DOCUMENT RESUME

ED 275 841 CE 045 426

AUTHOR	Hall, W.; And Others
TITLE	Information Technology Training within Traineeships: Options for TAFE-Based Courses.
INSTITUTION	TAFE National Centre for Research and Development, Payneham (Australia).
SPONS AGENCY	Victoria Education Dept. (Australia).
REPORT NO	ISBN-0-86397-049-4
PUB DATE	85
NOTE	116p.
PUB TYPE	Reports - Research/Technical (143) -- Tests/Evaluation Instruments (160)
EDRS PRICE	MF01/PC05 Plus Postage.
DESCRIPTORS	Banking; Building Trades; Comparative Analysis; Computers; *Cost Effectiveness; *Curriculum Development; Educational Needs; Educational Policy; Foreign Countries; *Fused Curriculum; *Information Technology; Policy Formation; Postsecondary Education; Printing; Program Content; Secondary Education; Technical Occupations; *Technological Literacy; Tourism; *Trade and Industrial Education
IDENTIFIERS	*Australia; United Kingdom

ABSTRACT

A study explored ways in which traineeship courses could be designed to include training in information technology. The skills and performance standards required of information technology training in the printing, tourism, banking, construction, and computer industries were identified. Next, the current provision of such training in Australia and the United Kingdom was compared, and the costs and benefits of the major options for providing information on technology training in Technical and Further Education (TAFE)-based courses were analyzed. It was determined that practical training in information technology should be included in the off-the-job component of all traineeships. Two across-industry traineeships should be developed in the electronic office and in computing and software. All programs developed should address core skills required for personal development and future employment, practice skills in common use over a wide range of occupations, and job-specific skills. Grants should be made available to fund inservice teacher training, purchase of basic information technology equipment, and first-year evaluation of all new training programs developed. (Appendixes include the project interview schedule and questionnaire and lists of organizations visited, information technology core skills in the Certificate of Prevocational Education and Youth Training Scheme in the United Kingdom, and skills and performance standards for potential traineeship jobs in the five aforementioned industries. A 63-item bibliography is also provided.) (MN)

TAFE

TAFE NATIONAL CENTRE FOR
RESEARCH AND DEVELOPMENT

INFORMATION TECHNOLOGY TRAINING WITHIN TRAINEESHIPS: OPTIONS FOR TAFE-BASED COURSES

This report was commissioned by the Commonwealth Department of Education under its Review and Evaluation Program.

Adelaide 1985

TD/TNC 11.4
ISBN 0 86397 049 4

Published by:

TAFE National Centre for
Research and Development
296 Payneham Road
Payneham South Australia 5070

(Incorporated in South Australia)

Printed by D.J. WOOLMAN, Government Printer, South Australia

CONTENTS

FIGURES

Chapter 5

Chapter 6

TABLES

1. DEFINITIONS, ABBREVIATIONS AND ACKNOWLEDGEMENTS

1.1 Definitions and abbreviations used in the report

Definitions

Information technology

IT [information technology] is the acquisition, production, transformation, storage and transmission of data by electronic means in forms such as vocal, pictorial, textual or numeric, such as to facilitate the interaction between [people] and between [people] and machines. IT also includes the applications and implications (social, economic and cultural) of thes processes.*
(Adapted from Further Education Unit, 1984, p. 1.)

Traineeship

A traineeship is a formalised mechanism which incorporates work and learning experiences leading to a qualification both for further employment and for career orientated education.

Abbreviations

AEC	Australian Education Council
BTEC	Business and Technician Education Council
CGLI	City and Guilds of London Institute
CAD	Computer aided design
CAI	Computer aided instruction
CAM	Computer aided manufacture
CPVE	Certificate in pre-vocational education
DTI	Department of Trade and Industry
FEU	Further Education Unit

* In our adapted definition, the word men in the FEU version has been replaced by people.

ITC	Industry Training Committee
IT	Information Technology
ITeC	Information Technology Centre
Kirby Report	Report of the Committee of Inquiry into Labour Market Programs
MSC	Manpower Services Commission
NOW	New Opportunities for Women
PEP	Participation and Equity Program
RSA	Royal Society of Arts
TAFE	Technical and Further Education
YTS	Youth Training Scheme

1.2 Acknowledgements

The TAFE National Centre for Research and Development was commissioned in March 1985, to undertake the study which had to be completed by the end of August 1985. Six months is a short period for such an investigation, and its completion would not have been possible without the help of the individuals and groups listed in Appendix C. The Centre gladly acknowledges the advice and information provided by State/Territory TAFE Authorities, by training authorities, and by representatives of industry and commerce.

The United Kingdom's Further Education Unit offered special assistance, and their help is acknowledged.

2. SUMMARY

2.1 Project aims

The TAFE National Centre for Research and Development was commissioned by the Commonwealth Department of Education to undertake this study. The purpose of the project was to provide information to the Department which would contribute to the development of its policy advice to the AEC Task Force on Education and Technology concerning the ways in which TAFE-based traineeship courses could be designed to include training in information technology. There were three specific aims:

- to identify in broad terms and for selected industries the skills and performance standards required of training in IT for traineeships, given the target group and the purpose of the traineeship system;

- to obtain information on the current provision of IT training for the traineeship target group (or other relevant groups), both in Australia and in the United Kingdom in terms of its educational effectiveness and cost effectiveness;

- to identify costs and benefits of major options for TAFE provision of such IT training, including any in-service training required for existing TAFE personnel.

The project timetable prevented a detailed consideration of IT training in countries other than the United Kingdom.

2.2 The Project's context

The final report of the Committee of Inquiry into Labour Market Programs (Kirby Report, 1985) was presented to the Minister for Employment and Industrial Relations on 21 December 1984. Open access to structured and recognised training for all groups was an important element of the Kirby Report. New training arrangements were proposed and, for 16 and 17 year olds, part-time employment and part-time formal off-the-job education and training were to be combined to produce traineeships. The Kirby Report defined formal off-the-job training in the following way:

> The formal off-the-job training component of traineeships should be broad based, focusing on a family of occupations, and including humanities and social studies. There is no reason why the general studies part of the formal training should not be taught through vocational as well as academic programs.
>
> The training should, we suggest, seek to develop communication, mathematical, manual, visual and problem solving skills. Education in information technology, that is, the technology and processes associated with computer based communications systems, should also be included. The skills required to manipulate and use information technology systems will be important for personal development and future employment. (p. 115)

The development of visual and problem solving skills is a complex matter, much neglected in curriculum development, and should be the subject of a specially funded investigation.

Recommendation 19 of the Kirby Report then stated:

> The Australian Education Council's Task Force on Education and Technology should be asked to report on the ways in which traineeship courses could be designed to include training in information technology.

This report deals with the above recommendation, i.e. it suggests ways in which TAFE-based courses may include IT training within traineeships. In framing their recommendations the writers of this report have borne in mind the proposals of the Kirby Report, that is, a minimum of 13 weeks (per year) off-the-job training component, preferably in the form of day release (two days a week) or, in exceptional circumstances, block release.

Technology in general, and IT in particular, is making a profound and lasting impact on Australian society, particularly in the area of employment, placing the least educated at gravest risk as a consequence. Knowledge of IT and basic IT skills can help to reduce this risk.

The IT component of traineeships should help in achieving the higher mean skill level required by Australian industry and commerce. Further, the off-the-job education in IT being suggested in this report should help trainees to cope with the changes in their everyday lives as a result of advances in technology.

2.3 Overview

The TAFE National Centre for Research and Development was commissioned to suggest ways in which TAFE based courses could include information technology (IT) training in traineeships. The Centre's investigations included present provision of IT training for the target group (both in Australia and the United Kingdom) and costs associated with IT training.

The techniques employed in the investigation were: a literature review; structured individual and group interviews; collection and analysis of available materials; questionnaire response analysis; and observation of Information Technology Centres (ITeCs) in the United Kingdom. TAFE, industry and commerce, and training authorities were included in the investigations.

There was overwhelming agreement that IT training should be included in traineeships. Present TAFE courses catering for populations similar to the anticipated traineeship population are the Participation and Equity Program (PEP), pre-vocational courses and pre-apprenticeship courses. Many of these courses include some IT, the content of which generally falls into three broad categories: awareness and introductory; industry orientated; and computer science.

The traineeship population in the United Kingdom has available to it a unique approach to IT training, that of the Information Technology Centres (ITeCs). The United Kingdom ITeCs were originally set up to be agents of social change in inner-city areas. They were placed in areas of high unemployment, and have been successful in enabling the young unemployed to get jobs. ITeCs are extremely well funded (capital and recurrent) and they operate on a 5:1 student/staff ratio. ITeCs usually offer each of three types of training in (a) computing and software, (b) electronics and hardware, and (c) the electronic office. Australia should investigate the feasibility of setting up ITeCs especially in locations with high unemployment.

This report suggests that IT curriculum content should be divided into three areas:

(a) core skills and knowledge required for personal development and future employment;

(b) practical skills in common use over a wide range of occupations;

(c) specific skills required for a particular industry or occupation.

IT curriculum content in each of these areas is suggested in this report.

A student-centred, practical approach to IT was favoured, rather than teaching groups of students a highly theoretical course.

It would be a sensible use of resources for this curriculum to be developed co-operatively by the States/Territories. The National Core Curriculum approach is one successful way of achieving such co-operation.

The report strongly urges that the social implications of IT should be an essential component of traineeship IT courses. Various curriculum models for IT courses are suggested, as well as the IT content which could be included within those models. For the teaching of IT to be successful, the present in-service training of TAFE staff will need to be greatly extended.

The cost of including IT in the off-the-job component of traineeships has been calculated as $513 per year per trainee salary costs, assuming (a) student/staff ratio of 12:1, (b) 4 of the 13 weeks' training per year devoted to IT, (c) staff teaching load of 20 hours per week, (d) student load of 40 hours per week, (e) staff wage of $25,000 + 20%, and (f) distribution of traineeships across a number of colleges. This would mean an additional annual salaries bill of $38.5 million for IT staff supervising 75,000 trainees.

Basic equipment costs to furnish a laboratory for 24 trainees would be $98,000 (excluding furniture, fixtures and fittings). The equipment costs have been calculated as $419 per trainee, assuming (a) practical IT training per trainee is 4 weeks, (b) the trainee spends 40 hours per week in the laboratory, (c) laboratories are in use for 39 weeks each year, (d) the laboratory is used for 40 hours each week, (e) 24 trainees can be accommodated in a laboratory. The equipment is expected to have a life of about three years.

Cost of IT staff salaries (based on 1282 staff)	 $38,500,000
Salary cost per trainee	$513
IT lab. equipment cost (based on 321 [24-place] labs)	 $31,400,000
Equipment cost per trainee	$419

These are not lavish expenditures and are essential if the IT component of off-the-job training is to be successful.

The report does not consider the value of using IT to deliver instruction. A special opportunity is presented for IT mastery objectives to be learnt through IT, but that would be the subject for another investigation.

2.4 List of recommendations

Recommendation 1 (p. 17)

That information technology should be included in the off-the-job component of all traineeships.

Recommendation 2 (p. 24)

That two across-industry traineeships be developed in

- the electronic office
- computing and software.

Recommendation 3 (p. 34)

That a practical approach to information technology should be adopted in the off-the-job component of traineeships.

Recommendation 4 (p. 46)

That there should be a short, urgent feasibility study to determine whether Information Technology Centres should be established, especially in locations having high unemployment. The study should make recommendations on:

- location
- funding
- course aims, content and length
- links with industry
- links with TAFE authorities
- course accreditation
- staffing

- student admission
- appropriate non-institutional places of learning (including mobile information technology workshops).

Recommendation 5 (p. 54)

That all traineeships should provide opportunities to learn information technology knowledge and skills in each of the following three areas:

- core skills and knowledge required for personal development and future employment;
- practical skills in common use over a wide range of occupations;
- specific skills required for a particular industry or occupation.

The total time allocation should be about 4 weeks (of the 13 weeks allocated to off-the-job training).

Recommendation 6 (p. 55)

That consideration of some of the social implications arising from the impact of information technology should be included in all traineeship courses.

Recommendation 7 (p. 55)

That in-service training of TAFE teachers should be undertaken to enable them to teach the social implications of information technology. The in-service training should include content and teaching approach.

Recommendation 8 (p. 65)

That the curriculum structures used in traineeships should be evaluated during the first year. The evaluation should include qualitative and quantitative measurements of costs and benefits to trainees, employers and TAFE.

Recommendation 9 (p. 73)

That there should be adequate equipment and salaries provision for the information technology component of traineeships.

Recommendation 10 (p. 73)

That grants for basic information technology equipment should be a minimum of about $98,000 per laboratory for 24 students. Staffing costs for the information technology component only should average about $513 per trainee.

Recommendation 11 (p. 76)

That grants should be made to each TAFE Authority to provide up to eight weeks' in-service training in information technology for teachers involved in the provision of the information technology traineeship core curriculum.

Recommendation 12 (p. 76)

That a National Curriculum Committee with representatives from TAFE Authorities and Industry should be established to review, maintain and update the core curriculum proposed in this report on a regular basis and to monitor the development and production of teaching/learning materials on a national basis.

Recommendation 13 (p. 76)

That TAFE Authorities should establish systems for:

(a) collecting information for advice to the National Curriculum Committtee;

(b) preparation of curricula in industry specific areas of information technology;

(c) complementing the National Core Curriculum content according to their requirements;

(d) co-operating with others to produce a national glossary of information technology terms to be regularly amended and updated;

(e) investigating the information technology needs of those colleges likely to be involved in traineeships.

3. PROJECT DESIGN

3.1 Introduction

Because of the nature of the project, it was decided at the TAFE National Centre for Research and Development, to adopt a team approach rather than to employ one person only to undertake the study. The team consisted of four people, all of whom worked part-time on the project:

- Executive Director (TAFE National Centre for Research and Development)
- Research and Development Officer (an expert in information technology)
- Research and Development Officer (an expert in curriculum development and evaluation)
- Head of a Learning Resource Centre seconded from SA TAFE.

The techniques employed by the team were:

- literature review
- structured individual interviews
- structured group interviews
- collection and analysis of available materials
- questionnaire response analysis
- observation of information technology centres in the United Kingdom.

Each one of these will now be briefly described, in turn.

3.2 Literature review

The literature review included computer searches, perusal of researchers' personal libraries and the Centre library, an examination of recent magazine and newspaper articles (e.g. computer supplements in The Australian), and an analysis of government reports (e.g. material produced by the South Australian Council for Technological Change). Of special use was the material provided by the Further Education Unit, London. Summaries of relevant findings arising from the literature review are given in Chapter 5.

A general conclusion reached was that there was not much literature available on traineeships, which was not surprising, nor on present courses which are closest to traineeships, which was surprising. For example, there was very little hard data on the PEP's curricula structures. We should learn from this experience and develop curricula before starting the traineeship programs.

There was no shortage of material on IT, which was mostly of two kinds: (a) a mass of technical material, and (b) a growing literature on the social impact of technological change. The Organisation for Economic Co-operation and Development, for example, has calculated how many typists in West Germany are likely to be made redundant because of the introduction of word processors, and how many blue collar workers in the United States are likely to lose their jobs because of the introduction of robots and other technological aids.

There was almost no information on costs and benefits. Although a small number of predictive calculations have been made in some Australian States, our research in this area is very much intelligent guesswork.

3.3 Structured interviews

Structured interviews (Appendix A) were held in every State and Territory of Australia. The draft interview schedule was first tested in Victoria; it was then refined before being used throughout Australia. Interviews were held with two groups - TAFE and non-TAFE. Groups of TAFE staff (often consisting of PEP co-ordinators, traineeship organisers, IT specialists and other interested people) were interviewed, detailed notes were taken and later analysed. Non-TAFE groups were interviewed and they included representatives from the National Industry Training Committees (ITC) and representatives from selected industries. The National ITCs were in the areas of building and construction, plastics, printing, retailing, tourism, and local government. The industries considered were public sector (local government, transport, education, health), retailing, tourism, and banking and finance.

Individuals with special responsibilities for traineeships or information technology courses were also interviewed. In every case, individuals and groups generously gave of their time and were remarkably frank in their opinions. The project would have been impossible without their co-operation and without the co-operation of the TAFE Authorities.

3.4 Collection and analysis of available materials

Material was obtained from within Australia and from the United Kingdom. Much of the United Kingdom material dealt with ITeCs (Section 5.4 summarises the contents of that material).

Relevant Australian material examined included PEP course outlines (with special regard for curriculum structures), pre-apprenticeship and pre-vocational courses which had an IT component, and any other courses dealing with IT, as well as draft papers on proposed traineeships.

3.5 Questionnaire

A draft questionnaire was prepared, evaluated, rewritten and then administered to computer companies, banks and industry and commerce associations. A copy of the questionnaire is shown in Appendix B. The results of the survey, which are described and discussed in Chapters 4 and 6, provided information on IT content in selected industries.

3.6 United Kingdom information technology centres

One member of the research team spent three weeks in the United Kingdom visiting ITeCs and various other bodies with responsibility for IT training. Altogether, seven ITeCs and eight other organisations were visited (Appendix C).

At each ITeC, a structured interview was held with the manager and other staff. Trainee classes in progress were observed, and some learning materials were collected. The equipment in the workshops and laboratories was noted in each case. General information such as syllabus documents and budgets was also collected.

At the other organisations (e.g. MSC, FEU, BTEC), an interview was held with the officer responsible for IT training. Appropriate policy and syllabus documents were collected for further reference.

4. TRAINEESHIPS AND INFORMATION TECHNOLOGY

4.1 Traineeships in the States and Territories

A traineeship can be described as a formalised mechanism which incorporates work and learning experiences leading to a qualification for further employment and career orientated education.

