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# A PILOT SURVEY OF CALCULATORS AND COMPUTERS USED IN ABORIGINAL COMMUNITY SCHOOLS OF THE NORTHERN TERRITORY

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## INTRODUCTION

Batchelor College is a tertiary education institution servicing the needs of Aboriginal communities mainly in the Northern Territory and "top end" of Australia. Within the School of Education there is the Teacher Education programme which has been operating in various forms since 1976, and has successfully piloted and implemented a community based operation known as Remote Area Teacher Education (RATE) (see Kemmis 1988). The program at mid- year 1990 underwent re-accreditation, and in his paper Reconstituting the Curriculum Framework for the Batchelor College Teacher Education Program, Ian Stewart (Head of School) argued for the development of four integrated strands over four sequential stages (Stewart 1989). These strands are: Community Studies; Curriculum Studies; Language Studies; and Professional Studies.

Within Curriculum Studies there is a draft mathematics component (Stanton 1990). This draft document attempts to avoid the technique oriented (Bishop 1988, p. 8) shortcomings of the previous mathematics curriculum (Davies 1989, Stanton 1989 a) and adopts a social constructivist approach that takes into account the special needs of tribally oriented Aboriginal students and children (Graham 1986). For example, one recent study of a group of Aboriginal post primary girls showed that problem solving in mathematics was conceived of as ritual symbol manipulation and algorithm doing (Stanton 1989 b). Bishop is worried that such a technique oriented curriculum cannot educate "But 'technique performance' is . . . what calculators and computers can do . . . Surely what is needed now is more understanding and critical awareness of how, and when, to use these mathematical techniques, why they work and how they are developed. This requires not only much greater thought, but also a different kind of thinking and therefore it requires a very different approach to curriculum" (Bishop 1988 , p.8).

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\* This article is based on a survey conducted in 1990 by Ron Stanton, a lecturer in Mathematics at the School of Education Studies, Batchelor College, N. T.

The new mathematics curriculum draft recognises that in order to escape the binds of narrowly focused techniques there is a need to make explicit the linkages of calculator and computer technology across the curriculum map, intersecting not only the symbolic components but also societal and cultural. Attention is drawn to the notion of conflicting values between traditional and Western (M. T.) culture and it is asked how a workable and acceptable balance may be negotiated, between progress and control for example. "This technology is highlighted each semester as students are taken through the program, from basic calculator techniques and computer games to the use of spreadsheets and data bases integrated with other on going activities of course. . . The inclusion implies that there be a strong support policy with regard to the provision of the necessary machines and software both at Batchelor College and in community schools" (Stanton 1989 a). But what is the status of computer and calculator availability in schools ?

### **RESEARCH BRIEF**

The main purpose of this project was thus to provide Batchelor College curriculum developers with information on the current and future availability and use of calculators and computers in the Aboriginal community schools having links with the teacher education program.

There was a need to know:

- what kinds of computers were being used and where they were located e.g. offices, classrooms, computer rooms etc ?
- what plans there may be for expansion or the incorporation of new technology e.g. scanners ?
- what software applications are in common use in the primary schools ?
- what calculator numbers are available and how are they distributed between classes ?
- what are the major differences between schools in the provision of hardware and software ?
- who are the computer resource people in the schools ?

The focus of this survey is thus on the availability of machines and software rather than details about how they are being used in the day to day education program, or what might be the attitudes of teachers, students or parents towards the use of computers in education. It is hoped the latter will form the focus of another study.

## THE SCHOOLS SURVEYED

Thirty two schools were selected for inclusion in this survey. A list was first drawn up of all schools which have (or recently have had) Batchelor College teacher education students working with them. These were sorted according to enrolments and the 30 largest were included along with two smaller schools which were added as a matter of interest. The smallest schools of all have total enrolments ranging from 11 up to about 60 pupils. It was felt that their calculator/computer status would be sufficiently different from that of the larger schools as to warrant a separate study at a later date. The sample selected thus represents all of the larger schools of the Northern Territory which have a working relationship with Batchelor College teacher education students. With one exception, the schools are all located in Aboriginal communities. Four are non-government agency schools. The locations of the 32 schools are shown on the Northern Territory map (see inside back cover).

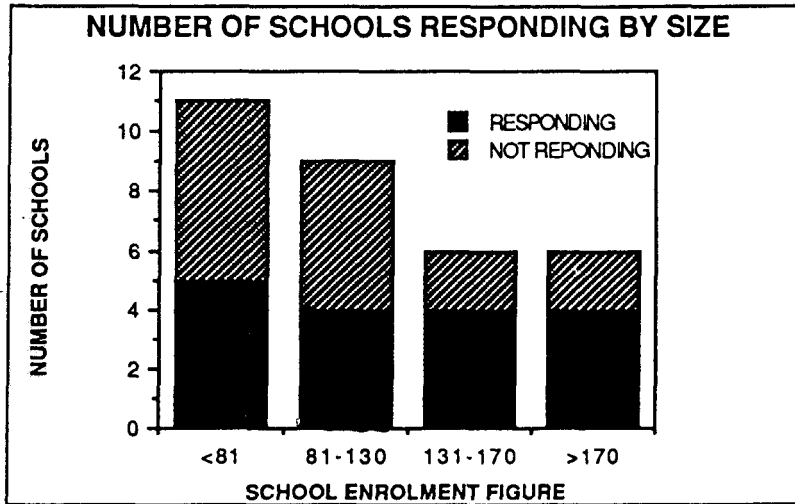
While selecting the schools on the basis of size was not difficult, determining actual enrolment figures for the primary grades was problematic. Enrolment figures were taken from the *N.T. Education Directory* (1990) and there appears to have been considerable variation across schools as to how the figures were compiled. In some cases a total figure is given which presumably includes both pre-school and post-primary along with primary school enrolments. In other cases these figures are given separately. Some schools declare significant numbers in outstation classes while others make no mention of such enrolments.

