Learning Technologies Project: Results from the Student Survey 1999-2001

Conducted by

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In partnership with
DECS\textit{tech} Learning Technologies Project
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INTRODUCTION

Learning technologies, or more recently termed, information and communication technologies (ICT), have become a major focus of state and national efforts to improve student educational outcomes. Around Australia, millions of dollars have been channelled towards the integration of technology into school curricula. South Australia is no exception.

The use of learning and information technologies has the potential to enhance learning for all students in our schools. In recognition of this, the South Australian government established the $85.6 million DECStech 2001 Project aimed at ensuring that by the year 2001 technology … is able to be an embedded, integrated part of learning activities, and technological applications will be, at all levels, curriculum driven. (DETE 1999, p.1)

The call for quality research into the effectiveness of learning technologies is a common feature in much of the related literature (Cuttance 2001). Kilvert (1997) highlighted this need in his paper discussing research issues facing Australian schools in the next ten years. The broad question of how schools use technology to amplify, extend and transform the quality of student learning was one such concern. The DECStech 2001 Project held a similar concern, and as one of its main objectives, flagged the need for research into student learning outcomes and the changes “attributable to the use of learning technologies across the full spectrum of learning areas” (DETE 1999, p.22). As the cornerstone of this three-year project, a network of nine schools were given support to embed ICT throughout mainstream curricula and afforded a unique opportunity to measure change.

In response to the need for quality research examining the impact of ICT on student learning outcomes, collaboration between the Flinders University School of Education and the Learning Technologies Project resulted in the development of an online survey designed to measure change in student outcomes at the participating schools. This paper summarises the attitudinal component of the longitudinal study and presents preliminary findings.

A LONGITUDINAL DESIGN

The design of this study was mainly shaped by two areas of need raised in the DECStech Report (DETE 1999). The first was in response to one of the project’s objectives, to measure changes in student learning outcomes attributable to the use of learning technologies, and the second was in recognition of the need for longitudinal research, as highlighted in the report, under directions for research:

… what is now required is a longitudinal study to establish structures and processes through which clear and useful advice and support relating to curriculum applications of information and learning technologies can be provided to department schools. (DETE 1999, p.15)

The major school based impetus for the DECStech Learning Technologies Project involved six Adelaide metropolitan public schools (four Primary and two Secondary schools), known as Discovery Schools, and three South Australian country schools (two Primary schools and a R-12 Area school), called the Global Discovery Schools. The Project spanned a three-year period between 1999 and 2001, during which time, the Discovery and Global Discovery schools were intensively involved in a process
of development and change. The first year was an establishment year where the Discovery and Global Discovery schools identified their needs, planned and initiated strategies to continue building curriculum more widely enriched by ICT. Over the following two years, students and teachers continued to experience changes in the learning environment as ICT were increasingly embedded throughout the curriculum, with the objective of increasing students’ learning outcomes. Clearly, the DECS tech Project offered a unique opportunity to measure change and a longitudinal study was considered as the most appropriate method.

### Student Learning Outcomes

Improving student learning outcomes clearly goes beyond merely increasing academic achievement. In Australia, many reports (DETE 1999; Moran, Thompson, and Arthur 1999; EducationVictoria 1998) foresee opportunities for learning technologies to:

- increase and change the ways students interact and collaborate with each other and their teachers;
- support students’ growth in independence along with an increase in the range, depth, complexity and originality of the thinking and products;
- allow students to take greater responsibility for their learning in classrooms that are more student centred and student controlled;
- allow students to participate in a more varied range of learning activities matched to their individual needs, interests and capabilities; and
- support students in acquiring knowledge, skills and attitudes which will be essential for a successful and fulfilling life in a digital community.

A US study, based on 176 research reviews and reports (IESD 1999), provides compelling evidence that technology, combined with good teaching practice, can:

- have a significant, positive effect on student achievement in all major curriculum areas;
- have positive effects on student attitude towards learning and self-concept; and
- encourage equality for students of different socio-economic background when used in the classroom, reducing the divide between the ‘haves’ and the ‘have nots’.

