptops.

One mathematics teacher was a novice computer user when the project began in 2001. By the end of 2003 he was pleased with his own learning and progress with the laptop in 2002, but wished for more time to practise and learn new skills. His use of the laptop had been primarily for administrative purposes and for lesson planning and preparation for a senior mathematics subject which he had taught for the first time in 2002. However, in 2003 only 2 of the 19 students in the class had laptops. This made it difficult to do anything in class using the laptops. However, the teacher used his own laptop with the data projector on a few occasions to demonstrate Excel and other mathematical programs for students in other year levels.

## Developments in other subject areas at School 2

Two School 2 staff outside the mathematics and science departments were interviewed at the end of 2003. One teacher taught the Year 9 and 10 gifted and talented class, and one teacher taught English and Year 12 and 13 media studies. Both had been "peripherally" involved in, or affected by, the Notebook Valley project. The gifted and talented class had access to laptops that were not part of the Notebook Valley project. For one term, about 7 students in the class received weekly support and assistance from the Digital Opportunities LCT content co-ordinator, to develop websites for the New Zealand "Living Heritage" site.[27] The Digital Opportunities LCT content co-ordinator thought that the website development had been a positive experience for the students who were involved. However, the school network system had been "really tightly locked down", and this, along with network failures, caused some frustrations for the students and the content co-ordinator. The teacher of the gifted and talented class also thought the project had gone well, although some students felt that it "dragged on a bit" because they only worked on it once a week.

The English/media studies teacher commented on how the laptop project had incidentally benefited his Year 12 and 13 media studies class in 2002. About 4 of the 19 students that year were "laptop students". Since the class involves a lot of film-making, the laptop students installed film-editing programs onto their laptops. This meant that instead of having just 2 editing suites in the classroom, the class had at least half a dozen. The teacher thought this had been "really excellent" because it allowed the students to operate independently in their film work.

The English/media studies teacher was adamant that *all* students should have access to a laptop. One of his biggest frustrations in English teaching was the lack of junior students' access to basic word processing for editing and developing creative writing. When his junior English class had access to the computer lab for writing in 2002, the teacher said students had "loved" the editing/writing process. He felt there was enormous potential for enhancing students' learning if access to computers was universal. In the teacher's opinion, the senior science and mathematics focus of the Notebook Valley project was "far too narrow and possibly in the wrong place". He suggested that the ideal scenario would be for all Year 9 students to have laptops, so they could learn to integrate these as their primary data processing tool:

> *If they had them from day 1, and teachers were actually trained to integrate the laptop's facilities into their programme, there would be a huge leap forward in the kids' ability to communicate, not just in English, but in all areas. (Media studies/English teacher)*

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[27] http://www.livingheritage.org.nz

### School 2's plans for 2004 and beyond

The science HOD described the current plans for 2004 as being "Where to from here?" While final decisions had not been made by the end of term 4, there was some talk of setting up a pod of 20 laptops for the mathematics and science departments to share. The science HOD had already allocated some departmental budget for purchasing probes and data-logging equipment.

One science teacher was keen to acquire software or simulations that would enable students to do 3-dimensional modelling of molecules. In 2003, she had taken a class of students to university to see such a program, and thought this had been beneficial for students:

> *I think it developed their 3-dimensional thinking better...thinking at the atomic level. That's quite a difficult skill to develop, and it's a really important skill in chemistry. (Science teacher)*

However, the teacher felt she needed help to establish the technology to be able to do more of this sort of work with students:

> *I've got quite a few IT skills, but when it comes to downloading programs and mucking around with that sort of stuff, I'm not super-confident. Especially on setting it up so a whole class could do it, things like that. (Science teacher)*

## TRENDS AND DEVELOPMENTS AT SCHOOL 3

### General trends and developments at School 3

#### *2002*

The way that School 3 organised the laptop project differed slightly from the other 2 schools. In both 2002 and 2003, approximately 30 of School 3's Notebook Valley laptops were allocated to Year 12 science and mathematics students. Approximately 20 more laptops were retained as a classroom set. These laptops were housed in a "laptop lab" that could be booked by teachers, like a normal school computer lab, with booking priority going to the science and mathematics departments. The science and mathematics HODs at School 3 thought that retaining a set of laptops within the school had been the most successful aspect of the project in 2002. The school's class set of laptops was reportedly booked regularly for use by science and mathematics classes, particularly at junior level. Several teachers commented that the laptops had become a "regular thing" for the Year 12 laptop students, and that it was normal to see these carried around like textbooks. However, some teachers noted that by the end of 2002, many senior students no longer brought their laptops to school with them.

#### *2003*

For the mathematics department, and to a lesser extent, the science department, the "laptop lab", rather than the Year 12 "laptop students" was the primary focus for the development of ICT-based teaching and learning in 2003. Both departments were beginning to learn to use software that had been purchased through the project, including *SchoolKit, Crocodile Clips* in science, and *Geometer's Sketchpad* in mathematics. There had been several attempts within the science department to acquire the necessary equipment, software, and training to enable students to do

automatic data-logging. However, as described further below, this had not been successfully achieved by the end of the year.

## Developments within School 3's science and mathematics departments 2002–2003

### *Mathematics department*

Throughout the Notebook Valley project the mathematics department at School 3 tried to take a whole-department approach to ICT development. In 2001/early 2002 the mathematics department compiled a webpage with links to various online math resources, and this was used by mathematics teachers. Late in 2002, mathematics department staff began an e-mail tutorial programme on how to use *FX Draw*, a mathematics drawing software program. The program was a tool for the creation of resources (for example, to draw diagrams for test questions), purchased through the Notebook Valley funding allowance.

### *Using laptops in the classroom*

In general, staff felt there was little growth in classroom laptop use for the mathematics department during 2002:

> *[The laptop project has been] not spectacular, sort of mediocre…it's been such a busy year in many respects with all sorts of things going on, that we haven't given it the focus and time that it could have used. (Mathematics teacher)*

One mathematics teacher had been trying to use the laptops regularly with students in 2002 and used a lot of online resources for teaching. She felt the laptops had been motivating for students, particularly the Year 11 NCEA students who used them for online mathematics revision sites. She did not know what impact this revision had on student achievement.

The mathematics HOD thought there was huge potential for ICT to contribute to mathematics teaching and learning:

> *The future for me is the use of machinery to do routine tasks…instead of doing lots of calculations, the machine can do that and then the students can work at a more conceptual level. For example, modelling aspects. (HOD mathematics)*

In terms of the laptop project the mathematics HOD named 3 immediate obstacles to developing the potential for teaching with ICT: time pressure; the domination of assessment; and inadequate professional development for teachers and students.

### *Developing Year 9 and 10 ICT teaching units*

In 2003, the main focus for School 3's mathematics department was to enhance Year 9 and 10 mathematics through ICT. Specifically, the department wanted to develop resources, and teachers' ICT knowledge and expertise, using the software applications *Geometer's Sketchpad* and *Schoolkit*. The aim was to find ways to use ICT:

> *To teach and [help students] learn things better, rather than sort of an add-on. In other words, to do things you couldn't do without [ICT]. (Mathematics HOD)*

With the assistance of a staff member from Digital Opportunities LCT, the mathematics department developed a Year 9 geometry unit using *Geometer's Sketchpad,* and a Year 10 statistics unit using *SchoolKit.* The units were approximately 6 periods each and involved students working in the laptop computer lab for about 3–4 of these periods.

The mathematics HOD felt that in the first half of the year the project went "extremely well". The HOD attributed this largely to the Digital Opportunities LCT staff member who was working with the department in terms 1 and 2:

> *It was the first time we had someone working with us and doing professional development that was directly and usefully meeting our needs. (Mathematics HOD)*

However, after this person left the project in August, the HOD felt things had "been pretty downhill" in terms of building on from the progress they had made. Although the department was continuing to do the things they had begun in the first half of the year, there was some lack of progress onto new or different uses of ICT. Getting software installed and working properly on the school network had also been a problem during the year, although most of these difficulties were resolved by term 4.

Two Year 10 mathematics classes were observed in the laptop labs in term 3. One class was observed during 2 consecutive periods while they worked through a *SchoolKit* unit on statistics. Another class was observed using the laptops to participate in several Internet-based activities connected to the "Mathsweek" website. These included "Census-at-school", an international online survey for students in Year 5 to Year 10. Students answer a series of online questions about themselves, their day-to-day activities, and so on.

The classroom observations and teacher interviews both indicated a mixture of successes and challenges for the junior mathematics units taught using the laptops. For example, several mathematics teachers noted that some students in their classes did not tend to read and follow the instructions that led them through the learning exercise. Consequently, most of the students' questions in class were technical or procedural questions about "what to do next", rather than questions about the mathematical content of the teaching. Teachers found that some students required several periods to become confident and competent users of software programs like *Excel*. In some cases, students' lack of expertise with the software appeared to impede their ability to analyse their data (and hence to begin to think statistically). On the other hand, some students in the laptop classes were observed to work almost independently of the teacher, seeking help from peers as required. Students' engagement with the learning tasks also appeared to vary considerably. In one class, some students worked steadily through an activity, while others took a considerable amount of time to log onto the laptops and open up the correct files.

Some episodes showed the potential for ICT to engage students who might otherwise be uninterested in their mathematics classes. One example from a Year 10 class is described in the box below.

**Episode from a Year 10 laptop class observation**

*This lesson involves a class of Year 10 students in the laptop computer lab. Students use two Internet-based activities during this period: "Census-at-school", an international online survey for Year 5 – Year 10 students, and the Flash Mind Reader,[28] a web-based interactive activity. Both activities are linked to Maths Week (11–15 August 2003).*

*The Flash Mind Reader is an interactive puzzle which operates by asking students to pick a 2-digit number, then add the digits together, and subtract the total from the original number. When students click on a crystal ball on-screen, a symbol appears which "magically" corresponds to the number students have calculated. The mathematical explanation for this "trick" is that the final number is always a multiple of 9. However, several students find that the Mind Reader is correct only some of the time (as this is not possible, it must have been their calculation error). One group of boys calls this out to the teacher. The teacher comes over and asks them to work through the calculation a few times. Under the teacher's supervision, the Mind Reader "works" each time. Many of the students seem surprised and puzzled by how it works. Several times the teacher says to the class "There's a mathematical explanation for how it works." Some time later, a group of boys argue amongst themselves about how the Mind Reader works. One student thinks that it "follows the mouse" (i.e. notes where the cursor is on the screen as he runs the mouse over the number while he calculates). He tests this theory out a few times by running his cursor over the numbers as he does his calculation, and each time, the mindreader "reads" his mind (or, according to his theory, tracks where his cursor is). He calls the teacher over to explain that he has worked out how it does it. He demonstrates, and the teacher asks him to do it again without running the cursor over the screen. The Mind Reader still works. Later, the teacher explains that this student usually gives up on maths tasks or dismisses them as all too difficult, so she was impressed that he had come up with an idea that he was willing to test out.*

At the end of 2003 mathematics staff commented that they were making progress in developing the integration of ICT into their departmental teaching programmes. One teacher thought it would take several more years to develop a good mathematics syllabus taught using many media, before "best use" examples of computer use in mathematics would be seen.

### *Science department*

School 3's science HOD thought the laptop project had gone "reasonably well" in 2002. However, laptop use in classrooms was variable for reasons including lack of network connections, teachers' knowledge or confidence to use ICT, and the proportion of students with laptops in the classroom. Overall there were no major changes in the use of the laptops in science classrooms during the year. The TKI workshop on web publishing was well received by science staff but nothing further had come of this. Several teachers said there was not enough time or guidance to take this any further and it was "not a top priority" compared with other demands on their time, particularly NCEA. The science HOD continued to promote the use of laptops within the department and to use laptops where appropriate with his senior students. However, he suggested the laptops were a lower priority for some teachers, and classroom use depended largely on the circumstances of each

[28] http://cabobble.com/cabobble/crystalball.aspx

teacher. The science department was beginning to make more use of shared documents for science teaching resources. The science HOD hoped eventually to have the departmental work schemes on the school intranet with links to a variety of useful resources.

### *Classroom use*

Overall, use of the laptops in School 3's science classrooms continued to be reasonably sporadic and infrequent. At least 1 teacher still did not have network access in the classroom, and 2 teachers reported that students had been doing mostly practical work or topics that didn't suit using laptops in class. Two teachers still felt that they did not have the skills or confidence to make effective use of the laptops in class.

The science HOD felt that NCEA level 2 had taken priority over laptop use for the Year 12 teaching in 2003. However, he thought that teachers' use of software in junior level science classes was better than in previous years. In most cases, use of laptops for teaching and learning occurred through the laptop lab, rather than students' own laptops. For example, the HOD's Year 13 biology class spent about a week in the laptop lab finding simulations on the Internet to help explain theoretical concepts for a biotechnology unit. For a topic on human evolution, students used the Internet for research, and presented their findings with PowerPoint using the teacher's laptop and a data projector. Another teacher who taught Year 12 biology said only 2 or 3 out of 16 students had a laptop, and the students did not often bring their laptops to class.

