# WHAT DID WE THINK WE WERE DOING?

*Reflections on the History of Educational Computing in Victoria, Australia*

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Abstract: This paper reflects on some aspects of the introduction of computers into Australian schools and teacher education, with an emphasis on the state of Victoria. Developments in the U.K. and the U.S.A. have significantly influenced Australian educational computing, often being adopted with a local flavor. This is acknowledged here through the use of vignettes that illustrate local incidents, which are then related to occurrences in other Australian states as well as other countries.

Key words: Teacher education; Educational computing; Australia

## 1. INTRODUCTION

Despite the brief history of educational computing it is impossible to record all the successes, failures and individuals. Herein we consider selected episodes in educational computing in one Australian state, but with links that extend further afield. We claim neither primacy nor uniqueness, knowing of similar occurrences in other places, both earlier and later. We focus through seven vignettes – short descriptive sketches of episodes in which one or other of the authors have participated. It is still possible to talk with some pioneers of educational computing, and such discussions, together with information from archived journals and handbooks, are the major resources for this paper.

## 2. THE AGE OF ENTHUSIASTS

In the 1970s it might have seemed to some teachers, students and parents that advocates for using the new computing technology in education were curiously obsessed. Computing brought a new language of acronyms and pejorative terms such as "kill", "crash" and "abort", as well as threats to move teaching away from being teacher-centered. Educational administrators faced issues of teacher re-training, supply of hardware and software, and curriculum development, all of which were going to be costly at a time when education was not necessarily a political priority.

Much of what we take for granted today in educational computing can be traced back to the innovative ideas and practices of enthusiasts. The vignettes in this paper occasionally identify enthusiasts, but always acknowledge their conviction and efforts.

Vignette 1: Computing in teacher education, 1970.

In March 1970 students majoring in mathematics at Bendigo Teachers' College are busily translating simple mathematical formulae into the only high level programming language available to them, FORTRAN IV, and transcribing the code line by line onto coding sheets.

A week later students receive cards wrapped in computer printout. The lecturer had taken their coding sheets to the computing facility at the local higher education institution, and then returned several days later to collect the processed output. As students read their printout there are moans, exclamations and occasional sounds of triumph. Following a quick check of individual success or failure the students begin trying to understand the error messages in their printout. If there are many errors the whole program is again transcribed onto coding sheets, ready to be re-punched and batch processed.

The following year the students commence their career as classroom teachers. All are assigned to rural primary schools without access to computers.

Prior to 1970 very few Australian teacher education students had any contact with computers. While universities had computers and taught computer science, school computing activities were almost non-existent. Then teacher education institutions began to recruit mathematics and science staff with some computing background. Around this time the authors of this paper were appointed to teacher education positions but did not have computing in their job description. Because of the growing interest in computing in schools, all three were soon involved in teaching computing and supervising research in the area.

Prior to desktop computers becoming readily available, few teachers had access to the mainframe or minicomputers used in higher education, severely restricting the scope and content of hardware related topics; there was a strong emphasis on teaching programming, with a mathematical bias.

Vignette 2: Formal computing qualifications for teachers.

> By 1975 formal computer education for Victorian teachers was provided through post-graduate B.Ed. degrees offered by most faculties of education. In Melbourne undergraduate pre-service primary and secondary teacher education courses were offered at the Melbourne College of Advanced Education (MCAE), while post-graduate courses were available at the University of Melbourne..
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> The 1975 pre-service educational computing subjects were incorporated into mathematics. For secondary teachers MCAE offered elective subjects at different levels of the four-year course. "Computer Programming" (FORTRAN IV); "Computer Science I" containing searching and sorting algorithms, assembly language, Boolean algebra, and data structures; and "Computer Science II" covering the history of computing, simulations, Turing machines, data structures, operating systems, social implications, and computers in education.
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> The University of Melbourne offered only two postgraduate subjects: an introduction to programming, and an investigation of educational uses of computers.

According to Walker (1991) the first Australian school microcomputer project began in 1976 when two teachers from a Melbourne non-government school turned their personal interest in microcomputers into an exploration of the educational potential of this technology.