The integration of technology into a classroom changes the learning environment – what is being learned, why and how it is learned, the role of the teacher, social interaction, and more. It also changes how people think about technology, and how they think about themselves, learning and the school environment. Much of the research into the effects of ICT recognises that student learning outcomes encompass the growth of the person and not just their performance. One method commonly used in longitudinal research to measure personal development is through the use of attitudinal questionnaires and it is the main tool adopted in this study.
The Attitudinal Surveys

Three well-known attitude scales were chosen that specifically address students’ attitudes towards school (Keeves 1974), self-esteem (Coopersmith 1986), and the use of computers in learning (Jones and Clarke 1994). These scales require students to respond to statements using a three or five-point Likert scale. The Likert Scale is used because it is easy to administer and is generally considered to be the most useful type of attitude scale for use in a group-testing situation. Additional questions, compiled and constructed by the author, measure students’ computer skill, expertise and access. The resulting survey, comprising a total of some 155 items, including responses indicating gender, age and the language most commonly spoken at home, was conducted online on three occasions during the term of the Project. Reports describing the instruments and detailing results of the first two student surveys are available (Dix 2000, 2001).

THE DISCOVERY AND GLOBAL DISCOVERY SCHOOLS

The nine schools, originally chosen from among many entrants for the DECS tech Project, were selected on merit. The schools involved represent both Primary/Secondary and country/metropolitan settings and, to optimise findings, should be analysed in context at the school and even classroom level (Archer 1999; Rowe 1996). However, such an in depth analysis is beyond the scope of this paper and can not afford more than a brief demographic of each learning environment, based on the 2001 context statements and discussions with each school.

As part of their commitment to the Project, the Discovery and Global Discovery schools were involved in a range of research projects under-pinned by three broad questions:

1. In what ways are learning technologies making a difference?
2. Which teaching strategies facilitate the embedding of learning technologies in the curriculum?
3. Which system/school structures support this?

The Student Online Survey was one such research project.

The Discovery Schools

All six Discovery schools are located in the metropolitan area. They are supported to reflect on, research and further develop the exemplary ways in which they embed ICT in their school curriculum. They are also supported to influence other schools by conducting three-day Discovery courses and develop teacher resources aimed at improving teachers’ practices embedding technology in their curriculum in ways that extend student learning outcomes. Each Discovery school received funding to operate the Discovery courses. At the time of the project, the computer to student ratio in these schools ranged from 3:1 to 7:1.

The Discovery Primary Schools

The first of the four Discovery Primary schools is located in the western suburbs. This large school of approximately 650 students comprises separate Junior Primary
(R-3) and Primary (4-7) schools managed by two Heads and under one principal. The school development priorities of ICT and Literacy support their long-term objectives to develop cultures of effective communication, of local and global inquiry and of critical thinking and creativity. The school has been recognised in the educational community for its participation and success in educational reform with a strong tradition of using ICT, and include being selected as an Apple Distinguished School and a Technology Focus School (1995-1998).

Further south, the second school has approximately 420 students from reception to Year 7. Although ICT are a priority, full network and internet access was only recently made available in 2000, assisted by their selection as a Discovery School. The school has a computing suite of 17 multi-media stand-alone IBM computers along with one in each classroom. A number of Apple Laptops are available for staff and students to book.

The third Primary school is located in the northern suburbs and caters for a diverse range of students from reception to Year 7. The school provides for approximately 400 students with a strong focus on developing an information literate community. Through learning teams, constructivist approaches to learning and curriculum integration of ICT are supported.

The last metropolitan Primary school, also located in the northern suburbs, consists of approximately 290 students and has been involved in the disadvantaged Schools Program. Their main priority, to increase student directed curriculum, is supported by their focus and development in ICT.

The Discovery Secondary Schools

The first of the two Secondary schools, located in the western suburbs, provides for a diverse range of approximately 700 students from Year 8 to 13, as well as Adult Re-entry. The school has a significant number of Aboriginal students and as a Focus school, has been recognised as a leader in catering for students with Disabilities. Their strategic partnership with Microsoft allows the school to deliver the Microsoft Certified Professional course and the 3COM Networking Certificate.