The interviews conducted with the individuals and groups mentioned in Section 3.3 indicate a consistent acceptance of the above definition. This is, and will continue to be, important if a national consistency in the implementation of traineeships is to occur.

The major concern expressed relates to what individuals variously describe as:

- the career path following traineeships
- a 'ladder of opportunity'
- the need to avoid traineeships becoming ends in themselves.

In general, the interviewees were concerned that there was no guarantee of employment at the end of the proposed traineeships. They noted that there are five possibilities at the end of a traineeship: continued employment in the same industry, employment in another industry, self-employment, further education and unemployment.

In terms of this project, which focuses on IT content in the off-the-job curriculum provided by TAFE, the specific concern was that the traineeship should be the basis of further knowledge and skill development. There is, therefore, a strong expectation that curriculum for trainees should be developed in such a way that it will enable the granting of credit or status in higher level subjects and/or courses in TAFE.

This concern is based on the endorsement in the Kirby Report of broad-based transferable skills rather than training in job specific skills; for example, in terms of IT, trainees could learn to apply, limited skills on brand-specific hardware and software.

It was clear that the interviewees' interpretation emphasised both the formalised experiences during the traineeship and the post traineeship options available.

4.2 Examples of other traineeships, with emphasis on course structure

The Kirby Report (p. 113) points out that traineeships in one form or another have previously existed for various occupations but have declined over the last 10 to 15 years. In the recently proposed traineeships, the Report suggests a structure for the off-the-job component of a minimum of 13 weeks in the form of two days a week or, in exceptional circumstances (e.g., in the case of young people in remote areas) block release (Kirby, p. 115).

During the interviews conducted for this project, efforts were made to identify traineeships being developed or implemented. Two examples have been identified in the tourism industry. One in Cairns, Queensland, and the other in Perth, Western Australia. The Cairns example requires the completion of a pre-vocational course, has three eight week off-the-job components and extends over two years. The Perth example is aimed at hotel management and extends over two years with intermittent off-the-job components.

One issue is worth pointing out about these examples; that is, the merit, or lack of merit, in a block of off-the-job training prior to any on-the-job experience. This issue has been raised extensively during interviews. Because the traineeship off-the-job curriculum is intended to be broadly based (Kirby p. 115) and transferable, a caution regarding the degree of initial job-specific content is given, for fear of it being too narrow in scope.

The alternative course structures considered by the project team are described in Section 6.5.

4.3 Traineeships and rationale for including information technology content

The Kirby Report (p. 115) states: 'The skills required to manipulate and use information technology will be important for personal development and future employment'. This raises two issues, that of personal development and future employment.

These two issues have extensive implications for both off-the-job and on-the-job curricula for trainees. Further, there is broad recognition that the present traineeship age group has not (to a large degree) had the opportunity formally to learn about and apply IT. Based on the project interviews there are, however, two schools of thought regarding the non-formal learning that has occurred in IT among this age group. Firstly, many people stated that some of these young people knew more IT already than could be taught even in the whole 13 weeks. Secondly, others in this age group were just as IT ignorant as the majority of the more adult population. Therefore, it appears that there are three options in curriculum decision making that should be taken into account when considering the inclusion of IT in the off-the-job traineeship curriculum. These options are 'catch up', 'skills in demand', and 'broad foundation'.

The 'catch up' option would be based on the viewpoint that the trainees have not had the opportunity to acquire basic IT knowledge and skills. In other words, they would need to catch up. The 'skills in demand' option would be based on a curriculum providing IT knowledge and skills that would be immediately applicable in the work place. The 'broad foundation' option would be based on the IT curriculum being orientated to the trainees' acquiring knowledge and skills that would be applicable more in the long term rather than in the short term. It should be possible for traineeship curricula to be designed to allow for different entry profiles.

Regardless of which option is the basis of curriculum decision making, the impact of IT on the life-style, and work, of individuals (and society in general) should be implemented as major components of the off-the-job curriculum, and as extensively as possible in the on-the-job training program. Also, it should be remembered that there will also be an on-the-job program which will include extended skills and knowledge.

Overwhelmingly, the interviews with representatives from industry and commerce, TAFE Authorities, and training authorities, showed that IT should be included in traineeships. The next section describes the responses of the industrial sector to the questionnaire, all of which showed that IT is a component of its work. Interviews indicated that about four weeks of IT within the 13 weeks off-the-job component was reasonable, as the United Kingdom visit confirmed. The four week period has been determined by what is considered to be minimum curriculum content, and that content was based upon interviews, questionnaire responses and observation at ITeCs.

Recommendation 1

That IT should be included in the off-the-job component of all traineeships.

4.4 Information technology content for traineeships in selected industries

Industry leaders in a range of industries were surveyed to determine:

- the types of jobs within each industry which have the potential for inclusion in the new traineeship system;

- the IT skills and performance standards (in broad terms) required in these jobs;

- the extent to which IT is used in each industry.

The performance standards for the IT skills were classed into three broad levels:

- awareness or 'literacy'
- understanding
- acquisition of specific practical skills.

These levels are frequently assumed to be hierarchical and cumulative. That is, understanding requires awareness, and specific practical skills require both awareness and understanding in the skill for efficient performance. However, the assumption should be tested because some educators believe that skill in doing often precedes understanding. Awareness can come about as a result of doing, especially in the ITeC context.

Through interviews and written responses it was clear that leaders within some of the industries surveyed were not yet ready to nominate job types that could be included in the traineeship system. However, a sufficient number of leaders within five industries provided the information sought. The five industries are:

- printing
- tourism
- banking
- construction
- computers.

The following jobs were nominated by <u>two or more</u> industry leaders for possible inclusion in the traineeship system.

printing

- print salesperson
- carton maker
- clerical assistant
- keyboard operator
- secretary

tourism (including hospitality and catering)

- waiter/waitress
- receptionist
- bar attendant
- kitchen hand

banking

- bank clerk/customer service officer
- typist/receptionist
- computer operator
- data input operator

construction

- estimating/estimators assistant
- contracts administrator/costs clerk
- payroll/accounts clerk
- planning/scheduling assistant
- word processor/typist
- administrative assistant

computers

- word processing operator
- computer sales trainee
- field engineer trainee
- programmer
- customer support representative

An important feature of the above list of jobs is that the word processing/secretarial job is included in four of the five industries. This suggests a traineeship in word processing/secretarial skills across all industries is desirable. This is discussed further in Section 4.5.

The IT skills and performance standards for each job are listed in Appendix E. Although each job has some industry specific and job specific IT skills, the three practial skills of:

- word processing,
- spreadsheets, and
- database packages

were required in one or more jobs in all five industries.

The extent of IT use in the five industries was surveyed. Twenty one IT areas were listed, and each respondent was asked to indicate whether the extent of use of each area was:

- not used,
- little used,
- moderately used, or
- greatly used.

Respondents were also asked to comment on likely future use within their industries.

The results are summarised in Table 4.1. Although the five industries are fairly diverse, their pattern of use is quite similar, except in the following eight areas:

- mainframe computers
- mini-computers
- optical scanning print input
- computer networks
- databases
- programming skills
- systems analysis skills
- computer controlled processes.

In all eight areas the construction industry has the lowest extent of use, and the banking, printing, or computer industry the highest extent of use.

Overall, the computer industry is perceived to have the highest extent of use of IT and the construction industry the lowest extent of use. This result would be expected in view of the nature and structure of these industries. The banking and printing industries are not far behind the computer industry in overall extent of use.

Table 4.1
Extent of use of information technology in five industries

AREA	EXTENT OF USE (0=not used; 1=little used; 2=moderately used; 3=greatly used)					
	Printing	Tourism	Banking	Construction	Computers	Future increase in use
1. Mainframe computers	1.6	0.9	3.0	0.8	2.4	-
2. Mini-computers	2.6	1.9	2.2	1.1	3.0	Tourism only
3. Micro-computers	2.2	2.2	1.4	1.8	2.3	Significant
4. Personal computers	1.8	1.7	1.4	1.4	1.8	Significant
5. Keyboard input	2.8	2.7	3.0	2.4	2.9	-
6. Optical scanning print input	1.0	0.4	2.0	0.1	0.8	-
7. Voice recognition and synthesis	0.2	0.1	0.2	0.0	0.6	-
8. Computer networks	2.0	1.6	2.4	0.9	2.5	Significant
9. Information bulletins	0.4	1.5	1.4	0.3	1.4	Significant
10. Telex	2.6	2.5	2.4	1.6	2.3	-
11. Electronic mail	1.2	0.9	1.0	0.3	2.1	Significant
12. Telephone switchboard	3.0	3.0	2.6	2.6	2.8	-
13. Word processing	2.4	2.5	2.2	1.6	2.8	-
14. Database on computer	1.4	1.3	2.4	0.6	2.3	-
15. Computer aided manufacture	2.2	0.2	0.2	0.1	1.1	-
16. Robotics	0.2	0.1	0.0	0.0	0.4	Printing only
17. Simulation	0.4	0.1	0.2	0.1	0.6	-
18. Numerical control machines	0.2	0.4	0.8	0.1	0.9	-
19. Programming skills	2.0	1.3	2.2	1.2	2.8	-
20. Systems analysis skills	2.2	1.6	2.2	1.1	2.9	-
21. Computer controlled processes	2.2	0.9	2.6	0.4	1.1	-

Other areas of IT used in each industry that were specially mentioned by respondents are:

- <u>printing</u>
  - computer aided design
  - transmission of text from clients
- <u>tourism</u>
  - facsimile
  - message switching
  - computer cash registers
- <u>banking</u>
  - electronic banking
- <u>construction</u>
  - computer aided design
  - facsimile
  - interactive computer-based training
- <u>computers</u>
  - computerised voice system
  - computer aided design
  - integrated office automation.

Five areas were widely seen as greatly increasing in use in the industries surveyed within the next few years. These areas are:

- micro-computers
- personal computers
- computer networks
- information bulletins (teletext, viewdata)
- electronic mail.

Over the five industries the three areas of micro-computers, personal computers and computer networks are moderately used generally, with use expected to continue to increase.

The two areas of information bulletins and electronic mail are little used generally over the five industries, but use is expected to increase considerably over the next few years.

Increased use specific to the industry was perceived in two areas. Mini-computer use was expected to greatly increase in the tourism industry. The use of robotics was expected to greatly increase in the printing industry.

The above responses were based on replies from a total of 44 different organisations representing the five industries of printing, tourism, banking, construction and computers.

4.5 Two 'across-industry' traineeships

Examination of the potential traineeship jobs and their IT skill requirements reveals two important outcomes.

Firstly, the job of typist/word processor/secretary is nominated in four of the five industries. This suggests that a traineeship in typing/word processing could be considered for all industries. Because of the experience in this area in the United Kingdom's ITeCs (as reported in Section 5.4), we further suggest that a somewhat broader traineeship be offered in 'the electronic office', instead of the narrower word processing field. Such a traineeship should have similar content to the Electronic Office specialisation at the Marconi-Wirral ITeC as reported in Section 5.4, with the major topics being word processing and typing.

Secondly, some of the potential traineeship jobs in all of the five industries surveyed required specific practical skills in computer spreadsheets and database packages. This suggests that a traineeship in 'computing and software' could be considered for all industries. The term 'computing and software' is used here to mean the use of computers and software packages, and is used in the same way by ITeCs in the United Kingdom (see Section 5.4). While most of the emphasis is on the use of commercial software packages, some training in programming is included in the one year traineeships.

The following jobs could be covered by such a traineeship:

- <u>printing</u>
  - print sales person
  - clerical assistant
  - keyboard operator
- <u>tourism</u>
  - receptionist
- <u>banking</u>
  - computer operator
  - data input operator
- <u>construction</u>
  - payroll/accounts clerk
  - planning/scheduling assistant
  - administrative assistant
- <u>computers</u>
  - computer sales trainee
  - programmer
  - customer support representative.

The off-the-job component of this traineeship could be similar to the computing specialisation at the Marconi-Wirral ITeC as reported in Section 5.4.

Recommendation 2

That two across-industry traineeships be developed in

- the electronic office
- computing and software.

5. CURRENT INFORMATION TECHNOLOGY COURSES

5.1 Definition of information technology

In Australia, the term 'information technology' has become prominent comparatively recently. It is not surprising therefore that it has generated various broad and narrow definitions.

The term 'information technology' seems to have first gained wide use in the United Kingdom in the late 1970s to early 1980s. There it has largely replaced the earlier and closely related terms of Informatics (from the Russian 'Informatika') and Telematics (from the French 'la telematique') (Maddison 1980, pp. 10,11). The term is now widely used in the United States and Europe, often instead of the narrower and overlapping terms of Computer Science, Computer Technology and Communications Technology.

The rationale for the use of such a new term is the convergence of the two technologies of computing and telecommunications. This convergence in recent years has resulted in more powerful applications of computers for information handling, (for example, the electronic office) and information is a major commodity of today's society. Some of the important information technology applications are shown in Figure 5.1.

In 1984, the FEU in the United Kingdom produced a Policy Statement on Information Technology in Further Education. The Statement included a definition of IT as follows:

> Information technology is the acquisition, production, transformation, storage and transmission of data by electronic means in forms such as vocal, pictorial, textual or numeric, such as to facilitate the interaction between people and between people and machines. IT also includes the applications and implications (social, economic and cultural) of these processes. (Adapted from FEU, 1984, p. 1).

It is suggested that this definition be used in Australia because it is sufficiently broad to include the computing and telecommunications technologies. This definition is also widely accepted by education and training bodies in the United Kingdom.

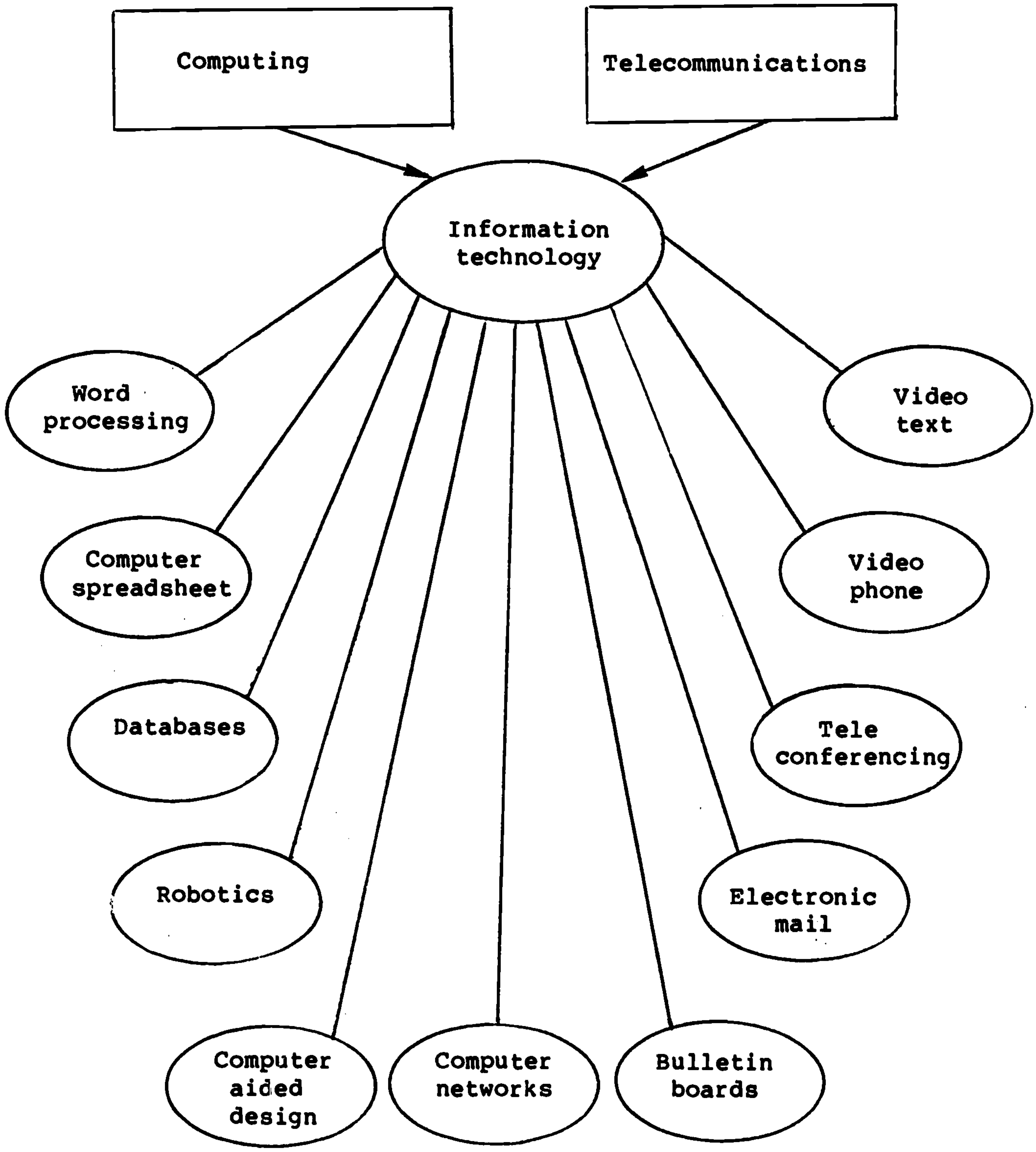


Figure 5.1 **Some of the newer computing and telecommunications manifestations of IT**

The interview schedule in Appendix A and questionnaire in Appendix B indicate how our definition of IT has developed during the project.

The essential feature of IT is the transmission of information by electronic means. It will sometimes be convenient to use a shortened and simplified definition of IT as follows:

> IT is that technology associated with the processing, transfer and storage of information by electronic means.