Vignette 3: Government funding for a school computing project.

> Subsequently the two teachers applied for and received a Commonwealth Schools Commission Innovation Program grant to develop their interest in microcomputers into an educational initiative in the school in which they both worked. They were required to locate hardware suitable for use in the school. Secondly, they were to produce software, practically all of which had, in the beginning, to be written personally. Finally, they were required to publish a newsletter to promulgate their activities. (Walker, 1991, p.296)

In an era of "plug and play" hardware and self-installing software, it is difficult to imagine the challenges faced by these two teachers. By 1980 computer hardware and software were progressing in directions unimagined

by engineers and researchers in the 1950s and 1960s. Paradoxically, hardware size and cost decreased while operating speed, memory size and versatility of application increased. Until the late 1970s almost all computer use was based around mainframe computers or minicomputers. Although large, slow and inflexible by today's standards, the Digital Equipment Corporation PDP family of minicomputers made educational uses feasible. Compared with other computers of the time, the PDP-8 was an inexpensive general purpose computer suitable for use in a variety of roles in higher education.

Australian researchers were following with interest developments in educational computing taking place in the USA and the UK. Bitzer and others at the University of Illinois had developed the PLATO project, breaking new ground both conceptually and technologically. Based on mainframe hardware, PLATO introduced educators to time-sharing, computer games, and what became e-mail and newsgroups. Using acoustic couplers and the telephone system, workstations were able to operate well away from the Illinois campus – even as far away as Australia.

Early research into computer assisted instruction by Patrick Suppes and Richard Atkinson at Stanford University had investigated using computers to teach the basics of reading and mathematics. The program for learning mathematics was highly structured, was based on behaviorist learning principles, and included programmed feedback to learners, lesson branching, and record keeping for student attainment and progress.

Overseas journals including *Technical Horizons in Education* (1972), *Creative Computing* (1974), the *Oregon Computing Teacher* (1974), (subsequently *The Computing Teacher* (1979) then *Leading and Learning with Technology* (1995)) were avidly read by Australian computer education enthusiasts. The first educational computing journal produced in Australia arose from the research grant outlined in Vignette 3. *COM-3* began in 1977, was edited by Tim Mowchanuk and published at Essendon Grammar School where he taught. In early issues it was stated that, *COM-3 stands for the first three letters of the words, COMMUNITY COMPUTER COMMUNICATION. It stands for all permutations and combinations of these words and symbolizes the role of the computer in altering our society through its powerful information processing capabilities.* (Mowchanuk, 1977, p.1) *COM-3* became the official journal of the Computer Education Group of Victoria (CEGV), reaching educational computing enthusiasts throughout Australia.

Vignette 4: Enthusiastic educators form a professional association.

In May 1978 a public meeting led to the formation of the Computer Education Group of Victoria. Initially supported by a mathematics teacher association, the CEGV organized and ran a national educational computing conference in 1979 and by linking up with the two teachers noted in Vignette 3 began to produce a journal on a regular basis.

Although a state-based association, the first CEGV conference featured keynote speakers from education systems, schools, and universities from several Australian states. CEGV conferences have become annual events, even though there is now a national educational computing association with a bi-annual national conference. The first US National Educational Computing Conference (NECC) was held in 1979. An Australian national association was formed in 1982, a national conference held in 1983, and the first issue of a national journal, *Australian Educational Computing,* was published in July 1986.

The first CEGV conference enabled early users of computers in education to meet with fellow enthusiasts, and to realize they were not alone, a point reinforced by the attendance of interstate teachers and a display of hardware, software and publications from around the world. The emphasis has always been on computer applications and their relevance to teaching and learning in Australian classrooms, although some research is reported. In 1979 many conference sessions demonstrated software developed by teachers, including programs for displaying Chinese characters, teaching German, drill in mathematics and English, and a student records and school accounting system.

