

EDUCATIONAL COMPUTING IN SECONDARY SCHOOLS
OF THE CAPE EDUCATION DEPARTMENT:
A RESEARCH SURVEY
TO ASSESS COMPUTING FACILITY ACQUISITION AND ITS UTILIZATION

THESIS

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A B S T R A C T

Secondary schools under the jurisdiction of the Cape Education Department (CED) have, over the past 10 years, been acquiring computer equipment without a national policy on educational computing in South Africa, and within only broad parameters provided by their department. The aim of this study was to determine the present status of educational computing in these schools.

A literature survey on educational computing was undertaken and a number of international and local 'computers-in-schools' initiatives were elucidated. A field survey, involving all CED secondary schools (239), was initiated by sending questionnaires to principals of these schools - a return rate of 89% was achieved.

The results of the research revealed that most CED secondary schools have already acquired computer facilities. The role of pressure groups such as teachers, parents, business sector etc together with other factors that might have influenced schools in acquiring their computer facilities was also investigated. The investigation also revealed where and how these facilities are being utilised: most schools use their computers for administrative functions, with the computer-as-a-tool for teachers and pupils also fast gaining ground. Computer-assisted learning activities, where the computer is integrated with subject curricula, are however still limited.

The extent of both teachers' formal training in educational computing and their familiarity with different software applications were also determined. Schools were also required to indicate the areas where they experience problems in getting teachers and pupils more involved in 'computers-in-education' activities.

The present educational computing position in secondary schools of the CED will have to serve as a foundation for the department's CISR Project embarked upon in 1991.

U I T T R E K S E L

Hoërskole van die Kaaplandse Onderwysdepartement (KOD) het die afgelope tien jaar rekenaartoerusting bekom sonder dat 'n nasionale beleid rakende 'rekenaars-in-die-onderwys' in Suid-Afrika bestaan, en binne slegs breë riglyne van hul departement. Hierdie studie is onderneem om die aard en omvang van die benutting van rekenaars in hierdie skole te bepaal.

'n Literatuurstudie rakende 'rekenaars in die onderwys' is gedoen waarin spesiale aandag aan internasionale en plaaslike inisiatiewe gegee is. 'n Opname, om die huidige posisie in skole te bepaal, is onderneem deur middel van vraelyste wat aan die skoolhoofde van al die hoërskole (239) verbonde aan die KOD gestuur is. Nege-en-tagtig persent (212) van die respondente het op die versoek om die vraelyste te voltooi en terug te stuur, gereageer.

Die ondersoek het getoon dat skole reeds groot hoeveelhede rekenaartoerusting bekom het. Daarbenewens, is die rol van verskillende drukgroepe, onderwysers, ouers, die privaatsektor ens., asook die verskillende motiverings vir die verkryging van hierdie rekenaars ondersoek. Die respondente moes aandui op watter manier rekenaars in die skole benut word. Daar is bevind dat rekenaars in die meeste skole hoofsaaklik vir administratiewe doeleindes aangewend word, alhoewel die gebruik van die rekenaar as hulpmiddel vir onderwysers en leerlinge al hoe meer veld begin wen. Van werklik effektiewe rekenaar-ondersteunde onderrig-/leeraktiwiteite, waar die rekenaar vakkurrikula ondersteun, is daar egter nog nie veel sprake nie.

Daar is tydens hierdie opname ook ondersoek ingestel na die formele 'rekenaars-in-die-onderwys'-opleiding van die onderwyserkorps asook na vaardighede ten opsigte van die gebruik van verskillende sagtewarepakette. Verder moes aangedui word waarom probleme ondervind word om onderwysers en/of leerlinge meer betrokke by rekenaarsverwante aktiwiteite te maak.

Die bevindinge van hierdie navorsingsondersoek behoort in ag geneem te word tydens die implementering van die KOD se RISK-Projek wat in 1991 geloods is.

GLOSSARY OF TERMS

Authoring language

cross between a high level programming language and a program generator, mainly optimized to produce computer-aided learning courseware.

Authoring system

an end-user orientated tool that enables courseware to be constructed by those who are not expert in the use of conventional programming languages.

BASIC

acronym for Beginners' All-purpose Symbolic Instruction Code, the most widely available program language for use with micros.

Clearing house

a place where information on a specific topic (in the context of this dissertation - computer software) is gathered, stored, evaluated and disseminated.

Compatibility

a measure of how well two different systems can work together in sharing programs, files and other data.

Computer

a programmable symbol processing device; a system that links hardware and software in order to carry out simple repetitive tasks at great speed and with little error; a modern, high speed, digital, electronic, stored program data processor.

Curriculum

all the learning which is planned and guided by the school, whether it is carried on in groups or

individually inside or outside the school.

Data base management system

general purpose software tool which can be used to store large volumes of structured data and which allows the user to manipulate (search, sort, reorganise, etc.) the data in order to find patterns and trends.

Departments of education

at present the different departments responsible for formal education of various population groups of South Africa (for further elucidation see Appendix E).

Desktop publishing

the use of a versatile software program to produce high quality documents, incorporating text and graphics, with a printer.

Formal education

planned education at recognized institutions such as schools, colleges, technicons and universities.

Generic software

denoting off-the-shelf (i.e. generally available), or not specific software; it could be spreadsheets or open-ended software for physics teaching.

Hardware

the set of physical parts of an IT system, i.e. the ones that can be touched, as opposed to the software that makes the system work.

Hypermedia

any computer-controlled system which allows the user to interact with a number of media, e.g. text and graphics on film, on CD-ROM, etc.

Hypertext

a simple type of hypermedia, which gives access only to text, with the user reading the text as

a linear book, or moving round in any way one may imagine; the index is electronic, and there is often a dictionary and/or glossary on call too.

Information technology (IT)

the handling of information by micro-electronic means; handling includes transfer, processing, storage and access, IT's special concern being the use of hardware and software for these tasks for the benefit of individual people and society as a whole.

LOGO

a high-level, logic based, interpreted program language devised by Seymour Papert and others at MIT in 1967, and aimed at learners of programming.

Magnabyte - tradename for Telex - OHP monitor display unit.

Modem

a hardware link (interface) between a digital IT unit (e.g. a computer) and an analog phone line to a local exchange.

Mouse

a handheld, input unit used as a pointing device, i.e. one that controls the movement of a cursor on a screen.

MS-DOS

abbreviation for Microsoft's DISK OPERATING SYSTEM, the world-wide standard operating software for IBM compatible microcomputers.

OHP Monitor Display Unit

a LCD data projection panel; when connected to the computer as a peripheral, and placed on an overhead projector it projects the monitor's image onto a large screen.

PASCAL

a compiled high-level program language widely used in teaching, and therefore for general

purpose use.

Peripherals

any hardware unit that is not part of the computer's central processor (CPU), e.g. printer, mouse, screen, etc.

Personal computer

any stand-alone micro for use mainly by one person at a time (also called a micro-computer).

Plotter

an output device for giving hard copy of a graphic image; in a flat bed plotter, the paper rests on a flat table, and the pen moves to and fro on a carrier which itself moves up and down.

Printer

a machine for putting the data output by a computer onto paper as a hard (permanent) copy.

Printer sharer

a manual or automatic switch that links any set of small IT systems (e.g. micros) to one printer.