In the longer definition, the five processes of acquisition, production, transformation, storage and transmission are mentioned. A complete IT application combines all of these processes except perhaps for the optional process of storage. This is illustrated in Figure 5.2. The processes used in four examples of IT are listed in Figure 5.3. This figure illustrates some of the similarities between computer and communication technologies.

5.2 <u>Information technology courses in TAFE: an overview</u>

Courses offered by the TAFE Authorities were examined as part of this project to identify factors relevant to an IT component of the off-the-job component of traineeships. To do that, handbooks and syllabus documents from certificate, diploma, PEP and related courses were analysed for their approach to IT courses.

Course documentation was not always available or complete, being sometimes available only in draft or non-approved revision form, while the large number of introductory or awareness courses offered as college initiatives in Stream 6 frequently had minimal documentation. All Authorities were devoting considerable effort to course revision and to the preparation of new courses. These efforts are clear indicators of the level of demand placed upon TAFE, of the changing, expanding nature of the subject, and of the efforts being made to provide appropriate responses to the demand.

In the examination of the course documents available, attention was given to identifying common areas in curriculum content, course structures and the range of courses offered, as being factors which would be particularly useful in the development of a core curriculum in IT.

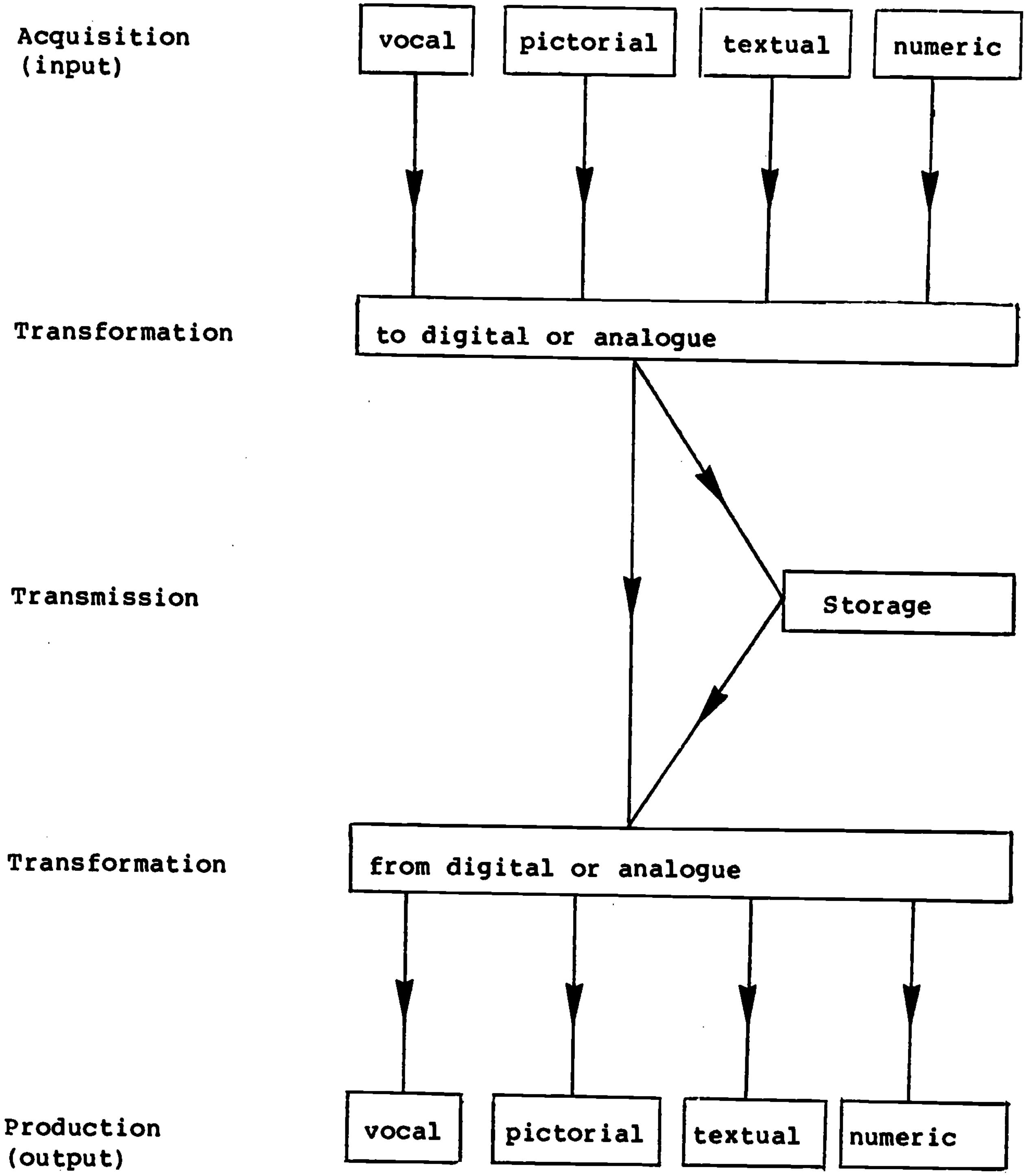


Figure 5.2 Processes involved in all Information technology applications

Type of IT / Type of process	Processes used			
	Television	Telephone	Stand-alone computer	Interactive video
1. Acquisition	Pictorial and vocal - video camera	Vocal - telephone mouthpiece	Textual and numeric - keyboard	Pictorial, vocal, textual, numeric - video camera, keyboard
2. Transformation	To analogue signal*	To analogue signal	To digital signal	To analogue and digital signals
3. Transmission	Cable or broadcast	Cable	Cable/micro-circuits	Cable, micro-circuits
4. Storage	Video tape	No	Computer tape, disk, or micro-chip memory	Laser disk
5. Transformation	From analogue signal*	From analogue signal*	From digital signal	From analogue and digital signals
6. Production	Pictorial and vocal - television receiver	Vocal - telephone earpiece	Textual and numeric - visual display unit or printer	Pictorial, vocal, textual, numeric - monitor

* In some newer technologies, digital signals are used instead of analogue signals.

Figure 5.3 The processes of four types of IT

The IT courses offered by TAFE Authorities generally fall into three broad categories:

- awareness and introductory
- industry orientated
- computer science.

Each one of these is discussed briefly below.

Awareness and introductory courses

Awareness and introductory courses are those which are self-contained, presume no prior knowledge and are aimed at introducing terminology, applications and basic skills. They are usually developed as college-based initiatives to meet community demand and do not form part of a formal course award. The colleges approach these courses in a variety of ways with respect to content, duration, methodology and skill attainment. The courses are generally based upon a theme which forms the core of the course (e.g. learning a computer language using an applications package), and this varies according to the type and level of teachers, computing hardware and software, and building resources available rather than as a result of differing community needs.

The following elements are common to these courses:

- they are short - usually less than 30 hours;
- no knowledge of computing is assumed;
- the practical approach is preferred;
- assessment is minimal;

Industry orientated courses

Industry orientated courses are specialised courses forming part of a recognised award, or available as individual, non-award subjects for updating of vocational skills. They are complementary to other subjects offered within the overall course of study. They are generally well established and clearly and thoroughly documentated in a structured manner determined by a formal process of involving industry and TAFE representatives. Objectives are stated in specific terms and are directed towards the successful attainment of a defined level of skill.

These courses are offered in three areas:

- technical and trade applications, e.g. computer-aided drafting, computer electronics;

- office practice, e.g. word processing, basic microcomputing for receptionists/typists;

- business studies, e.g. data processing, computer accounting.

The following factors are common to these courses:

- skill building is emphasised;
- measurement of success is carried out as a formal process;
- course content is application specific.

Computer studies courses

Although computer studies courses are designed for the computer industry, they have been identified as a separate category due to their comprehensive treatment of IT. As with the other industry orientated courses they are also usually well established within TAFE, with extensive documentation, clear objectives and formal assessment required. They share the same common factors as the industry orientated courses described above, and in addition frequently share the following:

- programming and systems analysis skills are emphasised;
- more than one language is usually taught - often Basic as an introduction and subsequently Cobol or Pascal;
- electives are often available in special interest areas.

Summary

IT is undergoing large changes under the influence of the rapidly expanding knowledge of new technology. The need to remain familiar with the level and extent of these changes has resulted in an unprecedented demand for training and awareness by industry and society, which expect TAFE to teach operator skills as well as impart knowledge about current and impending developments in IT. These requirements have implications for the contribution of the IT industry to curricula, how it is taught, and for the need regularly to review and update both content and methodology.

It is clear that TAFE Authorities and colleges are making considerable efforts to meet demands for computing skills and knowledge. It is equally clear that resources in all TAFE Authorities are under pressure, both at the equipment level and at the human level in providing teaching and curriculum support.

In general, there is variation among the Authorities in the overall content and methodology of their technology courses, even for apparently similar subjects. The traineeship scheme, however, will provide the opportunity for the development of a high degree of national consistency in IT courses. It would seem appropriate for a national body, with relevant industry representation to help introduce this consistency. National curriculum project task forces have shown that they are capable of doing this. This could also be an opportunity to consider national certification of traineeship awards.

While the TAFE Authorities generally teach the same core content in courses of similar types, content varies in specific areas of IT because of available equipment, industry needs and teacher knowledge. To allow these factors to influence IT curricula, as we believe they must, the TAFE Authorities will clearly need to play an important part both in contributing at the national level and in developing their own input into IT curricula. (The recommendations in Chapter 7 deal with this.)

There is some concern about the variation in the use and meaning of IT terminology between Authorities. Standardised interpretations are required, as well as more widespread recognition of new and developing terminology (see Recommendation 13d).

The more formal IT courses presently offered by TAFE may not be appropriate models for the core IT component of the traineeships because of their specific nature, which conflicts with the Kirby Report's concept of broad based transferable training. Awareness courses frequently have a wider approach to the subject.

The elements common to courses, however, are an indication that there is considerable agreement between providers about effective course structures and teaching methods. The core curriculum recommended in this report will attempt to accommodate these views as much as possible.

5.3 Relevant courses with information technology components: a summary

Preparatory and introductory courses such as those for PEP and pre-vocational education are designed for specific target groups and usually measure their success in terms of students getting jobs or undertaking further training. These courses were examined in this project for their approach to teaching IT.

Course structures

The IT component of these courses was usually short (less than twenty hours) and consisted of an introductory component and at least one specific IT application. Courses were usually integrated into an overall program (e.g. pre-vocational automotive, NOW program, introduction to trades) but remained sufficiently flexible to accommodate individual student projects. Assessment procedures were generally less formal than for other TAFE courses (e.g. industry orientated, computer science) and often involved staff and course evaluation as well as an assessment of student achievement. Credit for successful course completion was usually available in a further course of study, often at certificate level.

Teaching methods

An individual student-centred rather than a group-centred approach was adopted in most courses and a variety of teaching and learning methods was employed to achieve this. Group instruction using videos, films, demonstrations, lectures etc were frequently complemented by individual programs involving research, computer-aided instruction (CAI) and work experience. The emphasis in teaching methodology was almost always upon flexibility and variety. In all cases studied, the practical approach (where the learner is using an individual item of equipment) was the preferred means of introducing computers to students. Individual contracts were frequently arranged with students for specific projects which were monitored and assessed by the teacher. The key issues in teaching methodology were, clearly, retaining student interest, progression at an appropriate rate to achieve skills mastery and the solving of individual needs and problems.

Content

The IT content of these courses usually incorporated the three aspects: technology, user and society. The topics included in these general aspects are listed below. The extent to which these topics could be included was constrained by time (most of these courses are 20 hours or less).

TECHNOLOGY

- types of computers
- parts of a computer
- micro-processor
- terminology
- future technology.

USER

- keyboard skills
- applications packages
- programming
- systems analysis.

SOCIETY

- computers and daily life
- vocational opportunities
- changing work environment
- health and safety
- future developments.

Summary

IT courses in the PEP and pre-vocational areas generally demonstrated a flexible and innovative approach to teaching and learning. Personal and social issues related to IT were included in most courses and provided the opportunity for students to transfer knowledge and understanding to other aspects of their living and working environments.

These courses vary widely between colleges and client groups but are perhaps the type of TAFE course closest to fulfilling the need for 'skills . . . for personal development and future employment' (Kirby, p. 115).

There appear to be clear benefits (as indicated by interviews with teachers, and from the literature and syllabuses reviewed) to students in the IT teaching and learning approach adopted by most PEP, transition and pre-vocational teachers. These methods assisted in maintaining interest, awareness of related issues, improved learning and skill development. Given that there will be points of similarity between this group and trainees in age, experience and ability, a traineeship IT curriculum could benefit by adopting many of these practices.

There was general agreement that a practical approach to IT was essential. The performance standards shown on page 18 assume this, and the cocmments on page 62 reinforce the need for a practical approach.

Recommendation 3

That a practical approach to IT should be adopted in the off-the-job component of traineeships.

5.4 Information technology education and training in the United Kingdom

The pattern of IT education and training provided by the Further Education Colleges and other providers in the United Kingdom is not unlike that provided by TAFE in Australia. There are three broad types of IT courses:

- awareness and introductory
- industry orientated
- computer studies and IT.

A number of organisations in the United Kingdom have a national responsibility for education and training below degree level. The BTEC accredits the national certificate and national diploma courses in the United Kingdom. The CGLI accredits industry and technology based craft or trade courses.

The Royal Society of Arts (RSA) accredits arts and secretarial courses at craft level. The Joint Board for Pre-Vocational Education (administered by the BTEC and CGLI) accredits certificates in pre-vocational education. The MSC has overall responsibility for programs offered under the YTS in the United Kingdom.

The Certificate in Pre-vocational Education is of some interest in this study because a core of IT skills (Appendix D) is specified for all Pre-Vocational Education Certificates. This core consists of a mixture of broad-based skills and specific practical skills. No period of time is specified for the teaching of this core.

The YTS is also of interest because a core of IT skills (Appendix D) is likewise specified for all programs. This core consists mainly of specific practical skills. The amount of time specified for the teaching of this core of IT in the Youth Training Scheme is two weeks full-time. All those with experience in this program who were interviewed commented that two weeks was quite insufficient to achieve adequately the stated objectives of the core.

The ITeCs in the United Kingdom are of much interest in this study because they provide a model of IT training which is innovative, unique and successful. This success has resulted in a number of other countries closely studying the United Kingdom ITeC model and considering its implementation. These countries include Canada, the United States and Australia. France has already set up ITeCs which copy the United Kingdom model.

The relevance of the ITeCs to this study is also based on the assumption that the trainees within the ITeCs are largely similar in educational background and age to the future trainees in the Australian traineeship system.

Thus the remainder of this section examines the ITeCs and the training in IT that they provide.

Background

ITeCs in the United Kingdom aim to help unemployed young people, aged under 18, to obtain training and work experience in the area of IT. Over a 12 month period, trainees receive basic training in three general areas of activity:

- computing and software
- micro-electronics and hardware
- the electronic office.

In addition to vocational training, the young people also receive life and social skills instruction and, towards the end of the 12-month period, spend some time in relevant work placements.

The first ITeC allocation of 20 centres was announced by the British Prime Minister in July 1982. The initial centres were sited in the inner city areas of Glasgow, London, Liverpool, Bristol and Newcastle. In the subsequent expansion to 100 ITeCs, the allocations were based on the areas of high youth unemployment, mainly urban. Increasing demand has pushed the latest expansion to 175. Other recent developments have included proposals to establish satellite and cluster based centres to serve rural and less densely populated areas (e.g. North Wales, Lincolnshire and Devon).

Each ITeC offers between 30 and 70 trainee places. About 6,000 trainee places are offered in total.

The ITeCs are now an integral part of the United Kingdom Government's YTS, although only a small part. In early 1984, there were about 380,000 trainees in the YTS. These trainees were distributed among three modes of training as follows:

- Mode A — employer based: 280,000 trainees;
- Mode B1 — training workshops, ITeCs, or community projects: 70,000 trainees (about 5,000 trainees in ITeCs);
- Mode B2 — various other arrangements: 30,000 trainees.

All YTS programs are currently of one year's duration, but the United Kingdom Government has recently announced its intention to increase this to two years.

While the main function of each ITeC is currently to provide the one year training in IT for 16 and 17 year old school leavers, each ITeC provides a variety of other services as well.

These services include:

- trading (for profit) in IT equipment and services;
- offering (for profit) short training courses in IT;
- offering training in the core skills of IT for other traineeships under YTS (10 days full time or equivalent);
- offering training in IT for various groups (e.g. school students, teachers, and further education lecturers), under various government funded schemes (e.g. TVEI, TOPS);
- offering various community and IT services (e.g. youth club, access to Communitel viewdata).

Funding of the ITeCs

The ITeCs are funded mainly by the MSC but also receive funding from the DTI and a sponsor - usually the local council's education authority or a private sponsor.

Most of the ITeCs also obtain funds from their trading activities, which provide supplementary funds and also a source of real work experience; sometimes, however, they conflict with the training objectives of the ITeCs.

The amount of funding varies for each ITeC. Only the MSC and DTI contributions are fixed by a national formula. An outline of the funding from each source is given below:

1. **MSC funding**

   a. trainee allowances are £26.25 per week per trainee;
   b. staff salaries are paid, up to a maximum as per scale (at present the scale ranges from £5,574 to £9,114); The allowed number of staff is fixed by the ratio 5:1 for trainee:staff. Additional staff or higher than scale salaries must be funded by other sources;
   c. operating costs are allowed, up to a maximum of £630 per trainee + adult staff per year;

d. capital costs of £572 per trainee + adult staff are allowed. This is a 'one-off' grant.