Seymour Papert was the major drawing card for more than 1000 participants at the third CEGV conference in 1981. Scott Brownell from the Elizabeth Computing Centre in Tasmania had introduced LOGO into Australia in 1975 following a visit to the Artificial Intelligence Laboratory at MIT. Originally running on a DEC minicomputer situated in Hobart, Tasmania, access and use were limited because equipment had to be transported to a school, and connected to the phone network via an acoustic coupler. Sandra Wills, who was almost synonymous with LOGO in Australia in the period 1976-82, moved equipment around the state and demonstrated the potential of LOGO. Within a few years Tasmanian schools accessed LOGO via teletypes and terminals connected to the statewide time-share network. In Victoria and other states without networks, teletypes

linked to the telephone system via acoustic couplers enabled some students to experience LOGO.

By the early 1980s several Australian authors had published books proposing innovative approaches to learning through LOGO. *Learning LOGO on the Apple II* (McDougall, Adams & Adams, 1982) gained a worldwide audience as the authors adapted the content to reflect different dialects of LOGO running on computers such as the BBC micro, Commodore-64, and Tandy TRS-80. The book was translated into French, German and Chinese. Also locally authored in the same period, *Let's Talk Apple Turtle* (Nevile & Dowling, 1983) was aimed at younger children and linked LOGO to off-computer activities including writing stories, drawing, and making models.

Vignette 5: A personal computer in a primary classroom.

In the grade 6 classroom of a small independent primary school in Bendigo, the teacher, his class, a group of teacher education students, and a teacher educator are all gathered around a small VIC-20 computer. It is 1982 and the VIC-20 has recently become available in Australia but is still a rarity in schools.

Programming in BASIC the teacher and teacher educator developed a series of simple educational programs for students to use. Many of these programs involved students recalling factual knowledge, and were variations of the drill and practice format.

This was not the first such occurrence, even in Australia, and is included because it illustrates one of the most significant milestones in educational computing. 4- and then 8-bit microprocessors were released in the 1970s, followed by the first personal or desktop computers. Microcomputers bearing brand names including Apple, Atari, Commodore, and Tandy were available in Australia in the early 1980s, and soon appeared in schools and teacher education institutions.

## 3. MOVING TO FORMALIZATION

As schools and teacher education institutions investigated teaching and learning applications of microcomputers in the late 1970s, one Australian state took a different path. Partly due to geographic features – an island with relatively small land area and with almost all the population living in a few urban centers – Tasmania opted for time-shared networking based on minicomputers.

> *The computer network has been established over the past six years to provide the hardware for computing subjects and computer-based school administration in High schools, Matriculation colleges and Technical colleges.*
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> *Computing access is currently made available using a network of five PDP-8 computers which act as terminal concentrators to the central PDP-11/70. This system allows schools anywhere in the state, to connect on-line terminals to their nearest PDP-8 node. Nodes are located at Devonport, Burnie, Launceston and Hobart.*
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> (Brownell, 1977, p.31)

McDougall (1980) made no specific recommendations for hardware, although she acknowledged the imminent spread of microcomputers. In our era of constant hardware and software change it is worth noting the following comment, *It is recommended that, once adequately prepared teachers are available, each school own a micro-computer or interactive terminal facility* (McDougall, 1980, p,32) (emphasis added). This value placed on professional development was reflected in subsequent government policies and actions. State and federal funding in Victoria were channeled into teacher education and support, with successive governments showing little inclination to fund hardware for schools.

With computers becoming commonplace in educational institutions, administrators saw a need to develop formal computing curricula. In Victoria this process began with a subject at Year 12, the final year of secondary schooling. A description of the proposed subject noted that a similar subject *has been available to HSC students in Tasmania for the last 3 years, has been generally available in the U.K. for around 4 years and in the U.S.A. for at least 6 years* (Montgomery, 1978, p.19). The proposed Computer Science subject consisted of four (unequal) parts: software; hardware; applications; social implications. The plan was for a core (computer structure, algorithms, programming, data structures, file manipulation), which comprised two-thirds of the total teaching time, and two options from social implications, system case studies, and installation inspections. Then, as now, practical work was to form a significant part of the subject. By the time the subject was taught there were local textbooks available, with Woodhouse, Johnstone and McDougall (1982) and Montgomery and Juliff (1981) being popular.