One Year 12 chemistry teacher said about 15 out of 26 students in the class had laptops. The teacher "would have loved" to find ways to use the laptops in class, but this had not happened:

> *...because I haven't had the time to look up the programs, and see how I could incorporate it into my teaching. (Science teacher)*

The teacher reported that the students sometimes used the laptops to take notes or, on one occasion, to look up chemistry websites. On some occasions she used the laptop lab with Year 10 students, for example, to use science programs about food webs, or *Crocodile Clips* chemistry.

### *Ongoing barriers to laptop use in the classroom*

A Year 12 and 13 physics teacher at School 3 expressed frustration about the lack of ICT development in senior physics teaching in 2003. She felt her subject area was one which "could really benefit from using computers in the classroom", and she was very keen to exploit these benefits. However, in 2003, her Year 12 students had used the laptops very little in class. There were several reasons for this. Only about half the students had laptops, and there were only 4 Internet connections in the classroom. The teacher noted that connecting several laptops to a hub took about 20 minutes of classroom time, and with the amount of content that students needed to cover for NCEA level 2, the teacher and students could not afford to lose this amount of time setting up each period. To get around these problems, the teacher used the laptop lab with Year 12 students, for *Crocodile Clips* physics, and for useful physics websites she had found. However, the teacher noticed that students with their own laptops did not seem to like using *Crocodile Clips* in class, since they were able to do this themselves at home. These students, particularly the "high-achieving students", were more interested in the teacher "teaching them and telling them" while they were in class. On the other hand, other students who did not have their own laptops seemed to enjoy using the software, and working independently of the teacher. The physics classes also used

"Smart Pulleys" to automatically log data on speed, acceleration, etc., using old computers in a science backroom. However, this equipment was old and incompatible with the laptops.

School 3's science HOD had hoped to acquire the necessary hardware and software to use the laptops for data-logging in terms 3 and 4. However, this did not happen because the data-loggers required an additional plug in order to connect them to the laptops, and the HOD was unable to source these plugs before the end of the year. Science staff were disappointed by the lack of professional development in 2003. Although the HOD would have liked to work with someone from Digital Opportunities LCT to develop unit plans in a similar fashion as the mathematics department, a concerted programme of professional development for the science department was not able to be organised and delivered in 2003.

### School 3's plans for 2004 and beyond

The science and mathematics HODs had been discussing a different way of issuing laptops to senior students in 2004. Instead of allocating laptops to individual students for a whole year, the HODs wanted Year 12 and 13 students to borrow laptops for a block of time "like a library book", when they were working on specific units of work for which the laptop would be useful. The departments intended to continue having the laptop lab available for mathematics and science classes.

Among teachers, there were different opinions about the best way to allocate laptops. Some teachers thought that keeping all the laptops at school was the best idea, because it meant that they would not end up with classes where some students had laptops and others did not. On the other hand, at least one teacher thought it was pointless to have the laptops "locked up in school", because desktop computers were cheaper and could serve the same purpose.

School 3's mathematics department planned to continue developing its ICT-based mathematics teaching programme. The science department's slow progress in ICT development in 2003 highlighted for the HOD the need to have someone "with a real love of science and a good knowledge of ICT" available to help get things up and running. The physics teacher thought the best way to get started would be to look at each teacher's current programme, and consider how they could be supported to take the "next step" in ICT use. This would enable teachers and support people to identify what further resources, equipment, or training each individual teacher might need.

## SUMMARY OF TRENDS AND DEVELOPMENTS ACROSS THE 3 SCHOOLS 2002-2003

By the end of 2002, some staff felt the presence of the laptops was having an overall positive impact on each school's "ICT culture", and that students and staff were becoming accustomed to having their own laptops. By the end of 2002, there had been some new developments in the project. For example, 1 or 2 teachers from Schools 1 and 2 had begun working weekly with TKI and other Digital Opportunities project staff, primarily on skill and web content development, and these teachers expressed strongly positive attitudes towards the development work. Some new classrooms were completed or had network access installed. In at least one school, a decision was made to flood some science classrooms with laptops to avoid the problems associated with laptop "pepper-potting". However, consistent increases in the use of ICT across senior science and

mathematics classrooms were difficult to detect (Bolstad, 2003a). In general, staff who had been trying to integrate the laptops into classroom teaching and learning at the beginning of the project continued to do so where opportunities presented themselves, and staff who were not sure how to do this or did not see opportunities for doing so, did not.

The laptop project continued to have mixed success in 2003. Although some teachers felt the project had gained momentum in their school since 2002, others felt it had lost momentum. To a degree, all 3 Notebook Valley schools took steps towards greater ownership and self-determination of the laptop project in 2003. Some interesting developments occurred in some departments, particularly when this was associated with Digital Opportunities LCT support and professional development in areas identified by the individual schools, departments, and teachers to meet their perceived needs.

In all 3 schools, ICT use with junior students was a focus in 2003. At School 1, the mathematics department regularly took their junior classes to work in the school's computer lab. At School 2, a Digital Opportunities LCT team member was enlisted to work on a web development project with Year 9 and 10 gifted and talented students. At School 3, junior (and senior) science and mathematics students had access to a classroom set of Notebook Valley laptops housed in a "laptop lab". There was a feeling among many of the staff interviewed that ICT developments at Year 9 and 10 level would have a worthwhile and lasting benefit for both the students and the departments, as ICT gradually became meaningfully integrated into the departmental teaching and learning programmes.

Highlights for teachers in 2003 included:

- departments acquiring useful science and mathematics software, and installing these on laptops and/or the school network;
- developments in ICT-based teaching and learning in some Year 9 and 10 teaching programmes; and
- access to professional development and support from Digital Opportunities LCT that was tailored towards departmental or individual needs.

Reasons for the variable use of laptops in science and mathematics classrooms in 2002 and 2003 included:

- physical and technical barriers to laptop use in classrooms (in some cases classrooms were not networked, or were in the process of being rebuilt or refurbished);
- student laptop allocation being less than the number of students taking senior science and mathematics subjects, leading to the "pepper-potting" of laptops across classes;
- a lack of clear guidance on how the laptops were expected to be used with students;
- limits on teacher knowledge, skills, or appropriate tools and resources to use laptops for teaching and learning senior science and mathematics topics;
- insufficient teacher professional development or time to put new knowledge and skills into practice; and

- competition with other priorities (including a focus on the implementation of NCEA).

A related issue was a trend towards students not bringing their laptops to school because they were too heavy, or there was nowhere to store them during the day, or there were too few opportunities to use them. The next section provides further information about students' experiences of the laptop project, including data from student surveys and focus group interviews.

# 7. Experiences and impacts of the project for laptop students 2002–2003

## INTRODUCTION

This section provides an overview of key findings from the student survey and focus group data from 2002 and 2003. The first part of this section focuses on students' reported use of the laptops at school and at home, and outlines students' views about the benefits and advantages they gained from being part of the laptop project. Some of the problems and frustrations that students experienced as part of the laptop programme are also discussed.

The student data gathered during the 2 years of the research tended to corroborate information from staff that there was considerable variability of student laptop use in different classes and subjects. It is therefore unsurprising that, like staff, different students experienced the project differently, depending in large part on the contextual factors that impacted on students' opportunities, interests in, and ability to use the laptops effectively to support their school learning. Some of these contextual factors were described in the previous sections. For example: whether classroom(s) had network access; whether students were encouraged to use the laptop in their class; whether all students in the class had a laptop; whether the teacher had developed ways to incorporate ICT into classroom activities; and whether students or teachers perceived use of laptops to be relevant or useful in a given context. Like teachers, a theme that emerged for students was that it was often "up to the individual" to decide how, and how much, the laptop was used at school.

While a variability of individual experiences was evident in the research data, some general patterns emerged in both years of data collection. For example, in both years some students ceased bringing their laptops to school during the year. In both years, students identified the weight of the laptops and a lack of school-based storage for the laptops as significant issues. A lack of opportunities or reasons to use the laptops in some classes or subjects also convinced some students that it was not worthwhile to bring the laptop to school. On the other hand, the student survey and focus groups also provided information that some students were using the laptops at school and at home for a range of school- and leisure-related purposes.

The last part of this section considers evidence for the impacts or outcomes of the project for students, including impacts on students' ICT skills, interest, retention, and motivation in science and mathematics, and impacts for students' families.

## SURVEY RESPONSE RATES

Table 6 shows the number of student surveys collected in 2002 and 2003. For reasons described in Section 3, survey response rates were variable. The total number of students who completed both a beginning- and end-of-year survey was 65 in 2002, and 55 in 2003. Direct beginning- and end-of-year data comparisons were possible for these students.

**Table 6 Number of student surveys completed in 2002 and 2003[29]**

| | 2002 | | 2003 | |
|---|---|---|---|---|
| | **Term 1** | **Term 4** | **Term 1** | **Term 4** |
| School 1 | 29 (30) | 23 (27) | 19[30] (35) | 27 (27) |
| School 2 | 52 (52) | 22 (?) | 25 (?) | 15 (?) |
| School 3 | 29 (30) | 24 (28) | 23 (27) | 20 (27) |
| **Total** | **110 (112)** | **69 (?)** | **67 (?)** | **62 (?)** |

## STUDENTS' USE OF THE LAPTOPS AT SCHOOL

### *Use of the laptops in different subjects*

Although science and mathematics were the target subjects for Notebook Valley, in theory the laptop students were able to use their laptops across all their subjects. In both years, the term 4 survey asked students in which subjects they "often" used their laptops, in which subjects they "hardly ever" or "never" used their laptops, and (for the latter only) why this was the case. In both years, English was the most common subject in which the laptops were used (61 percent in 2002, 53 percent in 2003). In 2002, the next most frequent subjects were biology (52 percent), physics (30 percent), and chemistry (26 percent). In 2003, they were physics and biology (both 34 percent), mathematics (24 percent), and chemistry (21 percent). The most commonly named subjects for which students said they never or hardly ever used their laptops were mathematics (46 percent in 2002, 32 percent in 2003), followed by English (20 percent in 2002, 26 percent in 2003), and biology (around 17 percent in both years).

### *Use of laptops in science and mathematics subjects*

When the above percentages are adjusted for the number of students taking each science and mathematics subject, laptops appeared to be used most often in physics and biology, and least often in mathematics. Table 7 shows the proportion of students who reported using their laptops "often" in each subject, as a proportion of students who took that subject.

**Table 7 Percentage of students who used laptops "often" in science and mathematics subjects (2002 and 2003 data)**

| **Physics** (n = 60) | **Biology** (n =81) | **Chemistry** (n =59) | **Mathematics** (n =110) |
|---|---|---|---|
| 70 | 71 | 53 | 33 |

Mathematics was the subject with the highest proportion of students reporting they never or hardly ever used the laptops (Table 8).

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[29] Bracketed numbers indicate the number of laptops issued to students in term 1, and the number of laptop students still enrolled or who still had laptops in term 4. A question mark (?) indicates that this information was not supplied by the schools.

[30] Students who completed a term 1 survey in 2001 and had a laptop in both years were not required to complete another term 1 survey in 2002.

**Table 8 Percentage of students who "never/hardly ever" use laptops in science and mathematics subjects (2002 and 2003 data)**

| Mathematics (n =110) | Biology (n =81) | Chemistry (n =59) | Physics (n = 60) |
|---|---|---|---|
| 47 | 27 | 22 | 12 |

These data show some subject-based differences in students' classroom use of the laptops. But what factors contributed to these differences? Was it the nature of the subject, the circumstances of the classrooms, or because of the teachers' or students' decisions about the value of using the laptop? Did students in some classes use laptops "often", while students in other classes "never" used their laptops? Or was the variation between individual students in the same class? For example, were some students using laptops in most of their classes, and other students using laptops in none of their classes? Both the survey and focus group data indicated that both kinds of variability were occurring. 0 lists some of the more common reasons students gave for why they did not often use their laptops in science and mathematics subjects. The main 3 types of reasons were that:

- laptops aren't appropriate, or you don't need them/can't use them, for that subject;
- it was easier to do formulas, graphs, or calculations by hand using pen and paper; and
- the teacher doesn't like it, won't allow it, or doesn't suggest it.