Example: An ITeC has 40 approved trainee places. Thus the number of approved staff is 8 (at 5:1 ratio). The MSC funding for one year is:

Allowances	54,600	
Salaries	56,000	
Operating costs	30,240	
Capital costs	27,456	(one off)
Total from MSC	£168,296	

2. **DTI funding**

The DTI provides each ITeC with £55,000 in its first two financial years, and a further £20,000 in its third year. Thus, it provides a total of £75,000 in the first three years of each ITeC. This funding may be used for capital costs or supplementation of salaries.

Each ITeC is expected to replace this source of funding with profit from its trading activities after the third year.

3. **Local authority funding**

The amount of local authority funding varies considerably among the ITeCs. The Marconi-Wirral ITeC is an example of a low contribution from the local authority. It contributes the equivalent of about £16,000 by way of free rent and rates on the ITeC building. The Covent Garden ITeC is an example of a high contribution. The Greater London Training Board will contribute £132,000 in the next financial year to the Covent Garden ITeC.

4. **Private sponsor funding**

Some of the ITeCs are sponsored by companies such as IBM, Marconi, ICL, Rank Xerox, Ferranti and Tandy. The amount of company funding varies. The Marconi-Wirral ITeC was the first ITeC to be sponsored in this way. Marconi Underwater Systems Ltd pays the salaries of two extra staff at the ITeC, and provides various support services which would cost about £40,000 to £50,000 per annum.

The annual expenditure of each ITeC, excluding capital equipment such as computers, ranges from about £4,000 per year per trainee to about £6,600 per year per trainee. These figures include the trainee allowances, which amount to £1,365 per year per trainee. The highest cost item is staff salaries. The London ITeCs usually pay higher staff salaries and higher rent and rates than the ITeCs in the other regions.

The annual expenditures of four sample ITeCs in the United Kingdom are outlined below.

The Covent Garden ITeC in London has about £ 80,000 of capital equipment and has 36 student places which will increase to 42 student places for 1985-86. Its 1985-1986 annual expenditure budget is:

trainee allowances	49 000
salaries - training staff	96 000
salaries - support staff	32 000
rent and rates	51 000
software	11 000
other material	10 000
other costs	28 000
Total	£ 277 000

(£6,600 per trainee, including allowance)

The Derby ITeC in the Midlands of England has about £100,000 of capital equipment (last year £56,000 was spent) and has 38 student places. Its 1984-1985 annual expenditure was:

trainee allowances	52 000
salaries	73 000
rent, rates, power	16 000
software	1 000
consumables	6 000
other (postage, etc.)	5 000
Total	£ 153 000

(4,000 per trainee, including allowances)

The North Leicestershire ITeC in the Midlands of England has about £110,000 of capital equipment and has 30 student places. Its 1984-1985 annual expenditure was:

trainee allowances	41 000
salaries	78 000
rent	3 000
repairs and maintenance	10 000
other	13 000
Total	£ 145 000

(£4,900 per trainee, including allowances)

The Marconi-Wirral ITeC in the north-west of England has about £200,000 of capital equipment and has 64 student places. Its 1984-1985 annual expenditure was:

trainee allowances	93 000
salaries	133 000
software	20 000
other materials	26 000
rent and rates (notional)	16 000
Total	£288 000

(£4,500 per trainee, including allowances)

Equipment

The ITeCs in the United Kingdom are well equipped. All of the ITeCs visited adopted the following principles in deciding upon equipment:

- that there should be sufficient numbers of computers and typewriters to allow one trainee per unit of equipment;

- that preference should be given to 'business' rather than 'educational' computers (e.g. Haringey ITeC started off with BBC computers but is currently purchasing a number of IBM computers);

- that preference should be given to having a variety of computers and typewriters rather than one standard model. The trainees should be rotated to give them experience on a wide range of equipment.

A range of equipment typical of the ITeCs visited was found at Derby. Derby has 38 trainees covering the areas of electronic assembly, micro-processors, programming, software, and the electronic office. The Derby equipment mainly consists of:

- 20 computers (a 9 station LAN plus 6 QL, 2 Apricot, 1 IBM PC, 1 Apple, 1 DECmate computer) with a range of peripherals and software including word processing
- 4 electronic typewriters
- 4 printers
- 1 photocopier
- 4 oscilloscopes
- 1 etching tank for printed circuit boards (PCBs)
- power boxes
- tool boxes.

Curricula and accreditation

The curriculum of each ITeC is locally developed by the staff of the ITeC, who are guided by what they perceive to be the local employment opportunities and various other factors, such as:

- the 'core skills' of literacy and numeracy laid down by the MSC;

- provision of part of the training by the local Further Education College (in some, but not all, ITeCs).

Thus the curriculum of each ITeC visited varied considerably, but a general pattern was observed. The ITeCs usually offer each of three types of training in:

- computing and software
- electronics and hardware
- the electronic office.

All trainees undertake training in all three of these areas during an initial period, as well as education in life and social skills (including job search and interview techniques). In the latter part of their one-year training, they specialise in one of these three areas, and undertake a related job placement (monitored by the ITeC staff) for a period of one or two months.

The ITeCs varied greatly in the degree of specialisation in the one year program for the trainees. Near one end of the spectrum of specialisation is Derby ITeC, which offered only the first week as a common program before specialisation. Near the other end of the spectrum is Covent Garden ITeC, which offered a common program except for 10 weeks of specialisation near the end of the one year program.

The ITeCs see themselves as mainly providing 'on-the-job' training in aspects of IT. Some of the ITeC managers interviewed claimed that the job relevance of their training was ensured by the trading activities of the ITeC. The trainees undertook 'real work rather than academic tasks' Many of the staff interviewed mentioned that the hardware and software used by the trainees was the same as the equipment and material they would use when employed.

The broader aspects of IT and life and social skills was a smaller part of the one year program. Some ITeCs undertook this at the local Further Education College. At Derby ITeC for example, one day per week was spent at the nearby Derby Further Education College.

Although the ITeCs have locally developed curricula, there is now a movement towards a nationally accredited curriculum for two reasons:

- national accredition will allow more ready acceptance of certificates by prospective employers;

- linking with Further Education courses will be strengthened.

There is considerable merit in investigating the possibility of national accreditation within Australia.

In the United Kingdom, the vehicle of national accreditation appears to be the CGLI 'Information Technology 726 Scheme'. Most ITeC managers interviewed stated an intention to adopt this scheme, or at least some of the modules from it. The 726 Scheme is still at a somewhat early stage of development. A few of the introductory modules will be ready by the end of 1985.

Two other bodies in the United Kingdom are offering nationally accredited curricula of relevance to the ITeCs. The RSA offers typing and word processing curriculum modules, as well as a module in Computer Literacy and IT. The Joint Board for Pre-vocational Education has developed curricula for a Certificate in Pre-vocational Education. IT is one of the core competencies for all of the Pre-vocational Certificates, and forms a large part of the Technical Services Vocational Module.

While there is as yet no uniformity in the curricula of the ITeCs, the one year program offered by the Marconi-Wirral ITeC provides a general indication of the ITeC curricula. The main topics covered are:

- Introductory (15 weeks)

Computing (3 weeks)	spread sheet database programming (BASIC)
Electronics (3 weeks)	introductory (not digital)
Computing (3 weeks)	business applications (2 weeks) word processing (1 week)
Electronics (3 weeks)	soldering wire wrapping manufacture of printed circuit boards (PCBs)
Revision, special projects (3 weeks)	

The introductory program of 15 weeks follows the pilot introductory module of the CGLI's 'Information Technology 726 Scheme'.

The remainder of the year is spent on one of the following specialisation (including 6 weeks' job placement).

- Computing specialisation

  spreadsheets
  manual accounts
  computerised accounts
  programming in BASIC
  file handling
  graphics
  broader aspects of IT

- Electronics specialisation

  digital electronics
  electronic systems
  machine code programming
  interfacing computers to LED, printer and other peripherals
  project work

- Electronic office

  RSA modules:
  word processing
  typing
  book keeping
  office practice.

Teaching method

Although a variety of teaching methods is used in the ITeCs, the predominant one used in all of the ITeCs visited was the 'self-directed' approach. Learning materials from the following sources are used:

- locally prepared (by ITeC staff)
- software training manuals
- hardware training manuals
- other widely available training materials (e.g. from CGLI, RSA, Sight and Sound)
- commercial tasks (e.g. dictaphone, tapes, letters, specifications for printed circuit boards).

In the self-directed approach, trainees work on a training unit, small task, or project at their work stations (i.e. computer, typewriter or electronic workshop). A member of the ITeC staff supervises a group of 5 to 15 trainees working in this way.

It was obvious from observing the business-like conduct of the class, and the range of learning materials, that much work had been done by the staff at each ITeC in preparing appropriate learning materials and organising the projects and learning program.

Staffing

The trainee:staff ratio of 5:1, allowed for funding purposes by the MSC, is the minimum staffing level of each ITeC. Local sponsorship at some ITeCs allow this staffing level to be exceeded.

It should be borne in mind that these figures include non-teaching staff, including the manager and the clerical assistant. The teaching staff at the ITeCs are normally called supervisors or senior supervisors.

Derby ITeC provides a typical example of the staffing structure of the ITeCs. With 38 student places, the MSC makes an allowance for a staff of seven (at the 5:1 ratio), comprised of:

- 1 manager
- 1 deputy manager/senior supervisor
- 4 supervisors
- 1 clerical assistant.

The supervisors work 35 to 40 hours per week and spend most of this time supervising the trainees in their learning tasks. A small amount of time is spent on administration and staff development. The work pattern and amount of time spent on each work activity varies greatly among the ITeCs.

Many of the ITeC managers pointed out the difficulty they had had in obtaining supervisors with a suitable balance of technical and teaching skills. Most managers had appointed staff with a strong technical background. Such staff were encouraged to develop their communication and teaching skills through various staff development activities, including formal courses.

The amount of staff development activity varied greatly among the ITeCs. At Notting Dale five to six weeks of staff development activity per year were implemented. The totals for other ITeCs were closer to one week per year. Staff with a strong technical background tended to undertake communication/teaching courses. Staff with a teaching background tended to undertake IT 'updating' courses.

Outcomes

The ITeCs see their main objective as the provision of IT and other skills to enable trainees to obtain related employment. Given the current high rate of unemployment of young people, another objective stated is to impart broad-based and transferable skills to the trainees for possible future employment (particularly when the economy strengthens), and to encourage trainees to undertake further education.

The ITeC staff interviewed also saw various positive social consequences in training unemployed young people for one year. Many of the trainees in the ITeCs would expect to be unemployed for much or all of the one year period. One year at the ITeC is seen to be better than the alternative of unemployment, even if employment or a place in further education is not an immediate outcome of the one year program.

With regard to their primary stated objective, which is the provision of IT and other skills to enable trainees to obtain related employment, the ITeCs appear to be reasonably successful. The MSC undertook a survey in 1984 that showed that 61% of ITeC graduates were employed or undertaking full-time further education. This survey was, however, based on a small sample (about 15% of graduates). Staff at the MSC head office believe, from subsequent surveys, that the true rate is between 70 and 75%, of which 10 to 15% are undertaking full-time further education. Either way, the ITeCs are seen as being generally successful in their primary objective.

Of the ITeCs visited, the rate of employment of graduates ranged from about 60 to 80%. A further 10% approximately went on to further education. These figures were based on small samples (some of the ITeCs have been established for only one year). The only larger scale and long-term figures came from Marconi-Wirral ITeC. Their current records show that of their 191 graduates (from the last three years), 154 currently have jobs. The remainder are either in full-time further education, unemployed or have lost contact. The Marconi-Wirral ITeC staff emphasised (as did staff at some of the other ITeCs visited) that most of their trainees had obtained employment closely related to their training.

Summary and conclusion

The important features of ITeCs are that they:

- are well resourced;
- trade in IT services and IT training;
- provide other training services besides the one-year traineeship;
- provide much practical and real work experience;
- provide a mixture of broad based, transferable and specific skills;
- are largely controlled locally (but under broad national guidelines);
- provide access to training in a non-institutional environment.

The ITeCs in the United Kingdom have a positive impact on disadvantaged youths, particularly those who were relatively unsuccessful academically at school. At the same time, they are contributing significantly to the IT training needs in the UK, through the traineeship system and other training schemes.

Centres concerned with IT training have already been set up in Australia. The Federal Government could foster the establishment of ITeCs based on the United Kingdom model. ITeCs in Australia could support across-industry training in computing and software, and the electronic office (see Recommendation 2), and provide some, or all, of the off-the-job training in IT for other traineeships.

Recommendation 4

That there should be a short, urgent feasibility study to determine whether ITeCs should be established, especially in locations having high unemployment. The study should make recommendations on:

- location
- funding
- course aims, content and length
- links with industry
- links with TAFE authorities
- course accreditation
- staffing
- student admission
- appropriate non-institutional places of learning (including mobile IT workshops).

Some would argue that ITeCs should be set up immediately and evaluated. However, Australian conditions are different from those in the United Kingdom, and such a major, new approach ought to be thoroughly examined before large sums of money are spent.

6. CURRICULUM SUGGESTIONS

6.1 Introduction

The project has identified what it believes to be appropriate IT content for traineeships after conducting interviews and after an analysis of the industry survey of current and anticipated uses of IT. In addition, syllabus documents from the TAFE Authorities were examined.

The project team is, of course, faced with the difficulty of proposing IT curriculum and content for traineeship courses whose structure is still unresolved. Divergent views are held also concerning the traineeship student profile and anticipated vocational outcomes.

Despite this difficulty, the interviews and literature searches provided a reasonably clear indication of the type of IT curriculum content which should be included in the traineeships and that content is given in this section. Less clear is the ideal curriculum structure. There are many plausible curriculum structures for IT content, with variations in on-the-job versus off-the-job provision, and integration versus differentiation of core and industry specific IT content. The curriculum structure alternatives are discussed in Section 6.5.

6.2 Information technology core curriculum content

For the purpose of this report, the IT curriculum content has been divided into three areas:

- **Group A** - This consists of IT core skills and knowledge required for personal development and future employment.

- **Group B** - This consists of specific practical IT skills in common use now and likely to continue to be used over a wide range of occupations.

- **Group C** - This consists of skills which are specific to a particular industry or occupation.

Each of these groups is discussed below.

Group A

The content recommended in this report accommodates the stated expectations of the Kirby Report: that is, that training should develop broad based, transferable skills at a nationally consistent level and incorporate skills 'for personal development and future employment' (p. 115). Such skills within the area of IT will form part of the IT core content for all traineeships, and will be designated 'Group A IT Core Skills'.

The recommended Group A knowledge and skills are:

- IT terminology
- IT processes
- computer hardware
- computer software
- principles of programming
- person - machine communication
- history of IT development
- social implications of IT
- some applications of IT in industry, commerce, and the home.

The social implications of IT include labour market effects, education and training effects, and occupational health and safety. These areas could be integrated with other parts of the IT curriculum. Teaching the social implications of IT is discussed in Section 6.4.

The teaching of Group A knowledge and skills will involve a variety of methods and learning resources and may include lectures, demonstrations, discussions and practical projects. It is desirable that the teaching of these skills be integrated with the teaching of the Group B and Group C skills wherever appropriate.

Although Group A may be integrated with Group B, we suggest a minimum of 40 hours be allocated to the learning of Group A knowledge and skills, in addition to the time allocated to Group B. The length of time is based on information obtained from interviews and examination of syllabuses from the United Kingdom and Australia.

Group B

There are some specific practical skills in IT which are in common use now, or are likely to be in the next five years, and are required at operator level in all or most of the industries surveyed. It is recommended that such skills form part of the IT core content for all traineeships, to be designated 'Group B IT Core Skills'.

The recommended Group B skills are:

- computer operations
- terminal operations
- keyboarding
- using word processing packages
- using database packages
- using spreadsheet packages
- using viewdata or teletext

Computer operations includes starting up and closing down the system, loading and running a program, saving and copying magnetic files, and loading and running a printer.

Terminal operations includes logging-on and logging-off and using an applications program on a remote computer.

The emphasis on practical use of computer applications in the Group B skills means that it is worthwhile spending a limited amount of time on keyboarding skills.

The teaching of Group B skills will involve the provision of practical experience in each application. Nearly all of the time allocated to this area will require one-to-one trainee to computer/terminal interaction. To provide the appropriate experiences, there needs to be suitable provision of equipment (both hardware and software) and learning materials. These resource issues are discussed in Chapter 7.

Experience in Australia and the United Kingdom suggests that approximately 90 hours should be alloted to the learning of the Group B skills.

Group C

The Group C skills are listed for each of the five selected industries in section 6.3.

6.3 Information technology curriculum for selected industries

The skills and performance standards required for jobs that were nominated for possible traineeships are listed in Appendix E. Inspection of this list indicates that for many of the jobs in all five of the selected industries, specific practical skills are required in:

- word processing packages
- databases packages
- spreadsheet packages.

These have been included in the Group B core skills because of their wide application across industries. Although these are core skills, it is recommended that tasks related to the industry in which the trainee is employed or will be employed be used as examples in the learning of these skills.

The interviews and survey results (reported mainly in Section 4.4) indicated that there are a few IT skills which are to some degree specific to each industry. These skills are listed below. It is recommended that these be included in the curriculum for each industry (i.e. the Group C skills) or be included in the on-the-job training.

In some cases knowledge or skills in the area forms part of the Group A or Group B core. Where they are listed below, greater emphasis is required for trainees in the particular industry.

- <u>printing</u>
  - robotics
  - computer aided manufacture
  - computer aided design
  - transmission of text from clients

- <u>tourism</u>
  - mini-computers
  - facsimile
  - message switching
  - computer cash registers

- <u>banking</u>
  - mainframe computers
  - micro-computers
  - optical scanning
  - electronic banking
  - on-line equipment

- <u>construction</u>
  - estimating
  - computer aided design
  - facsimile
  - project management/scheduling

- <u>computers</u>
  - computerised voice system
  - computer aided designs
  - integrated office automation

The total IT curriculum content consists of the core skills (Group A and Group B) and the specific skills (Group C).