Since this survey was concerned with only primary school grades it was decided to use a "notional" enrolment figure by adjusting total figures by an arbitrary factor for pre-school and post-primary enrolment where actual figures were not provided. Analysis of the figures provided by schools with detailed enrolments showed that, on the average, both pre-school and post-primary enrolments represent slightly more than 10% of overall enrolments. This was the factor used to arrive at "notional" enrolments. No attempt was made to adjust for outstation enrolments so the final figure represents approximate enrolments in primary grades regardless of whether they are on site or at an outstation.

It might be pointed out that the survey form did provide for a detailed return on primary grade enrolments in the calculator survey section, but in the event very few schools had sufficient calculators to warrant completion of that section. In any case the question of actual enrolment figure for some Aboriginal community schools remains problematic when attendance patterns of the children are taken into account. The use of some "notional" figures in this instance is thus no doubt sufficiently accurate for the purposes of this survey.

### THE SCHOOLS RESPONDING

FIGURE 1.



17 schools made responses which represents a 53% return. The average enrolment of the responding schools was 13, 1 compared with 130, 3 for all the schools initially contacted. Figure I however shows that there should be caution in attempting to extrapolate results beyond the responding sample.

While 75 % of schools contacted with enrolments over 130 returned forms, only 9 out of 20, or 45% of the smaller schools responded. The smaller schools (i e with enrolments 130 and less) are thus poorly represented, and the reasons for "opting out" cannot be identified at this stage. One could imagine a scenario in which school administrations not "into" computers (for whatever reason) and lacking hardware, might see little point in returning the questionnaire. The opposite might apply in a school which has made an investment in computing. In any case, smaller schools will generally have limited access to the bulk funding needed to incorporate computing in the primary education programme.

On the other hand Figure 1. does show that the actual number of returns is quite evenly distributed across the four enrolment categories and represent half of the total population of larger schools that Batchelor College services. The information generated must therefore be of some value in determining general trends in computer/calculator availability and usage in these schools. Such information is not readily available at present.

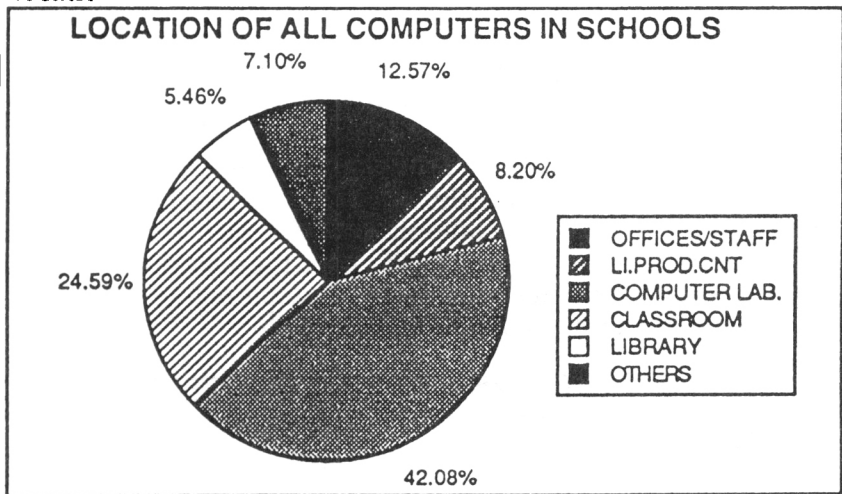
## COMPUTER NUMBERS AND LOCATIONS IN SCHOOLS

**TABLE 1.**

Location of computers in the survey schools.	
Office/staff room	23
Literature production centre	15
Computer room or laboratory	77
Primary classroom	45
Library	10
Other (e. g. adult education)	13
<b>Total</b>	<b>183</b>

Figure 2. shows these figures in a piechart format with percentages for each location.