**Table 9 Common reasons why laptop not used in science and math subjects all schools, 2002 and 2003 (n=131)**

| Reason why laptop is not used | Frequency (by subject) | | | |
|---|---|---|---|---|
| | Math | Chemistry | Biology | Physics |
| It's not appropriate/you don't need it/you can't use it for this class | 18 | 2 | 12 | 1 |
| It's easier to do formulas, graphs, or calculations by hand (pen and paper) | 15 | 3 | 3 | - |
| Teacher doesn't like it, won't allow it, or doesn't suggest it | 11 | 2 | 2 | 2 |
| We use textbooks or write-on notes in this class | 5 | 1 | 5 | 1 |
| I don't like using the laptop, or I don't bring it to school | 3 | 2 | 2 | 2 |
| Don't have the right programs or don't know how to use the programs | 4 | 1 | - | - |

Students in the end-of-year focus groups discussed some of the difficulties they had had using laptops in certain subjects:

> *I sort of thought there would be more use of it in maths. But it is kind of difficult. It has turned out that it is easier to do it on paper. (Student, 2002)*
>
> *Some classes have a workbook and that is all we use. (Student, 2002)*
>
> *Chemistry equations are hard to do on the laptop. (Student, 2002)*

Some students said they didn't use the laptop in any of their subjects because they rarely or never brought the laptop to school (or conversely, never brought their laptops to school because they never used them in any of their classes). Table 10 and 0 show how often students reported bringing their laptops to school in 2002 and 2003. In both years, there were interesting within-schools and between-school differences. In both years, half or more students at Schools 2 and 3 said they brought their laptop to school less than once a week. For School 3 students in 2003, this was 95 percent of students. In both years more students at School 1 reported bringing their laptop to school every day or most days. However, School 1 also had a policy of encouraging students to bring laptops to school, checking up to see whether the laptops were being used, and warning students the laptops could be removed if they were not seen to be used by the students. Even so, the number of School 1 students bringing their laptop "every day" decreased from 61 percent in 2002 to 33 percent in 2003.

**Table 10 Student use of the laptops at school 2002**

| | Percentage of students (n=69) | | | |
|---|---|---|---|---|
| | **Every day** | **Most days** | **Once or twice a week** | **Less than once a week** |
| School 1 (n= 23) | 61 | 26 | 4 | 9 |
| School 2 (n=22) | 5 | 5 | 18 | 73 |
| School 3 (n=24) | 17 | 25 | 8 | 50 |
| **Overall** | **28** | **19** | **10** | **43** |

**Table 11 Student use of the laptops at school 2003**

| | Percentage of students (n=62) | | | |
|---|---|---|---|---|
| | **Every day** | **Most days** | **Once or twice a week** | **Less than once a week** |
| School 1 (n=27) | 33 | 26 | 11 | 30 |
| School 2 (n=15) | 7 | 13 | 20 | 60 |
| School 3 (n= 20) | - | - | 5 | 95 |
| **Overall** | **16** | **15** | **11** | **58** |

Aside from school 3 in 2003, where there was a fairly uniform lack of reported classroom laptop use, student focus groups confirmed that use of the laptop at school varied between individual students. Some said they used the laptop:

> *...as much as I can. Every class that you use pen and paper for, there's no class where you can't use it. (Focus group student, 2003)*

At one school, most focus group students said they never or hardly ever brought their laptops to school, although a few had initially brought the laptops to school regularly. Students who stopped bringing their laptops to school suggested there was "no point" bringing them since they were rarely used in class:

> *You find you're not using it for anything school-related. You have to really make an effort to use for school-related purposes. (Student, 2003)*

Other students said their use of the laptops at school varied, depending on the subjects and classes they were doing. Sometimes they brought the laptop in for a whole week, while other weeks they did not bring it in to school at all.

## USE OF THE LAPTOPS AT HOME

### Prior access to computers

As a "digital divide" and a "laptop" initiative, one of the aims of Notebook Valley was to provide students with better access to ICT, both at home and at school. The surveys indicated that many laptop students came from homes where there was already a computer. This was true for 77 percent of students in 2002, and 96 percent in 2003. Although there were some differences in home computer ownership between the 3 schools, these were not statistically significant. However, fewer homes had Internet access prior to the project.

**Table 12 Laptop students' prior access to computers and Internet at home (% of students)**

| | **2002** (n=110) | **2003** (n=67) |
|---|---|---|
| Already had a computer in the home | 77 | 96 |
| Home computer already connected to Internet | 58 | 88 |

Of course, simply having a computer and Internet in the home does not mean that students necessarily had easy access to them. In both years, about 1 in 5 students said before Notebook Valley, it was *not* easy for them to use a computer whenever they wanted to. The 3 most common reasons for this in 2003 were: parents restricting students' use of the computer or the Internet (9 percent of all students); having no home computer (8 percent); or other people in the home always using the computer (8 percent).

#### *At home*

Table 13 and 14 show how often students reported using their laptops at home in 2002 and 2003. Overall, students seemed to use their laptops more at home than at school. Interestingly, students seemed to use their laptops at home more often in 2002 than in 2003. In 2002, 72 percent of students said they used the laptop every day or most days at home, while in 2003, only 55 percent of students reported this. Infrequent use of the laptops (once a week or less) also increased from 7 percent in 2002, to 24 percent in 2003.

**Table 13 Students' use of the laptop at home 2002**

| | **Percentage of students (n=69)** | | | |
|---|---|---|---|---|
| | **Every day** | **Most days** | **Once or twice a week** | **Less than once a week** |
| School 1 (n=23) | 74 | 17 | 4 | 4 |
| School 2 (n=22) | 41 | 14 | 41 | 5 |
| School 3 (n=24) | 33 | 41 | 17 | 13 |
| **Overall** | **49** | **23** | **20** | **7** |

**Table 14 Students' use of the laptop at home 2003**

| | Percentage of students (n=62) | | | |
|---|---|---|---|---|
| | **Every day** | **Most days** | **Once or twice a week** | **Less than once a week** |
| School 1 (n=27) | 19 | 52 | 19 | 11 |
| School 2 (n=15) | 33 | 40 | 7 | 20 |
| School 3 (n= 20) | - | 20 | 35 | 45 |
| **Overall** | **16** | **39** | **21** | **24** |

The 2003 data were analysed to see if there were patterns and relationships in students' use of the laptops at home and at school. This analysis showed that almost all students (91 percent) used their laptop at home for schoolwork. Most of these students (61 percent) also used their laptop in class, although 30 percent only used their laptop at home. In other words, most students who used the laptop, tended to use it both at home and at school.

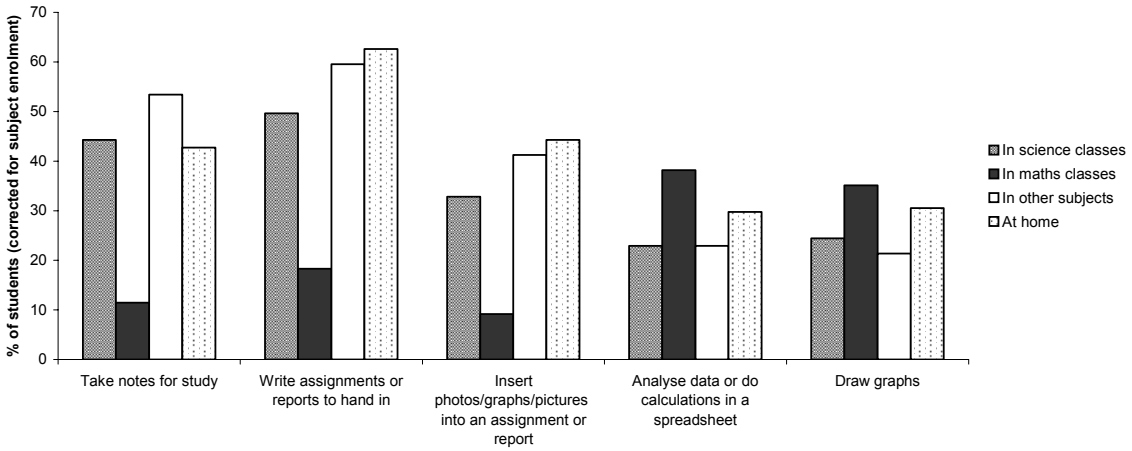
## USE OF THE LAPTOPS TO SUPPORT LEARNING

Some students were using the laptops at school and at home for a range of school- and leisure-related purposes. The figures on the following pages show uses of the laptops in science classes, mathematics classes, other subjects, and at home. The data from both the 2002 and 2003 cohorts have been pooled.

### Word processing and spreadsheet functions

Figure 1 shows how students reported using laptops for word processing and spreadsheet functions. Many students said they used the laptops to take notes or write assignments in science, other subjects, and at home. About a third used spreadsheets to do calculations or draw graphs in science, mathematics, or at home. There are some clear differences in students' use of the laptops for these functions at home and in different classes. For example, note-taking and assignment-writing occurred often in science classes and subjects other than mathematics, and at home. Spreadsheets, graphing, data analysis, and calculation occurred less often than word processing, but happened about the same amount in mathematics classes and at home, and less in science classes and other subjects.

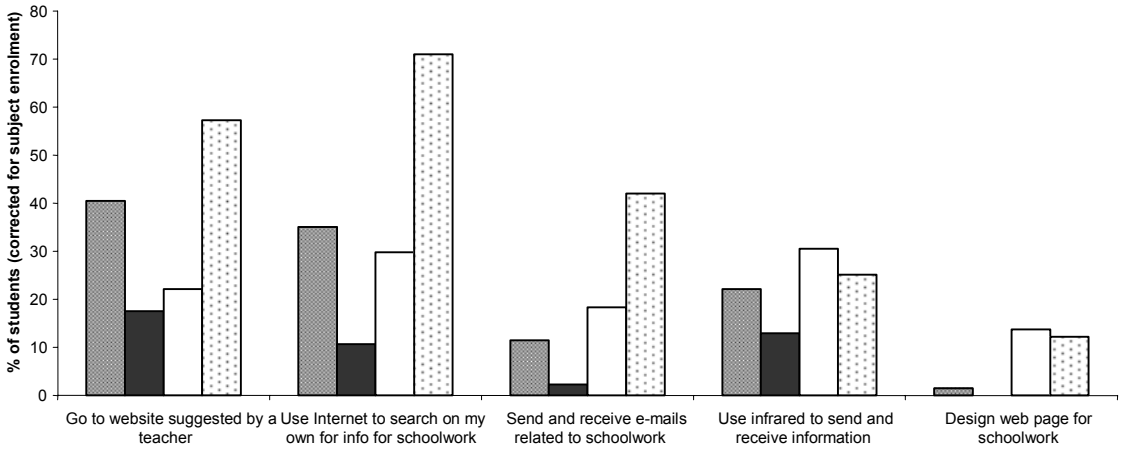
**Figure 1 Laptop use for word processing and spreadsheet functions (2002 and 2003)**




## Internet and e-mail

Figure 2 shows students' use of the laptops for school-related Internet and e-mail. In general, students' use of the laptop for Internet and e-mail occurred more often at home than at school. Over half (57 percent) said they went to websites suggested by their teachers at home. Forty percent said they did this in science classes, almost twice as many as for mathematics classes. Students also searched on the Internet for information, and used e-mail, more often at home (over 70 percent) than in class. Where students did use Internet or e-mail in class, this occurred more in science and other subjects than in mathematics. About a third said they used infrared to send and receive information in at least 1 subject class or at home. Few (less than 15 percent) said they designed web pages for schoolwork.

**Figure 2 Laptop use for Internet and e-mail (2002 and 2003)**

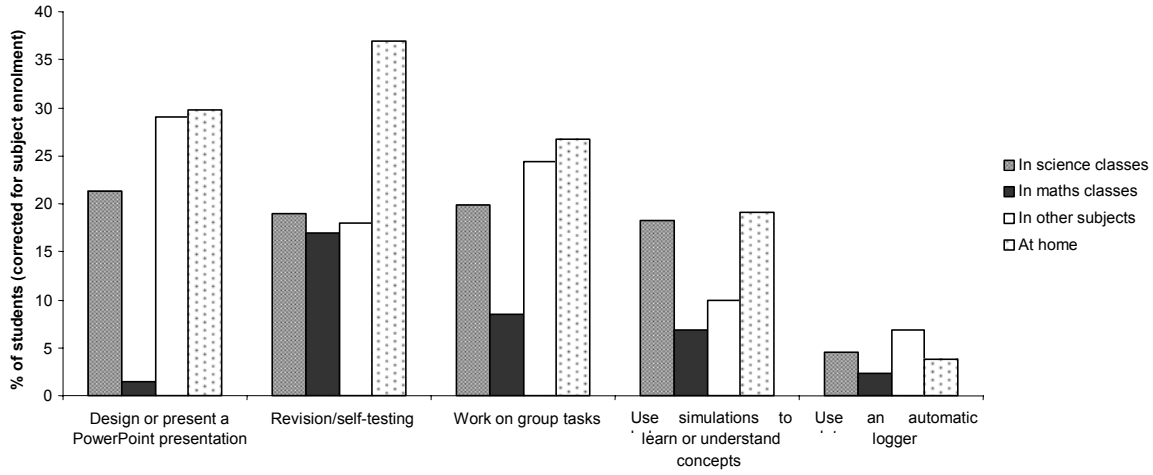



## Other uses related to schoolwork

Figure 3 shows other ways students used laptops in ways related to their schoolwork. Twenty-two percent of students designed PowerPoint presentations in science classes, while about 30 percent

did this in subjects other than science or mathematics, or at home. Between 16 and 20 percent of students said they used the laptop for revision or self-testing in class, and 37 percent reported doing this at home. More students used the laptops for group projects or group tasks in science classes, in other subjects, or at home than in mathematics classes. Use of simulations or subject-specific software was highest in science classes and at home (just under 20 percent in both cases). This is consistent with student and teacher interview comments about the use of programs like *Crocodile Clips* in class and at home. Very few students reported using data-loggers with their laptops.