The total IT curriculum content for the five selected industries is summarised in Figure 6.1 below.

The amount of time required for the learning of the Group C skills will vary between industries and will depend on the curriculum structure used (to be discussed in Section 6.5). However most of the time allocated to IT should be spent on learning the Group A and Group B core knowledge and skills, and so the total time allocated will not vary greatly. The information obtained from interviews in Australia and experience in the United Kingdom suggests that the total time allocated to IT should be 4 weeks (full time equivalent) out of the total of 13 weeks off-the-job training.

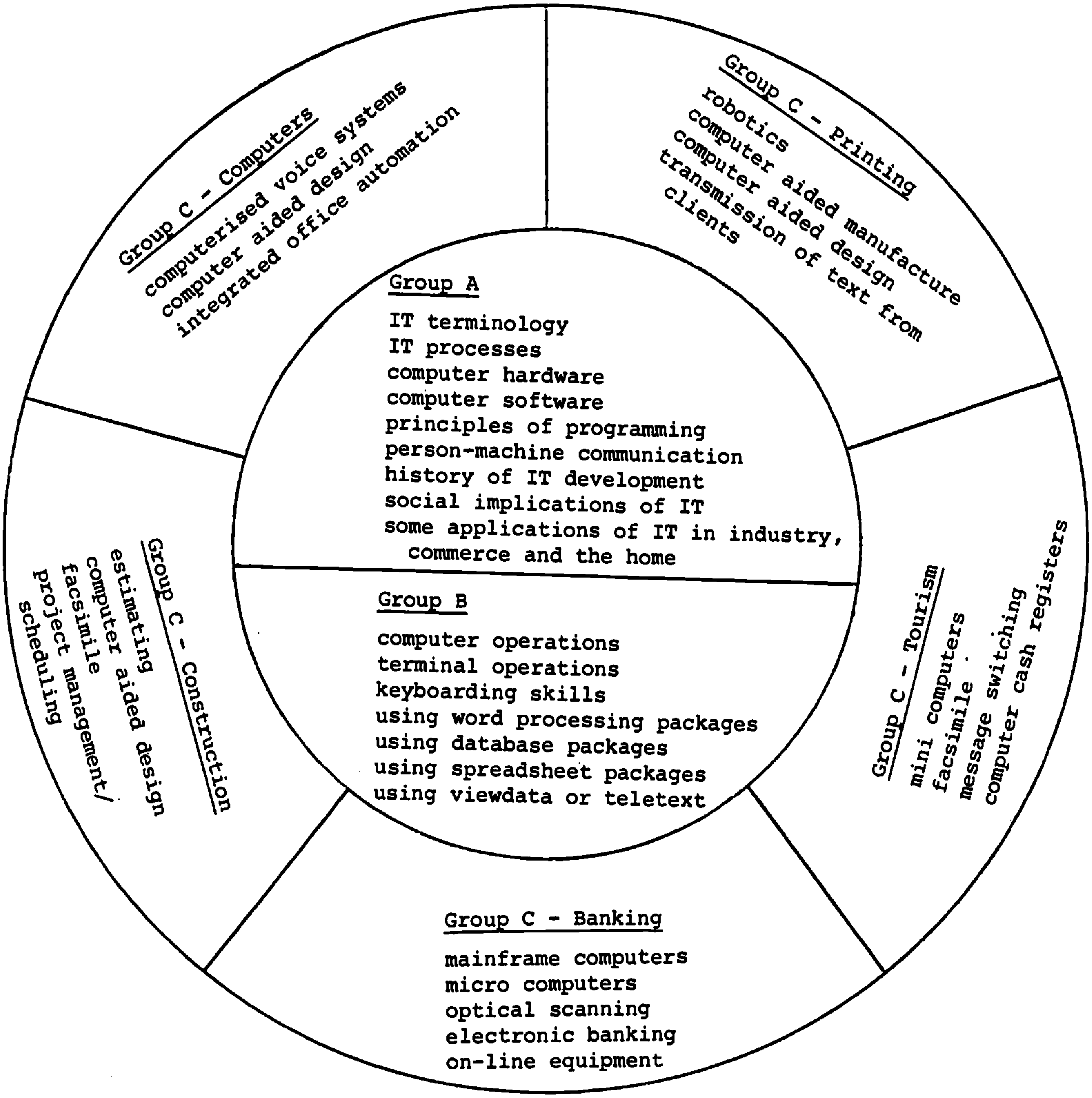


Figure 6.1 **IT content for five industries**

Recommendation 5

That all traineeships should provide opportunites to learn IT knowledge and skills in each of the following three areas:

(a) core skills and knowledge required for personal development and future employment;

(b) practical skills in common use over a wide range of occupations;

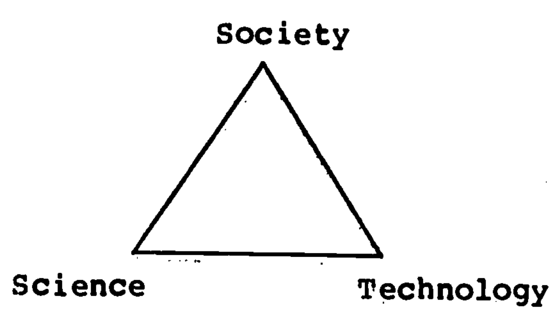
(c) specific skills required for a particular industry or occupation.

The total time allocated should be about 4 weeks (of the 13 weeks allocated to off-the-job training).

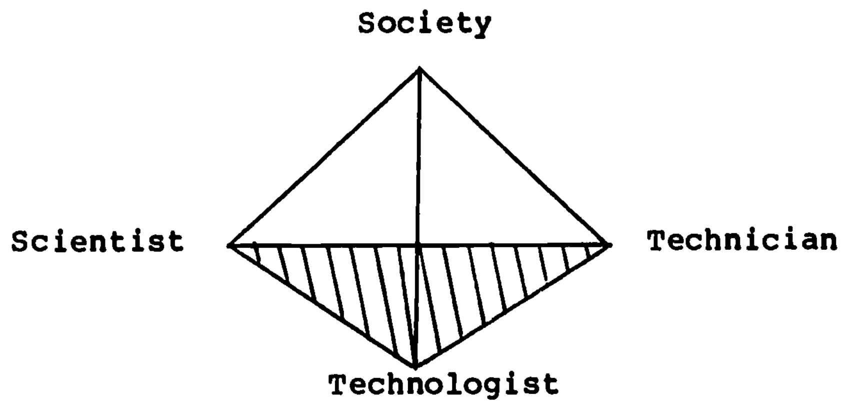
6.4 Teaching social implications

The impact of IT will be felt by almost all workers both in the home and in the workplace. Because of technological change, most people will have to change the way they do their jobs, and many will have to change the actual jobs they do, probably three or four times in a working life. The hours worked and the length of a working life could also be affected. The type of job done will also change (for example, the majority of Australians could eventually be employed in the information industry).

The reasons for these changes should be understood by all of those involved. Unfortunately, in general, our educational systems have not helped to bring about such an understanding. For example, until recently, school science courses were entirely 'pure' in content. Technological applications of science were rarely mentioned. This is now changing and school syllabuses usually point out the need to discuss the interactions of science and technology. More recently, it has been appreciated that science and technology are human activities, undertaken by people and affecting people. This has resulted in the development of the simple model:



This model has a 'technical' dimension missing, and, in any case, 'science' and 'technology' are subsets of 'society'. A better approach is the tetrahedral model shown below:



TAFE is largely concerned with the technician-technologist part of the model. Most TAFE courses would not devote much time to social interactions or to an explanation of basic science and applied science relationships. Certainly, highly theoretical considerations are probably best left to philosophy of science courses in higher education, but the social implications of development in IT should form an important part of any vocational TAFE course. Otherwise, when changes do occur to people's work (or life-style) they will feel that they have no control over events, nor will they understand what is happening and why.

Unfortunately, most TAFE teachers have not been trained in the social sciences and many may feel uncomfortable in discussing social issues. Therefore extensive staff development will be necessary if what is taught is to be relevant to students' general educational and social needs. This staff development will have to include teaching method as well as content, since social issues cannot be taught in the same way as technical skills.

Recommendation 6

That consideration of some of the social implications arising from the impact of IT should be included in all traineeship courses.

Recommendation 7

That in-service training of TAFE teachers should be undertaken to enable them to teach the social implications of IT. The in-service training should include content and teaching approach.

Some would argue that the social implications should be taught by 'guest' teachers because not everyone would feel competent to do this. However, social implications have to be thoroughly integrated, not just added on, otherwise they quickly get removed altogether because of alleged lack of time or inability to obtain a 'guest' teacher.

What to teach

The social implications of IT can be taught historically, conceptually, as a problem solving exercise or just by means of practical examples or case studies of technological innovations and their impact on society, to enliven more theoretical teaching. The historical approach could, for example, show that the present technological revolution is part of a progression. This progression is shown in Figure 6.2 below, with the other revolutions being indicated. The difference between the present revolution is that it extends the human brain also, whereas all of the other revolutions produced ways of increasing the efficiency of muscle power only.

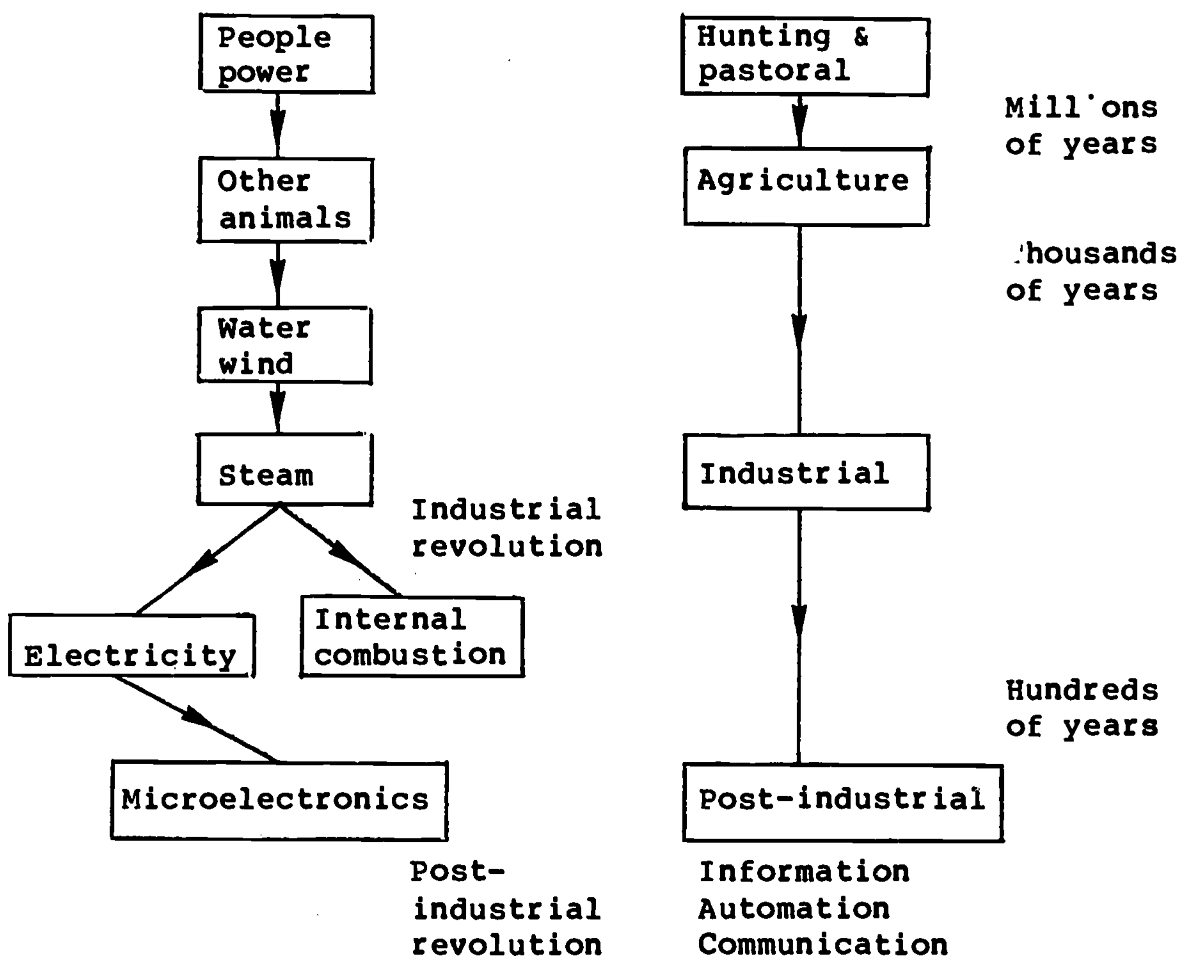


Figure 6.2 Technological revolutions

The content of the social implications component should include the effects of IT on the labour market, and the implications for training and retraining. Occupational health and safety need to be included. The implications for communication between computer literates and computer illiterates need to be discussed. There are numerous, everyday areas where IT in society can be used, including banking, engineering, motor car maintenance, retailing, office work, and so on. An interesting example of the use of IT in plumbing is provided by the United Kingdom's Further Education Unit.

> Plumbing can be taught as a knowledge-based skill, enhanced with the assistance of advanced computing. We can envisage hand-held powerful computers used on the job, giving access to the databases of local suppliers, and to the records and plans of the local council and water board. Complex planning and design problems may be resolved by describing them to the computer. How can I design this kitchen so that it contains a washing machine, a dishwasher and a sink, as well as radiators and a central heating boiler? Can the heating system that has been ordered support all those appliances? What modifications can be made to satisfy different constraints?
>
> We can envisage the plumber seeking the advice of an expert system, possibly based in the site hut. His/her problem might be the choice of appropriate pipes to meet the needs of the kitchen, and he/she may be restricted to a certain number of suppliers.
>
> Let us eavesdrop on the dialogue in the site hut.
>
> Plumber: What pipes should I choose?
> Computer: What appliances do you have and what do they take in?
> Plumber: The sink, washing machine and dishwasher each take in cold and hot water. The boiler takes in cold water.
> The cooker takes in gas.
> Computer: What sources do you have and what do they give out?
> Plumber: The water main gives out cold water. The boiler gives out hot water. The sink, washing machine and dishwasher give out waste water.
> Computer: What does the sink work with?
> Plumber: The water main and the boiler.
> Computer: What dimension is the sink input?

Plumber: 1 inch.
Computer: What dimension is the water main output?
Plumber: 2 inches
....
....
Computer: 1 inch pipe and 2 inch pipe are available from Store B.
1 inch to 2 inch converter is available from Store B.
....
....

Using a simple program the computer has solved some problems by obtaining information from the plumber, and others by checking the database of stock listed by local suppliers, from whom it could place an order at the end of the interaction. It can explain how it arrives at a conclusion. For example:

Plumber: Why do I need a 1 inch to 2 inch converter?
Computer: You need a 1 inch to 2 inch converter because you said that the sink takes in water and the water main gives out water.
In order to connect the sink with a dimension of 1 inch and the water main with a dimension of 2 inches I have suggested a 1 inch to 2 inch converter, which I know is available at Store B.

The plumber is not likely to want to spend time typing text on a keyboard. He should have the option of using a touch-sensitive screen, where he might touch the picture, or 'icon' of a sink, washing machine or other familiar part of the plumber's world instead of spelling it out. Such facilities are becoming available for personal computers, and can be used for practical purposes, especially for problems where the likely components to be fitted are known in advance. (FEU, 1984)

Although this is an interesting example, it also acts as a warning. Good hydraulic design practice would suggest a gradual reduction in pipe diameter rather than halving it suddenly. This points to the danger of a computer's output being accepted by someone lacking the appropriate knowledge and experience of hydraulics!

One aspect of the social implications of technological change which should not be neglected is the growing evidence that IT can tend to perpetuate some of the social barriers which presently exist:

> Recent research has revealed, for instance, that low-income, racially/ethnically different students in the US are less likely to have access to information technologies than their middle- or high-income peers. When they do, these technologies tend to be used to teach them in ways that systematically differ from middle- and high-income students. If the medium is the message, and this remains to be researched, the US may be in the process of creating an information society with differential access to the technology (and the other resources this implies) that parallels income and racial/ethnic lines. (AERA, 1985)

Positive steps will need to be taken in traineeship courses to see that this situation does not occur in Australia. We need to raise the level of access to high quality general education for all and avoid the formation of two societies.

6.5 <u>Alternative curriculum structures</u>

A large number of alternative curriculum structures may be implemented for the IT component of traineeships. These are generated by altering the following variables:

- degree of integration of IT with other parts of the program (both off-the-job and on-the-job parts);
- degree of integration of theoretical and practical parts of IT;
- pattern of attendence for off-the-job and on-the-job parts of the program (including distance and mixed-mode delivery systems).

The curriculum structure that is implemented may vary between States and Territories and between industries. In each case the educational benefits will need to be considered alongside the costs (e.g. staffing, equipment, accommodation), and administrative constraints imposed by bodies such as TAFE Authorities and employers.

Each of the three variables is discussed separately below.

Degree of integration of IT with other parts of the program

There are four approaches that are likely to be used in the provision of IT content, each having different degrees of integration with other parts of the program. These are summarised below:

- Approach 1: A separate off-the-job core subject in IT (of Group A and Group B skills). Group C skills are learnt on-the-job.

- Approach 2: A separate off-the-job core subject in IT (of Group A and Group B skills). Group C skills are integrated into other appropriate off-the-job subjects.

- Approach 3: A separate off-the-job subject in IT which includes both core and industry specific skills (i.e. Group A plus Group B plus Group C skills).

