Researching Pedagogy and Teaching Methodologies that Transform Student Learning in South Australian Classrooms

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Abstract

Education research should both inform and be informed by classroom practice. In a time of renewed commitment to education and computing, critical questions arise about the role of learning technologies in learning outcomes. This paper presents a systematic research program to investigate learning outcomes in the context of the Learning Technologies Project (1999–2001) of the   South Australian Department for Education, Training and Employment. The department has commissioned six formal research projects (2000–2001) into the purposeful inclusion of technologies to transform student learning. The projects collectively research constructivist teaching methodologies to embed learning technologies in the curriculum, pedagogy and learning outcomes, professional development models, whole school change in technology rich environments, and the role of technology in the early years of education. This paper outlines the context and nature of the research program and presents findings to date.

 The acquisition of computer technologies is proceeding rapidly in Australian schools and internationally. Considerable commitments are being made to establish school computer networks, provide Internet resources, and to accelerate the adoption of learning technologies in the classroom. The size and scope of the commitment causes us to ask some important questions. Are learning technologies making a difference? If so, in what ways? Is learning being amplified, extended and transformed? How can a state or district maximise the impact of its highly prized low pupil to computer ratio? Does a technology rich classroom mean that students are being equipped to take their place in an information economy? An opportunity to systematically explore these complex questions is presented by the Learning Technologies Project detailed below·.

The Learning Technologies Project

The South Australian Department for Education, Training and Employment serves 675 public schools with 175,000 students. In the last five years it has invested $85.6 million in establishing a technology infrastructure for schools. At present a major effort is under way to optimise the value of this investment for teaching and learning. The Learning Technologies Project (DETE

1999) was conceived as a curriculum intervention to amplify, extend and transform student learning outcomes through the uptake and purposeful use of technologies in the classroom. The project is funded for $7.3 million over the years 1999–2001.

The formal objectives of the Learning Technologies Project are to:

- discover how to transform learning
- develop and showcase best practice models with respect to pedagogy, teacher methods and school change
- develop principals' expertise as users, curriculum leaders and managers of technologies in their schools
- ensure departmental enabling policies and practices are in place.

Formal research is an integral part of the learning technologies project, and investigates the effectiveness of innovations and the complex dynamics of quality teaching and learning.

The school-based impetus for the project is delivered primarily through

- six focus schools, called *Discovery Schools*
- three rural schools, called *Global Discovery Schools.*

Four primary and two secondary Discovery Schools were selected in early 1999, on the basis that they were already engaged in curriculum driven practices with learning technologies. They are supported to reflect on, research, and further develop the ways in which they embed learning technologies in their school curriculum. Discovery schools influence other schools by conducting on site teacher professional development courses. This dissemination is underpinned by a practice in the Discovery schools that all innovations need to be replicable and sustainable by schools generally in the sector. While the six schools vary in size, ethos, socio economic location, technology infrastructure and the years of experience staff have both in teaching and with Information and Communications Technology (ICT), they are all metropolitan schools. Each Discovery school has a full time Project Manager to coordinate the delivery of the three-day courses. A feature of all Discovery schools is their commitment to developing students as autonomous learners, as teachers and as constructivist

learning managers. Implemented side by side with a state-wide Learning to Learn program, Discovery schools benefited from Learning to Learn seminars by world class speakers who address new and often competing understandings about the way students learn. Discovery schools have subsequently re-focussed their school values to include student metacognitive reflection, inquiry learning, student negotiated curriculum, active knowledge construction and knowledge transfer, and are striving to demonstrate this pedagogy through the purposeful use of ICT in the curriculum.

Global Discovery Schools explore and share with other rural schools creative use of online technologies to bridge barriers to learning caused by isolation and distance and to build on the strong sense of community in rural areas. There are two primary and one Reception-12 school. School size, culture and degree of isolation vary as much as staff experience of teaching with ICT. One is a three teacher school, another is close to 1000 Kilometres from the nearest large city. The schools were allocated high priority for the rollout of technology infrastructure. Although at the core of the schools' exploration of online technologies is their understanding and valuing of the integration of ICT through student centred learning, not all schools have moved as rapidly as their metropolitan counterparts in this direction.