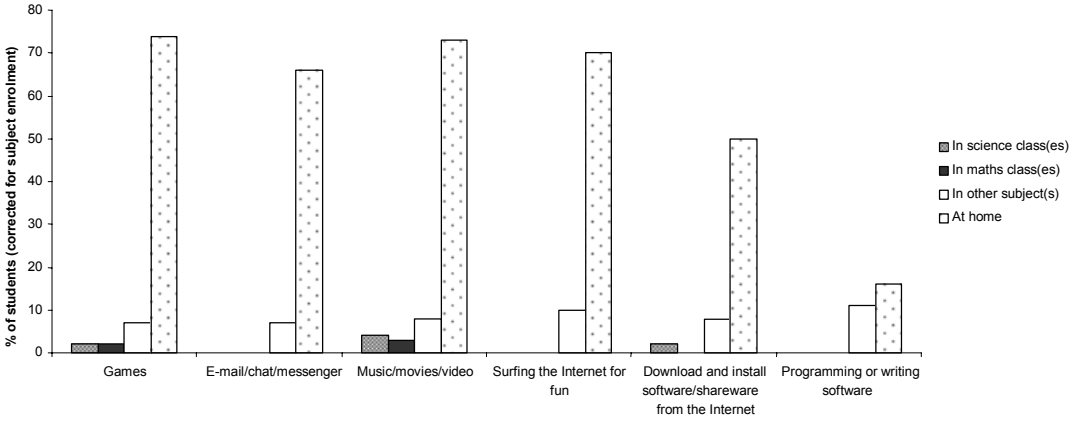
**Figure 3 Other school-related uses of the laptops (2002 and 2003)**




## Recreational laptop use

Students were asked to indicate what other uses they made of their laptops at home and at school. In both years high numbers of students used the laptops at home for e-mail, games, movies, and to surf the Internet (*see* Figure 4). Few students reported recreational uses occurring at school.

**Figure 4 Recreational use of the laptops (2003 data only[31])**




[31] The 2002 survey question did not produce reliable frequency data about students' "other" uses of the laptops, so this question was modified for the 2003 student survey to provide this information.

## Most popular uses of the laptops

Table 15 and Table 16 show which laptop uses were reported by 25 percent or more students in 2002 and 2003. Uses reported by over 50 percent of users are shaded in black. In 2002, 6 different types of school-related uses were reported by 50 percent or more students, with some uses particularly common in science, mathematics, or other subject classes. Equivalent frequency data on leisure-related uses (games, surfing the Internet for fun) were not collected in 2002 so these are not represented in Table 15.

**Table 15 Types of laptop use reported by 25% or more students (2002 student data)**

| | % students (corrected for subject enrolment) | | | |
|---|---|---|---|---|
| | At home | In science class | In maths class | In other subjects |
| Use Internet to search on my own for info for schoolwork | 81 | 48 | | 30 |
| Write assignments or reports to hand in | 70 | 66 | 30 | 57 |
| Go to a website suggested by my teacher | 59 | 70 | 28 | |
| Take notes for study | 49 | 63 | | 59 |
| Insert photos/graphs/pictures into an assignment or report | 52 | 44 | | 48 |
| Analyse data or do calculations in a spreadsheet | 27 | | 55 | 26 |
| Draw graphs using spreadsheet or other software | 32 | | 50 | |
| Send and receive e-mails related to schoolwork | 52 | | | |
| Use infrared to send and receive information | 27 | 34 | 36 | |
| Design or present a PowerPoint presentation | 30 | 31 | | 33 |
| Work on group tasks | 30 | 27 | | |
| Download and install software shareware from the Internet | 55 | | | |

In 2003, 8 types of use were reported by more than 50 percent of students. All but 1 of these was reported to only happen at home, and the 4 most popular uses were leisure-related. Uses that were popular in 2002 (like note-taking, or going to websites in science class, or doing data analysis or spreadsheets in mathematics) were reported by fewer students in 2003. However, it is also worth noting that at least some students in 2003 used their laptops to support their learning in a range of ways (shown with asterisks in Table 16). This is consistent with a theme emerging from the student interview and survey data, namely, that students and teachers felt for the most part it was "up to the individual" to find ways to use the laptop to support teaching and learning. Where this occurred, it was primarily through using the laptops to take notes, write reports and assignments, use spreadsheets for graphing and calculation, search the Internet for information, do PowerPoint presentations, and use subject-specific software and simulations where these were available. When analysed further, the data showed that over half the 2003 students used the laptop to support their learning through 8 or more of the 10 functions asterisked in Table 16, and most of these occurred at home.

**Table 16 Types of laptop use reported by 25% or more students (2003 student data)**

| | % students (corrected for subject enrolment) | | | |
|---|---|---|---|---|
| | At home | In science class | In maths class | In other subjects |
| Games | 74 | | | |
| Music/movies | 73 | | | |
| Surfing the Internet for fun | 70 | | | |
| E-mail/chat/messenger | 66 | | | |
| Use Internet to search on my own for info for schoolwork* | 55 | 28 | | |
| Write assignments or reports to hand in* | 55 | 43 | | 57 |
| Go to a website suggested by my teacher* | 55 | 26 | | |
| Download and install software/shareware from the Internet | 50 | | | |
| Revision/self-testing* | 37 | | | |
| Take notes for study* | 36 | 33 | | |
| Insert photos/graphs/pictures into an assignment or report* | 36 | 28 | | 34 |
| Analyse data or do calculations in a spreadsheet* | 32 | 33 | 34 | |
| Send and receive e-mails related to schoolwork* | 31 | | | |
| Design or present a PowerPoint presentation* | 29 | | | |
| Draw graphs using spreadsheet or other software * | 29 | 33 | 33 | |
| Number of different uses reported by 50 % or more students | 8 | - | - | 1 |

In an evaluation of the Landes laptop initiative in France (*see* p. 7 of this report), Jaillet (2004) also found that students' "personal" use of laptops for Internet, e-mail, and gaming exceeded their use for specific "educational" purposes both in school and outside school. However, neither Jaillet's research nor the Notebook Valley evaluation enable conclusions to be drawn about the learning or personal gains and benefits these types of uses may or may not have. It could be argued that such self-guided ICT use provides opportunities for students to develop new skills, abilities, and "digital literacies" that will enable them to learn and function more effectively in an ICT-rich world and workforce. However, few (if any) evaluations of ICT initiatives in educational settings have developed research methodologies which enable deep investigation of the learning processes and outcomes that might be occurring for students using ICT in these ways.

## Benefits of having a laptop at school

Students were asked to describe what they felt were the benefits of having a laptop to use at school. In both years, the most commonly listed benefit was to take and organise notes and do schoolwork (44 percent in 2002, 29 percent in 2002). In 2002, 20 percent of students said the advantage of the laptops was that it was faster to type than to write things by hand. In 2003, 18 percent of students said the laptops were advantageous for writing subject assignments or essays. While some students clearly felt the word processing functions of their laptops had been helpful, these types of use fall short of the ways in which business partners and stakeholders may have imagined the laptops would impact on the way students would learn science and mathematics, such as online learning environments, team working in the classroom, and relating schoolwork to the outside world. One

early idea was to enable students to analyse real scientific data collected by Antarctic scientists, and to discuss their findings with scientists on the Internet (Compaq Press Release, September 2001). Few students listed the use of subject-specific software or the Internet as a benefit of having a laptop at school (around 5 percent in 2002, and 8 percent in 2003). This finding is consistent with other data from teachers and students which indicates that these types of use happened at school on fewer occasions, and for fewer students, than word processing uses. In 2002, 12 percent of students said there was no benefit to having a laptop at school, or that they did not use their laptops at school. This increased to just under a quarter (24 percent) in 2003.

## Benefits of having a laptop at home

In 2002, the most frequently named benefits of having a laptop to use at home were related to schoolwork and homework (39 percent). Many students also mentioned the Internet in general, or using the Internet as a source of research information. Just under 6 percent of students said there was no benefit, or that they did not use their laptop at home.

In 2003, the most commonly listed benefits for having a laptop to use at home were: accessing, organising, or revising from notes, and finishing schoolwork (26 percent); surfing the Internet, games, music, or movies (21 percent); writing essays or assignments (15 percent); e-mail, chat, or messenger (13 percent); having another computer to use when family members were using the home computer (11 percent); convenience and portability (11 percent); and better access to information for research (10 percent). Thirteen percent of students said there was no benefit, or that they did not use their laptop at home.

### *The best things about the laptop project*

The survey asked students to describe the "best things" they had done with the laptops. The most frequent responses mentioned doing subject assignments or writing essays. Table 17 shows the 2003 students responses to this question. The data for this question was coded slightly differently in 2002 and 2003, so the 2002 data cannot be shown on this table. However, subject assignments and essays were also the most commonly named "best thing" in 2002.

**Table 17 The "best things" students did with the laptops in 2003[32]**

| | | % of responses | |
|---|---|---|---|
| Doing subject assignments/essays | | | 44 |
| ***By subject:*** | | | |
| | *English* | 11 | |
| | *Physics* | 11 | |
| | *Biology* | 3 | |
| | *Chemistry* | 3 | |
| | *Science* | 2 | |
| | *Other subject* | 15 | |
| Games/movies/music | | | 19 |
| Doing a (PowerPoint) presentation | | | 13 |
| School notes (taking, storing, accessing, revising, organising) | | | 10 |
| Using subject-specific programs or simulations to learn | | | 7 |
| Internet access (for research purposes) | | | 5 |
| Internet access (general) | | | 2 |
| Other | | | 9 |

Students' written responses sometimes fell into more than one coding category. Responses that were included in the "other" category included:

> *Recording myself.*
>
> *Accounting project including flow diagram and pasting company pictures from a website to my presentation.*
>
> *Powerpoint show—out of school project on water. Downloaded pictures and presented them.*

Some focus group students at School 1 said *Crocodile Clips* had been very good for physics, and that the laptops were helpful for biology essays and research, although they had only used the laptops for research in class about once a term. One student said:

> *I thought we'd use it more for the intended purposes and subjects—we used it more in English than maths. (Student, 2003)*

However, a group of students at School 2 said the best classes for using the laptops were physics, English, biology, and chemistry. One student said the laptops were useful in mathematics for doing spreadsheets, or looking up internal assessment tests and saving them on the laptop to refer to at home. Physics students enjoyed using the laptops to look at simulations and "moving diagrams" which they said helped them to visualise and better understand physics concepts:

> *It speeds up the whole process. You can do more with the laptop…simulations, like if you have trouble understanding the teacher you can teach yourself at your own pace. (Student, 2003)*

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[32] Students' responses in 2002 and 2003 cannot be shown on the same table because the coding schedules used for the 2002 and 2003 surveys were slightly different.

The students liked being able to do virtual experiments on the laptops, for example, using *Crocodile Clips*, or for doing self-test tutorials. Students thought the laptops were "great" for their science research projects, although they did note that since the school's network upgrade mid-year, they were no longer able to log on to the school network or Internet from school. The laptops were seen as useful for mathematics "because they have a calculator", but other students felt it would be better if there was actually a mathematics-based program they could use.

## How the project measured up to student expectations

Students in the term 4 focus groups were asked to reflect back on how they thought the laptop project measured up against the expectations they had at the beginning of the year. In both years students had mixed views:

> *The laptops are better than I thought they'd be. You don't usually see decent stuff at school. It's a change to see something decent. (Student, 2002)*

> *It's been what I expected. There's been some negatives. [For example] it's difficult to keep organised. We often get handouts, and you can't put them on your computers. I have asked teachers to put them on a disk for me and they get mad. (Student, 2002)*

> *I didn't expect they would help me as much. I find it a lot easier. For example, I can take it on holidays with me and send files, etc. Before, I wouldn't have taken schoolwork on holiday. Now, I take the laptop for fun, therefore my work is available and I might do that a bit. (Student, 2002)*

> *I thought we would have more opportunities to use it. (Student, 2002)*

In 2003, students still had different perspectives but some differences were evident between students at different schools. At School 1, some Year 13 laptop students in 2003 had also been part of the project as Year 12s in 2002. These students had been frustrated by the change of operating system in the laptops in 2003 which restricted students to the role of "system users", as opposed to "system administrators". As a result, the students said they "couldn't do anything" on their laptops compared to what they had been able to do in 2002. Although the HOD said this problem had been reversed in the second half of the year (meaning that the students' administrator rights on the laptops were restored), several students in the focus groups did not appear to be aware that this was the case. Overall, there was a sense of disappointment from the School 1 focus group students about how the laptop project had worked out in 2003, compared with 2002.

On the other hand, a focus group of 6 Year 12 students at School 2 had many positive things to say about the project in 2003. Most students said their expectations of the project had been reasonably high at the beginning of the year. They anticipated that having the laptops would help them organise their work, go through work at their own pace, and "teach us stuff". One student said they hadn't thought at the beginning of the year that the laptops would make a difference for them, but "noticed through the year" how laptops were helping and changing their experiences of school. Some students said that in many ways the project had been better than they had expected:.