- Approach 4: No separate IT subject, but all IT content is integrated into appropriate off-the-job subjects.

To illustrate the differences between these approaches, each is represented diagrammatically in Figure 6.3. (Each is based on the general diagram of Figure 6.1 showing the Group A, Group B and Group C skills.)

These four approaches are not exhaustive. Other approaches are possible. For example, Group A could be treated as a separate core subject and Group B could be integrated with other parts of the program in various ways. We recommend, however, that this should not be done, because the theoretical aspects of Group A should be closely related to the practical applications (Group B skills) wherever possible.

Approaches 1 and 3, and to a lesser extent Approach 2, allow good use of laboratory accommodation because the practical IT content may be scheduled for definite periods. With Approach 4, the timing of IT practical would be dispersed over the full duration of each subject if the IT content is fully integrated with the other content of the subject.

With regard to staffing, Approach 1 provides the most practicable arrangement. It requires staff with good practical knowledge of IT as well as teaching skills. Detailed knowledge of applications in particular industries is not required in Approach 1, but wherever possible, practical tasks related to the trainee's work would be set.

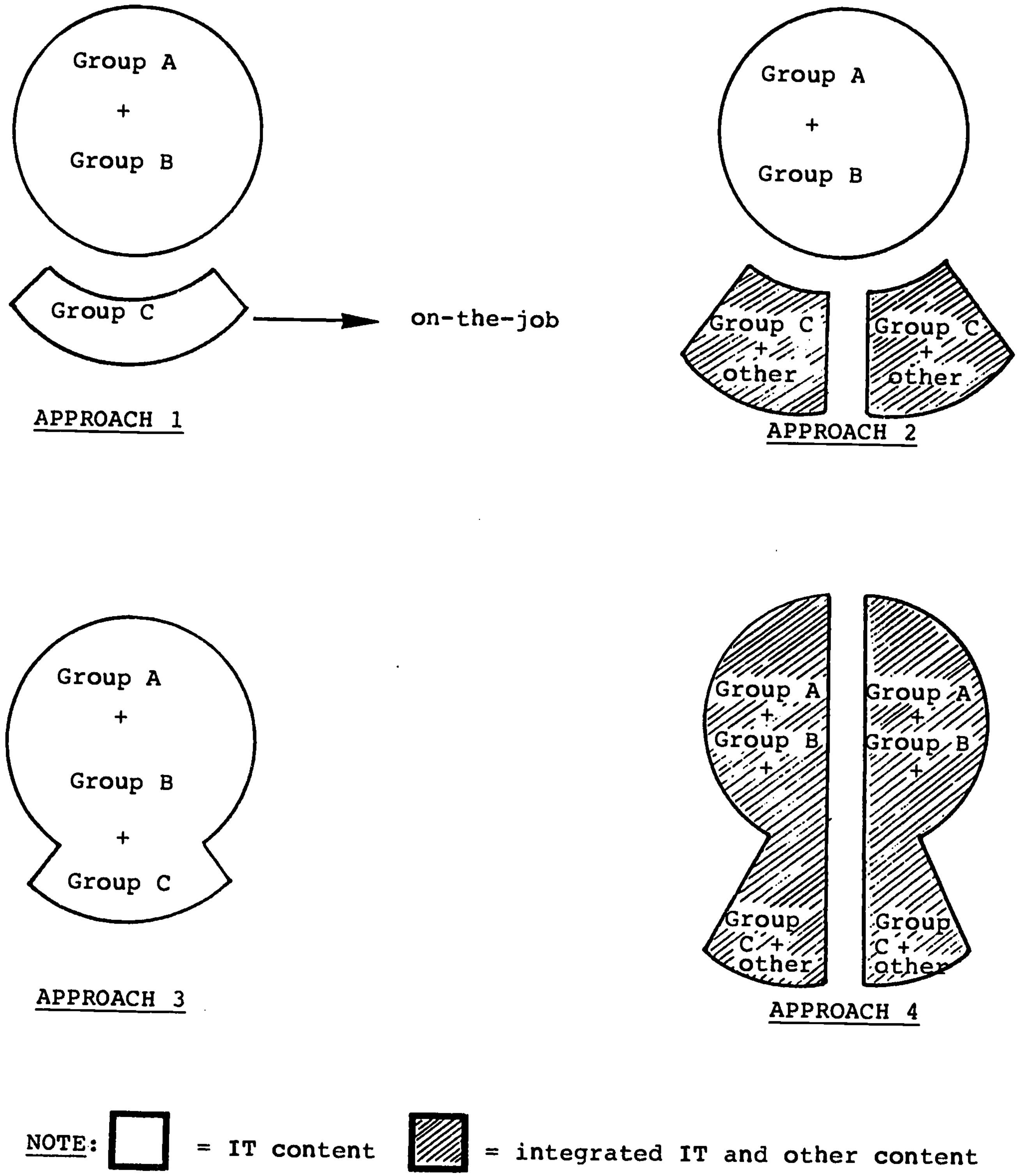


Figure 6.3 The four approaches to IT and other content

Approach 2 has a similar requirement for IT teaching staff, with the additional requirement that teachers of other subjects be familiar with appropriate Group C skills.

Approach 3 requires staff that have good knowledge and skills in both IT and the applications of IT to a particular industry.

Approach 4 requires staff that have good knowledge and skills in IT, the applications of IT to a particular industry, and other technical knowledge and skills related to that industry.

There are some educa'ional benefits to be obtained by integrating the IT with the other subjects to the maximum degree as in Approach 4, but practical considerations of staffing and laboratory accommodation strongly favour Approaches 1 and 2. The separate IT core in Approaches 1 and 2 also lends itself better to national development of curriculum and curriculum materials, which in turn gives better use of resources. Distance, mixed-mode and flexi-mode delivery systems using educational technologies could further increase the efficiency of the use of resources.

Degree of integration of theoretical and practical parts of IT

The Group A knowledge and skills mainly require theory rather than practical teaching. In Section 6.2 it was suggested that a variety of methods be used, including lectures, demonstrations, discussions and practical projects.

The Group B skills are entirely practical in nature, and in Section 6.2 it was suggested that nearly all of the time allocated to Group B skills should be spent on computer equipment in the laboratory.

If the equivalent of four weeks full time are allocated for IT, then full integration of theory and practical would result in four weeks (full-time equivalent) being spent in the laboratory. Full separation of theory and practical would result in about three weeks being spent in the laboratory and about one week being spent in lecture rooms or other facilities. (This assumes an emphasis on practical rather than theory, as recommended in this report.)

There seems to be little difference in practical consequences between the two approaches of integration or separation of theory and practical. The first approach is recommended because of the educational merits of integrating theory with practical, but the second approach may provide cost savings on accommodation and laboratory equipment, provided that optimum use of the laboratories is achieved.

If ITeCs based on the United Kingdom model are established in Australia, then they could be the venue for IT training. There are various options available:

- all of the IT training could be conducted by the ITeCs;
- the IT training could be conducted by the ITeCs in certain locations only, with the remaining locations using the TAFE colleges for IT training;
- within either of the above two options, the ITeCs could conduct practical IT training only (that is, training in the Group B skills), with the TAFE colleges conducting education and training in the other IT areas (that is, Group A and Group C knowledge and skills).

If the last option is used, there will need to be separation of the theory and practical aspects of the IT core.

Pattern of attendance for off-the-job and on-the job parts of the program

The pattern of attendance for off-the-job and on-the-job parts of the program has implications for all curriculum areas including IT. There are three broad alternatives:

- day-release pattern - attendance at off-the-job centre for two days every week;
- block release with induction block - attendance at off-the-job centre for 2 or 3 blocks over the year, with large block at start of traineeship;
- block release without induction block - attendance at off-the-job centre for 2 or 3 blocks over the year, but start of traineeship involves on-the-job training.

The first alternative allows the best opportunity for relating the off-the-job training with the on-the-job training.

The second alternative is most appropriate for trainees in industries requiring immediate productivity, because production processes are such that they must be learned as a whole rather than in parts. In industries where health and safety issues must be mastered before on-the-job experience, this model would also be appropriate.

The third alternative is appropriate in industries where an overview of work opportunities needs to be developed prior to training in a more specific job.

Further considerations on selection of a curriculum structure

This section identifies and discusses curriculum considerations that were consistently highlighted during the interviews conducted for this project. The order of presentation of these issues does not indicate priority of importance.

1. There is a core of IT content that every trainee should have the opportunity to acquire.

   The concern here is whether IT will be required content or elective content. The degree of opportunity would be dependent on availability of facilities, equipment and staff. The level (i.e. awareness, understanding, ability to use) of IT to be acquired may be dependent on the ability of the trainee.

2. A practical approach to learning IT should be used.

   Concern was expressed that the myth and mystery of IT should be eliminated. In order to achieve this, trainees should be immediately using and seeing the technology in use. This is based on the view that learners will choose to find out how and why something works after they experience what it does. A practical approach to learning, particularly in an area like IT, is important for the development of a positive attitude to these forms of technology as tools much the same as a hammer or a card catalogue.

   Trainees must understand that the computer is a tool and can only do what the user communicates to it or through the directions the user gives to a programmer.

   'Progressively computer use will not require knowledge of computer languages, but the ability to express oneself clearly in natural language' (Ennals & Cotterel, 1984, p. 17).

3. Relevance of content to the workplace should be incorporated as much as possible.

   This consideration is based on the concern that given the limited time available for IT content in the off-the-job curriculum, the uses and applications to the industry in which the trainee is employed should be used as examples. Individual trainee learning projects should realistically reflect the employing industry level-of-use of the technology, with some anticipation of future developments.

4. Learning outcomes should be partially measurable by increased productivity of the trainee.

People interviewed stressed the benefit to trainees and to employers that would result from trainees being able to apply quickly the knowledge and skills acquired in the IT off-the-job curriculum in job specific tasks. There is an expectation that the development of skills and the ability to apply those skills on-the-job will contribute to an enthusiastic pursuit of further education about IT and the level of use of IT by trainees and employers. Technology transfer effects, it is hoped, will accelerate the rate of technology adoption by industry.

5. Content in traineeships should lead to further study in IT and related courses.

In the process of curriculum development the details should be documentated of how and under what circumstances trainees will be granted credit or status in other subjects or courses. This reflects the concern (as stated in Section 4.1) that the traineeship curriculum should lead to further education opportunities and not be an end in themselves.

Recommendation 8

That the curriculum structures used in traineeships should be evaluated during the first year. The evaluation should include qualitative and quantitative measurements of costs and benefits to trainees, employers and TAFE.

7. SOME PRACTICAL CONSEQUENCES

7.1 Introduction

When traineeships are introduced, it will be necessary to use existing college facilities, rather than building new facilities immediately. This has been generally the previous arrangement whenever new schemes of this kind have been introduced. For example, the full-time components of pre-vocational courses (the closest to traineeships) generally use existing facilities. There are no 'pre-vocational' buildings in TAFE colleges. Similarly, there are no 'PEP' buildings (although the comparison is less valid).

It is clear that many colleges are already used to full capacity during the day time. Other colleges have spare space and some have spare equipment. However, there could be severe problems if, say, a TAFE Authority received a direction to place a large proportion of trainees in one location (e.g. in a country town, or in a particular suburb). Apart from this problem, any necessary additional space required in the first year or two of traineeships would probably have to be rented, until a new TAFE facility for traineeships, as well as for other courses, became available.

Already, because of the multi-purpose use of facilities, it can be seen how difficult it is to identify the cost of introducing the IT component for the off-the-job component of traineeships. The major variables in considering additional costs include:

- number of trainees
- length of IT component
- staffing
- equipment
- in-service training
- accommodation
- curriculum and materials development
- teaching approach.

These variables are considered in the following sections.

7.2 Staffing costs

One State Authority is thinking of enrolling 1500 students during the first year of introducing traineeships. Fifteen of its colleges would teach the off-the-job component. (These colleges already have some staff and some equipment for IT teaching.) This means that at any one period, about 500 students would be distributed for the 13 weeks' period over these 15 colleges (i.e. about 33 students per college). If the IT component is 4 weeks in length, the equivalent of one to two extra members of staff would be needed in each of the colleges; that is, about 26 extra IT staff overall. This assumes a 12:1 student/staff ratio, instead of the average 15:1 for all courses for that Authority, which is realistic given the practical nature of IT. The 12:1 ratio, in this example, is more than twice the 5:1 ratio for ITeC traineeships in the United Kingdom, but the same as the ratio used for classes of a highly practical nature in some Authorities.

In more general terms, the number of staff required to teach the IT component of the traineeship depends on:

- the number of weeks of IT teaching per trainee,
- the number of trainees,
- the trainee hours per week,
- the staff teaching weeks per year,
- the trainee:staff ratio,
- the staff teaching hours per week.

General formulae for calculating the number of staff required to teach the IT component and the cost of their salaries may be used by TAFE Authorities. Constraints on what is administratively feasible apply to most of the variables and these constraints vary among the TAFE Authorities. The formulae are:

$$\text{Number of IT staff} = \frac{\text{IT teaching weeks per trainee} \times \text{trainees per year} \times \text{trainee hours per week}}{\text{staff teaching weeks per year} \times \text{trainee:staff ratio} \times \text{staff teaching hours per week}}$$

$$\text{Cost of IT staff salaries} = \text{number of IT staff} \times \text{average salary cost.}$$

Assuming that the values listed in Table 7.1 are applicable nationally, and there is a total of 75,000 trainees per year nationally, the total number of staff required to teach the IT component in Australia would be 1282, and the total cost of their salaries would be, $38 million.

This salary cost amounts to $513 per trainee. These amounts and the equipment costings are summarised in Table 7.2.

Table 7.1
Factors affecting salary and equipment costs and the values assumed in a national costing

Factors affecting salary and equipment costs	Values assumed in a national costing
• IT teaching weeks per trainee	4
• trainees per year	75,000
• trainee hours per week	40
• staff teaching weeks per year	39
• trainee:staff ratio	12:1
• staff teaching hours per week	20
• practical IT weeks per trainee (concurrent with 1. above)	4
• trainee hours in laboratory per week	40
• weeks of laboratory use per year	39
• trainee:laboratory ratio	24:1
• laboratory hours used per week	40
• average staff salary cost	$25,000 + 20%
average cost of equipment in laboratory	$98,000 (24 place lab)

Table 7.2
National cost figures for salaries and equipment

Cost factor	National figures, using values in Table 7.1
Cost of IT staff salaries (based on 1282 staff)	$38,500,000
Salary cost per trainee	**$513**
IT lab. equipment cost (based on 321 24-place labs)	$31,400,000
Equipment cost per trainee	**$419**

If non-teaching staff were used to undertake part or all of the supervision of the trainees, staff costings would be lower. For example, if the same average salary applies but the staff backing or supervision increases to 48 weeks per year and 35 hours per week, the number of staff required is 595 and the cost of their salaries is $18 million. Under these conditions the salary cost amounts to $237 per trainee.

This calculation illustrates that the amount of supervision per staff member is a critical factor in any cost calculation. We are assuming a high proportion of practical, self-directed experience for the IT component which can be supervised by the teacher. This has implications for equipment and materials costs. One computer would be necessary for each trainee and the computer should be accompanied by appropriate learning materials (which, in turn, assumes that some finances have been devoted to curriculum materials development).

If new staff are appointed, they will not all be employed on traineeship teaching. Some existing staff will teach the new courses as well, giving a mix of newly appointed and experienced teachers. In general, new staff will be sought from industry or commerce and not from academia. It is thought that practical experience is crucial if the new teachers are to have credibility with the trainees. Therefore, a realistic wage must be offered to attract the right kind of new staff.

The demand for IT courses has been anticipated. Over the past few years, voluntary in-service courses have been held for TAFE teachers and full time lecturers have been employed to conduct these courses. Generally, the courses have been oversubscribed. The foresight of TAFE Authorities in offering this in-service training must be acknowledged.

One final point: the assumption is that 3 x 13 = 39 weeks would be devoted to teaching trainees in TAFE colleges each year. A four-quarter academic year would enable 4 x 13 = 52 weeks to be spent teaching (with allowances for public holidays).

7.3 Equipment costs

While Authorities might be able to cope in the first experimental year when numbers will be small, it is clear that funds will be necessary in subsequent years to employ extra staff, to plan new buildings (and to rent accommodation until the new buildings are available) and to buy equipment.

In one State, $250,000 has recently been spent on electronic equipment for a business course which is attended by 28 students for 30 hours per week, one half of which is being spent using the equipment.

An estimate of minimal basic equipment costs to furnish a laboratory for 24 trainees would be:

24 micro-computers @ $3,000	$72,000
6 printers @ $1,000	6,000
Other, associated equipment	10,000
Software	10,000
	$98,000

The costing is dependent on the average cost of the micro-computer. We are recommending that a range of models be included in each laboratory and that business micro-computers predominate. The average cost of $3,000 per unit is based on a range of models being used in each laboratory. Software may be included in the initial purchase, but further software packages would need to be purchased from time to time. Decisions by particular TAFE Authorities or particular colleges on the range of models of micro-computers and the amount of initial accompanying software will, of course, greatly affect the equipment cost. The figure of $98,000 would need to be revised upwards if an increased amount of software is to be included.

The total cost of equipment for each TAFE Authority or each college is dependent on a number of factors, including:

- the extent to which existing equipment can be used,
- the cost of software packages to be included,
- the amount of time in the laboratory for each trainee,
- the number of trainees,
- the trainee:laboratory ratio,
- the laboratory use per year,
- the average cost of equipment in each laboratory.