Program (computer)

a set of instructions to the computer in computer language, which controls its functioning for the benefit of the user.

Programme

a plan of events.

RAM

for a storage chip holding data in read and write memory.

SASPAC

acronym for School Administration System Package - developed by J. du Raan and Associates and sold on tender to the Cape Education Department in 1990.

Software

the set of one or more programs an IT system needs to carry out a task and can consist of operating software, utilities, program language software and applications programs.

Spreadsheet

a modelling program based on a grid of two or more dimensions with cells arrayed in rows and columns; the user can enter and edit data, copy and move the contents of cells, save and print the whole or a part of a table etc.

Word processing

a major use of IT; also called text processing, for such a program handles the text needs of a user; the user can enter text, edit it, work on the format (layout), print it out and save it in for future retrieval.

LIST OF TABLES

	PAGE
TABLE 2-1 Computer applications in education	7
TABLE 2-2 Classification of educational software	9
TABLE 2-3 Diagrammatic representation of a software taxonomy	10
TABLE 2-4 A taxonomy of educational computing	11
TABLE 2-5 Distribution of National Film Library programs according to their compatibility and secondary school subjects	20
TABLE 2-6 Computer applications and the physical location of hardware	29
TABLE 2-7 A model for educational computing integration	35
TABLE 4-1 Methodology flowchart	61
TABLE 5-1 Amount of money spent by schools to acquire computer equipment	70
TABLE 5-2 Types of computers acquired by schools	71
TABLE 5-3 Physical location distribution of computers	72
TABLE 5-4 Percentage schools with computers at different locations	73
TABLE 5-5 Number of computers in the computer room	74
TABLE 5-6 Utilization of computers in schools	75
TABLE 5-7 Computer-related devices acquired by schools	76
TABLE 5-8 Schools using administrative software programs	77
TABLE 5-9 Frequency of secondary schools using CAL-software	78
TABLE 5-10 Frequency of generic software application	79
TABLE 5-11 Extent of teacher training	81
TABLE 5-12 Teachers' familiarity with software applications	84
TABLE 5-13 How teachers use the computer	85
TABLE 5-14 Pressure groups' influence to introduce/extend computer facilities	87
TABLE 5-15 Importance of the rationale on which the initial decision to introduce computers was based	89
TABLE 5-16 Pupil involvement in educational computing activities-graphically	90
TABLE 5-17 Pupil involvement in educational computing activities - tabulated	91

TABLE 5-18	Areas where schools are experiencing problems in getting teachers more involved in 'computers in education' activities	93
TABLE 5-19	Areas where schools are experiencing problems in getting pupils more involved in 'computers in education' activities	96
TABLE 5-20	The relative importance of reasons for schools not having computers	100

TABLE OF CONTENTS

		Page
	ABSTRACTS	(ii)
	GLOSSARY OF TERMS	(iv)
	LIST OF TABLES	(ix)
	TABLE OF CONTENTS	(xi)
	PREFACE	(xvii)
	CHAPTER 1 : GENERAL ORIENTATION	
1.1	Introduction	1
1.2	Statement of the problem and the purpose of the study	3
1.3	Nature of the research	4
1.4	Delimitation of the research	4
1.5	Programme of the thesis	4
	CHAPTER 2 : AN OVERVIEW OF EDUCATIONAL COMPUTING	
2.1	Introduction	6
2.2	Classification of educational computing activities	6
2.2.1	The Retief Model	7
2.2.2	The Taylor/Chandler Model	8
2.2.3	The Bull and Cochran Model	10
2.2.4	The KRS Model	11
2.3	Computer literacy vs. Computer-assisted learning (CAL)	12
2.3.1	Computer literacy	13
2.3.1.1	The Programming Curriculum	13
2.3.1.2	The 'traditional' Computer Literacy Curriculum	14
2.3.1.3	The 'Computer-as-a-tool' Computer Literacy Curriculum	15

2.3.1.4	The Problem-Solving Curriculum	16
2.3.1.5	The Integrated Computer Literacy Curriculum	16
2.3.2	Computer-assisted learning	18
2.3.2.1	Traditional Computer-assisted learning	19
2.3.2.2	CAL with open-ended, content free (generic) software	21
2.3.3	A Computer Using Curriculum: the ideal computer curriculum?	22
2.4	Teachers as centres of gravity	23
2.4.1	Modes of teacher training for educational computing	24
2.4.1.1	Initial teacher training	24
2.4.1.2	Part-time studies	25
2.4.1.3	In-service training	26
2.4.2	Computer-using teachers in the 90's	27
2.4.3	Conclusion	28
2.5	The location of computers in the school	28
2.5.1	The computer room	30
2.5.2	Computers in the classroom	30
2.5.3	The mini-lab	32
2.6	The integration of educational computing into schools	32
2.6.1	Obstacles that prevent schools from implementing computers	33
2.6.2	Implementation of computers into schools	34
2.6.3	Pre-cautionary measures for computer integration	35
2.6.4	Conclusion	37

CHAPTER 3: A REVIEW OF EDUCATIONAL COMPUTING PROGRAMMES

3.1	Introduction	39
3.2	Rationales for using computers in schools	39
3.2.1	The Social Rationale	39
3.2.2	The Vocational Rationale	40
3.2.3	The Pedagogic Rationale	40

3.2.4	The Catalytic Rationale	40
3.2.5	Results of rationale practice	41
3.3	The Case of the United Kingdom: IT in the national curriculum	43
3.3.1	Introduction	43
3.3.2	Aims and requirements of IT in education for 5 - 16 year-olds	44
3.3.3	The situation of IT in 1989 (before the National Curriculum)	44
3.3.4	The major issues and implications arising from IT in the National Curriculum	45
3.3.5	Future considerations	46
3.3.6	Conclusion	46
3.4	The Australian Initiative	46
3.4.1	Introduction	47
3.4.2	The development of a national computer educational plan - a chronological description	47
3.4.3	The recommendations by the National Advisory Committee	48
3.4.4	The National Computer Education Programme	49
3.4.5	Policy considerations of the Australian initiative summarised	49
3.4.6	Conclusion	50
3.5	Computers in Education - The Ontario Initiative	50
3.5.1	Introduction	50
3.5.2	Some background	51
3.5.3	Evaluating the initiative	52
3.5.4	Conclusion	52
3.6	Kenya : Educational Computing in a third world country	53
3.6.1	Introduction	53
3.6.2	The CEPAC-project	54
3.6.3	Conclusion	55
3.7	HSRC/ISM: Computer Literacy Project in South Africa	55
3.7.1	Introduction	55
3.7.2	The aim of the project	55
3.7.3	Hardware and software used, and support rendered	56

3.7.4	Brief summary of conclusions	56
3.7.5	Conclusion	57
3.8	The computers in secondary schools policy of the Department of Education and Culture: House of Representatives (South Africa)	57
3.8.1	A brief history	57
3.8.2	Report on the use of computers in secondary schools at the end of 1988	58
3.8.3	The continued supply of computers to school	59
3.8.4	Conclusion	60

CHAPTER 4 : COLLECTION OF RESEARCH DATA

4.1	Methodology flowchart	61
4.2	General goals and objectives of the research	61
4.3	Research method used	62
4.4	Description of the questionnaire	63
4.5	Pilot study	65
4.6	Approval of the questionnaire by the Cape Education Department	65
4.7	The sample	66
4.8	Administering the survey	66
4.9	Validity of the research	67