With the introduction of the Year 12 Computer Science subject it became necessary to prepare teachers for this new discipline. Most Australian secondary teachers acquire an undergraduate degree with appropriate subject combinations, and then undertake a one-year Graduate Diploma in

Education. In 1981 the University of Melbourne included computer science as a teaching method in the Graduate Diploma in Education (Secondary). Although the focus was on content and assessment related to the new Year 12 subject, teaching computing at lower secondary levels was also covered. Woodhouse and McDougall (1986) is an example of an early computing textbook written specifically for teachers in training.

Vignette 6: University research and development, 1973.

In 1973 three students of first year Swedish are huddled around one of two interactive terminals located near the entrance of the University of Melbourne's Computer Centre. They read books balanced on their knees, filling in time while waiting for the computer to respond to their last typed message.

The Swedish vocabulary drill program they are using is the first software developed by the recently established Computers in Education Research Group. Despite the slow response time of the (primarily batch processing) computer, special letter combinations used to replace the accents normally used in Swedish, and the need to type instead of hand-write responses, student evaluation of the program is (astonishingly to us now) very positive.

Although early computers were inappropriate for the task, serious thinking about computer support for learning had begun in the University, and valuable experience was gained in educational software design. The Group developed programs to support teaching in a range of disciplines. Technical reports were produced describing the development and evaluation of the programs, and the experience gained contributed to development of an elective course, Educational Uses of Computers, for postgraduate education students in 1974.

Acceptance of both IT skills and classroom applications of IT as core pre-service teacher education for all new teachers in Victoria occurred some years after various aspects of IT became part of the primary and secondary school curriculum. Because many pre-service teacher education institutions believed that IT had educational implications for all teachers, and they were aware of developments in teaching with and about IT in local and overseas schools, there is a long history of IT in Victorian teacher education. IT subjects for teachers in training began in the early 1970s. Initially they were offered only as parts of other discipline areas, most often mathematics. In 1984 Monash University introduced a mandatory IT in education subject as part of the Graduate Diploma in Education (Secondary) course. This appears to be the first Australian mandatory IT specific course for prospective teachers, occurring well before the Victorian Government notified teacher education institutions in 1997 that it would soon employ only graduating

teachers who had successfully completed a subject that ensured competence in basic IT skills, knowledge, and classroom applications.

Throughout the 1960s, 1970s and 1980s much educational computing in Australia was piecemeal and reliant on the skills and knowledge of an ever-increasing band of enthusiasts. Even when education systems began to formalize school computing curricula and teacher credentialing, progress was gradual and often inconsistent between various authorities.

## 4. NOW AND TOMORROW

Finally, we take a brief look at some current developments in educational computing and then a glance toward the future. Society in 2004 is technologically rich and is becoming technology dependent in many aspects of life. Microprocessors are ubiquitous and now monitor, control and enable us to do things that were not even dreams half a century ago. Teachers are provided with notebook computers to support their professionalism (McDougall, Nicholson & Marshal, 2000), and are now under increasing pressure to use computer technology effectively, efficiently and often.

Vignette 7: Computing in teacher education, 2003.

As part of initial teacher education for primary teachers at the University of Melbourne, a Problem Based Learning (PBL) approach to learning in a technology rich environment has been implemented. Students are presented with four problems that they solve in collaborative groups. The context for all problems is a "virtual" primary school that students access through a website. From this site students can find school policy and curriculum documents as well as individual profiles of all staff members and information about class sizes and the physical aspects of the school campus.

The room in which classes are held for this subject has ten oval-shaped tables. Each table has a computer monitor set into the top, with the rest of the computer on shelves underneath. The computers are standard university machines with internet and intranet connections, as well as the facility to connect to a ceiling-mounted video projector. The tables are sufficiently large to enable five students to sit around one side and view the computer monitor.

The most significant differences between events described in Vignettes 1 and 7 are not concerned with advances in technology, but rather with the role of the technology. In Vignette 1 technology is central to the activity; the activity would be senseless without computers, even though computers were not physically accessible by the users. In Vignette 7 the technology has

become a means to an end and is no longer the focus of the activity, even though it is more powerful, more sophisticated and more readily available. We are confident this trend will continue as educators learn more about the interconnections between teaching, learning and technology.

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