**FIGURE 2.**



Of the 183 computers in the schools, 145 are located so as to be available for primary grade pupils use if needed. In other words 80% of computers in schools are principally for direct teaching purposes. Of these 145 computers about half are in computer rooms while a third are actually in primary classrooms

**FIGURE 3.**

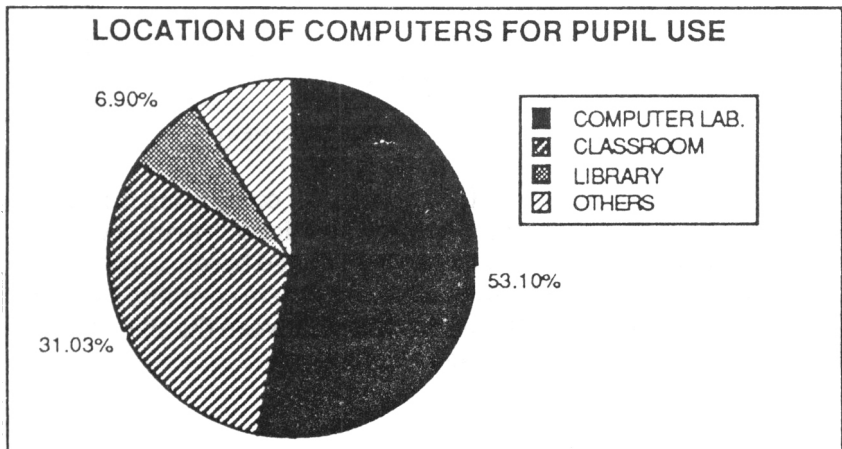


Figure 3 shows the manner in which machines for teaching are located in the schools surveyed. All of the schools reported that there were computing facilities available for pupil use, with the number of machines ranging from one in a small school up to 23 and 24 in two larger schools.

In 1985 Fitzgerald et al reported for South Australian Aboriginal schools that "79 per cent had some computer activities compared to 30 per cent in the comparable South Australian schools and 67 per cent in the national sample" (Fitzgerald, Hattie & Hughes 1985, p 20). They also noted that in the national sample more secondary schools had computing activities (98 per cent) than primary (57 per cent) (Fitzgerald et al 1985, p 19). The expansion in educational computing over the last five years has been very rapid and it would seem that N.T. Aboriginal schools have generally not been left out of the trend.

There are of course differences between individual schools in the potential access of pupils to a computer. Fitzgerald et al found in 1985 that "There was one computer per 123 students in city schools and one computer per 82 students in country areas" (Fitzgerald et al 1985, p. 18). These are combined primary and secondary figures, so the actual numbers for primary schools could be significantly less. In the current sample of the 17 Aboriginal schools there is overall one computer per 15 students which is a major advance on the Australia-wide figures of 1985. Even the most disadvantaged of the N.T. sample had one computer for 70 students, while one computer per seven, eight or nine students was not uncommon.

**FIGURE 4.**

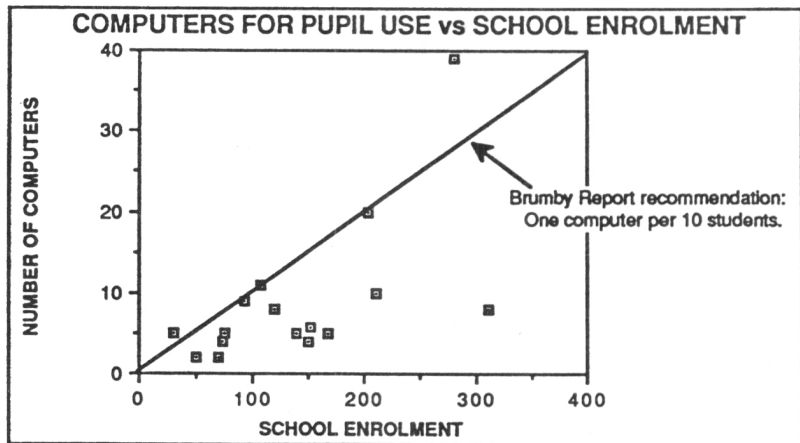


Figure 4 shows the actual number of computers for pupil use found in the 17 schools as compared with the "notional" primary school enrolment figure. In actual fact only 16 schools are plotted because a sister/brother school pair that share some computing resources were combined for this exercise. It can be seen that there is little relationship between the size of the school and the number of computers available to the pupils.

Overall there are 9.4 computers per school compared with the Australian 1985 figures of 9.3 for city and 4.9 for country schools (Fitzgerald et al 1985, p. 18). Once again these latter figures are inflated by the inclusion of secondary schools. More importantly, Figure 4. shows that there are wide differences between schools in the availability of computers for pupils. Overall there are 15.4 pupils per computer compared with the 10 minimum recommended in the Brumby Report (1990).

If smaller and larger schools are compared (cut off enrolment at 130 pupils as in Figure 1.) the outcome is shown in Table 3.

**TABLE 1.**

<b>Comparison of computer availability - small &amp; large schools</b>		
	<b>Large School</b>	<b>Small School</b>
Enrolment	> 130	< 131
Total enrolments	611	617
Number of schools	8	8
Average enrolment	201	77
Number of computers	98	47
Average No. of computers	12.2	5.9
Pupils per computer	16.4	13.1

These figures show that although the larger schools have twice as many computers as the smaller schools, it is the smaller schools which tend to provide better access in terms of pupils per computer. However both figures are high compared with the 1985 survey already mentioned above.

### **TYPES OF COMPUTERS IN USE**

The 1985 survey provides figures on the various types of machines used in schools for all states and territories including the Northern Territory (Fitzgerald et al 1985, p 21). These percentages for the N.T. can be compared with the figures found in this 1990 survey of Aboriginal schools.