The second High school is much larger with approximately 1200 students from Year 8 to Year 13 and lies south of Adelaide. The school caters for a diverse student population and continues to maintain a strong academic tradition. With one of the highest student to computer ratios of approximately 3:1, the school is focused on embedding ICT throughout the curriculum in ways that enhance students’ learning and support their development of lifelong learning skills.

The Global Discovery Schools

The three Global Discovery Schools are as diverse as their metropolitan counterparts as they are in location and play an integral role in their communities. They are funded to explore and share, with other country schools, creative uses of online technologies to bridge barriers to learning caused by isolation and distance and to build on the strong sense of community in country areas. The computer to student ratio in these schools is about 4:1.

One Primary school of approximately 60-70 students ranging from reception to Year 7 is located in the South East of the state. The main priorities include the expectation
that ICT are used in all classes and to implement strategies to support positive student attitudes, especially in boys. Furthermore, they see the use of ICT as essential in reducing the isolation and disadvantage inherent in living in an isolated environment.

The other Primary school, on the Yorke Peninsula, caters for approximately 80 students organised into three class groupings (R-2, 3-4 and 5-7) along with a preschool. A main priority is to promote a community of lifelong learning with a focus on the integration of ICT throughout the general curriculum and learning programs.

The third Global Discovery School is an Area School located in the far north of South Australia and provides for approximately 450 students from reception through to Year 13, many of whom are from multi-cultural or Aboriginal backgrounds. As a LOTE Focus school, a major priority is to use ICT to improve language teaching.

### The Study Sample

The Discovery Schools and Global Discovery Schools were encouraged to allow all middle school students, Years 5 to 7 in the Primary sector, and Years 8 to 10 in the Secondary level, to participate in the online survey conducted during the third term of each of the three years. Ultimately, however, the resulting number of students responding to the three scales depended on the schools' success in administering the online survey.

A total of 1749 Primary and 2463 Secondary students from the Discovery and Global Discovery Schools responded to the surveys, a response rate of approximately 75 per cent. However, for a strictly longitudinal analysis, only those students involved over all three years of the project will be tracked, as highlighted in Table 1, and constitutes a database of some 1316 students upon which the proceeding analysis was conducted. Table 1 summarises the number of students and average age at the time of data collection by year level and gender and demonstrates that the demographics of the students are representative of the broader educational sector.

**Table 1. The Primary and Secondary school cohorts of the Discovery and Global Discovery school sample**

<table>
<thead>
<tr>
<th></th>
<th>Global Discovery Schools</th>
<th>Discovery Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Primary School</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 5 (1999)</td>
<td>139</td>
<td>11</td>
</tr>
<tr>
<td>Mean Age (SD)</td>
<td>11.21 (0.52)</td>
<td>11.15 (0.25)</td>
</tr>
<tr>
<td>Year 6 (2000)</td>
<td>191</td>
<td>6</td>
</tr>
<tr>
<td>Mean Age (SD)</td>
<td>11.98 (0.53)</td>
<td>12.16 (0.66)</td>
</tr>
<tr>
<td>Year 7 (2001)</td>
<td>199</td>
<td>16</td>
</tr>
<tr>
<td>Mean Age (SD)</td>
<td>12.77 (0.50)</td>
<td>12.50 (0.70)</td>
</tr>
<tr>
<td>Secondary School</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 8 (1999)</td>
<td>283</td>
<td>0</td>
</tr>
<tr>
<td>Mean Age (SD)</td>
<td>13.81 (0.42)</td>
<td>13.73 (0.36)</td>
</tr>
<tr>
<td>Year 9 (2000)</td>
<td>240</td>
<td>1</td>
</tr>
<tr>
<td>Mean Age (SD)</td>
<td>15.59</td>
<td>15.75</td>
</tr>
<tr>
<td>Year 10 (2001)</td>
<td>264</td>
<td>9</td>
</tr>
<tr>
<td>Mean Age (SD)</td>
<td>16.33 (0.63)</td>
<td>16.49 (0.35)</td>
</tr>
</tbody>
</table>

Table 1 also shows that during the first year of the survey no complete responses were received from Year 8 students in the Global Discovery schools. Since only one school, the Area school, provided for Secondary schooling, the potential number of
respondents is low, as reflected in the proceeding years. However, internet access difficulties experienced in the first year compounded the problem and resulted in responses from only a handful of students, none of which were sufficiently complete to be usable. Therefore, the data received from these participants have been excluded in this analysis.