CHAPTER 5 : ANALYSIS AND INTERPRETATION OF RESEARCH DATA

5.1	Data processing procedures	68
5.2	Some general findings	68
5.2.1	Number of teachers with computer facilities at home	68
5.2.2	Amount of money spent	69
5.3	Computer hardware and software situation	71
5.3.1	Number and type	71

5.3.2	The location of computers in the schools	72
5.3.3	How and to what extent computers are being utilized	74
5.3.4	Computer peripherals	76
5.3.5	Software	76
5.3.5.1	Administrative software packages	76
5.3.5.2	Computer-assisted learning software	77
5.3.5.3	Generic or open-ended software	79
5.4	Teacher training	81
5.4.1	The extent of teacher training	81
5.4.2	Attendance of meetings of Educational Computing-study groups at teachers' centres	82
5.4.3	Schools offering computer literacy courses as part of staff development programmes	83
5.5	Teachers' familiarity with certain software applications	83
5.6	How teachers use the computer	85
5.7	Factors which influence schools to introduce computers	86
5.7.1	Pressure groups that played the most dominant role	86
5.7.2	Rationale on which initial decision to introduce computers was based	88
5.8	Nature of pupil involvement in educational computing activities	90
5.9	Problems that schools experience in getting teachers and pupils involved in "Computers in Education" activities	92
5.9.1	Does the school experience any problems in getting teachers more involved in "Computers in Education" activities?	93
5.9.2	Does the school experience any problems in getting pupils more involved in "Computers in Education" activities?	96
5.10	Why certain schools have not acquired computers	99
5.11	Summary	101

**CHAPTER 6 : EDUCATIONAL COMPUTING IN THE CAPE
EDUCATION DEPARTMENT - QUO VADIS?**

6.1	Introduction	102
-----	--------------	-----

6.2	Cape Education Department's educational computing policy prior to September 1991	102
6.3	NTB/HSRC investigation into the training of computer experts and computer literates in the RSA	105
6.3.1	Introduction	105
6.3.2	Plans of action	105
6.3.3	Elucidation	106
6.4	Computers in schools and colleges project (CISC)	107
6.4.1	Introduction	107
6.4.2	Aims of the CISC-project	107
6.4.3	Implementation	108
6.4.4	Hardware and software facilities	109
6.4.5	Training of teachers and pupils	109
6.5	Summary	111

CHAPTER 7 : CONCLUSIONS AND RECOMMENDATIONS

7.1	Final conclusion	112
7.2	A summary of recommendations	116
7.3	Areas where further research is needed	118
7.4	Final summary	118

APPENDICES:

A:	PROPOSED FURTHER DIPLOMA IN EDUCATION: COMPUTER LITERACY	120
B:	PROPOSED FURTHER DIPLOMA IN EDUCATION: SOFTWARE DEVELOPMENT	123
C:	QUESTIONNAIRE - ENGLISH	126
D:	QUESTIONNAIRE - AFRIKAANS	141
E:	THE SOUTH AFRICAN SCHOOL EDUCATION SYSTEM	157

REFERENCES	158
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DECLARATION

I declare that: "EDUCATIONAL COMPUTING IN SECONDARY SCHOOLS OF THE CAPE EDUCATION DEPARTMENT: A RESEARCH SURVEY TO ASSESS COMPUTING FACILITY ACQUISITION AND ITS UTILIZATION" is my own work, that all the sources used or quoted have been indicated and acknowledged by means of complete references, and that this thesis was not previously submitted for a degree at another university.



Pat Bean

Technology presents a challenge in approaches to its effective use - in some ways, like Mount Everest, "because it is there" !!

CHAPTER 1 : GENERAL ORIENTATION

1.1 INTRODUCTION

Information technology (IT), has become an indispensable phenomenon in modern society and the increasing development of this technology also means that it has become even more closely interwoven with all economic activities. Although lagging behind by a few years, South Africa is experiencing the same pattern that most of the developed countries of the First World are experiencing. A good illustration of this is provided by the sophisticated computer applications used by banks and other financial institutions as well as by the influx of computers into educational institutions.

If it is accepted that information technology will play an increasingly important part in the South African economy, an inevitable consequence is the growing need for a computer literate population. Hubbard asserts that "... if we foresee a society in which information technology pervades both work and home, then it must also pervade education" (1984:113). As this trend will affect all the people of South Africa, it would be logical to deduce that the formal education system will necessarily have to accept the responsibility for fulfilling this need.

How then can we best prepare our pupils for the future? It seems clear that as education inevitably involves information a natural place to look for help is in IT. Held, Newson and Pheiffer believe that "... preparing students for the future means that students need to be life-long learners, excited about learning, and self directed" (1991:21). Frequent opportunities to interact with computers as part of everyday lives and work provide one important avenue towards realization of these needs. Moreover, the advent of the computer in education has opened up possibilities for new and more effective teaching approaches.

Of course, the burning question that remains is to strike the correct balance between the formative and vocational spheres : "Education should never be equated to a production line for the world of work ..." (Human Sciences Research Council Investigation, 1991:46).

There is at present in South African educational policy a considerable lack of consistency and co-ordination regarding computers in education, except for the subject, Computer Studies. This is mainly due to the fact that

- a) educational policymaking is decentralised (there are at present 13 separate departments of education) (see Appendix E); and
- b) there is no national computer instruction policy and therefore no national curriculum, except for Computer Studies which is at present available only to a privileged few.

The use of computers in South African schools, other than for the teaching of Computer Studies, has become widespread, and many schools are experiencing the predicted 'Third Wave' of technology (Toffler 1979). Except in the cases where computer equipment has been supplied by departments of education for Computer Studies, the rapid acquisition of computer equipment by many schools over recent years has taken place on an ad hoc basis. It is because of this that different departments of education and schools have reached different stages in their use of computers in schools.

In certain departments of education, such as the Natal Education Department (Jacobs 1990) and schools under the jurisdiction of the Department of Education and Culture: House of Representatives (so called 'Coloured' schools), computer facilities and curricula for computer literacy have been supplied in the past.

On the other hand, certain other departments have not been so privileged. Before 1991, the Cape and Transvaal Education Departments gave no financial assistance to their schools for computer acquisition. Computer acquisition and utilisation has been taking place, therefore predominantly, on an ad hoc basis. These schools have only been able to acquire computer facilities through the efforts of parents, teachers, the private sector or even pupils. Schools of the Department of Education and Training (so called 'Black' schools) are in an even less fortunate position. They do not receive any financial assistance for computer facilities from their department and few of these schools are in

a position to enjoy the luxury of computers. Although the private sector has donated computer facilities to a few of these schools, the impact thereof has not been of any significance to date.

1.2 STATEMENT OF THE PROBLEM AND THE PURPOSE OF THE STUDY

The study proposes to address the following broad question:

What is the situation, in terms of computer acquisition and utilization, in schools functioning without specific educational computing guidelines on a national level and with only broad parameters from the department of education under whose jurisdiction they fall?