**TABLE 2.**

<b>Percentage distribution of computers.</b>		
<b>Computer</b>	<b>N.T. 1985</b>	<b>N.T. 1990</b>
Apple	38	39
Macintosh	0	28
Microbee	3	0
BBC	6	0
Atari	3	3
Tandy	3	0
Commodore	29	29
Others	18	1

What is of interest here is the way in which Apple, Commodore and Atari have maintained their percentage share of school computer use while a range of machines formally in use (Microbee, Tandy and others) have been displaced by the Macintosh.

This could be seen as the result of a combination of natural attrition and the Department of Education policy of limiting the range of approved machines for school use.

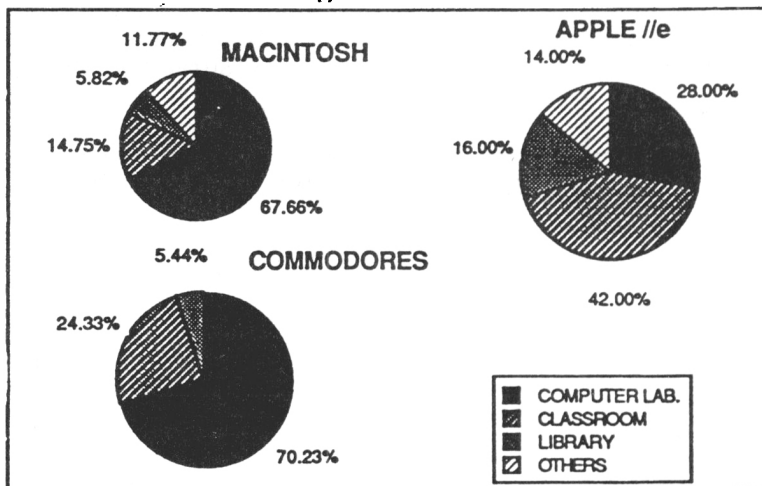
There can be little doubt that these figures do represent a well defined trend as school staff come to expect more power, flexibility and user friendliness from their computing machines. Staff in Aboriginal schools have likely become computer aware through observing and participating in the desktop publishing activities of Literature Production Centres attached to bilingual schools. The level of sophistication is most impressive with a number of schools already using Macintosh IIcx, scanners and colour printers in the Literature Production Centre. This survey also shows Macintosh SEs beginning to appear in local area networks for pupil use.

This trend will no doubt continue as the old Commodore 64 is retired from duty and the "Mac" wins more converts. One respondent in the survey was in a school with 7 new machines which belong in the "others" category. After complaining bitterly about lack of support and no suitable software the writer pleaded for Batchelor College to lend them a Macintosh on a long term basis. The College was unable to comply since we are ourselves engaged in coming to terms with a form of "MacLust".

### HOW DIFFERENT MACHINES ARE LOCATED

There are then three types of computers being used in schools in the main. Figure 3. earlier showed how all machines are located in schools with 50 percent in computer rooms. In actual fact the ways in which the different computers are located for pupil use shows considerable variation, as shown in Figure 6.

FIGURE 6.



The Apple II e group above actually includes 4 Apple II GS machines.

From an historical perspective the Commodore 64 machines probably made it early into the schools in any numbers where they were in the main located in the "computer room". Even today 70 percent of these machines are found in such places. A short time later Apple II e entered the scene but it will be noted that these machines were far less concentrated in specialised rooms. They were more likely to be spread out into classrooms and were even to be found in libraries. There was a call for "computing across the curriculum" and there was official support for making computers available in the classroom where they could be integrated with core subject studies (Bigum 1987, p. 38).

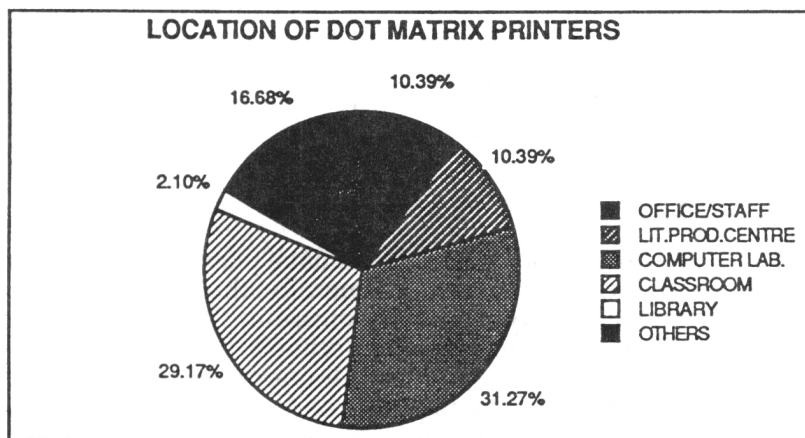
Very recently the Macintosh has been made available for the use of pupils in schools but note how they are being used. Like the Commodore, almost 70 percent of Macintosh are back in computer rooms now more likely to be referred to as "laboratories". Only about 15% are now in the classroom. Unfortunately this survey cannot provide reasons behind the swing, even though it would be interesting to speculate.

Significantly 6 of the 8 larger schools claim to operate some form of computer learning centre (75%) compared with only 2 of the eight smaller schools (25%). This would make sense since it is the larger schools which have computers in sufficient numbers to form the nucleus of a computer room grouping or make networking feasible.

## PRINTERS

In the schools surveyed there were 57 printers in use, or about 3. 5 per school. 48 were dot matrix (Imagewriter or similar) 9 were laser models.

