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# Computer Education in Australia Fifty Years Ago

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**Abstract.** This paper is about computer education in Australia fifty years ago when it was just at its beginning. It makes particular reference to the State of Victoria. The paper covers the period of the 1950s-1980s. It looks at how, after the first mainframe computers appeared, university courses in programming began in the 1950s and 1960s. In 1960 the Australian Commonwealth Government began looking for ways in which government departments could make use of computers and in 1963 set up the Programmers-in-Training scheme. This was later taken over by the Colleges of Advanced Education and became the template for many future business computing tertiary courses. Computing in schools made a minor start in the early 1970s with a few schools teaching programming in Maths classes using punch cards that were run at a local university. Arrival of the low-priced microcomputer in the late 1970s changed the situation dramatically with many schools quickly making use of them in education. Initially this involved teaching about information technology, but in the later 1980s computers began to be used in other subject areas.

**Keywords:** Information technology, education, curriculum history, Australia

## 1 Introduction

It is fifty years since IFIP WG3.4 – Professional and Vocational Education in ICT was formed. Fifty years ago in Australia, like many other countries, teaching about and use of computers in education was just at its beginning. Computer Science had appeared in universities, followed by various forms of Business Computing (which relates closely to WG3.4), but very little was happening in schools. The Australian Computer Society (ACS), founded in 1966, was offering some professional education in computing. The first major change was when the Australian government set up its Programmer in Training scheme in 1963.

There are two aspects to information technology in education: teaching about computers and information technology and using computers in other subject areas. This paper deals primarily with teaching about information technology as, in this period, very little else was done with computers as few academics or teachers had much idea of how they could be used, and there were also not enough available computers.

## 2 Computer Education Pre-History

CSIRAC<sup>1</sup>, Australia's first 'internally stored-program computer', and one of the world's first, commenced operations in 1948 [1, 2].

CSIRAC was located at the University of Sydney until 1956 when it moved to the University of Melbourne. CSIRAC continued in use at the University of Melbourne until 1964 when it was offered to the Museum of Melbourne. It is now on display in Melbourne's Scienceworks museum<sup>2</sup> [1].

University computing education in Australia began at the Department of Mathematics in the University of Sydney in 1947, before CSIRAC was operational, with a course on *The Theory of Computation, Computing Practices and the Theory of Programming*. In 1959 the university offered a *Post-graduate Diploma in Numerical Analysis and Automatic Computing*, followed in 1961 by other computing courses at undergraduate, masters, and doctoral levels. In the University of Melbourne, programming courses were given from 1956 as part of a Bachelor of Science degree, and in 1959 a formal subject in *Numerical Methods and Computing* was developed as part of the undergraduate Bachelor of Arts degree in Pure Mathematics [3]. Various computer courses evolved in the 1960s, but in most cases were still based in schools of mathematics or electrical engineering. It was not until the mid-1960s that computing began to be seen as a separate discipline, and university computer science and information science departments started to appear [4].

In 1968 in the US the ACM published "Curriculum 68: Recommendations for the undergraduate program in computer science" [5], and later its 1978 curriculum recommendations [6] which was widely used throughout the world.



**Fig. 1.** CSIRAC on display at the Museum of Melbourne

## 3 Research Methodology – Curriculum History

In the broadest sense, this paper could be seen as a study of how the computing curriculum at both tertiary and school levels developed over the last fifty or so years. It was thus appropriate in this study to make use of the lens of Curriculum History. Goodson [7, 8] who worked mainly with secondary school subjects and how they appeared, evolved, and sometimes disappeared, asserts that "*curriculum history is primarily a study in curriculum rather than a study in history*" [9]. Curriculum history is not a new lens with which to view educational change, dating from at least 1909:

<sup>1</sup> CSIRAC – Commonwealth Scientific and Industrial Research Automatic Computer.

<sup>2</sup> It is believed that CSIRAC is the only remaining first generation computing still intact and on display in the world.