The chief objective of the investigation was to establish the status of educational computing in the secondary schools of the Cape Education Department (CED). In addition the following subsidiary questions were posed:

- a) How far are teachers in these schools equipped to handle educational computing activities?
- b) What computer equipment has been acquired, to what extent is it utilised, and where has it been housed?
- c) What type of software is being utilised and for which purposes?
- d) What influenced the schools in their initial acquisition and subsequent expansion of computer facilities?
- e) What types of computer activities are pupils involved in?
- f) Why have certain secondary schools not as yet acquired computers?

- g) Have sufficient advances in educational computing been made to serve as a foundation for the 'Computers In Schools and Colleges Project' embarked upon in 1991 by the CED?

1.3 NATURE OF THE RESEARCH

An extensive literature survey was undertaken to study 'educational computing' practices. As the study was aimed at determining the status of educational computing in high schools of the CED, a field survey was undertaken.

Questionnaires were distributed to the principals of all high schools under the jurisdiction of the CED, namely 239 secondary schools in the Cape Province.

1.4 DELIMITATION OF THE RESEARCH

The research is limited to secondary schools under the jurisdiction of the CED. Private schools and schools of other departments of education, within the province, are therefore not included.

1.5 PROGRAMME OF THE THESIS

Chapter 2 presents an overview of the relevant literature and research on aspects of educational computing.

In Chapter 3 the different rationales for the introduction of educational computing are highlighted and a number of national and decentralised educational computing policies or projects are cited.

Chapter 4 describes the procedures involved in the collection of the research data. These include questionnaire design and distribution.

Chapter 5 focuses on the analysis and interpretation of the research data. The status of

educational computing in the CED, before the implementation of the 'Computers in Schools and Colleges-Project (CISC); is determined.

Chapter 6 describes the 'CISC-Project' of the Department of Education and Culture : Administration House of Assembly and also gives a review of CED Policy prior to the announcement of the project. The combined report of the National Training Board and the Human Sciences Research Council on computer literacy demands for South Africa is outlined in order to place the CED's initiatives in perspective.

In Chapter 7 a broad overview of the whole study is presented, conclusions are drawn and recommendations made. Areas where further research is needed are identified.

CHAPTER 2 : AN OVERVIEW OF EDUCATIONAL COMPUTING

2.1 INTRODUCTION

At present there is little consensus with regard to the use of terminology for the role of the computer in education. Terms such as 'computer-assisted learning', 'computer-aided instruction', 'computer-managed learning', 'information technology in schools', 'computer literacy', 'the computer in the curriculum', and many others, are often used indiscriminately.

The existence of such a variety of terms suggests that teachers, learners and software designers have different assumptions with regard to the teaching/learning situation. The different terms also imply different kinds of teaching methods. However, as pointed out by Retief (1989:148), "... although teachers should know what these differences are in order to try to obviate confusion as far as possible, these 'differences in the meaning of terms' must not be over emphasized as this may become counter-productive". As a solution to these problems would be the adoption of an all-inclusive and neutral term such as 'educational computing' (Scrimshaw, 1989:106).

The influence of a computer in education depends not only upon its own characteristics and the current program loaded, but also upon how it is employed in a particular teaching/learning situation. As there is no consensus on an acceptable definition for educational computing, many researchers attempt to arrange the activities of 'computers in education' in meaningful modes, schemes or even taxonomies.

2.2 CLASSIFICATION OF EDUCATIONAL COMPUTING ACTIVITIES

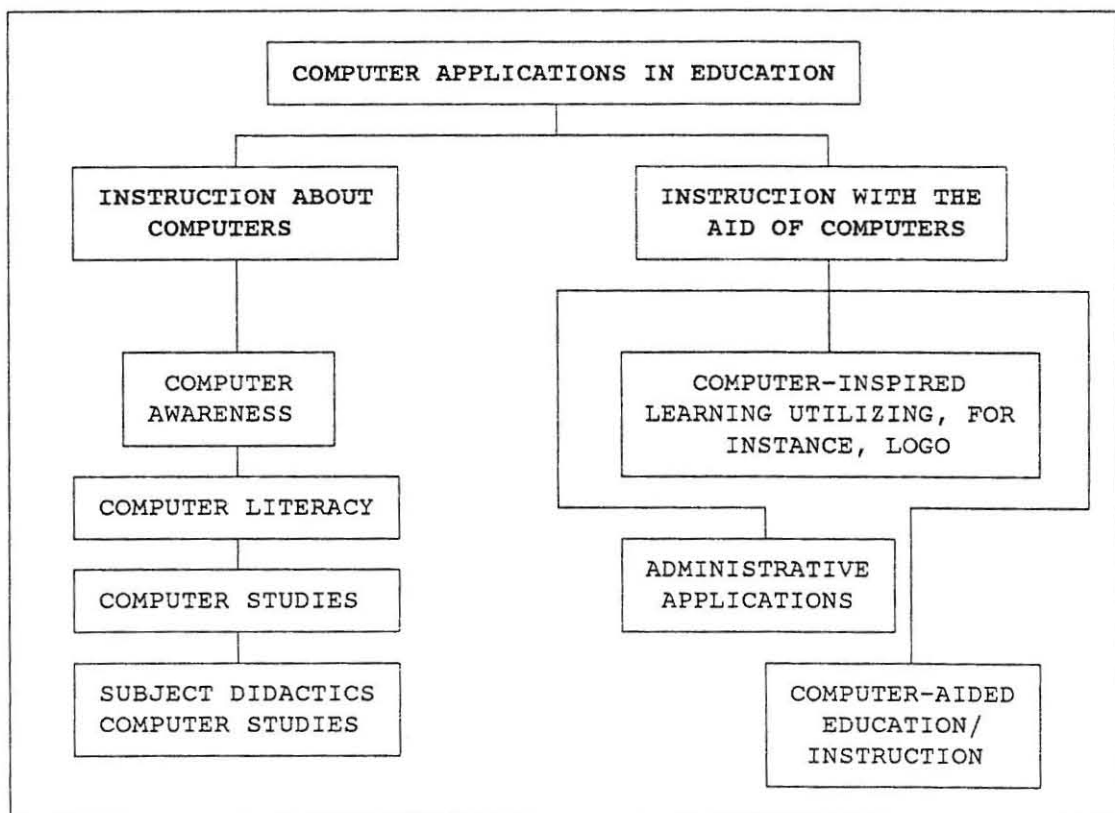
The rapid introduction of computers in education over recent years has in many cases been a piecemeal affair, with a variety of different applications. Schools have traditionally used computers in three ways, that is, for administrative and managerial applications, for enhancing the educational process and for teaching about the computer as a topic of study.

2.2.1 The Retief Model

One attempt at classifying the concept, 'educational computing' is by Retief and is presented in the following diagram (Table 2-1) which categorises computer applications in education into two broad areas, namely 'instruction about computers' and 'instruction with the aid of computers' :

TABLE 2-1: COMPUTER APPLICATIONS IN EDUCATION

(Retief 1989:148)



The applications identified in Retief's classification can be rearranged into the following two distinct, but broad areas, namely how computers are used by, a) pupils and b) teachers.