**FIGURE 7.**



Although every school had at least one computer somewhere on site it is perhaps surprising to learn that four schools had no printing facility at all. Three laser printers were in offices with the remaining six in Literature Production Centres. Only one school had two laser writers. Dot matrix printers were far more common and Figure 7. shows their distribution in schools. Of the 48 dot matrix printers 38, or close to 80 percent, were potentially available for pupil use. Of these machines 40 percent were in computer rooms with a further 37 percent actually in classrooms.

The locations of these printers were different for small and large schools. There were 27 printers for student use in large schools compared with 12 in the small schools. This represents pupils per printer ratios of 60:1 and 45:1 respectively, but it should be remembered that while two large schools and one small school claim no printing facilities at all, one other school has 7 dot matrix printers in a computer room.

In the larger schools 55 percent of printers are in computer rooms and 30 percent are in classrooms while in smaller schools the numbers are reversed with 50 percent in classrooms and only 8 percent in computer rooms. In small schools 42 percent of the machines are likely to be found under the "Others" locations such as Adult Education and Post Primary sections. This grab-bag of results probably reflects, more than any other, the great diversity of approaches and priorities in the way in which agencies and different sized schools are coming to terms with educational computing.

### **HARD DISK DRIVES**

There were 21 hard disks reported in use. Six were in offices and ten were located in Literature Production Centres. Of the four in classrooms three were in one of the larger schools where they were used in conjunction with Macintosh Plus machines. While 18 of the drives were found in large schools (85. 7%) there were three of these schools without hard disk drives. Three of the eight smaller schools reported drives in use (42. 9%) compared with five out of eight in large schools (62. 5%).

### **OTHER COMPUTING ITEMS**

Three of the large schools and one of the small schools reported scanners. One large school possessed a modern and one other smaller school had an A 4 screen for the Macintosh.

### **DEVELOPMENT PLANS**

Five of the eight larger schools have plans to expand their computing resources in the near future. Generally this involves the purchase of more machines of the type already in use in the school, i. e. Apple II e or Macintosh Plus. In three of these schools there would be expansion of computer learning centre facilities while one other is to purchase a second laser printer. One larger school will put three Apple II e into classrooms as well as expanding the computer room. One school will include in its expansion the purchase of two more IBM compatibles to join the two it already has.

In the larger schools surveyed there are plans to purchase at least 15 Macintosh (most destined for computer learning centres), eight Apple II e and two other machines, a total of 25. This represents an expansion of computer numbers in the larger schools of 25.5 percent. Such an expansion would improve access to computers in the larger schools from 16.4 pupils per computer to 13.1 pupils per computer, exactly the same ratio as currently found in the smaller schools.

Only two of the eight smaller schools planned any significant change. One was purchasing a Macintosh and printer and the other was planning to set up a computer learning centre but it was not made clear if this was simply a relocation of machines already used as a group or involved the purchase of additional machines.

## SOME SCHOOL COMMENTS ON FUTURE PLANS FOR COMPUTING

The following comments from survey school staff have been included as they provide insight into the plans, successes and frustrations of individual schools as they struggle to bring appropriate computer technology into Aboriginal primary school education.

*"Planned purchase 4 Mac Plus computers, 2 IBM compatibles. Software purchase planned as funds become available.*

*"We are planning to expand our Macintosh Plus numbers to include a classroom set for the computer centre and one for each primary classroom Yr 3/4, Yr 5/6, Yr 7. Year 7 students have access to the Macintosh computers."*

*"Due to the typical high turnover of staff in Aboriginal schools one teacher's idea turns into the following teacher's nightmare. No software, user infuriated, everyone else has Macs but we've got \* ✚ ✕ ☆ ✎ ! XXXXXXXX."*

*"We have 5 Apple II e computers ready to start up a laboratory/ put into classrooms, plus 1 printer. We haven't done anything about organising a room yet because we have had major alterations going on."*

*"A computer room is to be set up early in Term III. Each class will have a computer time each week. This term the computers have been either in classrooms or stored in the library."*

*"Purchase Literature Production Centre lazer printer."*

*"Awaiting 6 reconditioned Macs (unaware of model at present). On arrival of these computers we will be able to equip the computer/AV room and have small groups (say 10-12) using these machines."*

*"The school is in the process of acquiring up to 5 additional Apple II e's for the Computer Learning Centre which is to be established in Semester 2. Assistance from the Computer Education Unit will be sought at this time."*

*"We are approaching a situation where each room has an (Apple or Mac), a variety of software - applications/drill and practice and printer. The year 6/7 is set up with "special project" equipment - Mac, scanner, HP Desk Writer printer, hard drive and A 4 screen."*

*"The school is currently in the process of purchasing 3 X Apple II e computers."*

*"There are no plans at present to extend or move the computers"*

## WORD PROCESSING AND DESKTOP PUBLISHING APPLICATIONS

The range of word processing and desktop publishing applications in common use in schools can only be described as incredible. There are 25 applications in use over the 17 schools surveyed, but the most popular like MacWrite and Appleworks are only to be found in 6 schools.