**Missing Data and Statistical Comparison**

The occurrence of missing data can arise through several different causes. Students can inadvertently miss an item, or choose not to answer on personal grounds. Some students omitted a whole section if they did not complete the survey in the allotted time or were absent. A final difficulty in obtaining complete data resulted from computer network conflicts, in which case the school server crashed with the result that any students in the midst of a section were unable to send their responses. Encouragingly, this cause of data loss, although a concern during the 1999 survey, appeared to be non-existent in the subsequent 2000 and 2001 surveys, an observation that is supported by the nine per cent increase in data obtained each year. In the case where the majority of items were completed within any one of the three sections, those items missed were assigned the mean gender and year level value for that item, yielding a complete section.

Due to the small student populations in the three Global Discovery schools, total Primary school numbers were amalgamated and treated as a single entity during statistical analysis. In the case of the Secondary school responses, there was only one school and data was only available in the second and third year. Response rates from the metropolitan schools were sufficiently high to retained their own identifications.

To generate all statistical calculations, a spreadsheet and two statistical packages were employed; Microsoft Excel, SPSS and WestVar. Descriptive statistics (means and standard deviations) are used to describe the central tendency and dispersion on all measures. To test for differences between groups, probability testing was selected as the appropriate statistical method, since just two groups were compared in each case. Significance testing was performed using WestVar to allow for the effects caused by the clustering of students at the school level. The 0.05 level of significance was chosen for the rejection of the null hypothesis of no difference between groups.

Given the longitudinal nature of the study, information was collected from boys and girls on three separate occasions, in 1999, 2000 and 2001, and across six Year levels or grades. Such an array of data affords a multitude of statistical comparisons that can possibly be somewhat confusing. Figure 1 attempts to provide clarity. The main format in which students’ attitudes are presented throughout this report uses the bar graph and represents the mean response for each occasion clustered by gender. Any changes in mean attitude over the period can be viewed at a glance. If the changes are sufficiently different, beyond the normal level of random variation (set at the probability of 0.05), these are considered to be statistically significant and potentially attributable to any major influence in the environment.

The main method used in this report compares students in the same group over the three occasions. So the same group of students are tracked as they move from Year 5 in 1999 to Year 6 in 2000, and so on. The Secondary school students are similarly tracked as the move from Year 8 through to Year 10 over the three years. The diversity of the data also allows students from the same grade and same occasion to
be compared, in addition to comparison between country and metropolitan schooling, however, this will be the subject of a future report.

To further aid interpretation, the lowermost and uppermost values of the graph represent the 25th and 75th percentiles, respectively. Responses above the 50th percentile, indicated by the black, rather than dashed grid lines, are increasingly positive, while those falling below, are increasingly negative. Percentiles are calculated for each variable from the entire data set of that variable.

**Figure 1. Comparison over three years**

### CHANGES IN ATTITUDE

The nature and degree of change in the Discovery and Global Discovery schools will vary in extent from school to school, and although the use of ICT is a major priority within each school, it may not be the only program that effects the learning environment or influences attitudes. Within this caveat, any changes in student attitude could be attributable to the increased use of technologies in the learning environment.

**Attitudes towards school**

Students responded to items that focused on two main areas of school attitude. Attitudes towards school and school learning ranged from, a strong dislike for school and a strong desire to leave school as soon as possible, to enjoyment of school and a desire to obtain as much schooling as possible, while academic motivation was measured by questions ranging from, a lack of effort and involvement in school learning, to a desire to succeed in school learning and achieve academically.

Figure 2 shows a decline in students' attitudes towards school as they get older. The differences in attitude between the Primary and Secondary cohorts is most strikingly defined by the 50th percentile score of 78. Primary school students generally hold positive views about school and are well motivated to learn, while students in Secondary school fall below the 50th percentile and show a generally negative attitude towards school. It appears that such a trend may be more a function of age rather than related to the increased use of ICT. Encouragingly, the trend appears to reverses in Year 10, with students holding a more positive view towards schooling, and, interestingly, is the only statistically significant change at the 0.05 level. Whether this significant positive shift can be attributed to the adoption of ICT is a matter of speculation.
Of additional interest in Figure 2 are the differences in gender. In all but Year 9, the girls maintain a higher regard to school and are more academically motivated to learn. However, in both the Primary and Secondary cohorts, these differences appear to converge with age and may be supported by the increased use of ICT.