These uses are determined by different needs, as follows:

- a) Pupils use the computer in schools:
- (i) to become generally aware of its uses and limitations;
 - (ii) to learn computer programming (historically in BASIC, but more recently in structured computer languages such as PASCAL and LOGO);
 - (iii) to learn to use programs for word-processing, spreadsheet analysis, and information retrieval from databases, etc; and
 - (iv) to study selected topics from school subjects right across the curriculum, with the computer and educational software either complementing or temporarily replacing the teacher.
- b) Teachers in their capacity as educators or administrators use the computer:
- (i) as a productivity tool, for word processing, record-keeping and to support managerial and administrative functions;
 - (ii) as an educational medium to support teaching and learning in the classroom; and
 - (iii) to teach (or drill) certain sections of the subject content to certain pupils (traditional computer-assisted learning), thus freeing the teacher to perform other educational functions in the classroom.

A variety of classifying approaches to educational computing categorise the different types of educational software that have been developed:

2.2.2 The Taylor/Chandler Model

In 1980 Robert Taylor edited a book of readings, The Computer in the Schools : Tutor, Tool, Tutee, describing possible ways in which computers could be used (Adams 1988:1-6 and Bull and Cochran 1991:50-51). The term 'tutor' refers to the use of the computer as a teaching machine. As the microcomputer was developed further, a flood of educational applications appeared, but most of these were computer-assisted instruction applications such as tutorials, drill-and-practice, and simulations - all falling into the 'tutor' categories. Taylor describes applications such as spreadsheets and databases under the 'tool' category and uses the term 'tutee' to refer to instances in which the pupil learns

by teaching the computer - in other words, programming by the pupil.

Chandler (1984:8) developed a model to classify instructional software in terms of the locus of control applicable to each category. In tutorial type software programs, for instance, the computer and not the learner would be controlling the learning experiences to a large extent, whereas with content free tools or in programming, it is the learner who would be directing these experiences.

TABLE 2-2 : CLASSIFICATION OF EDUCATIONAL SOFTWARE

(Adams 1988:3 and Chandler 1984:8)

<----- program ----- LOCUS OF CONTROL ----- user ----->						
	TUTORIAL	GAMES	SIMULATION GAMES	EXPERIENCE SIMULATION	CONTENT FREE TOOLS	PROGRAMMING LANGUAGES
CHANDLER	* Programmed Instruction * Drill & Practice	* Computer as player or referee	* Computer as game world	* Mathematically based models of process such as scientific experiments	* Word-processing * Data base * Spreadsheet * Control technology * Statistics instruction * Graphic generators	* First generation eg. BASIC * Second generation eg. 'C'
TAYLOR	<----- TUTOR ----->				<----- TOOL ----->	<--- TUTE E --->

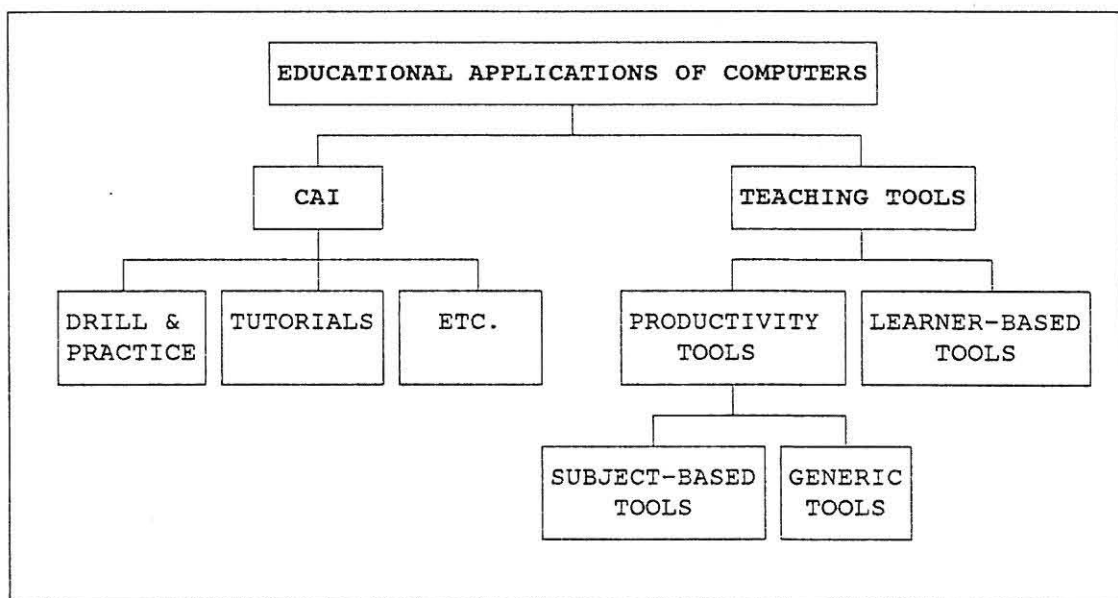
The above table (Table 2-2), based on Chandler's 'locus of control'-model, incorporates the classification system of Taylor.

2.2.3 The Bull and Cochran Model

Bull and Cochran (1991:52) re-examined existing educational software taxonomies and categorized educational software as follows:

TABLE 2-3 : DIAGRAMMATIC REPRESENTATION OF A SOFTWARE TAXONOMY

(Bull and Cochran 1991)



Bull and Cochran distinguish between 'Computer-assisted Instruction' (CAI) and 'Teaching Tools' on the same basis as Chandler does, that is the extent of control that the user has over the program (locus of control). They see traditional computer-assisted instruction, in terms of the computer replacing the teacher, that is where the computer both teaches the facts and directs and evaluates the pupil's practice efforts. Teaching tools on the other hand, shift the locus of control from the computer to the user and are divided into productivity tools and learner-based tools.

Word-processors, spreadsheets, databases and graphing tools are traditional examples of productivity tools where the focus is on the product, and are to an extent merely substitutes for tasks that were previously done by hand. With learner-based tools,

according to Bull and Chandler, "... the emphasis tends to be on the process rather than the product" (1990:53). These tools can be distinguished from productivity tools by their potential for encouraging exploration or discovery, e.g. LOGO. (see also Kozma 1987)