**TABLE 3.**

<b>Word processing/ desktop publishing applications and the number of surveyed schools using them.</b>			
MacWrite	6	Appleworks	6
Microsoft Word	5	Microsoft Works	4
Multiscribe	3	Printshop	3
Type!	2	Mastertype	2
Speedscript	2	Bankstreet Writer	2
Pagemaker	2	MacPaint	2
MacWord	1	Ready Set Go!	1
Newsletter	1	Zardex	1
1st Word Plus	1	Calamus	1
Clip Art	1	Adobe Illustrator	1
SuperPaint	1	Publish It	1
Digital Darkroom	1	Logo Writer	1
Children's Writing and Publishing Centre	1		1

The most that can be said of this outcome is that virtually every school uses a different set of word processing programs even though 70 percent of machines are of only two types, either Macintosh or Apple II e.

### **EDUCATIONAL PROGRAMS**

Again there is reported a range of programs in regular use with the majority only being found in one or two schools. The 21 programs reported are listed in Table 4. along with the number of schools using them.

**TABLE 4.**

<b>Educational programs and number of schools using them</b>			
Sticky Bear Maths	2	Sticky Bear Music	2
Sticky Bear Shapes	2	Crossword Magic	2
Granny's Garden	1	Alien Addition	1
Cricket Maths	1	Hangman	1
Flowers of Crystal	1	Spellout	1
Explore a Story	1	Carmen Sandiego	1
Meteor X	1	Animal Lab.	1
Playful Professor	1	Sheep Dog Trial	1
Rosie's Walk	1	Maths 2	1
Spellbrabbers	1	Animal Rescue	1
Boppie's Great Word Chase 1			

In addition to the above one school reported use of Hypercard and one other made use of custom materials. A number of schools reported "various Maths games". There are no doubt many more applications to be found in schools but the questionnaire simply asked for those commonly used. There are also a wide range of games in schools that are used both educationally and for recreation purposes, but these are not reported on here.

## SCHOOL GENERAL COMPUTER COMMENTS

A number of school staff provided comments specifically on computer use in the school. Only two schools claimed to have a written policy on computers and calculators. Some comments were as follows.

*"School use of computers at present is divided into (a) student use, (b) staff use, (c) LPC and TESOL, (d) office admin. (e) RATE, (f) Adult Ed. Upgrade in student materials and equipment is 1990 priority."*

*"Computers: KEY THRUST: individual 'timetabled access for each child in school (1) Language theme based - word processing, (2) Drill and Practice compliment, (3) Whole class activities involving specialised software."*

*"Mac computers are important to the staff because Batchelor College use them in the RATE program as well as full time students at Batchelor. Currently we have 12 RATE students and 4 full time Batchelor students."*

*"Currently we are not using the computer in our programming. I have been here just two weeks and there doesn't appear to be another member of staff to replace one that left. I personally am very interested to see students have skills in computing."*

*"Computer programme is just starting off. We expect to become operational next term."*

*"The students really enjoy working on computers. Sometimes I think their appeal is too strong and they are used as a pacifier. The computers should be used to complement the lessons and the children use the computer to add to their skills."*

*"We will be reviewing our word processing packages and the use and organisation of our computers early next term."*

*"Would be interested in 'new ideas' for classroom use that arise from this survey."*

*"Could Batchelor College please lend us a Mac SE long term please."*

## CALCULATORS

One large and one small school did not answer the second page of the questionnaire leaving 7 responding for each of both small and large schools. Two large schools and one small school had no calculators at all for primary pupil use. In the large schools with calculators there were 64 calculators for 1401 pupils which is 22 pupils per calculator compared with 3 pupils per calculator in the smaller schools. However, in the large schools, one only had just introduced 10 calculators for the use of Grade 7 pupils, otherwise all calculators are held in pool and schools have indicated no regular use in primary classes at all. Two large schools do have 30 calculators each, but these are for the use of post primary students.

The seven small schools had 186 calculators, or three-times the number held by the seven large schools, but 97 of these were in one school alone. For the six small schools having calculators the pupil access rate is 2.4 pupils per calculator overall, but individual figures range from 1 to 1 up 14 pupils per calculator. Unlike the larger schools, the smaller schools report regular use in 5 of the 6 schools holding calculators. Where calculators are used on a regular basis this tends to be in the upper grades of the primary school (and in post primary). In the one school which has a calculator for the use of each student this same pattern holds; there is daily use in Grades 5 up but no (or limited) use in the early grades even though the calculators are available.

### SCHOOL COMMENTS ON CALCULATOR USE

Five schools offered comment on the use or otherwise of calculators in the Aboriginal primary school classroom. The general tone of the comments are certainly less positive than those discussing the expansion of computing facilities.

#### "NOT USED IN SCHOOL"

*"We have had calculators as a general resource but it hasn't worked. They are abused."*

*"General opinion of staff is that they cannot get effective use from them. The children would rely on them. Can't use calculators before they can read numbers."*

*"Calculators are used intermittently in some classes but generally by the teacher. Children and Aboriginal teachers tend to regard the calculator as a toy rather than a mathematical tool - if time were available to work with Aboriginal teachers on a one to one basis the calculator could probably be used more effectively."*

*"5 calculators to be purchased in July."*

*"Used as a tool for corrections."*

*Calculators available - nil. "It's all been said."*

### CONTACT PERSONS

Schools were asked to nominate a contact person for computing in the school. Of the 16 schools responding 10 nominated males, 5 nominated females and one school nominated a male/female pair. This would indicate that schools look to males to take on responsibility as "computer co-ordinator/specialist" twice as often as they do for female staff. There was no significant difference between large and small schools.