### Self-esteem

Self-esteem is viewed as a many-faceted personality characteristic which may vary according to differences in age, gender, life experiences and aptitude and can be described as, “a personal judgement of worthiness that is expressed in the attitudes the individual holds towards him or her self” (Coopersmith 1967, p.5). Four areas of self-attitude were examined and include general interests, peer, parents and school. General personal attitudes and interests included questions ranging from not being easily bothered and having a high opinion of themselves to often wishing they were someone else and taking a long time to get use to anything new. Attitudes towards peers involved a selection of statements ranging from, being popular with kids their own age and having ideas that other kids usually follow, to not liking to be with other people and often being picked on by other kids. Attitudes towards parents and the home environment looked at questions like, being considered and understood by their parents to, wanting to leave home and being pushed too hard. Lastly, academic self-esteem posed questions ranging from, being proud of their school work and wanting to do better in school to, finding it hard to talk in front of the class and believing that the teacher did not make them feel good enough. Combined, these areas form an overall measure of self-esteem and provide important insight into the influences on students of embedding ICT into the curriculum.

The use of ICT in learning appears to be beneficial to students' self-esteem across both cohorts and may reflect the effectiveness of the communication aspects of learning technologies (see Figure 3). From the first year of the project, overall increases at each grade in the Primary setting and the Secondary setting are experienced and result in positive shifts that are significant at the 0.05 level over the time span. The 50th percentile of 114 suggests, however, that on average, self-esteem is generally low, particularly so for girls.
Any direct influence between students’ increased use of ICT and their attitudes towards themselves and towards learning is not obvious, but nonetheless, well documented and supported by research. Although these attitudes may reflect the influences of ICT indirectly, they are an important consideration in the overall learning outcomes of a student. Equally as important and possibly more direct, is the relationship between the use of ICT in learning and students’ attitudes towards them. To measure changes in students’ attitudes towards the use of computers in learning, students responded to a series of statements formulated within the framework of a tripartite model of attitudes, which identifies affect, behaviour and cognition as three distinct but interrelated attitudinal components (Jones and Clarke 1994).

The affective component contains the encoding of feelings associated with computers and requires students to respond to a selection of negatively worded items including, feeling highly intimidated by computers and helpless when asked to perform new tasks on a computer. The behavioural component includes behavioural intentions, verbal statements and overt behaviours in response to using computers. Students responded to positively worded items like, wanting to learn more about computers and wanting to use computers more often. The cognitive component refers to beliefs, knowledge structures and thoughts held, regarding computers, and include statements such as, believing computers to be a waste of time and creatively inhibiting, or finding them difficult to understand and isolating. Combined, these components form a comprehensive measure of student attitudes towards the use of computers in learning.

In an environment where students are increasingly confronted about their feelings and beliefs towards computers, the positive shift, overall, in attitudes (presented in Figure 4) is encouraging. However, the only significant shift in computer attitude occurs over Year 8 and 9, and, arguable, may be attributable to the increased use of ICT in learning.

The difference in computer attitude between boys and girls has been a topic of much concern in research, particularly for girls. The findings presented in Figure 4 are common to many previous studies and show that girls attitudes towards computers is generally much lower than that of boys. Male students, in particular show increasingly positive beliefs towards technology by falling above the 50th percentile.
score of 149; a trend which is maintained in both the Primary and Secondary cohorts. Secondary school girls present quite different behaviour compared to that of their younger peers by holding significantly lower attitudes towards computers, but do, however, follow the increasing trend.

![Chart showing attitudes towards computers in learning](image)

Figure 4. Students’ attitudes toward computers in learning

Changing attitudes and ICT

Although not necessarily obvious, the positive influence of students’ increased use of ICT and their attitudes towards themselves and towards learning and the use of ICT is supported by the research here and elsewhere. Although these attitudes may reflect the influences of ICT indirectly, they are an important consideration in the overall learning outcomes of a student.