The Research Program

As the report of the Australian Government's Department of Education Training and Youth Affairs, *Gateways—Information Technology in the Learning Process* (1996) suggests 'information technology can only contribute substantially to the improvement of schooling if it is appropriately embedded in powerful and interactive learning environments (established within) the broader context of (supportive) pedagogy, curriculum and school organisation.' In line with this statement research conducted in the Discovery schools can be grouped in three areas.

Student Learning

Are learning technologies making a difference? If so, in what ways? Which learning outcomes, measurable by the mandated curriculum, are improved by the implementation of learning technologies? Are there new learning outcomes?

Teacher Methodology

Which teaching strategies facilitate effective use of learning technologies in the classroom?

What are the methodologies or approaches that effectively integrate and embed learning technologies into the curriculum?

School Structures

Which system/school structures support the effective implementation of learning technologies?

Does the configuration, location and networking of computers within a school make a difference to student learning outcomes?

What successful models do schools have that promote equity of access, time and use of learning technology resources across the curriculum?

These research questions are addressed through six research projects. The term 'learning technologies' is used hereafter because it is embedded in the names of the projects. It refers to those newer digital Information and Communication Technologies which are commonly used for learning—for example, computers of all types and their peripheral devices, the Internet and Wireless Application Protocol.

Project 1: Teacher Attitudes and Uses of Learning Technologies

This project will carry out a longitudinal study of teacher attitudes, learning technology use, teacher skills and teacher beliefs about the efficacy of learning technologies. It will do this by means of an online survey (Barnes 2000). It will provide a picture of the development of these attitudes over time through the use of yearly surveys (1999–2001) covering all teachers in the schools. The teacher data inform and support other research projects.

Project 2: Student Attitudes

This involves a longitudinal study of student attitudes from Year/Grade 5–10 students. Three survey tools developed by Katherine Dix, Flinders University School of Education, ask students about their attitudes to:

- self, (adapted from the Self-Esteem Inventory (SEI) designed by Coopersmith (1986))
- school (in part adapted from a computer attitude scale by Jones and Clarke (1994))
- learning technologies (adapted from a computer attitude scale by Jones and Clarke (1994)).

Project 3: Examination and Documentation of Learning Technology Exemplars

This project examines and documents exemplary innovations in teaching and learning with learning technologies in the schools. In relation to these exemplars the project is investigating the extent of and mechanisms for embedding learning technologies in the curriculum, teacher and student perceptions of associated learning events and the capacity of young children in Grades R-3 for using the web. Specifically the project sets out to:

- identify examples of best practice of teachers, and collect associated lesson and other work plans
- determine, from the teacher's perspective, the most effective methods of embedding learning technologies in teaching
- investigate student learning outcomes and their relationship to evolving assessment practices
- in the context of greater student control of learning, examine students use of learning technologies and their perceptions of its influence on learning events and outcomes, and compare these to teachers' perceptions

- investigate evolving techniques in the management of teaching/learning events involving learning technologies
- in the context of usage of the Web, examine young students capacity for play and discovery, Web navigation, information management, effective searching, and evaluation of materials.

Project 4: The Relationship between the Elements of a Quality School and Learning Technology Use—LeFevre High School

This is a whole of school' case study being conducted at a large metropolitan high school over the period 2000–2001. Quality schools are identified with such elements such as leadership, high expectations of students and staff, a supportive school culture, challenging and relevant curriculum, quality professional development programs, partnerships between the school and its community, and decision making processes. The research explores the hypothesis that learning technologies can provide powerful support to curriculum delivery when these quality school elements are present. The research will also explore the impact that learning technologies have on:

- curriculum design, delivery and assessment.
- student attendance, participation, retention, achievement, and Students with Negotiated Curriculum Plans and student pathways
- indigenous students.

Project 5: Investigation into Methodologies for Improving Student ICT Literacy—Unley High School

This case study is predicated by a Unley High School vision of 'the development of autonomous learners' as the primary aim of schooling and a belief in the school that information literacy skills are an essential tool for independent learning. The school already has a 'Technology Access Program' that disperses ownership for embedding learning technologies across faculty areas and provides middle school students with the essential skills necessary to confidently access the curriculum. The skills are acquired through existing curriculum in preference to specific computing courses, which have a tendency to discourage curriculum areas from taking responsibility for embedding technology into their programs.