Looked at another way, of the 17 teachers nominated as computer contacts in the survey schools 11 were male, and this represents 64.7 percent of those staff. Perhaps it is not all that surprising that Fitzgerald et al in the 1985 survey found that 64 percent of computer resource people in schools were male then (as they are now). (Fitzgerald et al 1985, p 19). There were no Aboriginal computer resource teachers nominated in the Aboriginal schools responding to this survey.

## SUMMARY OF FINDINGS

For the data provided by the schools surveyed the following points are suggested:

### A. COMPUTERS

1. The schools are generally well resourced with computers compared with the 1985 survey of 1000 Australian schools (Fitzgerald et al 1985) but most still fall short of the Brumby Report suggested minimum of one machine per 10 pupils.
2. 80 percent of computers in schools are located for direct pupil access.
3. Larger schools surveyed are more likely to operate computer rooms, while smaller schools tend to put computers in the classroom.
4. Larger schools have plans to expand their computing resources by at least 25 percent in the near future, which will bring access by students in large and smaller schools together ( about 13 pupils per computer).
5. Smaller schools are not generally planning to expand computing resources beyond current levels in the near future.
6. Nevertheless schools under-resourced with computers (compared with other schools surveyed) are planning to upgrade, depending on funds being available.
7. Over 75 percent of machines in schools, and those to be purchased, are either Macintosh or Apple IIe. Most of the remainder are old Commodores and there are no plans to expand the number of these.
8. Staff in Aboriginal schools are being exposed to advanced computing technology through the activities of school Literature Production Centres.
9. There is a very large range of computer software applications for word processing, desktop publishing and education available across the schools but there are no applications common to all schools.

### B. CALCULATORS

1. In larger schools there are very few calculators and in general those available are seldom used in primary classes.
2. In the smaller schools pupils have up to ten times the access to calculators of those in larger schools, and calculators available are widely used across schools on a regular or daily basis.
3. Where calculators are available they are used almost exclusively in Grades 5, 6 and 7.
4. Many schools report a variety of problems experienced by staff attempting to use calculators in the primary grades. This is especially true of the larger schools.

## IMPLICATIONS FOR ABORIGINAL TEACHER EDUCATION AT BATCHELOR COLLEGE

1. Student teachers going into schools will find that there is an expanding interest in computers in education, but for N.T. Aboriginal community schools this interest revolves almost exclusively around Apple IIe and Macintosh machines. The Commodore machines available in schools are for the most part old machines approaching the end of their useful lives.
2. If students are to make use of these machines in their practice each will need to be familiar with the operation and maintenance of the three most common machines viz - Apple IIe, Macintosh and Commodore. At Batchelor College the majority of students are already using Macintosh (particularly) and some Apples for word processing. The large number of Apple II's actively used in the schools suggests that all students need to be familiar with their operation. At present this training is being left to chance or by negotiation with individual students. If this is to become a reality more Apple IIe will need to be made available for students and their use will need to be built into the program. Commodores are available for students if their home schools have these machines.
3. In word processing on Batchelor College students already have available MacWrite, Microsoft Word 3.02 and Microsoft Works for the Macintosh, Appleworks for Apple IIe and Zardax for the older Apples. Pagemaker is available for Macintosh advanced desktop publishing. For the Commodores there is Printshop while the BBC network has EDWORD on the network. It would seem that students need to be proficient in at least one basic word processor for the Macintosh e. g. MacWrite, and one for Apple IIe e. g. Appleworks.
4. For Macintosh graphics students have access to MacPaint, MacDraw and Superpaint but training in the use of these applications is at present by involvement in optional electives. Training in the use of these powerful applications needs to become part of the curriculum.
5. At Batchelor College almost all "educational computing programs" are available only on the BBC network. Exposure to these is through electives or an occasional computer focus in Classroom Practices. Students will also need to be familiar with the current educational software available for Macintosh and Apple IIe, but even more importantly, they need to be developing ideas about how these might be effectively incorporated into their practice.

6. The new Mathematics curriculum draft document (Stanton 1990) requires that teacher education students be taken beyond computer games, word processing and graphics. It requires that students be introduced to the use of the computer as a mathematical tool in data base and spreadsheet applications by their final year of study. This survey shows that there are Macintosh and Apple II e machines available in sufficient numbers in schools to take advantage of such skills in teaching, research and administration. Suitable programs are available in such programs as Microsoft Works and Appleworks.
7. The use of calculators in the surveyed schools must be seen as problematic for Batchelor College students. A National Statement on the use of Calculators for Mathematics in Australian Schools (CDC & AAMT 1987) opens with the recommendation that teachers should "ENSURE THAT ALL STUDENTS USE CALCULATORS AT ALL YEAR LEVELS (K-12)". This survey however suggests that, as a general rule, calculators are in regular use only in smaller schools for Grades 5 to 7.