With so many attitudes, what does it all mean? At this early stage of the analysis, definitive answers to the driving inquiry of how learning technologies influence and support students’ learning outcomes, are not yet available. However, the preliminary findings summarised here support previous findings and provide an encouraging longitudinal perspective of students’ attitudinal development.

- The decline in students' attitudes towards school as they get older may be more a function of age rather than related to the increased use of ICT.
- Primary school students generally hold positive views about school and are well motivated to learn, while students in Secondary school show a generally more negative attitude towards schooling.
- Girls generally maintain a higher regard to school and are more academically motivated to learn than boys. The gender differences appear to converge with age and may be supported by the increased use of ICT.
- Learning with ICT appears to be beneficial to students' self-esteem and may reflect the effectiveness of the communication aspects of learning technologies.
- Boys generally have higher self-regard than girls; a difference that may be reduced by the use of ICTs.
- The increased use of ICT in learning generally supports students’ attitudes towards computers and may be a direct reflection of the effectiveness of learning technologies.
Gender differences in computer attitude are similar to the findings of previous research and show that girls' attitudes towards computers are generally much lower than that of boys, particularly in the older cohort, but may be lessened by the increased use of ICTs.

LEVELS OF COMPUTER ACCESS

Changes in school attitudes, self-esteem and computer attitudes of these students, over the three-year period, may be better understood by placing these findings in the context of changing levels of computer access, both at school and in the home. In tracking these two groups of students, Figure 5 shows a clear increase in students' potential access to a desktop computer at home, with a combined mean ownership in the final year of 86 per cent in the younger cohort and 94 per cent ownership in the older cohort. The growing popularity of the PC over the Macintosh is evident and the level of average ownership indicates that many students own both a computer and a game station like Gameboy or Playstation.

Figure 5. Increasing home computer ownership over the three-year period

Although students' potential levels of computer access have clearly increased outside of school, it may not necessarily follow that students have gained greater access with in school, even though many schools chose to allocate their resources to address this need. To gauge students' beliefs about their access to computers in school, students were asked to select the most common situation in which they used computers in school; be it working alone or as a whole class, among others. However, whether students work individually, in pairs, or less commonly, in groups, may not be an indication of the number of computers available to students. It may be that some students prefer to work in pairs, or that the learning activity may require group work. Without this information available, the results were crudely interpreted as a decrease in grouping size inferred an increase in computer access. An additional and possibly more indicative measure directly asked students if they believed they had sufficient access to computers in school. These indicators, combined with students access to computers at home, are presented in Figure 6 as an overall measure of students' level of computer access. Increase in computer access in the Primary cohort is statistically significant at the 0.05 level, as is the apparent decline in access between Year 8 and 9. This drop may be a result, not of a decline in the actual numbers of computers in
the school, but in response to the increased demand on a limited resource. Indeed, one of the Secondary schools involved in the project, boasts the highest student to computer ratio in the public sector and averages one computer to three students.

![Figure 6. Levels of computer access](image)

**CHANGES IN ICT USE AND EXPERTISE**

**Computer use outside of school**

With an increase in the amount and diversity of ICT within school, it was of interest to gauge to what extent, if any, students' usage of ICT outside of school varied over the three-year period. From a list of eight items, ranging from surfing the internet and using educational programs to entering chat rooms and playing music, students responded as to how they used the computer outside of school. Figure 7 and Figure 8, respectively, present Primary and Secondary school students' mean responses to each item over the three years, accompanied by an equivalent gender comparison.

![Figure 7. Primary school students' use of the computer outside of school](image)

Web-based communications, the internet, e-mail, and chat-rooms, show the largest increases in usage outside of school in both the Primary and Secondary cohort and are among the most used facilities. In the final year of the project well over 80 per
cent of students regularly use the internet. While the internet appears to be more the domain of boys, e-mail and chat-rooms are favoured by the girls, particularly in the older cohort. The use of the computer to play and create music also reveals large shifts in both groups, while graphics and animation packages show a decline. Of the least used programs, educational software, reveals a declining usage from about 30 per cent in the Primary setting down to around 14 per cent in the Secondary setting and may be in response to increased internet usage. Webpage packages have also made little impact over the three-year period. Interestingly, with around 50 per cent of Primary students and 60 per cent of Secondary students, the use of the computer for word processing has remained relatively stable.