The research will examine an information literacy skills matrix grounded in using technologies for resource based learning with constructivist teaching methodologies. The matrix is being implemented as a coordinated school-wide initiative. The research will ask the questions:

- Is the information literacy skills matrix a useful tool to chart the growth of students as autonomous learners?
- What are the effective teaching strategies for moving students along the continuum of the information literacy skills matrix?

- How can teachers be supported to use these strategies?

Project 6: Models of Constructivist Learning

This project is currently in planning as an examination of constructivist learning across the schools and of the development of appropriate models for constructivist learning in technology rich learning environments. The project will also:

- measure the role constructivist methodologies with technology play in improving cognitive and non-cognitive learning outcomes for students.
- assess the development needs of teachers and develop a model of professional development to implement a constructivist approach in technology rich classrooms.
- gain understanding about the ways students learn and apply technical skills and knowledge in constructivist classrooms.

The research above in this Australian context is informed by the government study called *Real Time: Computers Change and Schooling* (Meredyth, Russel1, Blackwood, Thomas and Wise 1999).

Interim Findings

Over the first year of operations of the learning technology project there appeared to be paradigmatic changes in opinions about learning technologies and of teacher's relationships to them. These include:

- increased agreement for embedding technologies in the curriculum rather than scheduling separate computer lessons
- greater appreciation of the systems thinking of Peter Senge and Michael Fullan that promote whole school change and continuous learning
- development of new and often competing understandings about how children learn
- a growing appreciation of information literacy skills and resource based learning
- a greater understanding of constructivism, emphasising the active construction of knowledge through inquiry, discussion, reflection, metacognition and application of what is learned possibly due to the influence of Mackenzie (Mackenzie 2000)
- a widely perceived need for school based professional development.

Teacher Survey

Such shifts in attitude should become more visible through the teacher surveys over the three years of the project. The teacher baseline study in 1999 gives a picture of teachers at the start of the learning technologies project. There are some 268 teachers in the schools, with 212 in the urban Discovery schools. The primary schools have around 90% female teachers and the secondary schools 40%. Teachers are on average highly experienced with 70% having served over 17 years and a similar percentage having a full time load.

Table 1 below shows the planning for use of technology in one term of the 1999 year. It will be instructive to compare this table with data from later in the project; for the moment it indicates the low usage of many types of learning technologies, with word processing, the Web and encyclopaedias being the most commonly used.

Teacher objectives for the use of technologies are indicated in Table 2 below. There were no dramatic differences between the objectives of high school teachers and primary school teachers.

The baseline data for the teachers in the discovery schools are consistent with the larger sample of the government study called *Real Time: Computers Change and Schooling* (Meredyth *et al.* 1999).

Learning Technology Area	none	1–2 lessons	3–9 lessons	Above 10 lessons
1 Games for practicing skills	58	19	14	8
2 Simulations of exploratory environments	62	22	10	5
3 Encyclopaedias and other reference materials on CD-ROM	37	24	31	8
4 Word processing	26	20	34	21
5 Software for making presentations (Powerpoint)	65	11	17	8
6 Graphics oriented printing (Photoshop)	73	14	6	7
7 Spreadsheets or database programs	65	13	14	8
8 Multimedia authoring environment (Hyperstudio, Hypercard)	72	10	10	8
9 World wide web browser	34	26	26	14
10 Electronic mail	73	15	7	4
11 CAD	94	2	1	5

Table 1: Percentage of Teachers Planning Uses in Each Learning Technology Area in One Term (Urban Schools Only)

Objective for the use of technology	Percentage
1 Analysing information	9%
2 Learning to work collaboratively	10%
3 Communicating electronically with other people	6%
4 Evaluating and about selecting the most appropriate ideas and resources for the intended audience	8%
5 Improving expression and communication skills	10%
6 Finding out about ideas and information	13%
7 Improving computer skills	12%
8 For mastery	12%
9 Learning to work independently	6%
10 For remediation	4%
11 Synthesising and presenting information	10%

Table 2: Teachers Reports of Eleven Widely Held Objectives and Their Relative Percentages (Urban Schools Only)

Student Survey

Although the baseline data interpretation will be more informative after comparison with the year 2000 data, preliminary statistical analyses of the baseline data yields the following summary findings.

Students' attitudes towards school become less positive as they get older. Girls' attitudes towards school are generally higher than boys' attitudes, most significantly so in Years 6, 7 and 10.