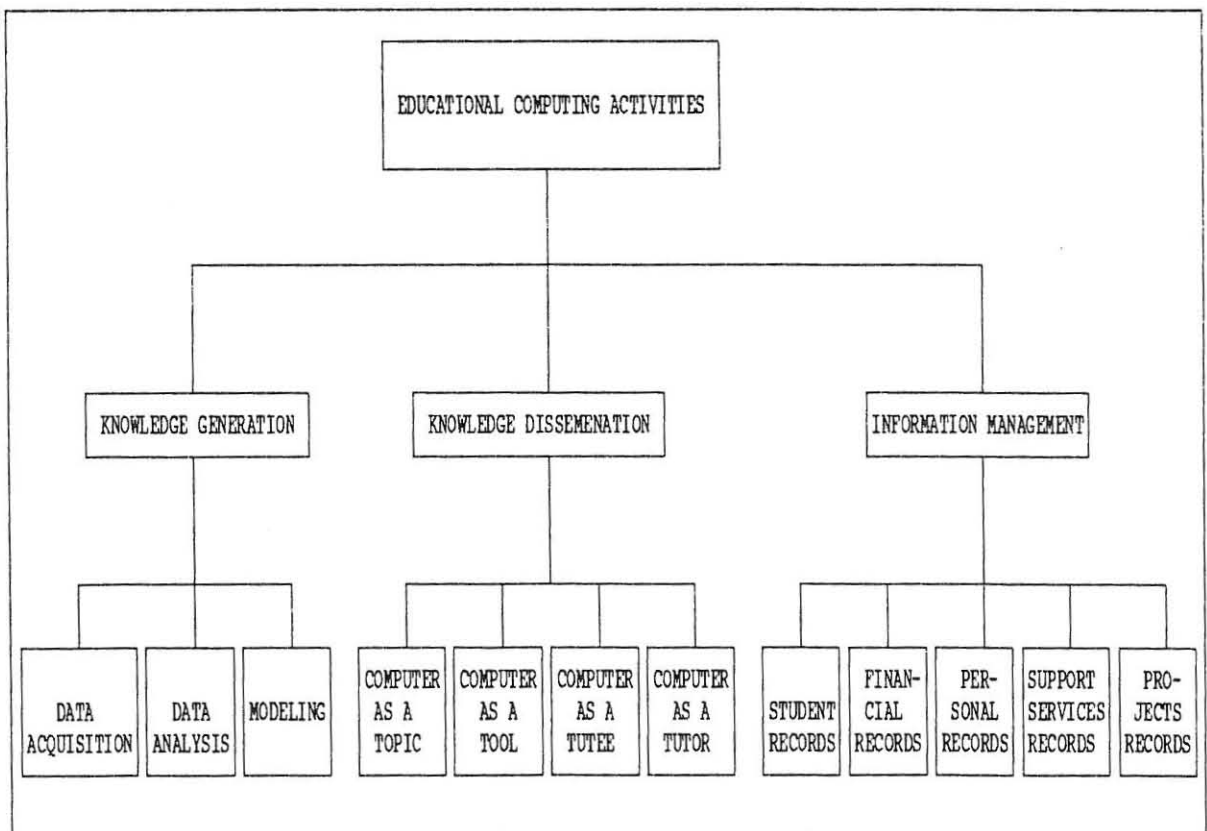
2.2.4 The KRS Model

Another, so-called, 'taxonomy of educational computing' is provided by Knezek, Rachlin and Scannell (1988:15) and is one of the most detailed available. Their taxonomy is designed from the perspective of the educational professional (the teacher) rather than that of an individual learner. Although their taxonomy is not 'learner centered' as Scrimshaw (1989:106) suggests an educational computing taxonomy should be, Knezek, Rachlin and Scannell, claim that, "... our attempt to be comprehensive would be doomed to failure if we ignored computer uses in education outside the classroom" (1988:17).

This comprehensive taxonomy illustrates the complexity of educational computing:

TABLE 2-4: A TAXONOMY OF EDUCATIONAL COMPUTING

(Knezek, Rachlin and Scannell 1988)



By adding a fourth 'T' to Taylor's computer as tool, tutor, and tutee, i.e. topic, the developers of this taxonomy describes all the instructional computing applications under one main heading, namely, 'knowledge dissemination', with the four T's as categories.

The authors are also of the opinion that the capability of the computer to generate new knowledge may have been overlooked in most previous schemes. Two examples of computing activities that resort under the main heading 'knowledge generation' are firstly, the use of a statistical package to discover relationships among data and secondly, a theorem-proving program that might discover new mathematical theorems.

For their third main heading, 'information management', Knezek, Rachlin and Scannell purposely avoided the title 'administrative uses' because teachers with administrative responsibilities commonly use the computer for activities other than information management. For example, a principal when performing a statistical analysis on data covering several years of final examination results is using the computer for 'knowledge generation' and when sending the results via electronic mail to a colleague, is using the computer for 'knowledge dissemination'.

The classification schemes presented illustrate the wide range of applications for computers in education and emphasise the inherent possibilities of the computer in educational practice.

2.3 COMPUTER LITERACY VS. COMPUTER-ASSISTED LEARNING (CAL)

The 'clear' distinction between 'teaching about computers' and 'teaching with the aid of the computer', as the two main components of educational computing, traditionally lead to a 'segregation approach' in the implementation of computers in education. One result of this, according to Woodhouse and Jones, "... is that computers have frequently been added to the existing curriculum in such a way that they seem to be an optional extra (computer science; computer literacy), or a departure from normal educational practice (computer-based learning)" (1988:381) [bracketed examples mine].

To get an idea of changes of direction and shifts in emphasis that have occurred in educational computing it would be necessary to look at the evolution of each of the two traditional components separately, that is, computer literacy (teaching about) and computer-assisted learning (teaching with). Finally, after examination of a number of computer curricula in operation at present an answer to the question, 'Is there an ideal computer curriculum?', will be attempted.

2.3.1 Computer literacy

The structure followed to indicate the change in direction that has occurred in the area of computer literacy is largely based on the work of Priscilla Norton in her article, 'In search of a computer curriculum' (1988:5-14) which can be summarized as follows:

At first most computer curricula were segregated from traditional subjects and were taught in isolation by computer specialists who were usually teachers with Computer Science qualifications. The segregation approach then started making way for what became known as the 'integration approach'.

The evolutionary process that has characterised computer literacy teaching since its inception is outlined in terms of five curricula, as follows:

2.3.1.1 The Programming Curriculum

When schools first (in the 1970's) began purchasing micro-computers it was generally assumed that, a) occupations of the future would involve computers, and b) that computer programming was an essential skill for mastery or control of the computer. For these reasons the teaching of programming became the backbone of the curricula for computers in schools, either as the specialist subject, Computer Studies, or as a major component in computer literacy courses. The fallacies of this approach, with its emphasis on programming, became evident when it was pointed out that,

... only about seven percent of all new jobs between 1980 and 1990 will be genuinely high technology occupations. Although it has been estimated that 75 percent of all jobs will involve the use of computers in some way, in most cases, they will require computer use not computer programming (Norton 1988:6).

The typical computer literacy course included (and in many cases still includes) aspects such as, an introduction to programming, terminology, history of computing, social issues, binary arithmetic, etc (Arch 1986:4). In South Africa too, many departments of education and individual schools developed and implemented computer literacy curricula with programming as a major component.

It is now gradually being realised that an over-emphasis on programming in computer literacy courses reflects a distorted view of how computers really function in society.

2.3.1.2 The 'traditional' Computer Literacy Curriculum

The traditional computer literacy model generally consists of 'computer awareness' and in some cases includes computer programming skills. The model has traditionally been presented as a separate curriculum and has enjoyed a wide following (Arch 1988:5). The two main advantages of such a segregationist approach are, a) that only one or two 'expert' teachers per school are needed to take the entire school through a computer literacy course and, b) that the routines of fewer teachers are being disturbed (Schiffman 1985:678).

In 1985 research done by Schuttenberg, McArdle and Kaczela (1985:19-22) in the U.S.A., highlighted the emphasis that schools of the time placed on certain skills to be acquired by pupils following computer literacy courses. They asked educators and parents which competencies/skills were currently being taught in their school districts. The five skills which obtained the highest frequency, were, in order of frequency, as follows: (a) the use of the computer keyboard; (b) the use or understanding of basic computer terminology ; (c) the creation of simple computer programs; (d) understanding the basic computer components; and (e) understanding the relation between hardware and software.

Hawkrige sees this type of course as "... merely a piece of after-the-fact justification for the rather low level of what has happened in many schools" (1990:3). He also indicates that the use of computers in this way is a waste of resources, because computers are potentially very powerful educational tools.