> *I use it a lot in English, use it for the Internet. I thought it would just be physics and maths. (Focus group student)*

*Other people in the family have used it as well. (Focus group student)*

Some of the students talked about how having a laptop made them "look and feel smarter, more sophisticated". One of the students commented that having the laptops "gives you confidence. It is something really positive." The students thought that other students thought it was cool that they had laptops, and asked them "What did you do to get that?" The students believed that this would encourage other students to take those subjects too:

> *I think it is a really good opportunity for students…seeing older students made you aim towards it. Now that you are an older student you feel like you are doing the same. (Focus group student)*

At School 3, 10 Year 12 students were interviewed in 3 groups in October 2003. Most of these students said they had "low" or "average" expectations of the laptop project at the beginning of the year.

> *I had 'medium' expectations. When I first got it I was stoked but soon lost interest. (Focus group student)*

> *I had high expectations, but then realised they are not really that useful. I thought there might be stuff for science and maths revision. (Focus group student)*

> *We didn't really expect too much of it. It was ok. I used it to e-mail work home from school. (Focus group student)*

At the time they were interviewed (October 2003) the School 3 students thought they would have to return their laptops to school before their Year 12 exams. One student complained that it was therefore "pointless" to keep notes on the laptop, since they could not refer to these in preparation for their exams.

## Support and training

In 2002, staff at School 1 identified ongoing "just in time" ICT training for students as an area of need (*see* Bolstad, 2003a p. 9). The school arranged with Digital Opportunities LCT to provide support sessions for laptop students in 2003. However, the focus group students said the Digital Opportunities LCT Tuesday morning laptop student support sessions had not been very helpful, and some complained about having to get up early on Tuesday mornings to be shown things they "already knew". Students said the Digital Opportunities LCT staff member had shown them a few things they could do using Word, and how to do advanced searches. Later, the students were supposed to come to the session with questions or things they wanted help with regarding the laptops. However, students said that because of the loss of administrator rights, students "had no questions to ask", and that students eventually stopped going to the sessions. Some of the Year 13 students said that it would have been great to have had the sessions the previous year:

> *Everyone needed it last year. This year there was no point. (Focus group student)*

The School 2 students had not had any support sessions or training in the use of the laptops but said that if they needed help, they could go to see one of the computer/ICT staff, or ask their friends. Students at School 3 said they had not had any training or support sessions relating to the laptops,

although some suggested that their Year 9 computer studies course might have been all the "training" they needed to use their laptops.

### Technical frustrations

Although the students at School 2 were able to install programs onto their laptops, some noted they could not put on "big" programs, for example, one that they could use for their CAD (computer-aided design) class. Students at School 3 said in 2003 that there were no printers in the school that the laptops could connect to. One student said the school didn't like students to transfer documents on disk (presumably for virus security reasons), and so "whatever you put on the laptop is stuck there forever". The amount of time it took to start up and log on to the network was also cited as a problem. Students at School 3 said it took about 5 minutes for the laptop to load up, which made it impractical to use in class.

### The weight of the laptops and a lack of storage space at school

In both years, the most common complaint from the survey and focus groups was the heaviness of the laptops and the laptop bags students had to carry to and from school. Students said that this was a significant burden, particularly when they also had to bring textbooks. There was also nowhere that students could safely store laptops during the day, or after school, for example, if students had sports practice. This was a common reason given by students who stopped bringing their laptops to school.

## STUDENTS' SUGGESTIONS FOR IMPROVING THE PROJECT

Students' suggestions for improving the project included:

- having lighter laptops or better carry-bags;
- reducing restrictions on what students were able to do with the laptops;
- having good technical support to fix laptop problems quickly;
- providing voluntary training sessions for students about how to use the laptops;
- having lots of good subject-specific programs available, and making sure the laptops have enough memory to install programs that the school uses;
- training teachers how to use various subject-specific programs, and reassuring teachers that the laptops are "a good thing to have in class, not a distraction"; and
- having broader selection processes for who gets the laptops, so that students in other subjects like English and history would be eligible to have a laptop.

Some students questioned the choice of science and mathematics as the target subjects for the laptop programme. In 2002, students in one focus group described it as "a strange choice". Another group said that it was unfair because "most students don't like those subjects" and that "certain people take certain subjects – it's not really fair". Other comments included:

> *There are more opportunities to use the laptop in English. In bio and math we are working out of books, and doing diagrams and equations [which are hard to do on the laptop]. (Student, 2002)*

*Change it to English and history. Especially NOT maths, it's not used. (Student, 2002)*

## IMPACTS OF THE LAPTOP PROJECT FOR STUDENTS

The student beginning- and end-of-year surveys and ICT skills checklist were designed to provide some comparative data to track changes for students during the year they had the laptop. Areas investigated included students' attitudes towards their science and mathematics subjects, perceptions of their science and mathematics classes, and students' ICT skills, knowledge, and confidence. Beginning- and end-of-year data was available for 65 students in 2002 and 55 in 2003 and these were analysed to check for detectable changes.

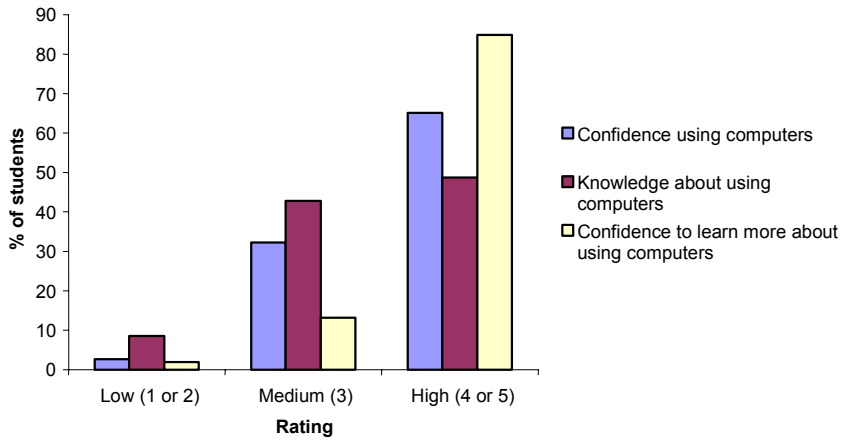
### *Attitudes towards science and mathematics*

Students were asked to rate their feelings about each of their science and mathematics subjects on a scale of 1 (very negative) to 5 (very positive) at the beginning and end of the year. In both years, students entered the year with reasonably positive attitudes towards their subjects. The data were tested to see if there was a statistically significant change in students' attitudes between terms 1 and 4. However, these showed no detectable upwards shift in attitudes in either 2002 or 2003.

### *Impact on ICT skills, knowledge, and confidence 2002*

In term 1 students rated themselves on a scale of 1 (low) to 5 (high) in terms of their confidence to use computers, their current knowledge about using computers, and their confidence that it would be easy to learn more about using computers. As shown in Figure 5, students' confidence in term 1 of both years was generally high. Students' confidence to use computers and learn more about using computers was higher than their knowledge about using computers.

**Figure 5 Student knowledge and confidence with computers (term 1, 2002 and 2003)**



### *Students' ICT knowledge and confidence in term 4*

In both years there were small increases in students' mean confidence to use computers, and knowledge about using computers. Most of the change was accounted for by some students shifting from the middle rating (3 or 4) to the top rating (4 or 5).

### *Impact of laptop on subject choice*

In 2002 and 2003, students were asked to rate a series of factors in terms of importance for their decision to choose to study mathematics or science. In both years, the 4 most important reasons for students for choosing both science and mathematics were: personal interest and enjoyment; needing the subject for future study or careers; having previously done well in the subject; and needing the subject to carry on the following year. The students' "most important reasons" for choosing to study mathematics or science subjects are consistent with other New Zealand research on student subject choice. For example, an ongoing New Zealand longitudinal study of the impacts of NCEA found that the contribution of science towards students' "future plans", along with expectations that they will personally enjoy science, are top of Year 11 and 12 students' list of stated reasons for choosing science subjects (Hipkins, Vaughan, Beals, and Ferral, 2004). In 2002 and 2003 most students rated the opportunity to use a Notebook computer as being of low importance or no importance in their decision to take either science or mathematics subjects.

### *Impact on students' home and family*

Table 18 shows the level of interest or support that students reported from their families in term 4.

**Table 18 Family interest or support for students involvement in laptop programme (2002 and 2003)**

| Level of interest or support from family | % of students |
|---|---|
| A lot | 19 |
| A bit/average | 58 |
| Not much or none at all | 21 |
| No response | 2 |

In 2002, just under 70 percent of students said other people in their homes used their laptop. In 2003, 58 percent of students reported this. In 2003, brothers and sisters were reported to use the laptop for games (39 percent), homework (26 percent), Internet (23 percent), e-mail/chat (19 percent), and music (19 percent). Parents were reported to use the laptop for the Internet (15 percent), work or homework (13 percent), games (11 percent), and e-mail (8 percent).

## SUMMARY OF 2002 AND 2003 STUDENT DATA

- Overall, the 2003 student survey data showed very similar patterns to the 2002 student survey data. The findings regarding the amount and nature of students' laptop use at school were consistent with information from teacher and student interviews which indicated that laptop use was sporadic across most classes, and was limited by a range of factors such as the proportion of students with laptops in each class, and the availability of appropriate software or resources for the topic being studied, and the time it took to set up the laptops and other equipment.

- Overall use of laptops at school appeared more frequent in 2002 than in 2003. Some students seemed to use the laptops to support their learning in a variety of ways, including using the Internet for research, creating PowerPoint presentations, and using subject-specific software and simulations in class or at home.
- Many students reported using laptops for word processing and spreadsheets both in science and mathematics classes, and at home. Many students used their laptops at home or at school to prepare assignments and reports for subjects other than mathematics or science. However, the percentage of students using the laptops for note taking in class decreased in 2002. Other uses that were commonly reported in 2002 (such as data analysis and spreadsheet use in maths classes) were reported by fewer students in 2003. Students generally used the laptops for a wider variety of functions at home than at school. These included leisure-related uses, and other uses like revision and self-testing, or creation of PowerPoint presentations.
- A consistent theme from the teacher and student interview and survey data was that students and teachers felt for the most part it was left "to the individual" (teacher or student) to find ways to use the laptop to support teaching and learning. Students used the laptops in different ways at home and school. The most common uses of the laptops at home in 2003 were for leisure.
- The survey data do not show significant impacts of the laptops on students' attitudes towards science and mathematics subjects, but students' knowledge, confidence, and skills with ICT show some increases between the start and end of 2003. The wide variation in laptop use between classes/students may explain why it was difficult to detect a consistent impact of the laptops on student attitudes towards their science and mathematics subjects. However, students' self-described increase in ICT knowledge, confidence, and skills does not seem to have been affected by the sporadic nature of laptop use in school.

# 8. Discussion and conclusion

## INTRODUCTION

The first part of this section evaluates the Notebook Valley project against its 3 initial aims:

1. To enhance the educational achievement of the students and community particularly in mathematics and science.
2. To help overcome the barriers of access, ability, and attitude.
3. To work in partnership with all stakeholders.

The final part of the section presents questions for consideration in the planning of future Digital Opportunities laptop initiatives.

The research questions for the Notebook Valley evaluation were as follows:

- How was the delivery of services to the schools managed? What are the pros and cons of the services delivered and the models of delivery and implementation?
- What was the impact of the use of Notebook computers on teachers and on students?
- What are some of the examples of good practice in the use of ICT by students and teachers, and in the development of resources, that stem from the project?
- What are the resources, skills, and conditions that are necessary to enable the effective utilisation of Notebook computers by senior mathematics and science students and their teachers to assist learning?
- What are the resources, skills, and conditions that are necessary to enable the continuation of the project?

These research questions guided the development of the research methodology, research instruments, data collection, and the analysis and reporting of findings during the Notebook Valley evaluation. This section presents an integrated analysis of findings pertaining to the research questions. The 3 initial aims of the Notebook Valley project are used as a framework for integrating this information.

## ASSESSING THE PROJECT AGAINST ITS INITIAL AIMS

At the end of 2003, staff were asked to comment on how the Notebook Valley project had gone with respect to the project's 3 initial aims.

Staff had both positive and negative views of the project's success. Most staff were grateful for the opportunity given to themselves, their students, and their school, to access laptops and other forms of ICT via Notebook Valley. However, teachers also suggested that there had been a lack of specific goals or expectations at the start of the project, and that this had impacted on the course of the project's development in their school:

*The outcomes and aims were undefined for the project. Basically we were given these laptops and told to go take them away and use them for learning. Everybody had a different vision for what they wanted to do with them. (Science teacher)*

*I think there wasn't anything set in concrete when we started on the project. There have been various stages where we have heard 'this is what we want to achieve' and 'this is what will happen'. But as the years have gone by, things have changed. I think if, at the beginning, we had had say 3 goals, and then a clear pathway of how we are going to get there, perhaps things would have worked out differently. (HOD)*

Some staff also commented that it was unfortunate that the timing of the project had coincided with the introduction of NCEA, because the latter had commanded a great deal of staff energy and attention in 2002–2003. However, several departments saw opportunities in 2004 to use laptops and other forms of ICT for specific science and mathematics achievement standards that focus on the use of technology in these subject areas.

