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).