General formulae for calculating the number of laboratories and the total cost of equipping the laboratories may be used by TAFE Authorities. These formulae are based on the assumption that existing equipment may not be used. If existing equipment is to be used then adjustments may be made.

$$\text{Number of IT laboratories} = \frac{\text{practical IT weeks per trainee} \times \text{trainees per year} \times \text{trainee lab. hrs per week}}{\text{weeks of lab. use per year} \times \text{trainee:laboratory ratio} \times \text{laboratory hours per week of use}}$$

IT laboratory equipment cost= number of IT labs x average cost per laboratory.

Assuming that the values listed in Table 7.1 are applicable nationally, and that there will be a total of 75,000 trainees per year nationally, the total number of 24-place laboratories required in Australia is 321, and the total cost of equipping them is $31,400,000. This equipment cost amounts to $419 per trainee. These amounts are summarised in Table 7.2. It is expected that this equipment would last for about three years.

If, because of more favourable attendance patterns, the average weeks per year of laboratory use can be increased from 39 to 48 weeks, then the number of 24-place laboratories required in Australia reduces to 260, and the total cost of equipping them becomes $26 million. The equipment cost under these conditions amounts to $340 per trainee.

In addition to the laboratory equipment costs, there would also be recurrent costs incurred in operating and maintaining the facilities and equipment. The costs of ergonomically appropriate furnishing is not reflected in the laboratory costing. To ensure occupational health and safety in the training environment, funding will need to be made available for appropriate furniture.

A practical approach to IT training is essential to obtain major benefits, and that must be recognised in any costing.

Although, in one of the options, the IT component of traineeships will be integrated into other content (i.e. there will not be a discrete 4 weeks labelled 'Information Technology'), nevertheless, extra equipment and space will still be needed. However, this space and the new equipment will not be identifiable as 'belonging' to traineeships and therefore that should not be expected even if special funds are to be provided.

Individual States might decide to set up ITeCs like those in the United Kingdom, in which case trainees could have access to these facilities, thus reducing the load on TAFE Authorities. Neverthe s, this merely means a shift in funds, and is unlikely to bring a reduction in total cost. It also means that the opportun y to integrate IT into the total curriculum becomes much more difficult, and so the total cost of providing IT for traineeship ITeCs is likely to be greater than if TAFE Colleges were fully funded for the IT component.

The following amounts are the 1985 salary and equipment costs of four United Kingdom ITeCs. These figures were obtained from the data reported in section 5.4, but the United Kingdom costs per trainee have been divided by a factor of 12 because each trainee in the United Kingdom spends an average period of about 48 weeks at the ITeC, whereas in the Australian context our calculations are based on 4 weeks of IT component.

Covent Garden ITeC:

Salary cost per 4 week trainee	£254
Equipment cost per 4 week trainee	£185

Derby ITeC:

Salary cost per 4 week trainee	£160
Equipment cost per 4 week trainee	£219

North Leicestershire ITeC:

Salary cost per 4 week trainee	£217
Equipment cost per 4 week trainee	£306

Marconi-Wirral ITeC:

Salary cost per 4 week trainee	£173
Equipment cost per 4 week trainee	£260

When comparing our figures for Australia of $513 salary cost per trainee and $419 equipment cost per trainee, it should be borne in mind that the United Kingdom costs are shown in pounds sterling. In the United Kingdom ITeCs salaries are usually lower than those in Australia, trainee:staff ratios are higher and the amount of time spent on supervision of trainees is higher.

These examples, together with the Australian figures, clearly indicate that in order to teach the IT component of traineeships, there must be adequate equipment and salaries expenditures.

Recommendation 9

That there should be adequate equipment and salary provision for the IT component of traineeships.

Recommendation 10

That grants for basic IT equipment should be a minimum of about $98,000 per laboratory for 24 students. Staffing costs for the IT component only should average about $513 per trainee.

The grants assume a lifetime of three years for equipment.

7.4 In-service training

The staff development requirements could be substantial in order to provide the expected IT content. The following statements represent the various views on in-service training expressed during the interviews.

- Staff development needs will be substantial.
- Workshops will be required to establish the likely student clientele and what teaching strategies will be appropriate.
- Co-operative efforts will be needed on the part of teachers in one section to help teachers from another to use available college equipment in different ways or with different applications.
- Retraining of present teaching staff to teach IT will be needed if an integrated model of the curriculum is used.
- Teachers need at least 24 classroom hours to minimally learn to apply software packages for word processing, spreadsheets and databases.
- One teacher to 10 learners is the ratio used most often for in-service training.
- There are presently large numbers of TAFE teachers on waiting lists to attend TAFE training programs in using computers.

The implications for staff development and in-service training are extensive. Comments by interviewees indicate the following situation:

- There is presently a shortage of qualified IT teachers and trainers. The interview results indicate that approximately 5 per cent of TAFE teachers are presently able to teach IT at a fundamental level. It should be noted, however, that these teachers are already committed to existing teaching schedules. There are enthusiastic amateurs employed in TAFE Authorities who could be called upon to provide in-service training.
- Where teachers will have to be trained to teach IT, it is expected that six to eight weeks full time would be the minimum requirement. The in-service training would have to reflect the proposed content for the trainee curriculum in order to implement the national consistency recommended by the Kirby Report. The aim of this staff development would be to produce teachers with a knowledge of technology and applications and with a clear view of the past and probable future roles of IT in society.

- Often, in the past, specialist teachers have been placed in situations where general learning is required. This has created difficulties and should be carefully monitored in this instance.

The Commonwealth Tertiary Education Commission's Supplementary Report for 1986 and 1987 (CTEC, 1985) recommends that $1 million in 1986 and $1.5 million in 1987 be spent on the preparation of curriculum and teaching materials, and to undertake staff training in areas which relate to traineeshi s. This money should be available immediately so that essential work can be started.

7.5 Accommodation

There appear to be five broad possibilities here:

- using existing facilities in the TAFE colleges;
- developing new facilities (such as ITeCs or College based resource centres);
- hiring facilities;
- using existing commercial facilities;
- using facilities owned by other educational institutions.

It is our understanding that there is limited available accommodation in the TAFE colleges for additional students. Many PEP activities have experienced similar accommodation problems and have used hired facilities.

Two major factors in selecting accommodation will be:

- whether the IT content is separate from or integrated into other content;
- the level of competence to be achieved by the trainees.

Accommodation decisions will also need to take into account the nature of the equipment (e.g. whether special air conditioning, wiring, lighting, furnishing are required). In addition, increased security arrangements may be required for the protection of both hardware and software.

For lectures and discussion groups which can be conducted away from the IT equipment, accommodation will be needed in order to maximise the use of the IT equipped facilities.

7.6 Curriculum revision and materials development

In order to support employer needs for employees with up-to-date knowledge, and to enhance the future employability of trainees, IT courses must include the latest developments in technology and applications and current awareness of new and developing IT issues in both industry and society. Curriculum revision will therefore need to be frequent, planned and informative and be actively supported by a quick-response curriculum process rather than the cumbersome approach to curriculum development which is usually employed.

Ways of satisfying the demand for sophisticated teaching/learning materials will be needed if national consistency of outcomes is to be achieved.

The program should be designed so that trainees can progress at their own pace in this exciting and challenging subject of study. Many people around Australia have developed or are developing self-paced learning packages as well as audio-visual materials in the IT area. Self-directed learning in IT is in accordance with the Kirby Report's view of trainees making an investment in their own learning and is seen to be worth pursuing.

Recommendation 11

That grants should be made to each TAFE Authority to provide up to eight weeks' in-service training in IT for teachers involved in the provision of the IT traineeship core curriculum.

Recommendation 12

That a National Curriculum Committee with representatives from TAFE Authorities and industry should be established to review, maintain and update the core curriculum proposed in this report on a regular basis and to monitor the development and production of teaching/learning materials on a national basis.

Recommendation 13

That TAFE Authorities should establish systems for:

- collecting information for advice to the National Curriculum Committee;
- preparing curricula in industry specific areas of IT;
- complementing the National Core Curriculum content according to their requirements;
- co-operating with others to produce a national glossary of IT terms to be regularly amended and updated.

- investigating the IT needs of those institutions likely to be involved in traineeships.

Teaching approach

As stated in the Overview, this report does not consider the value of using IT to deliver instruction. Nevertheless, one variable affecting costs will be the teaching approach. The degree to which off-campus, mixed-mode and flexi-mode approaches are used will affect cost. A separate investigation is required to consider teaching approaches.

REFERENCES

American Educational Research Association. (1985). Information technology and evaluation: Research on learning, equity and policy. Educational Reasearcher, 14, 4.

Commonwealth Tertiary Education Commission. (1985). Supplementary Report for 1986 and 1987. Canberra. AGPS.

Ennals, R., & Cotterel, A. (1984). Implications of fifth generation computers for further education. London: Further Education Unit.

Further Education Unit. (1984). A framework for action in IT: A policy statement. London: FEU.

Kirby, P.E.F. (Chair, Committee of Inquiry into Labour Market Programs). (1985). Report. Canberra: AGPS.

Maddison, J. (1980). National education and the microelectronics revolution. Avon, U.K.; Clevedon.

82

BIBLIOGRAPHY

American Educational Research Association. (1985). Information technology and evaluation: Research on learning, equity and policy. _Educational Researcher_, 14, 4.

Business and Technician Education Council. (1984). _Robotics: Standard units_. London: BTEC.

Businc and Technician Education Council. (1984). _A report on the responses to the discussion document on educational policy_. London: BTEC.

Business and Technician Education Council. (1983). _Computer aided engineering: Guidelines and units_. London: BTEC.

Business and Technician Education Council/City and Guilds of London Institute. (1985). _The Certificate of Pre-vocational Education: Part A: The CPVE framework and criteria for approval of schemes_. London: BTEC.

Business and Technician Education Council/City and Guilds of London Institute. (1985). _The Certificate of Pre-vocational Education: Part B: Core competencies and vocational module specifications_. London: BTEC.

Business and Technician Education Council/City and Guilds of London Institute. (1985). _The Certificate of Pre-vocational Education: Part C: Preparatory module specifications_. London: BTEC.

Business Education Council/Technician Education Council. (1979). _BEC/TEC higher national awards in Computer Studies: Courses for careers in computing: Programming and systems analysis: Course guidelines:_ London: BEC.

Carrington, D. (1985). _IT in CPVE: A software directory for the non-specialist tutor_. Walsall, U.K.: Education Development Centre.

City and Guilds of London Institute. (1985). _Introductory Certificate in Information Technology: Pilot scheme_. London: CGLI.

Department of Employment and Industrial Relations/Technical Education Commission. (1984). Computer related occupations: A labour market and training assessment. Canberra: DEIR/TEC.

D'Orazio, R.J. (1983). Computers in adult education. In Technological Horizons in Education, 10, 5.

Ennals, R., & Cotterel, A. (1984). Implications of fifth generation computers for further education. U.K.: Further Education Unit.

Equal Opportunities Unit. (1984). New opportunities for women: Curriculum resource book for lecturers. Adelaide: SA Dept of TAFE.

Further Education Unit. (1982). Computer aided design in FE. London: FEU.

Further Education Unit. (1983). Computer aided profiling. London: FEU.

Further Education Unit. (1984). Information technology in FE. London: FEU.

Further Education Unit. (1984). A framework for action in IT: A policy statement. London: FEU.

Further Education Unit. (1984). Computer literacy. Vols 1 - 4. London: FEU.

Further Education Unit. (1985). Computer based learning in FE: A staff development model. London: FEU.

Further Education Unit. (1985). Supporting and developing staff for IT: A conference report. London: FEU.

Further Education Unit. (1985). Robotics: Guidance for further education. London: FEU/PICKUP.

Further Education Unit. (1985). Design of microelectronics programmes: A consultative document. London: FEU.

Further Education Unit. (1985). Computer literacy for UK shipping management ashore and afloat: A summary. London: FEU/PICKUP.

Gow, H. (1984). Saving, creating and equalising job opportunities: Some British answers to Australian questions. Melbourne: Victorian Council of Social Services.

Holti, R., & Stern, E. (1985). The case of the United Kigndom. social experiments and experiences with new information technologies. Paper presented at the seminar of the FAST Network and the Fondazione A. Olivetti. London: The Tavistock Institute for Human Relations.

Kirby, P.E.F. (Chair, Committee of Inquiry into Labour Market Programs). (1985). Report. Canberra: AGPS.

Lacroix, W.J. (1983). The future in review. In Journal of Epsilon Pi Tau, 9, 2.

Leuhrmann, A., & Spain, T. (1984). The best way to teach computer literacy. In Electronic Learning, 3, 7.

Lloyd, J., Taylor, J., & West, C. (1984). Computer literacy unit one: General guide. London: FEU.

Lloyd, J., Taylor, J., & West, C. (1984). Computer literacy unit two: Core materials. London: FEU.

Lloyd, J., Taylor, J., & West, C. (1984). Computer literacy unit three: Further computing. London: FEU.

Lloyd, J., Taylor, J., & West, C. (1984). Computer literacy unit four: Vocational options. London: FEU.

Maddison, J. (1980). National education and the microelectronics revolution. Avon, U.K.: Clevedon.

Manpower Services Commission. (1983). Computer based training: A guide for trainers and managers. London: MSC.

Manpower Services Commission. (1983). The Coventry computer based learning project. London: MSC.

Manpower Services Commission. (1984). Report on the TOPS sponsored pilot scheme for computer based training consultants. London: MSC.

Manpower Services Commission. (1985). Core skills in YTS: Part 2: Computer and information technology: Youth training scheme manual. London: MSC.

Mountney, P., & Mageean, P. (Eds). (1985). Issues in TAFE. Adelaide: TAFE National Centre for Research and Development.

Napier, J.D. (1983). Computer literacy and social studies teacher education: Changes in form and Context. Paper presented at the Annual Meeting of the Social Science Education Consortium. Athens, Georgia: Social Science Education Consortium.

National Training Council. (1985). Conference on industry and training. Report of proceedings. Canberra: AGPS.

New South Wales. Department of TAFE. (1979). Technological change and the impact on secretarial work. Sydney: N.S.W. Dept of TAFE.

New South Wales. Department of TAFE. (1981). Seminar on technological change: Its implications for TAFE. Seminar papers. Sydney: N.S.W. Dept of TAFE.

New South Wales. Department of TAFE. (1982). Small business computer users questionnaire survey. Sydney: N.S.W. Dept. of TAFE, Curriculum Services Div.

Ritchie, J.B. (Chair, Standing Committee on Training for Advanced Technology). (1984). Microelectronics training needs report. Canberra: AGPS.

Ritchie, J.B. (Chair, Standing Committee on Training for Advanced Technology). (1985). Address to COSTAC and strategy for advanced technology related training. Canberra: National Training Council.

Ritchie, J.B. (Chair, Standing Committee on Training for Advanced Technology). (1985). Submission to the Senate Inquiry into New Technology and Employment by the National Training Council. Canberra: National Training Council.

Ritchie, J.B. (Chair, Standing Committee on Training for Advanced Technology). (1985). Address to COSTAC and strategy for advanced technology related training. Canberra: National Training Council.

Royal Society of Arts Examinations Board. (1984). Computer literacy and information technology scheme: 1984-5 tutors' handbook. London: RSA.

Scott, W.D. & Co., & Arthur D. Little Inc. (1984). Information technology in Australia: Capabilities and opportunities, Vols 1 and 2. Canberra: Dept of Science and Technology.

Self, C.C. (1983). A position on a computer literacy course. Unpublished paper presented to the University of Massachusetts. Amherst, Mass.

Smith, I.S., & Campbell, R. (1981). Information technology revolution. U.K.: Longmans.

South Australian Council on Technological Change. (1982). Technology appraisal: Communications technologies: An introductory summary. Adelaide: Dept of Employment and Industrial Relations.

South Australian Council on Technological Change. (1982). Technology appraisal: Scanning in supermarkets: Employment effects in South Australia. Adelaide: Dept of Employment and Industrial Relations.

South Australian Council on Technological Change. (1983). Technology appraisal: Automation: Robots in manufacturing technology. Adelaide: Ministry of Technology.

South Australian Council on Technological Change. (1983). Technology appraisal: Electronic funds transfer. Adelaide: Ministry of Technology.

South Australian Council on Technological Change. (1983). Technology appraisal: Videotex: Information for home or office. Adelaide: Ministry of Technology.

South Australian Council on Technological Change. (1984). Technology for the aged. Adelaide: Ministry of Technology.

South Australian Council on Technological Change. (1984). Technological aids for the handicapped. Adelaide: Ministry of Technology.

South Australian Council on Technological Change. (1984). Report on the likely effects of technological changes in the bread manufacturing industry. Adelaide: Ministry of Technology.

Thompson, D.J. (1983). A course in information technology in secondary schools - Part II. In Computer Education, 44.

The Australian College of Education. (1984). _The human face of technological change_. Conference Papers from the Silver Jubilee Conference, Canberra, May 1984. Carlton, Vic.: Australian College of Education.

Wooden, M., & Kriegler, R. (1985). _Technological change and its implications for industrial relations_. Adelaide: National Institute of Labour Studies.

APPENDIX A

INTERVIEW SCHEDULE

INFORMATION TECHNOLOGY CONTENT FOR TRAINEESHIP CURRICULUM

1. What is your State's/Territory's understanding of the term 'information technology'?

2. What content on IT do you believe should be included in the traineeship curriculum?

   For the purpose of this project, information technology is to be defined as the technology and processes associated with computer-based communications systems, and includes electronics, computers, communication and related applications technologies.

3. Does this differ from what is presently being provided?

   If no - could I have the syllabus documents?

   If yes - what is seen to be the difference?

4. What curriculum structures are used to provide the content?

5. Can you describe one or more curriculum models you think should be used for the traineeships?

6. How would the IT content fit into the model(s)? (Integrated, separate, other subject areas.)

7. What criteria would you use to decide what content should be provided:

   Off the job?

   On the job?