Furthermore, many curriculum experts and most critics of this type of computer literacy curriculum do not accept the segregation of 'knowledge of computers' and 'the use of computers' into two separate curricular areas, nor do they believe that the computer can be presented as a field of study separated from school curricula. Instead they feel that pupils, receiving computer literacy training, should see a meaningful application relevant to what they are doing (Norton 1988:8).

2.3.1.3 The 'Computer-as-a-tool' Computer Literacy Curriculum

In reaction to the traditional computer literacy curriculum Hebenstreit suggests that

... the real problem is elsewhere ... How should we educate and train people to make better use of these increasingly powerful tools? There lies the real challenge for education (1983 In: Norton 1988:11).

The software tools referred to, namely word-processing, spreadsheet analysis and database management, account for the majority of computer applications practices. Therefore, giving pupils experience with these applications would seem a logical step in preparing them for the future (Schiffman 1985:679).

What succeeded the traditional computer literacy curriculum was still segregationist, but it was a computer literacy curriculum based on the computer as a tool. Computer literacy classes are still being taught by specialists in a computer laboratory situation, with no or little application in traditional subject areas, these approaches concentrate on the teaching of skills associated with the use of a variety of applications software such as word processors, database managers, spreadsheets and graphics tools.

This lack of interaction with other school subjects has been criticised as follows: " Every

intellectual tool must be demonstrated to be educationally useful, to contribute in some way to the learning process" Bork (In: Norton 1988:12). Knowing how to use a word processor is of little use unless one has something to write about or, learning to use a database is important only if one needs to organise data and solve a specific problem.

2.3.1.4 The Problem-solving Curriculum

Another segregationist approach often encountered involves the use of the computer to make pupils better problem solvers. One of the leading proponents of the problem-solving computer curriculum is Seymour Papert, the inventor of LOGO (Yates & Moursund 1989:13). Papert reasons that by taking advantage of educational opportunities to master the art of deliberately thinking like a computer, the learner is able to articulate what thinking is (Norton 1989:12).

LOGO (turtle graphics) is very popular in primary schools as a means of improving pupils' problem-solving skills. LOGO's application in high schools is primarily aimed at preparing pupils for further studies in structured programming with, for example, Pascal. Research undertaken by Clements (1985), Rieber (1987) and Johnson *et al.* (1987) (In: Yates and Moursund 1989) tested the hypothesis that computer programming using Logo, Basic, and Pascal, improves problem-solving skills, but did not offer any significant results.

Each of the above-mentioned segregationist approaches to computers in education has worthy goals, but there are also serious shortcomings, as indicated.

2.3.1.5 The Integrated Computer Literacy Curriculum

As early as 1982, Bitter (In: Norton 1989:9) suggested that many of the goals of a computer literacy curriculum could be achieved within traditional subject areas/curricula. The overall guidelines for such an approach are, a) to show the computer as a tool with many different applications, and b) to have all teachers involved in the teaching of computer literacy.

After a survey of schools under the jurisdiction of the Natal Education Department, Jacobs indicated that

What seems to have happened is that a change in computer application methods has occurred. There has been a movement away from Computer Literacy and Computer Studies courses towards the use of CAL by teachers in all subject fields (1990:401).

Ruthven describes the computer in such an approach as "... a tool for communication, information handling, learning and enquiry ... Within this paradigm, computer literacy is seen as the ability to select or design, and then implement, a computer solution" (1984:138). Schiffman argues the importance of utility packages/programs because their use in the classroom, can

- a) promote the acquisition of life-long computer skills which are particularly relevant for people to function in the information age;
- b) increase teachers' and pupils' productivity;
- c) be adapted to integrate many curriculum areas; and
- d) stimulate problem solving skills in pupils (1986:27-31).

The HSRC/ISM-project undertaken in secondary schools in South Africa also supported this type of curriculum:

The ability or skill to use a computer as a tool is what we regard as computer literacy, ... computer literacy by means of utility packages which were to be integrated into subject teaching ... (Human Sciences Research Council Project 1991:9).

All the skills elaborated upon in the computer curricula discussed so far, that is, programming, computer literacy, problem-solving and tool-use, can be accomplished within the framework of the integrated computer curriculum. For instance, programming can be taught as an example of mathematical principles while a tool such as a word processor or a database can promote faster writing or more efficient information collecting and handling. Even problem-solving strategies may be introduced within the curriculum criteria stated for most subjects.

Another advantage of the integrated computer literacy curriculum is its manageability (Norton 1989:13). Rather than adding additional computer literacy classes to an already crowded timetable schedule, this computer curriculum fits nicely into an already existing curricular structure.

In conclusion it is clear that the traditional, or for that matter, any segregated computer literacy approach is severely limited. There has been a definite shift in emphasis towards the use of the computer as a tool or teaching across the curriculum. However although the integrated approach seems to offer the ultimate solution for computer literacy education, Norton points out that it does not necessarily contribute to more efficient teaching and learning:

... the computer integration curriculum carries with it a set of unspoken assumptions which fail to recognize the unique potentials of the computer and current changes in society, ... and defines teaching and learning as content specific and content oriented and presupposes an existing curriculum that is best left unchanged (1989:13).

This opinion is supported by Collins and Martinez, after analysing data from two major national surveys in the United States of America: "Computers are rarely used to enhance learning and instruction in traditional subject areas, despite abundant recommendations that support curricular integration" (1989:7).

2.3.2 Computer-assisted learning (CAL)

The term, CAL, will be used to include both computer-assisted learning and computer-assisted instruction.

Two paradigms can be distinguished in the thinking and practice in the field of 'computer-assisted learning' (CAL): The first, or traditional approach associates CAL with computer-based education (CBE) systems such as TOAM or SERGO (for school mathematics); and/or with subject specific software programs where pupils interact with the computer on a one-on-one basis with the teacher's role in the actual

teaching/learning-process scaled down. In the second paradigm the emphasis is more on open-ended, content free software with a tool-approach which is integrated into the curriculum.

These two examples of computer-assisted learning approaches will now be elucidated:

2.3.2.1 Traditional Computer-assisted learning (CAL)

There are many ways in which 'traditional' CAL-programs can be used to support teaching and learning. Up to nine different ways or 'modes' were identified earlier in this chapter, of which drill and practice, the tutorial, demonstrations, simulations and pupil programming are the best known (Retief 1989:148-157).