All 3 Notebook Valley schools took steps towards greater ownership and self-determination of the laptop project in 2003. Some interesting developments occurred in some departments, particularly when this was associated with Digital Opportunities LCT support and professional development in areas identified by the individual schools, departments, and teachers to meet their perceived needs.

In all 3 schools, ICT use with junior students was a focus in 2003. For the science and mathematics departments at School 3 this was achieved via the school's laptop lab. At School 1, the mathematics department regularly took their junior classes to work in the school's computer lab. At School 2, a Digital Opportunities LCT team member was enlisted to work on a web development project with Year 9 and 10 gifted and talented students. There was a feeling among many of the staff interviewed that ICT developments at Year 9 and 10 level would have a worthwhile and lasting benefit for both the students and the departments, as ICT gradually became meaningfully integrated into the departmental teaching and learning programmes.

There was also some evidence of ICT developments in other subject areas that had some connection to the Notebook Valley programme. For example, Year 12 students at School 2 used their laptops for video editing in a media studies class (although this occurred in 2002, not 2003). A social science teacher at School 1 was reported to have become a "convert" to ICT use after seeing laptop students doing PowerPoint presentations in their class.

## Enhancing the educational achievement of students, particularly in mathematics and science

Most staff thought it was difficult to assess the impact of the project for the Year 12 and 13 "laptop" students' educational achievement. Staff thought some students' skill and confidence with ICT had increased, particularly for students without prior access to home computers. There was some evidence from the student survey data to support this. Some staff and students also felt that the use of particular programs (for example, *Crocodile Clips*), had helped to enrich students' understandings of science or mathematics concepts, particularly those that involved "dynamic" demonstrations of cause-and-effect or changes over time. However, teachers felt they had insufficient information to evaluate the impact on students' science and mathematics achievement.

It was difficult for staff to identify a significant impact on achievement in cases where students' use of the laptops for science and mathematics seemed to be minimal.

On the other hand, staff at all 3 schools thought the Notebook Valley project, and other concurrent ICT developments in the school, would have long-term benefits for younger students and future students in the school. These benefits were thought to accrue from:

- greater staff confidence and experience using ICT for teaching;
- increased access to ICT within the school;
- useful science and mathematics software and equipment purchased through the Notebook Valley funding; and
- the development of departmental intranet sites and shared resources.

These developments were viewed as having the potential to enhance students' learning experiences (and achievements), through the long-term integration of ICT as a tool for teaching.

## Helping to overcome the barriers of access, ability, and attitude

### *Staff access, ability, and attitude*

Many staff said the best thing about the Notebook Valley project was having access to their own laptop. This was particularly valuable for those who did not have their own computers, or easy access to a computer workroom. Staff entered the project with a wide range of prior knowledge and confidence to use computers, and those who were least familiar with computers at the beginning were generally the most enthusiastic about their personal ICT skill development by the end of the project. Some teachers who were not going to get the Notebook Valley laptop again in 2004 said they did not know how they would cope without it, and thought they would have to buy their own if they were ineligible to receive a laptop through the STELA scheme. Some staff felt there was a general attitude shift towards ICT among staff in their school, from some initial fear or lack of confidence in ICT, to a greater interest and willingness to use ICT, or to try new things using ICT.

Staff entered the project with a range of views about how the laptops could support students' science and mathematics learning. In 2002, some teachers felt that, in theory, ICT had the potential to radically transform the way students learned science and mathematics. Other teachers were less familiar with ICT and the range of ways it could be applied to support science and mathematics learning. However, even teachers who saw great potential for using ICT perceived constraints on their ability to actually do so in their teaching. These constraints included:

- physical and technical barriers to ICT use in their classroom (e.g. limited network connections in their classroom, and the time required to log in to the system);
- a lack of access to, or familiarity with, useful software or systems that could support teaching and learning in their subject area;
- the "pepper-potting" of laptops across classes, so that not all students in a class had a laptop;
- a lack of time to explore and experiment with different ICT resources or tools, and adapt these for use in their particular teaching programmes; and

- the demands of covering all the curriculum content required for senior students to complete their NCEA assessments.

In 2003, some progress was made in overcoming the physical barriers to classroom ICT use. For example, several teachers' classrooms were wired into the school network, where they had not been connected previously. All 3 schools acquired *Crocodile Clips* and other science and mathematics software, and staff were becoming familiar with the use of these programs. However, the other constraints listed above continued to impact on staff and students' use of ICT for learning.

### *Students' access, ability, and attitude*

Staff felt that the degree to which the laptop programme benefited Year 12 and 13 students depended on whether the students already had access to a computer and the Internet at home. School 3 staff thought the biggest "access" benefit for students came via the laptop lab that was established in the school in 2002–2003. Although it was difficult to detect student attitude changes specifically connected to the project, some teachers and Year 12 students at School 2 reported younger students asking what subjects they had to take in order to get a laptop.

Students themselves had mixed opinions about the impact of the laptop programme for them. Some students said they appreciated having their own laptop, and used it often at home for schoolwork and leisure, and, to a lesser extent, at school. Other students said they never brought the laptop to school, and rarely used it at home. Many students found it awkward to bring the laptop to school because it was heavy, and there was nowhere that it could be stored during the day. Other students said it was not worth bringing the laptop to school because it was not used in class. The degree to which students used the laptops to support their learning appeared to vary considerably between individuals. Most students used the laptops to complete assignments or essays. However, some students also used the laptops to support their independent learning in other ways. Many students liked having easy access to subject-related programs and simulations, their own notes, and old exams or revision materials, so they could learn concepts at their own pace, or prepare for tests and exams. Students at School 3 found it frustrating that they had to return their laptops before their final exams, because this seemed to negate the value of storing their course work and materials on the laptop during the year.

## Working in partnership with stakeholders

### *Developing shared resources*

One area in which staff felt the project had not been successful was co-ordination and communication between the Notebook Valley schools. Most teachers said that ideally, it would have been useful to share and divide responsibility for the development of ICT-based resources amongst the 3 schools. One mathematics teacher said: "There should have been one big group of people communicating and sharing information, knowledge, expertise, resources." However, this barely occurred during the project. A few staff felt that the circumstances of the schools involved in the project had mitigated against this sort of co-ordination and communication:

> *The project began in a culture of competition between the schools. That is not the best environment for schools to work collaboratively on a project. (HOD)*

Others felt that the opportunities to develop such co-ordination had been too few and infrequent to establish purposeful and productive collaborations;.

> *There were a few PD sessions, but even then we spent maybe a couple of hours with people from other schools, then we went away again, and nothing happened. (Science teacher)*

Several teachers said that to achieve successful collaboration, staff needed clear goals and pathways, with well-structured planning, support, and guidance. For example, 1 teacher suggested that the science (or mathematics) departments at each school could develop a goal such as producing 3 resources that could be used at Year 10 level, within a term:

> *You need to have clear goals and expectations for the department, and for teachers within that department, so that they know what they have to do, when they have to do it by, and what the purpose of it is. (Science teacher)*

Such an arrangement would "need to be managed and monitored", to ensure that the goals were achievable, and that schools weren't "doubling up" by producing resources already developed by other schools.

### *Teacher professional development and release time*

The professional development experiences of individual staff in the project varied. In 2001 and 2002 most teachers attended at least 1 conference or inter-school meeting related to the Notebook Valley project. In 2002 some staff had regular one-on-one contact with Digital Opportunities LCT staff, while others had little contact with people from outside the school in relation to the project. All 3 schools engaged in some form of in-house ICT professional development for teachers in 2001 and 2002.

The variability of staff professional development experiences continued in 2003. For some teachers, 2003 was a year of much learning and progress, with a high level of interaction with Digital Opportunities LCT staff (for example, the science HOD at School 1). The mathematics department at School 3 had considerable support from Digital Opportunities LCT to develop ICT-based teaching units for Year 9 and 10. Some staff at School 1 received professional development sessions at the end of the year based on specific areas that the staff and Digital Opportunities LCT had identified as needs areas during the year. Other teachers' professional development associated with the project was patchier:

> *In the second year, it was really good with [the Digital Opportunities LCT content co-ordinator of 2002]. We made some real progress. Then we lost all the momentum, with staff changes [in the school and in the Digital Opportunities LCT]. (Science teacher)*

For some staff, 1 or 2 sessions to view or learn particular pieces of software such as *Omnigraph* or *PASCO* data-logging were their only professional development in 2003.

Many teachers felt that a lack of teacher release time was a major impediment of the project:

> *I'd understood at the beginning [of the project] that there was going to be quite a lot of release time. I don't think we've had much at all. (HOD)*

There was a range of ideas about how to maximise the value of release time for ICT development. The general opinion was that the most productive development would occur when staff could be released for "blocks" of time, to work on a resource, and to teach other staff in their department, or in other schools, how to use it.[33] One HOD suggested that the Notebook Valley release time allocation should have been used to fund a relief teacher in the department who would be able to release other teachers for 2 or 3 weeks at a time. Having "people with the right knowledge and skills to run the professional development" was also seen as crucial. The HODs felt this required somebody with both ICT knowledge and knowledge of the subject area (science or mathematics). Ideally, a support person would be very conversant with useful science and mathematics software, or have the time and ability to learn the software quickly. In 2003, some teachers participated in Digital Opportunities LCT professional development sessions that were more tailored to their own or their department's self-identified needs, and found this sort of support helpful.

## Teachers' advice and recommendations

Teachers were asked to reflect back on their experiences in the Notebook Valley, and give their advice or recommendations about what was required for a similar project to be successful and sustainable. The most common recommendations were as follows:

- to involve schools in initial decisions about the scope and parameters of the project, as well as its goals and aims;
- to establish clear goals and pathways for the project, with well-structured planning, support, and guidance for staff and students;
- to have someone with knowledge about ICT and ICT-based teaching and learning to oversee the project, identify and evaluate existing software and web-based resources, create ICT teaching resources for teachers, and provide professional development;
- to build from, and maintain, the momentum generated by teachers' visits to Navcon and other ICT conferences, by creating further opportunities for staff to develop and share ideas for using ICT with their peers;
- to allocate adequate blocks of release time for staff to become familiar with software and resources, and develop these into appropriate teaching resources for their department;
- to ensure that an appropriate technical infrastructure is in place before the project begins, and that the software and hardware systems are compatible with one another; and
- to provide adequate technical support for staff and students, which is not necessarily reliant on the school's main ICT systems manager.

There was a range of views about the most appropriate or effective ways of deploying the laptops. Some staff thought students without home computers and Internet should be given a laptop for the year. Others thought the laptops were most useful when they were retained as a school set, available for classes to book as required. Another teacher noted that the weight of the laptops was a very significant issue for the project's success, because it led many students to stop bringing the

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[33] This occurred for a short time in term 1, 2002, when the Ministry of Education Digital Opportunities project manager seconded a School 3 teacher to work on resource development for the Notebook Valley project. The arrangement concluded when the teacher left New Zealand in term 2, 2002.

laptops to school. He suggested that a smaller, lighter device such as a PDA[34] might be a more practical tool.

There were plans in all 3 schools to change the laptop allocation system in 2004, so that senior mathematics and science students could be issued the laptops for a block of time, like a library book. Students would be eligible for a laptop when there was a particular research topic or unit of work where it was clear that the laptop would be useful.

## QUESTIONS TO RE-EXAMINE FOR FUTURE DIGITAL OPPORTUNITIES LAPTOP INITIATIVES

While some positive outcomes were achieved from Notebook Valley, the research findings raise some questions about the significance of these outcomes in proportion to the cost of this ICT initiative. The equivocal results of the evaluation suggest that if further projects of this type are planned, 2 types of re-thinking are needed. The first is a re-thinking of the educational aims underpinning the Notebook Valley project concept. The second is a re-thinking of the processes through which the project concept is translated and implemented into practice in schools.

### Rethinking the educational aims of the Notebook Valley project

Regarding the educational aims of Notebook Valley, the following questions arise from this evaluation.

- Were laptops the best choice of ICT equipment to help schools meet the aim of enhancing the educational achievement of students, particularly in mathematics and science?
- Was it clear to all partners at the outset of the project exactly why (and how) laptops were expected to enhance teaching and learning in these subject areas?
- Were Year 12 and 13 science and mathematics students the best target group for allocation of the laptops, or could students at other year levels, or in other subject areas, or students with special educational or learning needs, have gained more from access to the laptops?