8. What traineeships do you think will be developed?

   In what industies?

   For what kinds of jobs?

9. What are the major <u>costs</u> of including IT in the traineeship curriculum?

10. What are the major benefits of including IT in the traineeship curriculum?

11. What are the staff development implications?

    How much will be necessary?

    What in-service training is being conducted in this area presently?

12. Are there individuals that you think should be contacted to obtain information?

APPENDIX B

QUESTIONNAIRE

TAFE NATIONAL CENTRE FOR RESEARCH AND DEVELOPMENT LTD.
296 Payneham Road, Payneham, South Australia 5070, Australia. Phone (08) 42 7905
(Incorporated in South Australia)

INDUSTRY SURVEY

INFORMATION TECHNOLOGY WITHIN THE NEW TRAINEESHIPS

INDUSTRY SURVEY
INFORMATION TECHNOLOGY WITHIN THE NEW TRAINEESHIPS

The Commonwealth Department of Education has commissioned the TAFE National Centre for Research and Development Ltd. to undertake a project that will lead to recommendations for the **information technology component of traineeships.**

For the purpose of this project, information technology is to be defined as <u>the technology used in the storage and transfer of information by electronic means</u>. It incorporates computers and computer applications.

The development of traineeships is a key proposal in the Report of the Committee of Inquiry into Labour Market Programs (the "Kirby Report").

One of the main aims of this project is to identify in broad terms and for selected industries the skills required in information technology for these traineeships.

We are surveying several industries that have the potential to provide traineeships in significant numbers. People are being surveyed in each industry by personal interview or questionnaire. The people we are seeking to survey are industry leaders who are likely to be familiar with the potential application of traineeships within their industry. Knowledge of the present and likely future applications of information technology within the industry would be an advantage, but if this is not the case, persons completing this questionnaire could consult others within their industry.

As you are one of the persons described above, please kcould you assist us by completing the questionnaire attached, and return it to us by Friday 26th July. We thank you in anticipation of your co-operation. Should you have any queries about this project, please do not hesitate to contact Bob Davis, Geoff Hayton or Charlotte Sandery on (08) 42.7905

1. **YOUR NAME:** ....

2. **POSITION:** ....

3. **ORGANISATION:** ....

4. **ADDRESS:** ....

....

5. **TELEPHONE NUMBER:** ....

6. **INDUSTRY:** ....

7. Please indicate the <u>extent of use</u> of each area of information technology in your industry, by circling one number for each area listed.

<u>KEY</u>

0 = not used
1 = little used
2 = moderately used
3 = greatly used

Also please comment on likely future use in your industry (if known) in the space provided (e.g. comments like "very important in the industry within the next 5 years" would be helpful).

AREA	**EXTENT OF USE** (Circle one Number)	**COMMENTS ON LIKELY USE**
mainframe computers	0 1 2 3	....
mini computers	0 1 2 3	....
micro computers	0 1 2 3	....
personal computers	0 1 2 3	....
keyboard input	0 1 2 3	....
optical scanning print input to computer	0 1 2 3	....
voice recognition and synthesis by computer	0 1 2 3	....

computer networks (i.e.computers linked together)	0	1	2	3	....
information bulletins via T.V. (e.g. teletext/view data)	0	1	2	3	....
telex	0	1	2	3	....
electronic mail	0	1	2	3	....
telephone switchboard	0	1	2	3	....
word processing	0	1	2	3	....
databases on computer (e.g. Ausinet, Medline, CSIRONET)	0	1	2	3	....
computer aided manufacture	0	1	2	3	....
robotics	0	1	2	3	....
simulation	0	1	2	3	....
numerical control machines	0	1	2	3	....
programming skills	0	1	2	3	....
systems analysis skills	0	1	2	3	....
computer co tr 'led processes	0	1	2	3	....
other areas o information technology in your industry (please specify):					
(i)	0	1	2	3	....
(ii)	0	1	2	3	....

96

8. Your industry is included in this survey because it is possible that traineeships will be offered (in some or all States and Territories) in your industry.

State the job titles of up to three jobs (e.g. Station Attendant, Sales Assistant, Bank Clerk) within your industry which have the potential for inclusion in the proposed new traineeships scheme.

JOB TITLE	**MAIN DUTIES**
1.	....
	....
	....
2.	....
	....
	....
3.	....
	....
	....

9. Industry Applications.

This part of the survey is designed to identify the level of information technology knowledge and skills required in specific applications for each job type you have named.

KEY

A = no knowledge required
B = "literacy" required
C = understanding required
D = specific skills required

For each application, circle one letter per box for each job title you have named. Comments about potential changes in level required would be appreciated.

APPLICATION	JOB TITLE 1	JOB TITLE 2	JOB TITLE 3	COMMENTS
1. Word processing (e.g. report writing, documents, letters)	A B C B	A B C D	A B C D	....
2. Spreadsheets (e.g. work scheduling, estimating, planning)	A B C D	A B C D	A B C D	....
3. Database packages (e.g. Inventories, accounts, catalogues, records)	A B C D	A B C D	A B C D	....
4. Other applications (please specify)				
(i)	A B C D	A B C D	A B C D	....
(ii)	A B C D	A B C D	A B C D	....
(iii)	A B C D	A B C D	A B C D	....

Thank you for completing the questionnaire. Kindly return in the stamped addressed envelop provided.

APPENDIX C

ORGANISATIONS VISITED

99

ORGANISATIONS VISITED

AUSTRALIA

Australian Capital Territory

ACT Apprenticeship Board
Department of Employment and Industrial Relations
Office of Further Education

New South Wales

Australian Software Research Centre
Department of TAFE
Human Resources Division, Department of Industrial Relations

Northern Territory

Darwin Institute of Technology
Department of Industry and Small Business
Education Department, Division of TAFE

Queensland

College of Tourism and Hospitality
Department of Education, Division of TAFE
Industry and Commerce Training Commission
Mt Gravatt College of TAFE

South Australia

Adelaide College of TAFE
Department of Technical and Further Education
Industrial and Commercial Training Commission
Kensington College of TAFE
Regency College of TAFE
Staff Development Centre

Tasmania

Apprenticeship Commission of Tasmania
Education Department, Division of TAFE

Victoria

Department of Community Services
Industrial Training Commission
Office of the TAFE Board
Youth Guarantee Directorate

Western Australia

Department of Employment and Training
Education Department, Technical Education Division

INDUSTRY TRAINING COMMITTEES

National Training and Development Executives

Building and Construction
Local Government
Plastics
Printing
Retailing
Tourism

South Australia Training and Development Executives

Building and Construction
Food Processing
Local Government
Plastics and Rubber
Printing
Retailing
Road Transport
Timber

UNITED KINGDOM

Business and Technical Education Council
Camden ITeC
Channel 4 Teletext Service
City and Guilds of London Institute
Covent Garden ITeC
Derby ITeC
Derbyshire College of Higher Education
Further Education Unit
Haringey ITeC
Manpower Services Commission
Marconi-Wirral ITeC
Microelectronics Education Programme
North Leicestershire ITeC
Notting Dale ITeC Consultancy Unit
The Tavistock Institute of Human Relations

APPENDIX D

INFORMATION TECHNOLOGY CORE SKILLS IN THE CERTIFICATION OF PRE-VOCATIONAL EDUCATION AND THE YOUTH TRAINING SCHEME IN THE UNITED KINGDOM

INFORMATION TECHNOLOGY CORE SKILLS IN THE CERTIFICATE OF PRE-VOCATIONAL EDUCATION (UNITED KINGDOM)

It is intended that the aims and objectives presented under this heading should be developed throughout an approved CPVE course and should allow students to acquire, practise and transfer their achievement within a variety of relevant and integrated activities.

Main Aim

To develop appreciation of the implications of Information Technology (IT) for society and individual and to provide the opportunity to acquire a practical introduction to its basic applications.

Aim 1: Awareness of IT

To develop awareness of the social implications of IT for work, leisure and domestic use by

1.1 plotting and explaining the growth and development of IT

1.2 investigating the main ways in which IT is leading to changing requirements in the job market and may be affecting the characteristics of employment in various sectors of the economy

1.3 investigating some possible effects of the growth of micro-technology on industry and society including the need for security of information

1.4 recognising the need for security of information and the need for access to personal information held on data bases.

Aim 2: Use of Micro-computers

To develop confidence in the use of micro-computers and their application by

2.1 connecting up and preparing a simple micro-computer system for use

2.2 loading a pre-written program from backing-store and using it to perform a set task

2.3 using application packages eg word processing, accounting packages, spread-sheets and data bases in real or simulated business situations

2.4 using teletext or viewdata systems to obtain or disseminate specified information

2.5 using unit replacement procedures to locate and rectify faulty equipment.

Aim 3: Data processing

To develop practical appreciation of data handling and computer programming by

3.1 illustrating a logical sequence of instructions - drawing a simple flowchart

3.2 reading and amending a simple program

3.3 writing and using a simple program involving input, processing and output from a spcification provided

3.4 recording and presenting data in a form appropriate for input and use in a existing electronic data base

3.5 interpreting data and drawing conclusions - from VDU and line printer.

Aim 4: ˇplications of IT

To develop an appreciation of the field of IT and its wide range of applications by

4.1 identifying the main features of IT systems by giving examples of the roles and applications of micro-processors, computers and transmission systems in commerce, industry, education, the media, public services and the home

4.2 relating applicaitons such as graphics, networks, robotics, CAL information bases to the examples derived from 4.1 above

4.3 identifying basic functions and elements of software systems, such as information of message coding, transmission and processing

4.4 giving examples of uses of large electronic communicationn systems

4.5 listing, and analysing using a system diagram, the hardware elements (inputs, outputs, major sub-systems) of an electronic communication system

4.6 discussing the concept of distribution processing and describing the devices and techniques which enable machines to communicate

4.7 investigating the control, measuring and monitoring functions of devices associated with such equipment as the BBC Buggy, Robot Arm, Turtle, Graphics Pad.

Tutors and students should be aware that the objectives listed above may also apply to other core areas and that appropriate recognition should be given to their achievement.

INFORMATION TECHNOLOGY
CORE SKILLS IN THE
YOUTH TRAINING SCHEME (UNITED KINGDOM)

1. Introduction

It is important that hands-on experience be provided to include activities in the three applications areas outlined below. One activity should be included from each of the three areas listed. The activities should be relevant to the trainees' occupational training and to their training programme generally.

2. Core activities - applications

These applications have been chosen because they represent very common activities which are becoming increasingly relevant in all aspects of our lives.

WORD PROCESSING

Trainees should be able to create, edit and print simple documents.

Typical examples would include

- production of the trainee's curriculum vitae or a job application;
- production of a standard letter to more than one addressee.

DATABASE MANAGEMENT (record handling)

Trainees should be able to design a record format, store, process and retrieve information.

Typical examples would include

- production of a customer name and address list;
- production of stock records;
- production of trainee record files.

OTHER ACTIVITIES

This area will allow flexibility of choice and relevance for each individual trainee. One of the following options may be chosen:

Other applications packages

Typical examples would include:

- controlling a robotic device;
- graphic design;
- music synthesis;
- invoicing.

Systems investigation

If computer-based systems (for example, in-process control) and/or telecommunications systems are an integral part of the workplace, or are used in other similar work areas nearby it may be appropriate to encourage the trainee to look in greater detail at the operation of these systems. This could be developed by the use of micro-simulation packages. Such an activity could prove valuable in giving trainees insight into a range of computer applications leading to an awareness of both the strength and limitations of the use of computers.

Applications and use of telecommunications and computer network facilities

Applications might include:

- viewdata services (search and retrieval of commercial viewdata service information);
- electronic mail (transfer of documents, messages and graphics);
- video conferences;
- accessing external databases via remote computers;
- use of computerised telephone systems;
- use of telex facilities.

3. Core activities - operations

The operational skills listed below should be acquired and assessed in the context of applications. The emphasis on applications means that limited time should be devoted to keyboarding skills.

Trainees should be given guidance on health and safety aspects of using computers at an early stage of training.

Trainees should:

MICROCOMPUTERS

- be able to carry out procedures to start up and close down the system
- be able to load and run a program from the backing store device
- be able to save copy magnetic file and follow handling procedures
- be able to load stationery and obtain printed output

TERMINALS (IF APPLICABLE)

- be able to carry out log-on and log-off procedures
- be able to sign on to applications software
- be able to load stationery and obtain printed output.

SKILLS AND PERFORMANCE STANDARDS FOR POTENTIAL TRAINEESHIP JOBS IN FIVE INDUSTRIES

SKILLS AND PERFORMANCE STANDARDS FOR POTENTIAL TRAINEESHIPS JOBS IN FIVE INDUSTRIES

Three broad levels of performance are specified for IT skills:

- awareness or 'literacy'
- understanding
- acquisition of specific practical skills.

For the purpose of this study, these levels are assumed to be hierarical and cumulative. That is, understanding requires awareness, and specific practical skill requires awareness and understanding. The performance standards listed below are additional to the IT core skills of Group A and Group B (listed in Section 6.2).

PRINTING INDUSTRY

Job: Print Salesperson

Main Duties:

- customer liaison
- marketing
- selling
- taking telephone ads

Skills in IT:

- awareness of CAD and CAM
- understanding of word processing
- specific practical skills in using spreadsheets and database packages

Job: Carton Maker

Main Duites:

- form setting, cutting and creasing machinery
- folding and glueing of folding boxboard cartons
- quality control

Skills in IT:

- awareness of CAD and CAM

Job: Clerical Assistant

Main Duties:

- accounting
- stock control
- payroll

- payroll
- advertising
- circulation
- word processing

Skills in IT:
- specific practical skills in word processing, spreadsheets and database packages

Job: Keyboard Operator

Main Duties:
- pre-press input

Skills in IT:
- specific practical skills in word processing, spreadsheets, and database packages

Job: Secretary/word processor

Main duties:
- typing
- word processing
- telephone

Skills in IT:
- understanding of spreadsheets
- specific practical skills in wordprocessing

TOURISM INDUSTRY

Job: Waiter/Waitress

Main Duties:
- serving food and beverages to guests
- operating cash register
- collecting restaurant bills

Skills in IT:
- specific practical skills in computer cash registers

Job: Receptionist

Main Duties:
- reservations
- customer contact
- basic clerical and accounting
- operating computer register

Skills in IT:
- understanding and some specific practical skills in word processing and database packages

Job: Bar Attendant

Main Duties:
- serving and dispensing liquor to customers

Skills in IT:
- nil

Job: Kitchen Hand

Main Duties:
- assisting chef with food preparation
- kitchen cleaning

Skills in IT:
- nil

BANKING INDUSTRY

Job: Bank Clerk/Customer Service Officer

Main Duties:
- customer interface
- on-line access to central database

Skills in IT:
- understanding of on-line equipment
- specific practical keyboard skills

Job: Typist/Receptionist

Main Duties:
- typing
- word processing
- telephone

Skills in IT:
- understanding of spreadsheets
- specific practical skills in word processing

Job: Computer Operator

Main Duties:
- data entry
- report production
- supervise computer processes
- operate mainframe

Skills in IT:
- understanding of word processing and spreadsheets
- specific practical skills in database packages and on-line equipment

Job: Data Input Operator

Main Duties:
- data entry to computer

Skills in IT:
- awareness of spreadsheets
- understanding of word processing and databases
- specific practical skills in keyboarding

CONSTRUCTION INDUSTRY

Job: Estimator/Estimating Assistant

Main Duties:
- estimate man-hour rates
- calculate quantities
- record actual rates/costs

Skills in IT:
- awareness of word processing and spreadsheets
- understanding of database packages

Job: Contracts Administrator/Cost Clerk

Main Duties:
- record contract costs
- monitor construction budget
- assess progress payments

Skills in IT:
- understanding of spreadsheets and database packages

Job: Payroll/Accouhts Clerk

Main Duties:
- pay records
- job cost accounting

Skills in IT:
- understanding of spreadsheets
- specific practical skills in database packages

Job: Planning/Scheduling Assistant

Main Duties:
- determine construction sequence
- estimate construction times
- record construction progess

Skills in IT:
- awareness of word processing
- understanding of database packages
- specific practical skills in spreadsheets and critical path analysis packages

Job: Word Processor/Typist

Main Duties:
- typing
- word processing
- general clerical

Skills in IT:
- awareness of spreadsheets
- specific practical skills in word processing and database packages

Job: Administrative Assistant

Main Duties:
- spreadsheet analysis
- reporting

Skills in IT:
- specific practical skills in word processing, spreadsheets and database packages

COMPUTER INDUSTRY

Job: Word Processing Operator

Main Duites:
- typing
- word processing

Skills in IT:
- understanding of spreadsheets and database packages
- specific practical skills in word processing

Job: Computer Sales Trainee

Main Duties:
- identify potential buyers
- match customer needs with appropriate computer hardware and software

Skills in IT:
- understanding of word processing and spreadsheets
- specific practical skills in database packages

Job: Field Engineer Trainee

Main Duties:
- maintain hardware in field

Skills in IT:
- awareness of word processing and database packages
- specific practical skills in electronics and hardware

Job: Programmer

Main Duties:
- post installation support of software

Skills in IT:
- awareness of accounting and other packages
- understanding of word processing and spreadsheets

AUTHORS OF THE REPORT

Dr W.C. Hall is Executive Director of the TAFE National Centre for Research and Development. Mr G. Hayton and Ms C. Sandery are Research and Development Officers at the TAFE National Centre for Research and Development. Mr Hayton is an information technology education expert and Ms Sandery is responsible for research into curriculum development. Mr R. Davis was seconded from the South Australian Department of TAFE where he is employed as the Head of the Learning Resource Centre at Croydon Park College of TAFE. Mrs M. Cominos edited the report and Ms T. Ferrara did the word processing.