*“If a history of any educational subject encourages and deepens with us the habit of looking with a keener interest for educational provision to the full social, economic, political and religious needs of a community in a past period, from the point of view of the contemporary aims and scope of knowledge of that period, then the study justifies itself.” (10 :vii-viii)*

The methods applied in Curriculum History involve documents analysis, oral narratives and life-story interviews of those involved. Two important documents here are *A History of Australian Computing*, a book by Trevor Pearcey [1] creator of CSIRAC, and *The Last of the First - CSIRAC: Australia's First Computer* [2], but neither has much to say about education. The main source of data for this study was thus life history interviews with those involved in computers and education at this time, covering the parts they played. They included Gerry Maynard (O&M Inspector with the PMG and PBS Inspector), Geoff Dober (trainee from a Programmer in Training course), Peter Juliff (academic from a College of Advanced Education), Tony Montgomery (University academic), Bill Davey (secondary school teacher) and Tony Salvas (secondary school teacher). The interviews were informal, but opportunity was given for the interviewees to tell of the part they played in this, and how it was important.

#### **4 The Commonwealth Defence and PMG Computing Projects**

In 1957, no computers were in use in business in Australia [1]. The only computers outside universities were at the Bureau of Census and Statistics and the Weapons Research Establishment. In 1960, the Australian Commonwealth Government directed the Commonwealth Public Service Board (PSB) to look at ways computers could be used in administration of the Department of Defence and the Postmaster General’s Department (PMG). There was, however, a problem with the severe shortage of people having a good knowledge of computing. Added to this was that after fulfilling the needs of these projects, very few knowledgeable people were left to undertake other computing work (11). Clearly more training was needed, but the universities were then unable to deliver business-related training. It was not possible to get these needed people from overseas as many other countries were experiencing the same problem.

In 1960 the PSB began the needed training by running a twelve-week course in ‘*Analysis and Design of Mechanised Systems*’ [12]. Although this was seen as successful in providing a ‘crash course’ in computing (11), the Commonwealth Public Service Board saw a need for a complete and more detailed course and so, in 1963, set up the twelve-month Programmer in Training Scheme (PIT). Its 1966 PIT Automatic Data Processing (ADP) Course Outline and Syllabus indicated that:

*The Public Service Board has been conducting courses in A.D.P. Systems Analysis and Design since 1960. These courses have provided essential training not only to a large number of practitioners in the Commonwealth Service but also to personnel engaged in A.D.P. activities in Commonwealth Instrumentalities, State*

*Government Departments and in Departments and Authorities of Malaysia and Singapore. Technical Colleges in Victoria and a number of State and overseas organisations have adopted the course as a basis for their A.D.P. training. (13)*

#### **4.1 The Programmer in Training Scheme**

These twelve-month courses trained staff in establishing and operating commercial and administrative applications, and involved twenty hours per week of formal class time for one year. They were open only to graduates. The curriculum of the Programmer in Training (PIT) courses had four phases [1, 11]:

- Phase 1 (10 weeks): Introduction to the Course and to the Service (1 week), Computer Equipment and Techniques (1 week), Computer Mathematics (1 week), Programming (5 weeks), Systems Analysis and Design (1 week), Examinations (1 week).
- Phase 2 (12 weeks): Departmental training.
- Phase 3 (12 weeks): Computer Equipment and Techniques (1 week), Programming (4 weeks), Systems Analysis and Design (4 weeks), Statistics (2 weeks), Examinations (1 week).
- Phase 4 (12 weeks): Departmental training.

Maynard [11] points out that:

*The programming part of the early PIT courses started off with a study of machine code then moved to assembly language before finally getting down to Business FORTRAN, which was a very powerful language developed by Control Data. Later, studies of COBOL and PL1 were also introduced. [11]*

The Commonwealth Public Service Board continued to run the PIT courses until 1970 when it handed over their operation to four tertiary institutions: Caulfield Institute of Technology, Bendigo Institute of Technology, Canberra College of Advanced Education and New South Wales Institute of Technology [11]. In many ways the PIT courses could be seen as laying the foundations of later business computing diplomas and degrees offered in Colleges of Advanced Education (CAEs) and Institutes of Technology. The importance of the PIT courses on the developments in business computing and information systems degrees was significant [14].

## **5 Information Technology Hardware in this Period**

### **5.1 Non-Computer Information Technology**

Information Technology does not just involve computers, and Oxford University Press [15] defines it this way: “*The study or use of computers, telecommunication systems,*

*and other devices for storing, retrieving, and transmitting information*". Several non-computer technologies that were available at this time and had a use in education included Cassette tape (1963), Videotape – VHS (1976) and CD (1982).