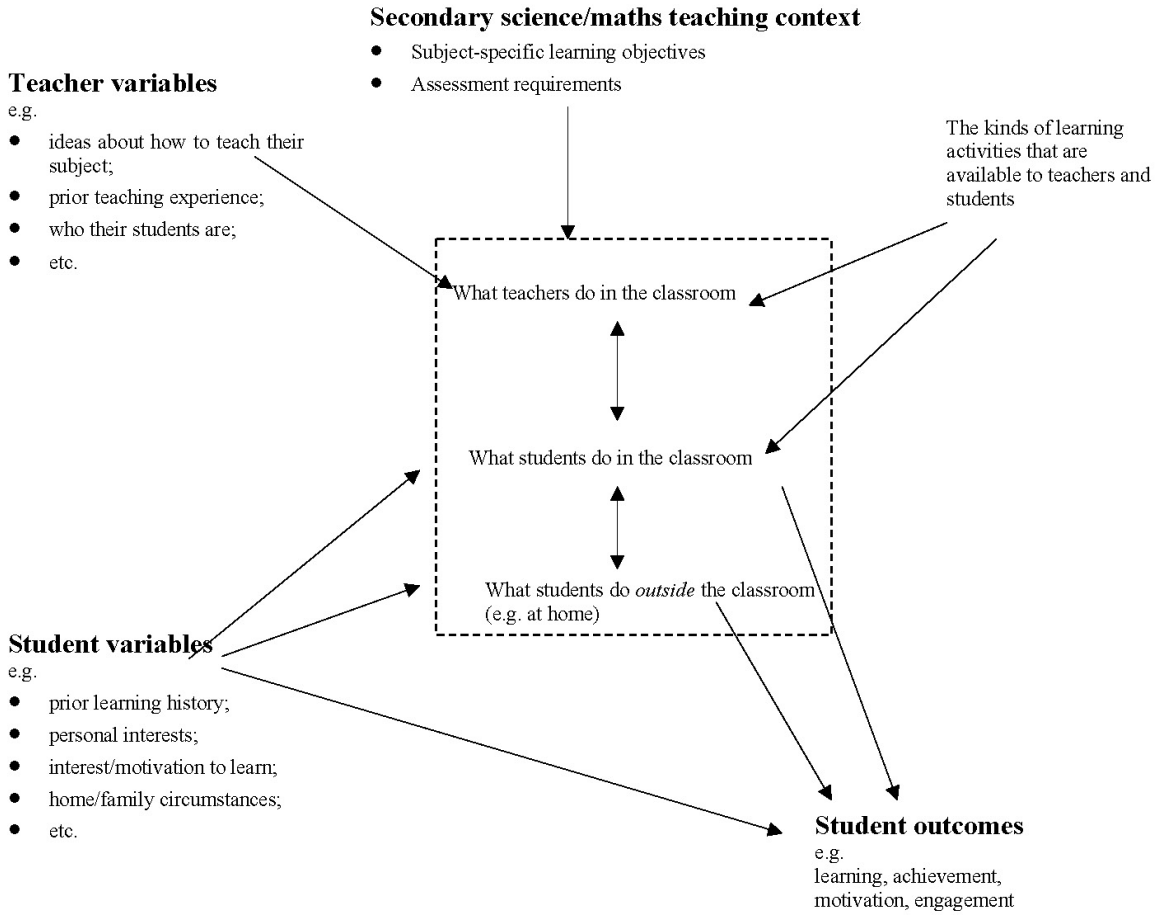
The distribution and use of portable computers in education is usually justified in the basis of 2 arguments (Siegle and Foster, 2000). The first is improved learning, and the second is the development of a constructivist approach to teaching which places students at the centre of their learning. However, a common element missing in many such ICT initiatives is a strong theory-driven model which directly considers the processes of learning, and what enables learning to occur, and identifies all the contextual variables which feed into this process.

Lesgold (2003) describes at least 3 possible sets of processes which might be affected by an ICT innovation (and thereby impact on students' learning and achievement): those that change teacher behaviours; those that change student learning processes; and those that change teachers' thinking, leading to new classroom arrangements or practices that in turn change the thinking that students do in class. A simple model for thinking about student learning might state that student outcomes will be related to some specific things that teachers and students do in the classroom. However, student outcomes will *also* depend on who the students are, and what kind of teachers they have. What teachers and students do in the classroom also depends on who the students are, who the teachers are, what sort of learning activities are available to teachers and students, and the teaching

[34] Personal digital assistant

context (which for Notebook Valley was a secondary science and mathematics teaching context). Subject-specific learning objectives and assessment requirements would play a role here. Figure 6 shows a diagrammatic example of some of the general teaching and learning processes and relationships operating within secondary science or mathematics classrooms.

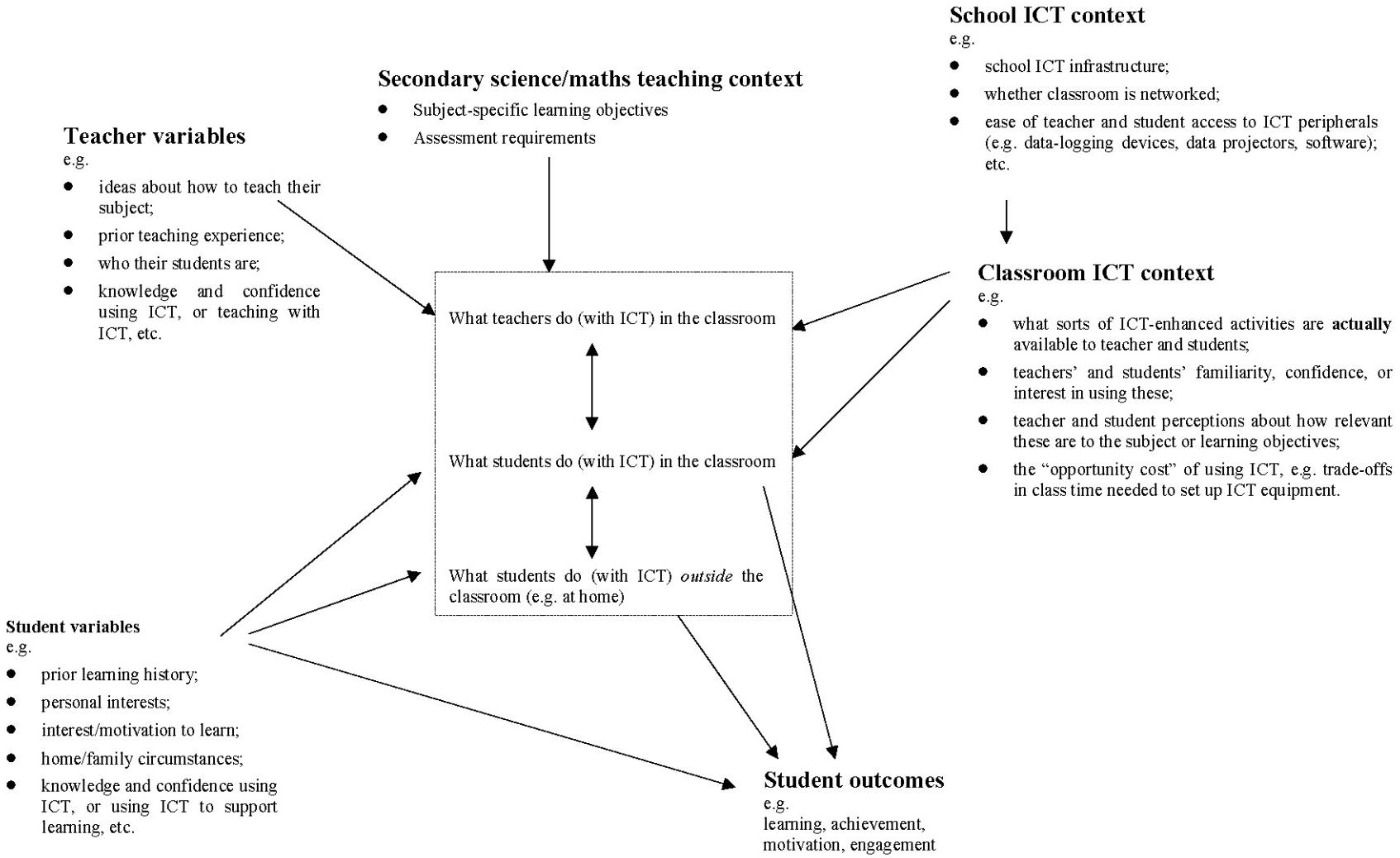
**Figure 6 A simple model of teaching and learning relationships, linked to student outcomes**




As Figure 6 shows, a whole web of processes and relationships can be hypothesised as contributing to student outcomes. Identifying and articulating these processes and relationships *prior* to an ICT innovation is important for 4 reasons. First, to plan how a particular ICT innovation might add to or modify this existing web. Second, to determine what support, resources, and conditions might be needed, and where in the "web" these should be targeted. Third, to determine what sorts of information needs to be collected to evaluate the impact of the ICT innovation, and fourth, to know how to make sense of that information and connect it back to the ICT innovation.

Figure 7 shows the same diagram, modified to show the added dimension of ICT use by teachers and students.

**Figure 7 A simple model of teaching and learning relationships with ICT use, linked to student outcomes**



A model like the one shown in Figure 7 could be useful for planning a new initiative like Notebook Valley, particularly to consider how the ICT project design would need to allocate resources, infrastructure, and professional development to support changes in teaching and learning practice that might lead to positive outcomes for students.

**Resources and infrastructure**: what teachers and students do with ICT in the classroom is partly determined by the kinds of ICT-enhanced activities that are actually available in their classroom. These in turn depend on factors such as the school's ICT infrastructure, whether the classroom is networked, and teachers' and students' access to peripherals such as data-logging devices, data projectors, or software. The subject-specific learning objectives and assessment requirements will also have an influence on what teachers and students do in the classroom. These factors would need to be considered in the design of an ICT initiative:

- Given the subject, and the goals or objectives of the project, what sort of ICT devices would be most useful for these students and these teachers?
- How will they/could these forms of ICT be used?
- How many devices are needed?
- What other ICT peripherals might teachers and students need to extend the uses they can make of their ICT devices?

**Professional development:** what teachers and students do in the classroom is also determined by teachers' and students' familiarity and confidence, or interest in using the ICT devices and activities that are available to them, and their perceptions about how relevant or useful these are to the subject or learning objectives of the class. Teachers' use of ICT in the classroom will also be influenced by their ideas about how to teach their subject, who their students are (i.e. the teachers' views about the needs and abilities of their students). What teachers and students do with ICT in the classroom will also be affected by the assessment requirements for those students. Student assessments could be seen as an opportunity for developing new and innovative ICT practices, or they could be seen as a reason for not using ICT (for example, if ICT is seen as taking time away from preparing students for their assessments). Professional development to support the ICT initiative should be designed around these factors.

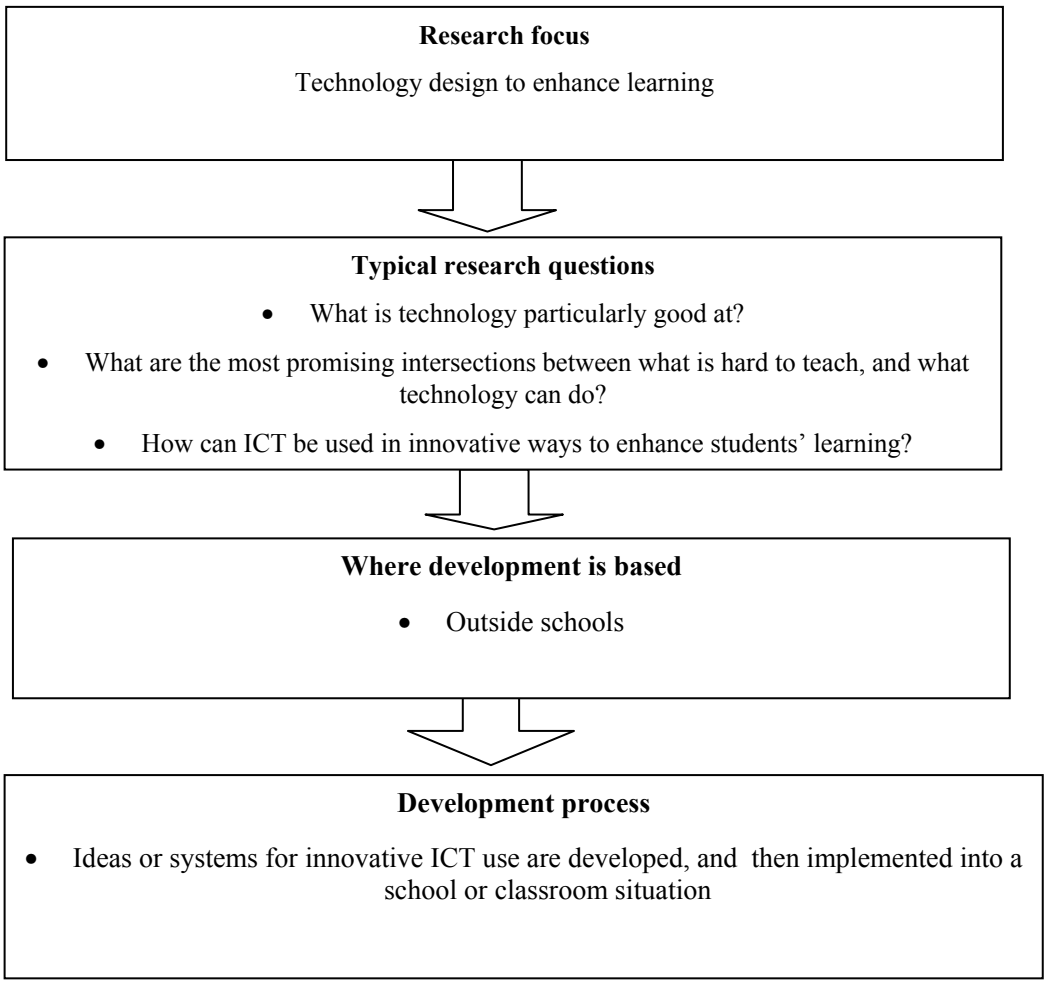
## Rethinking the process for translating and implementing the Notebook Valley concept into practice

Regarding the process for translating and implementing the Notebook Valley concept into practice, the following questions arise from the evaluation:

- Was there enough involvement from schools in shaping the goals and aims of the project, and identifying pathways towards achieving these?
- Was the professional development provision and approach appropriate to meet the needs of staff (and students) in the Notebook Valley schools?
- Would it have been possible to anticipate the difficulties in arranging professional development through a stakeholder organisation, and could a different approach have been used?