Self-esteem appears to be the lowest for boys during Years 6 and 7, while girls maintain the most positive self-image during Years 7 and 8. (Figure 2.) However, girls generally have a lower self-esteem than boys do.

Attitudes toward technology are positive: however, over the sample there is an apparent divergence of attitudes resulting in a more positive computer attitude in the older male students compared to their female peers. (Figure 3)
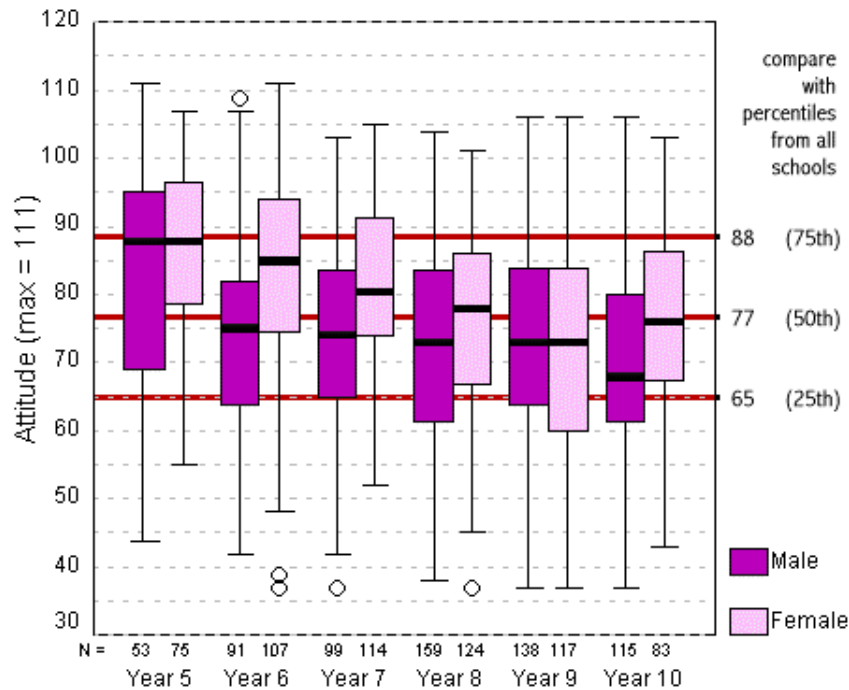
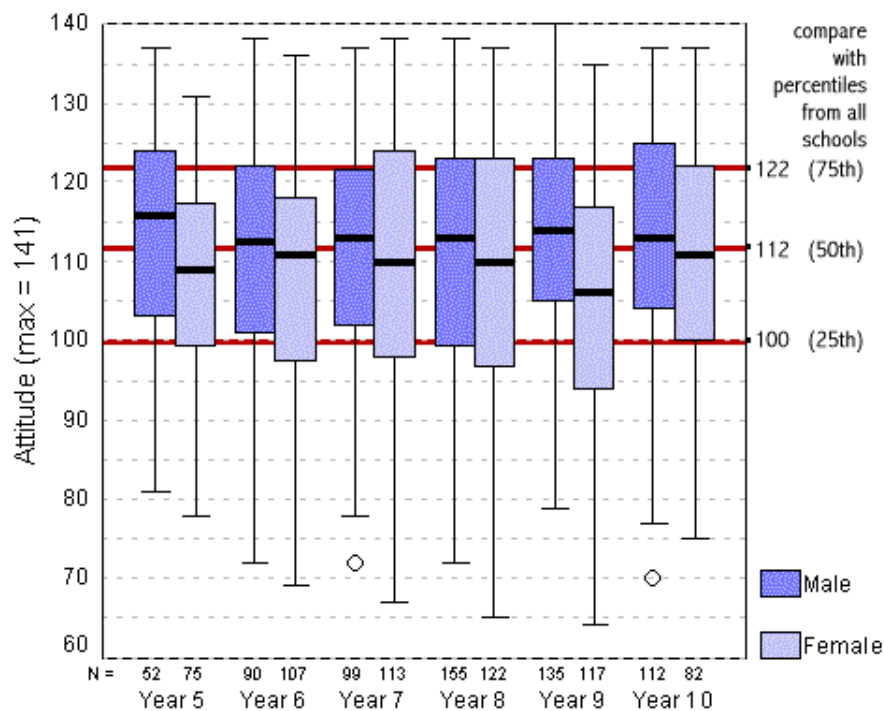**Figure 1: Students' Attitudes Towards Schooling, Comparison by Gender and Year Level**