![Figure 8. Secondary school students' use of the computer outside of school](image)

**Other forms of ICT use outside of school**

Learning technologies are generally thought of as computers, software and communications equipment used as tools to enhance student learning, so although the computer is the most commonly associated, the diversity of ICT extends well beyond. To further understand the extent of students' technology literacy outside of the classroom and beyond that of the computer, an additional eight items were presented, ranging from the TV and mobile phone to video cameras and fax machines. The use of a digital camera was not included in the first year of the project so data is not available. Students were asked what other forms of technology they had used outside of school during that week.

The results for the Primary and Secondary school cohorts are presented in Figures 9 and 10, respectively, along with gender differences. As can be expected, TV, radio, CDs and video players are widely used by the majority of both boys and girls. The change in their use over the life-span of the project has remained relatively stable, with a minimal decrease in the popularity of the videos. The largest shift in usage is observed in the adoption of the mobile phone and is particularly popular with the older girls. In the final year of the project, nearly 70 per cent of Primary school students and nearly 80 per cent of Secondary school students used a mobile phone during that week.
Although the increased use of mobiles can not be attributed to the increased use of learning technologies in school, increases in the use of digital and video cameras and scanners, to over 20 per cent of the cohort, may be related. The use of these technologies finds greater popularity with male students. The least used form of technology, the fax machine, still has about 18 per cent of the students regularly accessing it.

![Graph showing primary school students' use of other forms of ICT outside of school](image9)

**Figure 9. Primary school students' use of other forms of ICT outside of school**

![Graph showing secondary school students' use of other forms of ICT outside of school](image10)

**Figure 10. Secondary school students' use of other forms of ICT outside of school**

**Acquisition of ICT knowledge and skills**

Inquiry into students' acquisition of computer knowledge and skills provides an interesting insight into the extent and origin of that knowledge. The list of basic computer skills, which is by no means exhaustive, includes items like, using and searching the World Wide Web, sending e-mails, creating home-pages and presentations, using music and graphics packages and anti-virus software, among others. Students responded to each of the 12 items by selecting where, if indeed they
had, first learned the skill; either at home, school, or another location, such as a friend's house.

Figure 11 presents a snapshot of students' skills in the final year of the project. Well over 90 per cent of students indicated that they knew how to surf and search the World Wide Web, use a word processor, send e-mails and use drawing packages. All but the last two of these were predominantly learned at school and all are similarly attained by girls and boys. The importance of the schools' role is further evidenced in students' acquisition of spreadsheets, designing home-pages and creating presentations through the use of packages like PowerPoint. The majority of the 70 to 80 per cent of students that could do these things, first learned to do them at school. In these skills, however, a gender difference is more apparent and favours boys.

Knowledge about playing and installing games predominantly originates from the home environment, as do creating and playing music and using anti-virus software.

![Figure 11. A snapshot of students' computer skills and gender differences in 2001](image)

In general, nearly 60 per cent of the students possess the complete spectrum of computer skills and knowledge, but are much more likely to be male. How these have developed over time, however, can not be illustrated in a snapshot view. Figure 12 provides the three-year comparison of students' acquisition of the range of computer skills with the omission of game skills and using anti-virus software, since it is not generally considered a primary learning objective.

Clearly, school plays an integral role in the development of students' ICT skills and knowledge. The mean growth in students' computer skills and knowledge, from 80 per cent in 1999 to 88 per cent in 2001, is predominantly gained through the school environment, although this occurs to be reasonably constant over the period of the project.
Of increasing dominance is the growth in technology use and access in the home environment. Over the period, acquisition of computer skills remains relatively stable in school at around 44 per cent, while home acquisition shows an overall increase of 11 per cent, possibly in relation to an overall decline of 3 per cent in the other category.

Also shown more clearly in Figure 12, is the gender difference in levels of computer knowledge. A greater majority of male students, 9 per cent on average, maintain more skills and knowledge compared to their female counterpart.