A central feature of the Notebook Valley project model is the partnership between schools, the Ministry of Education, and business stakeholders. There is much literature to support the idea that ICT innovation approaches are most successful when there is a strong partnership model. In a recent review of 40 studies of the impact of ICT in education, Culp, Hawkins, and Honey (1999) distinguished between 2 prevalent strands of research. The first strand focuses on ICT design to enhance and strengthen learning, without a strong partnership model between schools and ICT developers. This leads to the development of tools, software, or technology applications that are intended to be integrated into the classroom to improve student learning. The emphasis is usually on the development of materials, tools, applications, or systems in an external setting which are then transferred to practitioners in a separate implementation phase. The sequence of events described by Culp et al. is represented diagrammatically in Figure 8 (developed for this report).

**Figure 8 Research on ICT design to enhance learning, without a partnership focus**

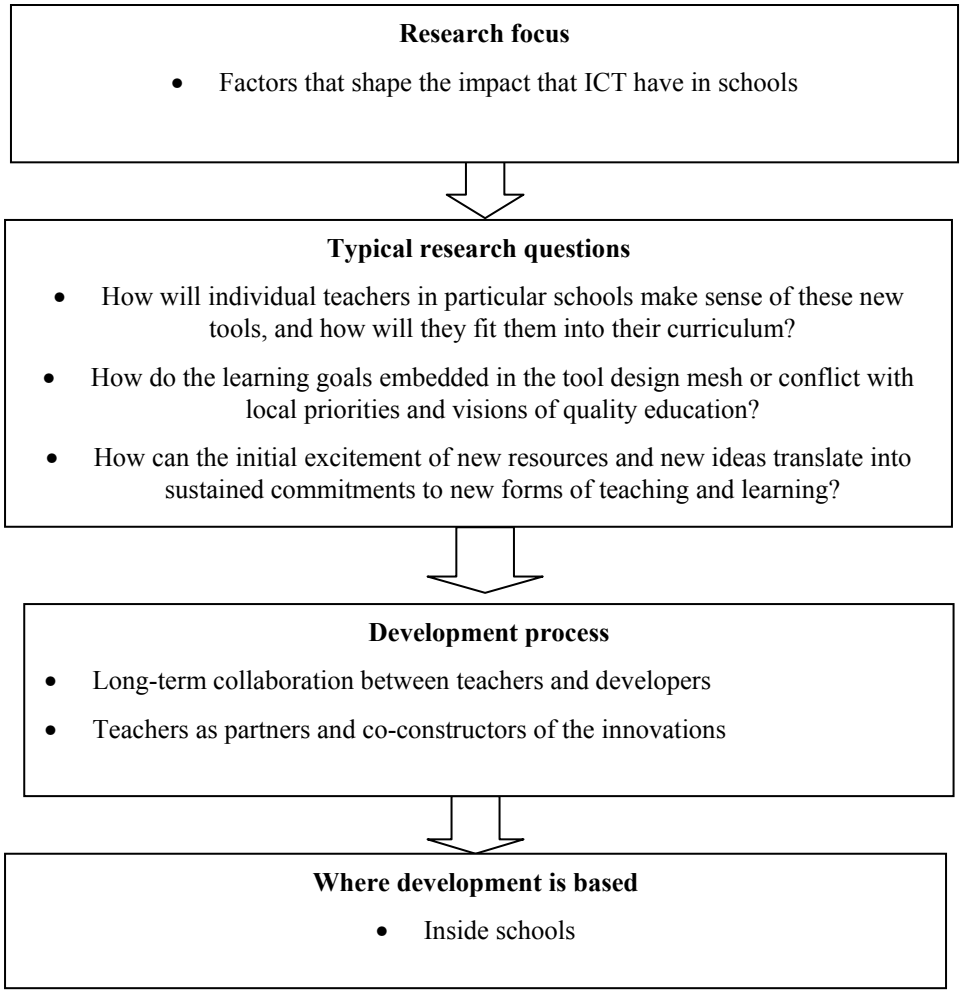



In some instances, researchers and developers working through this process have succeeded in helping teachers and students use technology creatively to engage in work that they could not otherwise do in the classroom. However, these kinds of projects frequently encounter issues of scalability, ownership, and localisation. In-school educators rarely adopt the innovations in any sustained manner:

*...they remain 'islands of innovation' or 'proof of concept' demonstrations, used in the classrooms of individual enthusiasts; they don't begin to touch the core of school practice in a significant way (Culp et al., 1999, p. 7).*

The second research strand focuses on the intersections of technology design, learning, school culture and practices, and other factors that shape the impact that ICT can have in schools. This line of research is underpinned by the view that the impact of ICT on specific aspects of teaching and learning can only be understood in the context of ICT use in real schools and classrooms (*see* also Lewin et al., 2000; MacFarlane, 2001; Passey et al., 2000). The research asks different questions and follows a different process (represented diagrammatically in Figure 9).

**Figure 9 Research on ICT design to enhance learning, with a partnership focus**




Typically, this kind of research involves teachers and developers playing an active role in interpreting ICT as tools for reforming schools, and in supporting and sometimes guiding the change process. It often leads to long-term collaboration with educators and teachers as partners and co-constructors of the innovations and of the research process, rather than passive recipients.

A consistent finding from the research reviewed by Culp et al. is that a high degree of involvement and input is usually required from teachers in the design, development, and implementation of ICT

innovations in their schools, if these innovations are to significantly affect teaching practice (*see* also Apple, 1995; NFIE, 2000).

## Conclusion

The Notebook Valley project provided a range of benefits for the teachers, students, and schools. These benefits included: increases in teacher and student knowledge and confidence using ICT; changes in school "ICT culture"; the acquisition of useful ICT software and peripheral ICT equipment; the development of school and departmental intranet systems; and the beginning of more ICT-based teaching schemes for some junior science and mathematics classes.

However, the use of laptops in classroom teaching and learning within the Notebook Valley schools was often constrained by contextual circumstances. These included physical and technical barriers to classroom ICT use, for example, limited network connections in their classroom, the time required to log in to the system, and "pepper-potting" of laptops across classes. Non-physical barriers to classroom ICT use were also identified. These included: teachers' unfamiliarity with, or lack of access to, useful science and mathematics software or equipment; and a lack of time for teachers to explore and experiment with different ICT resources or tools, and adapt these for use in their particular teaching programmes. The time demands of covering all the curriculum content required for senior students to complete their NCEA assessments also placed constraints on ICT use in some senior classrooms. These contextual circumstances in turn created limitations on the project's potential to transform science and mathematics teaching and learning experiences and practices for Year 12 and 13 students in the schools during its 2½ years.

Some positive developments for staff and departments in the Notebook Valley schools began to occur when teachers and Digital Opportunities LCT staff collaborated to develop ICT-based science or mathematics teaching units, or to discuss options for acquiring and integrating particular software or ICT peripherals which might be useful for science and mathematics teaching and learning. Teachers and Digital Opportunities LCT staff suggested these developments required a combination of ICT knowledge and expertise, and a working knowledge of the context for secondary science and mathematics teaching. This is consistent with other research which indicates that ICT innovations in schools have the most sustainable impact on teaching and learning when educational ICT developers and teachers collaborate as co-constructors of the innovation.

To promote long-term positive changes in secondary teaching and learning through ICT innovations, it is suggested that an approach be adopted which:

a) takes into account the contextual circumstances surrounding teaching and learning in secondary schools, and identifies how and why ICT can enhance or transform these; and

b) engages teaching staff and people with expertise in the educational use of ICT in co-constructing the parameters of an ICT innovation that meets the needs of teachers and students, *and* stimulates self-sustaining change in teaching and learning practices.

A suggested strategy is to form a working group of ICT innovators, curriculum and pedagogical advisers, and seconded secondary teachers who could spend time developing teaching methodologies, tools, and resources which exploit the learning possibilities of ICT, and trial these in relation to particular teaching objectives or learning needs of students in target school(s).

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# Appendix 1. Equipment and supply for notebook valley in 2001

**Reproduced from Digital Opportunities Milestone report, (Ministry of Education, December 2001)**

| **Schools** | **Renaissance**<br>4 printers<br>4 Smarttools | **TKI**<br>Website<br>Content development | **Compaq**<br>4 LAN servers<br>200 laptops<br>4 datashow projectors | **Microsoft**<br>200 computer operating software packages | **TelstraSaturn**<br>4 high speed connections and free Paradise Internet connections |
|---|---|---|---|---|---|
| Standard package $2000 | 1 printer<br>1 Smarttools | | 1 LAN server<br>50 laptops<br>1 datashow projector | 50 computer operating software packages | |
| Naenae College | | | 1 LAN server<br>70 laptops<br>1 datashow projector | | |
| Parkway College | | | 1 LAN server<br>50 laptops<br>1 datashow projector | | |
| Taita College | | | 1 LAN server<br>40 laptops<br>1 datashow projector | | |
| Wainuiomata College | | | 1 LAN server<br>40 laptops<br>1 datashow projector | | |

# Appendix 2. Notebook valley professional development plans

# Digital Opportunities Project

# Professional Development Plan
# 2000/01 – 2001/02

## *Professional Development Rationale:*

A recent Ministry of Education planning meeting highlighted the following crucial areas of professional development required to promote an eLearning environment.

To be successful we need:

- To give schools opportunity and resources to design their own professional development needs – maybe in conjunction with existing regional networks.
- Have professional learning to focus upon Action Research strategies to evaluate effectiveness of changes in ICT practice.
- To continue to provide long term supported PD for schools within clusters which allows for other initiatives to develop within e.g. action research.
- Give encouragement to new emerging leaders who are mentored and given opportunities to work on change required to bring about constructivist cultures.
- To provide 'PD' opportunities for the community focusing on new teaching methods and innovations which are enhanced by the use of ICT.
- To increase their understanding of what teaching and learning is all about, what current research now tells us, how ICT is part of the creative process of higher order thinking, and let them share and celebrate the achievement of their children.
- Have schools appoint facilitators to encourage a deeper understanding of a learning community using the concepts and tools promoted by Peter Senge, e.g. shared vision, team learning.

# DIGITAL OPPORTUNITIES PROFESSIONAL DEVELOPMENT

| Strand | Aim | Action | Outcomes |
|---|---|---|---|
| 1 | **Raise the functional skill levels in the educational use of IT for all teachers in project schools** [note that some regions have been involved in ICTPD Clusters and their teachers will be further down the road of computer literacy] **to the point where they are confidently able to integrate IT in their classroom teaching.** | Schools will use in house expertise to deliver appropriate training to staff using the weekly release time provided by the MOE. This training will see all teachers familiar with and able to use with confidence the following elementary functions :<br>Use of<br>• Excel/Word/PowerPoint/E-Mail/Internet<br>They will be able to create and save documents in appropriate folders.<br>Maintain class and school records for assessment and reporting. | **By term 1 2002 all staff will have had access to training and be able to demonstrate regular use of computer skills.** |
| 2 | **Curriculum applications of ICT to become regular feature of the school's classroom pedagogy**. | **TKI and MOE to provide expert training through workshops, curriculum development exercises and the support of lead teachers in co-operative development of shared exemplars. Each school has used the MOE provided release time allow a co-ordinator to facilitate these actions.** | **By term 4 2002 all schools will have provided access to ICT for curriculum delivery in a wide variety of classrooms with maths, science, and technology in particular able to demonstrate integrated e-learning strategies.** |
| 3 | **Project and National conferences will be provided to deliver whole group information about exemplary practice and the latest ICT developments.** | **Project principal committees to be involved in the organisation of local conferences with financial support from the Digital Opportunities Budget. National ICT conferences will be supported by MOE Digital Ops staff and funding if appropriate.** | **By Term 3 2002 <u>all teachers</u> in the projects will have attended specific project conferences or represented their schools at national conferences.** |