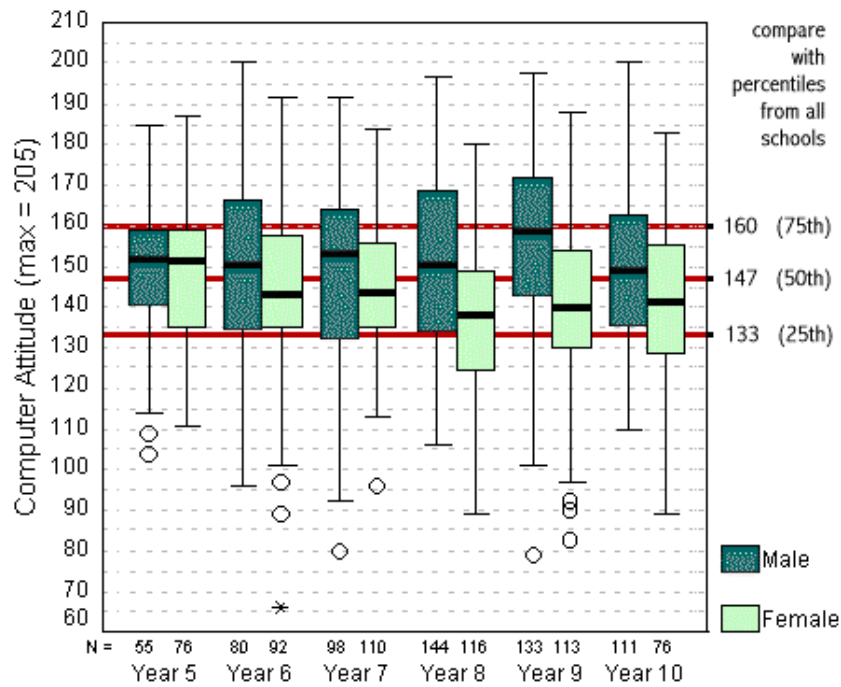**Figure 2: Student Self-Esteem, Comparison by Gender and Year Level**

Figure 3: Students' Comparison of Computer Attitudes by Gender and Year Level
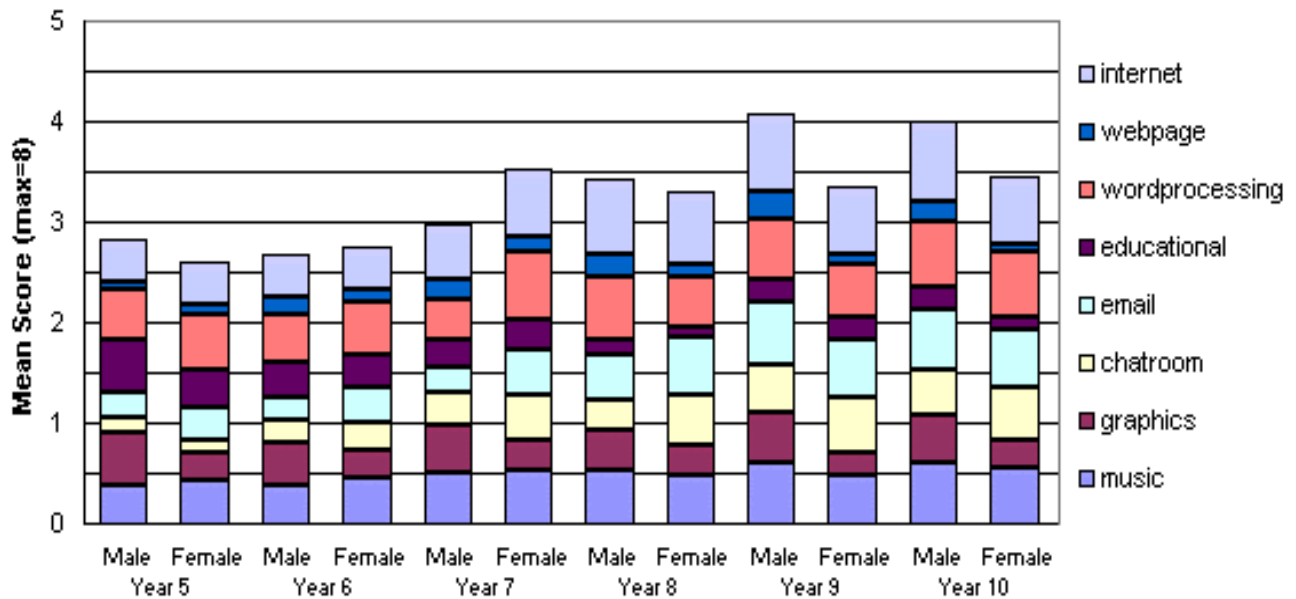