## 5.2 Early Mini and Micro Computer Technology

It was not until development of the minicomputer that educational computing became easily accessible to universities and CAEs. Significant machines were the Digital Equipment Corporation PDP 11/70 (1975) and the DEC VAX which was introduced in 1977. These were readily accessible to tertiary institutions because of their lower cost than mainframes.

At this time also, a number of computer technologies appeared, leading the way towards affordable microcomputers, and perhaps the most significant was the Intel 4004 Microprocessor (1971). Floppy disks became available in the 1970s and 1980s: 8-inch disk (1972), 5.25-inch disk (1976) and 3.5-inch disk (1981).

## 5.3 Development of the Internet and Email

Beginning with the ARPANET (1969), after several intermediaries the Internet appeared widely in Australian universities and elsewhere in the world in 1989. It wasn't until 1991 that the World Wide Web became available. Although some forms of email had been available since the 1960s, it was not until the 1990s that it came into popular use with Microsoft Mail, Gmail, Hotmail and Yahoo.

# 6 Tertiary Courses in Computing

As mentioned earlier, university computing began in mathematics and later also in engineering departments. Computer Science did not appear as a separate discipline until the mid-1960s but held an important place from that time on. From then on 'academic' computer science courses were taught in Melbourne and Monash Universities in Victoria, and later in other universities.

At that time tertiary education in Australia was undertaken in two different types of institutions: Universities and Technical Colleges. University courses were mainly in Computer Science. The universities typically made use of mainframe computers to perform their major processing needs, but Mathematics, Engineering and Computer Science departments more often had minicomputers like the PDP-11.

Peter Juliff (16) points out that in the 1960s, 'computing subjects' in the Technical Colleges taught about punch-card machines, accounting machines and computers. The Technical Colleges were later to become Colleges of Advanced Education (CAE) and by the 1970s were all offering some type of computing course, usually based on the use of minicomputers. Although some courses in Computer Science were offered, most courses were Business Computing related, aimed at: "*developing computer profession-*

*als for employment in government and industry*” [17:8] as what was important in business was not so much the computer itself as using one to perform business functions well.

In the 1970s, CAE computing degrees of a Computer Science nature were offered in Applied Science Faculties, and Business Computing degrees in Business Faculties. Business computing courses in the CAEs did not evolve from university Computer Science courses, but instead their foundation can be seen to have come from the PIT courses, which were “*oriented towards training staff for the establishment and running of commercial and administrative applications of computing*” [11]. This was particularly the case after their operation moved to the Caulfield, Bendigo, Canberra, and New South Wales Technical Colleges. By the late 1980s, Business Computing had come to be known as Information Systems.

Montgomery [18] remarked that it was unfortunate that often Department of Computer Science and Department of Business Information Systems at the CAEs did not work together closely. He argued that “*What should be taught to a Business Information Systems person is in many respects what we are teaching to our Computer Science students: information processing techniques. There should be one decent systems analysis course ...*” [18]. This made communication between teaching staff and students in these separate areas quite difficult.

## 7 Computer Education in Australian Schools

Early in the 1970s a few Secondary Schools had managed to acquire access to mini-computers and made use of these in Maths classes. This was the beginning of the use of computers in Australian schools, but in the later 1970s things began to take off.

In the 1970s and 1980s each state set up its own Computer Education Centre, beginning in 1968 with the Angle Park Computing Centre in South Australia (19). In the mid-1970s Tasmania set up the Elizabeth Computer Centre and a state-wide timesharing network (TASNET).

To assist schools in coming to grips with this technology, in the early 1980s Victoria set up a system of Computer Education Consultants who were seconded teachers who travelled around schools to illustrate this technology and assist teachers with its use. I was a Computer Education Consultant for Northern Region in Melbourne. In Victoria, the State Computer Education Centre (SCEC) commenced operations in 1985 [20]. At SCEC I held the appointment of Educational Computer Systems Analyst.

Following Seymour Papert’s use of a turtle in conjunction with Logo programming, in 1979 a Tasmanian company produced the Tasman Turtle, designed for use with Logo and an Apple II computer [21, 22]. This proved popular both in making programming in Logo more concrete and as a demonstration of the power of robotics [23]. Later a connection was established between Lego and Logo [24, 25].