It is an expectation of the new mathematics curriculum that Batchelor College students will follow point two of the above statement in that they will "ENSURE THAT THE CALCULATOR IS USED BOTH AS AN INSTRUCTIONAL AID AND A COMPUTATIONAL TOOL IN THE LEARNING PROCESS"(CDC & AAMT 1987). It is clear that Batchelor College staff will need to be sensitive in their approach to this aspect of practicum in co-operating schools. In fact, it might be appropriate that Batchelor College staff and students work with school staff towards the implementation of Point 5 of the above statement and "INITIATE DISCUSSION LOCALLY REGARDING THE ROLE OF CALCULATORS IN THE SCHOOL AND SOCIETY" (CDC & AAMT 1987).

## SUMMARY

The Batchelor College Teacher Education program proposes that ways be found which will allow for the demystification of mathematics so that it is revealed as a cultural product and made accessible as a way of knowing to Aboriginal Australia. In order to achieve this it is proposed that there be a shift in emphasis in the curriculum away from mastery of 'doing techniques' towards affirmation of mathematics as a reflective enterprise; a way of knowing. Following Bishop, the way through is to make full use of calculators and computers, "technique-handlers *par excellence* ", in performing the time consuming techniques and to concentrate our efforts more on ". . . understanding and critical awareness of how, and when, to use these mathematical techniques, why they work, and how they are developed" (Bishop 1988, p. 8).

If such a program is to be implemented the first proviso is that the places where students will train and work should have available appropriate software and hardware accessible in sufficient number to the students. Such a state of affairs is close to being achieved at Batchelor College although there is fine tuning still to be done.

This survey shows that, in the larger schools in Aboriginal communities having a working relationship with Batchelor College students, there are a sufficient and expanding number of computers and calculators available so as to not preclude commencement of the program. The recent Brumby Report recommends that schools have a minimum of one computer per 10 students and the Aboriginal schools here surveyed are approaching that figure at about 13 students per computer (though there are variations between schools) (Brumby 1990). With calculators it seems that even though some schools may use them in a restricted manner, most schools have some that could be made available for the use of students in the classroom.

What this survey does not show is the precise manner in which computers are being used in the education process. Only two schools of the 17 claim to have a written policy on the use of computers. Some schools have computer rooms, other locate computers in classrooms. The software used would indicate that most have some form of word processing facility for pupil use, along with some language or mathematics drill application and an occasional adventure simulation such as Flowers of Crystal. A further study needs to be carried out into the ways in which schools are actually making use of such programs.

Meanwhile there is a need for creativity in handling the interface between computers and mathematics pedagogy in the Aboriginal teacher education context of Batchelor College. Care must be taken not to fall into meaningless slogan system traps such as 'computer literacy' or 'computing across the curriculum'. "They are the sorts of notions you would, on the surface, have trouble disagreeing with, like motherhood" (Bigum 1987, p. 39). Bigum notes, for example, "Computing across the curriculum' is a vogue slogan that appears able to assimilate all of a schools' computing. This new emphasis seems to me to support a law of conservation of curriculum: in any curriculum change, curriculum will be conserved. In other words curriculum change is a euphemism for rearranging the existing curriculum" (Bigum 1987, p. 38).

Trudi McIntosh in The Australian of 24th July 1990 reports on a presentation by Mr. Barry Kissane of Murdoch University at the recent World Conference on Computers in Education (WCCE 90) in Sydney. In his paper, 'Computing and the Secondary School Mathematics Curriculum', Kissane reportedly warns that "Mathematics departments in many

Australian secondary schools have 'given up the ghost' as far as computing is concerned . . . They have decided to leave computers in the computer education area of the school and continue teaching mathematics in their own area of the school as if computers had never been invented". Kissane calls for the mathematics curriculum to be moved forward taking into account lessons of the past and the possibilities of today's technology. . ." most of the barriers to curriculum change are psychological, economic and political, rather than technological, which accounts in large measure for the difficulties in making changes".

As noted by Willis and Kissane "Certain uses of computers, particularly for instructional computing, . . . have the potential to entrench some of the worst aspects of current pedagogy. If those who are presently involved in teaching mathematics and mathematics education do not take the initiative for change then others will. Decisions about what school mathematics should and could be about and its relationship to computing technology may well be made on grounds other than educational ones or by those who have little understanding of the nature of mathematical activity. Neither would bode well for the mathematics education of our students" (Willis & Kissane 1989).

The first semester unit, and an ongoing theme, of the new mathematics curriculum proposed for study by teacher education students of Batchelor College is titled "What is this thing called mathematics" (Stanton 1990, p. 11). Willis and Kissane have similarly concluded that ". . . mathematics and mathematics education courses should be framed by the following three questions:

What is mathematics ?

Why is it important ?

Why do we teach it to children?

Developing a stance on these three questions should form the new 'basics' in the preparation of all teachers of mathematics. It is only through such questions that profound and important changes, as well as fads and fashions, can be recognised as such" (Willis & Kissane 1989, p. 92).

## CONCLUSION

The Teacher Education program at Batchelor College is in the unique position of being able to genuinely come to terms with addressing the above issues in both the education of Aboriginal student teachers and the pedagogical practices they will incorporate in the Aboriginal classroom. As this survey has shown, it is no longer a question of whether computer and calculator technology will be used in Aboriginal schools, but rather how best that technology, available and expanding, be incorporated into, and no doubt change, the mathematics curriculum.

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