Figure 4: Students' Specific Computer Usage Outside School

Outside school computers are used by boys more than girls (Figure 5). The main difference is evident in the amount of time spent playing games, a difference that increases with age.

Specific computer usage outside school suggests that Internet, email and chat-room use increase with year level.

Utilizing the computer for educational purposes decreases as students get older, suggesting that fewer students use educational programs at home in the higher grade, although the interpretation of "educational" may not be the same in self reporting across the age groups.

Students' use of other forms of technology rate television, radio, CD and video among the highest. Apart from students in Year 7, boys use alternative forms of technology more than girls do.

Average ownership suggests that many students own both a game station and a computer.

The Windows platform significantly dominates over the Macintosh across all schools and year levels.

The prevalence of game stations appears to increase in the Primary sector and then decrease in the Secondary sector.
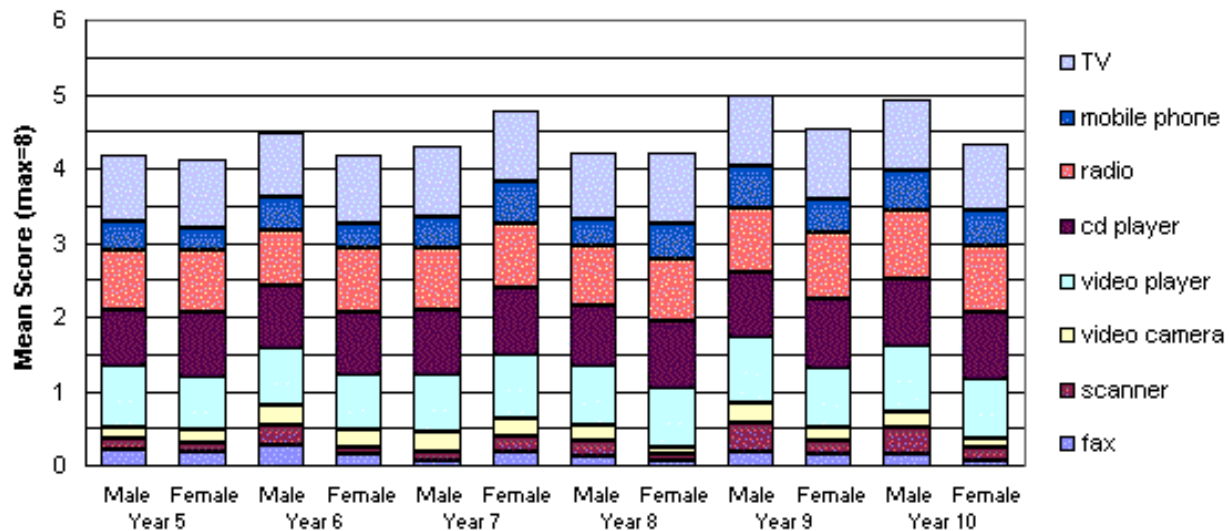
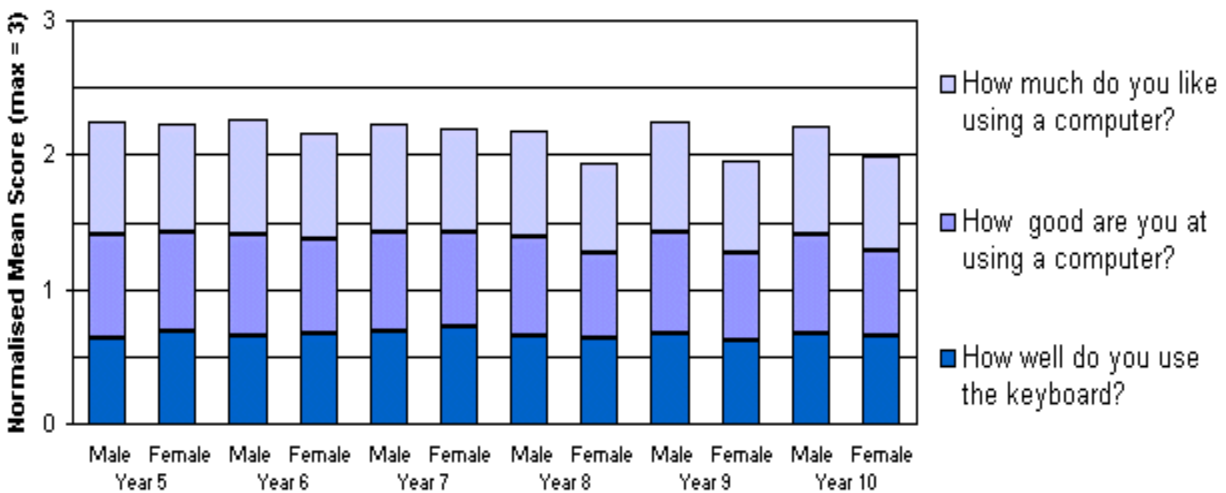**Figure 5: Students' Use of Other Forms of Technology Outside School**