As a result of the rapidly growing number of microcomputers in schools in the late 1970s and early 1980s, in 1983 the Commonwealth Schools Commission set up the National Advisory Committee on Computers in Schools (NACCS) to provide funding and co-ordination of computers in education nationally [26]. The NACCS report:



*Teaching, Learning and Computers* pointed out that “*The widespread availability of a variety of hardware has opened up opportunities for school use of computing that have not previously existed*” [27]. These included:

- Computer Awareness (Computer Literacy) courses in upper primary and lower secondary schools,
- Computer Science / Computer Studies / Information Processing,
- Using computers across the curriculum,
- Curriculum Support including preparation of teaching materials and student records,
- Communications with other teachers, students, and remote databases, and
- Administrative applications for database management and financial management. [27]

The most popular machine in Secondary Schools in the late 1970s and early 1980s was the Apple II, while some Primary Schools started to venture into computing with the Commodore Pet. In Victoria in the late 1970s the Technical Schools Division recommended that its schools use the Micromation computer – a multi-user CP/M machine. It then tried to convince the Secondary Schools Division to standardise on CP/M, rather than using the Apple II, Commodore or Tandy. This caused some dispute, but the Secondary Schools decided not to adopt CP/M.

### **7.1 Educational Software**

In the 1970s South Australia, Tasmania and Western Australia had support for developing software and set up the TASAWA consortium for its exchange. Three examples of educational software from overseas at the time were ‘Oregon Trail’ (MECC), ‘Lemonade’ (Apple II) and ‘Suburban Fox’ (Acorn BBC computer). Although having much in its favour, this software had a very foreign outlook – lemonade stalls and fox hunting are unknown in Australia. This highlighted the need for locally produced software, and this soon began to appear, the most well-known and popular being the First Fleet Database from the Elizabeth Computing Centre in Tasmania.

## **8 Educational Computers Specially Built for Schools**

The first ‘Personal Computers’ appeared in the late 1970s and early 1980s with the most significant for education in Australia being Apple II (1977), Radio Shack TRS-80 (1977), Commodore PET (1977) and Atari (1979). Many others appeared later into the 1980s including Commodore VIC-20 (1980), Acorn BBC (1981), IBM PC (1981), Microbee (1982), Apple Macintosh (1984) and IBM JX (1984). These were, however, incompatible with each other, and in the early to mid-1980s, before the PC and Macintosh became dominant, many countries around the world worked to develop their own educational computers. These included: Poly Computer (New Zealand, 1980), Acorn BBC Computer (UK, 1981), Compis (Sweden, 1981), ICON Computer (Canada, 1983)

known locally as the ‘Bionic Beaver’, Piccoline (Denmark, 1984) and Tiki (Norway, 1984).

In 1985, the Australian Government decided that, like these other countries, Australia should develop its own educational computer, mainly to provide an opportunity for the Australian computer industry to manufacture it and provide software for this new machine. Another reason was that, as mentioned earlier, much of the available software at the time had a very foreign outlook – American or British, and little things like the Apple Macintosh’s ‘Trash Can’ were annoying as in Australia we use a ‘Rubbish Bin’.



Fig. 2. Bunyip stamp

The Government set up Educational User Requirement and Educational Technical Requirement working groups to develop the computer [28]. These groups met and worked in Canberra and came up with a design for the Australian Educational Computer. When all the design work was done, however, the Australian Government decided not to proceed, and the computer was never built. Like Frankenstein’s monster [29], the Australian Educational Computer was never sufficiently ‘real’ [30] to be given a name of its own, but I will call it the Bunyip<sup>3</sup>. Those of us involved in this project had assumed that the computer would be manufactured by an Australian company such as Microbee, but in retrospect, after the PC and Apple Macintosh came to dominate the market in the late 1980s, the decision not to proceed was probably correct [31].

## 9 Computers in Secondary Schools

Early in the 1970s a small number of Victorian Secondary Schools began to make some use of minicomputers purchased through innovation grants from the Commonwealth Government. Burwood High School obtained a PDP-8 (initially loaned from DEC), McKinnon High School purchased a Wang computer, but because of the high maintenance cost shared it with Box Hill High School, and Maribyrnong High School also used a Wang computer. These computers were expensive, not very powerful, and quite difficult to use. They were typically based in Maths departments to teach programming. In most cases this was the result of their teachers’ own experiences in Computer Science at university [32].