Figure 12. A three-year comparison of the Primary and Secondary school students' acquisition of computer skills (excluding installing and playing games and using anti-virus software)

Although boys appear to be more likely than girls to have higher levels of computer knowledge and skills, a strong relationship also exists with age as shown in Figure 13. Generally, the older the student, the greater the level of knowledge. It is interesting to note that the Primary school students at Year 7 (in 2001) held equivalent, if not more knowledge than the Secondary school students at Year 8 (in 1999).

Figure 13. Year level differences in the acquisition of computer skills

Computer expertise

In order to derive students’ beliefs about their computer and keyboarding skills, in general, students were asked to self-rate themselves either as Excellent, Good or Not Good. Figures 14 and 15 present the longitudinal data. Across the Primary and Secondary cohorts, boys show growing beliefs, over the period, about their proficiency in using the computer and keyboard. Furthermore, the Secondary boys’ beliefs are significant at the 0.05 level, and potential, can be attributed to the increased exposure to ICT. Clearly, the girls hold much lower views about their
computer and keyboarding skills, compared to their male counterparts, significantly so in all but the Year 5 groups. The apparent decline in beliefs in the Primary girls, over the period, although a concern, are not significant. It is interesting that the same group of girls would believe their computer and keyboarding skill to be declining when other indicators, such as their acquisition of computer skills (see Figure 12) suggests a steady growth over the period. It may be reflective of the belief that the more they learn, the more they realise there is to learn, and as a result, rate themselves hard each year. The older cohort of girls appears not to face the same dilemma, showing significant increases, over the period, in their beliefs about using a computer and keyboarding, and arguably, may be an indicator of the effectiveness of the Learning Technologies Project.

Of additional interest is the difference between students’ beliefs about their computer and keyboarding skills (see Figures 14 and 15). Students generally believe that they have good computing skills but only adequate keyboard skills, and of these beliefs, Primary students are more positive.

**Computer enjoyment**

Through the intense exposure to learning technologies over the three-year period, it was of some concern that students may in fact feel saturated by ICT as it increasingly pervaded every aspect of their school curriculum. Certainly, such sentiments were echoed by several of the Discovery and Global Discovery school teachers. Accordingly, students were simply ask how much they liked using the computer and were able to respond with either, I love it, I like it or I don’t like it. Figure 16 summarises the results by presenting the mean responses of the boys and girls for each Year level.
Similar to the computer expertise in Figures 14 and 15, students’ enjoyment of computers (see Figure 16) shows a significant gender difference in all but the Year 5 group, in favour of boys. Boys also show a small but positive shift in the Primary and Secondary cohorts between the first and last occasions, none of which, however, are significant at the 0.05 level. The Primary school girls show quite a different trend as they increasingly dislike using the computer. Whether their declining beliefs about their computing expertise is a source of frustration and a reflection of their computer enjoyment, or whether they feel saturated by technology, the decline in computer enjoyment is not significant. What is of significance, more encouragingly, is the increase in liking computers in the Secondary school girls between Year 9 and Year 10, and like their male counterparts, show an overall increase from the first occasion.

With the majority of students liking the computer, particularly in the Primary sector, and all but the Primary school girls showing an increase in computer enjoyment over the period, significantly so for the Secondary school girls, it suggests that, arguably, the increased use of learning technologies has had a positive impact on students’ feelings towards using a computer.

**CONCLUSION**

At this early stage of the analysis, definitive answers to the driving inquiry of how learning technologies influence and support students’ are not yet available. Clearly, the preliminary findings presented in this paper should at best, be treated as conjecture, but do present an encouraging longitudinal perspective of students’ attitudinal and skill-based development. The overall view of technology as an educational tool is highly optimistic and reflects much of the findings from similar research. Embedding ICT throughout the curriculum provides students with the opportunity to gain necessary life skills, essential in an increasingly ICT driven world. In general, Learning Technologies have found to have positive effects on students’ attitudes towards learning and on student self-concept. Students feel more successful in school, are more motivated to learn and have increased self-esteem when ICT are employed as an integral tool in their learning environment. Furthermore,
REFERENCES