Figure 6: Students' Computer Enjoyment and Skill by Gender and Year Level

Students' reports of their enjoyment and ability when using a computer are very positive but tend to decline with age (Figure 6). At the primary level, boys and girls hold similar beliefs. However at the secondary level, female students hold a lower opinion about their ability, compared to the study population.

On average, students work in groups of two when using computers at school.

In the Primary years, school plays an equal role with the home environment in providing opportunities for students to become more knowledgeable and proficient in using learning technologies.

Skills such as using the World Wide Web and spreadsheet packages are predominantly first learned at school, while playing computer games and sending email messages occur at home.

In summary, girls' attitudes to school and computers show similar trends—relatively positive and stable in upper primary school (Years 5–7) but falling away in the early years of high school (Years 8 and 9), before improving a little in Year 10. Their self esteem does not reflect these trends; it rises rather than falls as they move through upper primary school, stabilising in

Year 8 rather than falling away. There is however little difference in Years 9 and 10.

Boys, unlike girls, maintain a relatively positive attitude to self through Years 5 to 10 of school. Unlike girls, there appears no consistent relationship between boys' attitudes to school and to computers. For example in Year 6 their attitude to school drops away significantly while their attitude toward computers rises. Boys remain positive about computers to Year 10 and consistently less positive in their attitude to school.

Conclusion

This paper has presented a systematic research program into the impacts of learning technologies dimensioned along the axes of student learning, teacher methodologies and school structures. Various projects within the program shed light on each of these dimensions and the mutual influences of all of them. At this point the research program provides a snapshot of the beginning of an ambitious attempt to transform student learning in South Australian government schools. Much more will be known in 2000 and 2001 as the various projects report their findings. It is hoped

that a rich and energetic picture of learning supported by learning technologies will emerge.

References

BARNES, A. (2000): *Discovery School Teacher Survey*.
http://www.education.unisa.edu.au/discovery/survey/ (Accessed 28/10/2000)

COOPERSMITH, S. (1986*): Self-Esteem Inventories*. USA, Consulting Psychologists Press.

DEPARTMENT OF EDUCATION TRAINING AND EMPLOYMENT (1999): *Learning Technologies* http://www.tsof.edu.au/LT.SA/ (Accessed 28/10/2000)

DEETYA (1996): *Gateways—Information Technology in the Learning Proces*s. Canberra, Department of Employment, Education, Training and Youth Affairs.

JONES, T. and CLARKE, V.A. (1994): Computer attitude scales for secondary students. *Computers in Education* **22**(4): 315–318.

MEREDYTH, D.,RUSSELL, N., BLACKWOOD, L., THOMAS, J. and WISE, P. (1999): *Real Time. Computers, Change and Schooling.* National Sample Study of Information Technology Skills. Canberra, Australia, Department of Education, Training and Youth Affairs.

MACKENZIE, J. (2000): *From Now On* http://fromnowon.org (Accessed 28/10/2000).