In 1974, Monash University introduced MONECS (Monash Educational Computer System) that made use of mark-sense cards to teach programming in FORTRAN or BASIC to school students [33]. This provided a big computer education impact on schools at this time, as before the advent of the microcomputer it was impossible for an average school to offer students hands-on access to a computer [33]. With MONECS, students would mark the cards in class and their teachers would take a batch of cards to a local university to run on its PDP-8 computer. This allowed a class of 30 students to each get two program runs in a one-hour period [34]. Unfortunately, in most cases the initially results were disappointing for the students as they involved finding many syntax errors. At this stage, like the universities, schools saw computing as a branch of

mathematics concerned with algorithm design, and most teachers involved came from a Maths/science background.

In 1978, the Victorian Education Department's Secondary Mathematics Committee, recognising the potential of computers in mathematics education, set up a Computer Education Subcommittee. They then formed the 'Computer Travelling Road Show' which visited schools around the state and performed demonstrations to teachers of computer applications in mathematics, commerce, word processing and graphics. They normally showed these on an Apple II computer [35].

### 9.1 Computer Awareness Courses

By the end of the 1970s, microcomputer like the Apple II, Tandy TRS-80 and Commodore PET, being much cheaper than minicomputers and less difficult to use than arranging for the use of mark sense cards on a university minicomputer, changed things considerably in schools. Costing about A\$2,000 a 16KB Apple II<sup>3</sup> was affordable by most schools, but expensive enough that most schools could only afford one or two machines. This placed restrictions on how they could be used. But the question was, apart from teaching programming, what could you do with a computer?

In Australia, like most countries in the late 1970s and early 1980s, few teachers had any knowledge or experience in using computers. A report by Anne McDougall, commissioned by the Victorian education department, noted that:

*Computers have been called electronic 'brains' and there is no doubt that in the popular view, they are surrounded by an aura of mystery and are credited with powers they do not possess. The result is that most people outside the computing profession have attitudes of awe and fear towards computers and feel helpless and powerless in a highly computerised society. (36)*

It was thus seen that students needed to be made *aware* of computers and what they could and could not do, and so *Computer Awareness* courses<sup>4</sup> began to be offered in Secondary Schools when the situation was quite different to what it is today. A typical Computer Awareness might have the following three components:

1. What a computer is and how it works, computer programming (probably in BASIC), history of computer technologies.
2. Uses of information technology in science, engineering, and business.
3. The implications on society of increased use of computers [33].

### 9.2 Secondary School Computer Science Courses

In 1981, Computer Science was first offered as a Higher School Certificate (Year 12) subject in Victoria. Year 12 subjects are important for university entrance and so it was disappointing when both Melbourne University and Monash University did not allow

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<sup>3</sup> The Apple II used a cassette tape recorder as storage and a television set as a monitor.

<sup>4</sup> In some countries these courses were called Computer Literacy.

it for admission for their courses. They said that they did not see the 35% external examination as sufficient. The subject assessment also comprised option work with 35% school-based consensus moderation and 30% practical work. The universities consider the subject to have insufficient serious academic worth, and not appropriate at a secondary school level. The other Victorian universities and the CAEs however did accept Year 12 Computer Science as a valid subject [37].

### 9.3 Use of Computers in Other Subject Areas

Probably the first use of computers in different subject areas began in 1982 with the release of the First Fleet Database software by the Elizabeth Computing Centre in Tasmania. This attracted immediate interest as students were keen to see if they had a convict relative who arrived from England in 1778. The software was available for Apple II computers and required no background knowledge of computers to use [38]. Use of computers in accounting, science and other subject areas followed, but discussion of this is beyond the scope of this paper.

## 10 Conclusion

Fifty years ago in Australia, Computer Science was underway in universities, and the government and business were just starting to make use of computers. The Programmer in Training scheme had run successfully and was just transferring to the CAEs. Courses in Business Computing were beginning. Only a few schools were then using computers, and these for programming in Maths classes. It is difficult now to look back at this period in education as it is so different to today when almost every student has an iPad, and computers are used for many functions in schools. But why is it worthwhile to look at computer education in the 1970s and 1980s? Will this help us to understand things today or to plan how to deal with future educational technologies? As George Santayana [39] once said: *“Those who cannot remember the past are condemned to repeat it.”*

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