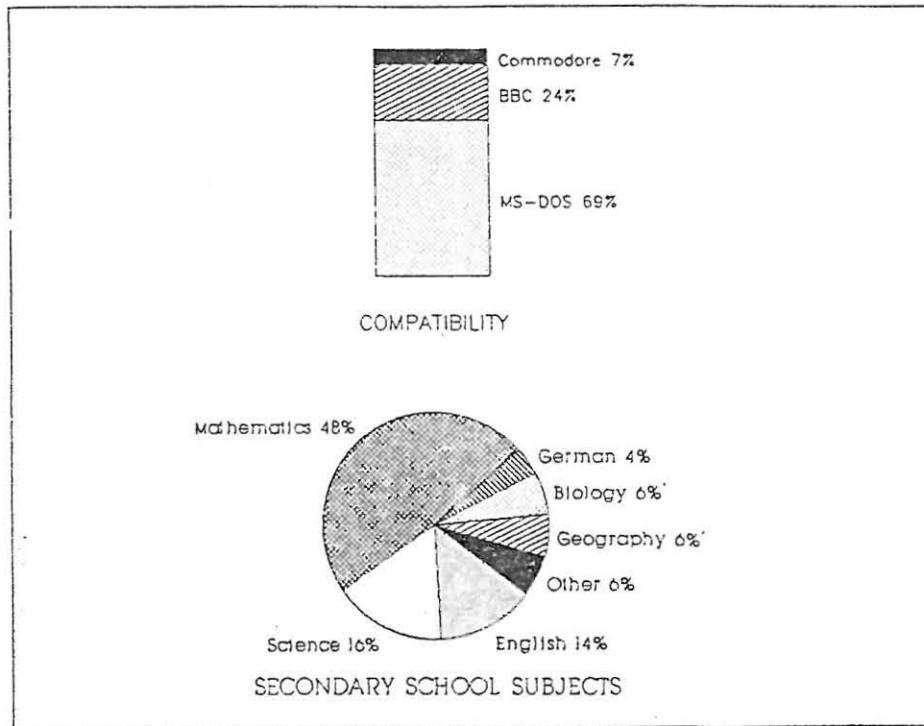
Traditional CAL programs usually involve pupils going to the computer room where the computer dominates and controls the learning progress; often there is excessive repetition. Furthermore, such subject specific software is usually aimed at a specific age group or at pupils with certain abilities and is in most cases not transferable to other subjects.

Literally thousands of subject specific instructional software packages are available in many overseas countries. In South Africa the position is somewhat different with very little development of subject specific software taking place. The incompatibility of overseas syllabi together with the effects of sanctions can be cited as reasons for the relative 'shortage' of subject specific software, locally.

Jacobs (1990:401) surveyed the availability of instructional software in South Africa and found that the most comprehensive catalogue was that of the National Film Library (NFL). She found that of the 600 programs contained in the catalogue, only 140 are suitable for CAL in secondary schools. Table 2-6 illustrates the distribution of NFL programs according to their compatibility with different types of computers, and according to their relevance to various secondary school subjects.

TABLE 2-5 : DISTRIBUTION OF NFL PROGRAMS ACCORDING TO THEIR COMPATIBILITY AND SECONDARY SCHOOL SUBJECTS

(Jacobs 1990) ;



Considering the wide variety of subjects in secondary schools, the amount of software presently available in South Africa seems insufficient to warrant the large-scale introduction of 'traditional' CAL in secondary schools. Furthermore, according to Retief (1989:152), even internationally, 'traditional' CAL has not yet realized the great expectations that existed when the first programs were developed during the fifties. He comments that although many benefits are claimed for computer-aided learning (CAL), the implementation thereof has, so far, not had the expected impact on education, because:

- a) educators still do not know how computers can be used correctly and effectively;
- b) there is an inadequate didactic-pedagogic foundation and weak programming principles are applied in the design of many CAL-programs;
- c) in larger programs pupils get bored as the teaching style of programs lack sufficient variety;
- d) the development of high-quality, didactically founded CAI lesson material is manpower-intensive and time-consuming and therefore expensive; and

- e) teachers must 'learn' every program and in many cases documentation tends to be inadequate or altogether lacking (Retief 1989:152).

In order for the software problem in education to be addressed effectively, Benn suggests that

... teachers will have to consider writing their own software...it is possible to develop software for educational use without being a skilful programmer - by using an authoring system (1990:614).

2.3.2.2 CAL with open-ended, content free (generic) software

A distinction is often drawn between open and closed CAL programs, the latter referring to the traditional CAL discussed above.

Open-ended or content free programs are usually general purpose software tools (e.g. spreadsheets, databases and word processing). Although, in many cases, not specifically developed for instructional use, these programs offer remarkable opportunities for education.

Many advantages for the use of these programs in education have been identified (Degl'Innocetti and Ferraris, 1988; Thompson, 1988 and Watson, 1988). The reasons given are that these programs:

- a) can be used as learning tool, where the user is in control;
- b) are adaptable as they need no fixed methodology and may be used in different subjects;
- c) can be applied across-the-curriculum, that is, the same program can be used in different subjects;
- d) are child-centered in that they require active involvement from the pupil;
- e) are open-ended thus allowing the user to create an environment for problem solving and enquiry; and
- f) have the ability to extend the present curriculum and aid curriculum development.

Thompson, though, cautions against

... those who argue that so-called generic software is now all that is required; ... that a good teacher should be creative with little more than a word processor, spreadsheet, database, paintbox etc (1988:B11).

He argues that teachers deserve the best of software to assist them; to expect teachers to use only generic type software "... will serve only to reinforce the cottage industry aspect of British education" (1988:B11).

2.3.3 A Computer Using Curriculum: the ideal computer curriculum?

The search for a computer curriculum, according to Norton, "... presents educators with the opportunity and the vehicle for re-inventing curricular goals not just integrating the computer with current curricular goals" (1988:11). All the proposed computer curricula, both those for computer literacy and for computer-assisted learning, rest on a concept of learning and teaching which emphasises the mastery of a set of basic computer skills and certain knowledge about the computer, held to be important for full participation in society (Norton 1988:10).

The search for a computer curriculum should not be a search that focuses on the computer but, rather, one that focuses on the curriculum. "It is not a search for a set of computer experiences, ... but the search for a curriculum that puts processes for acquiring experiences and applying knowledge at the centre" (Norton, 1988:11). Through such a curriculum, learners can become engaged in the processes of learning and inquiry rather than focussing only on the products of learning (Ray 1991:19, Bull and Cochran 1991:51).

This approach does not mean that traditional subject content is to be abandoned, but rather that the teacher should view the subject content as a vehicle for the teaching process, rather than as an end (or product) in itself. Such a curriculum, by using the computer as part of the learning environment for teaching process, would capitalise on the unique potential of the computer.

The 'computer-using curriculum' would therefore add competencies to the traditional subject curriculum's general educational objectives. Through the use of computers and subject content as vehicles students will:

- a) discover ways to talk about and direct their thinking and problem-solving strategies;
- b) explore techniques for working co-operatively while attacking complex related problems; and
- c) create meaning from information by using processes modeled during a variety of computer applications for searching, sorting, evaluating, and reporting information (Norton 1988:12).

Although Norton's recommendation that one use the computer's unique potentials as a vehicle to 're-invent' the curriculum might not materialise soon, all computer using teachers should keep these goals in mind when planning educational computing activities.

2.4 **TEACHERS AS CENTRES OF GRAVITY**

A primary and crucial component for the successful implementation and subsequent use of the computer in education must involve those who teach with and about computers - that is the teachers themselves. Teachers with the expertise to provide the leadership and guidance, and school principals with the necessary enthusiasm and the collective commitment to integrate computers in everyday teaching/learning, are essential for a meaningful computers in education programme (Ng 1989:80).

At present the training of teachers for computers in education is taking place in many different ways, that is, during preservice training, through part-time studies, in in-service education, etc. Issues such as the impact of the computer on the teacher's task, how teachers can best be supported when introducing computers in the school, and what knowledge base the computer-using teacher of the 90's requires, are often discussed in education literature.

The shift in emphasis that has taken place in educational computing practice, discussed earlier in this chapter, should be reflected in teachers' computer training curricula. Callister and Burbules stress that "... knowledge about the flexible use and evaluation of software is much more important than knowledge for the development of software, that is programming, design principles, technical capabilities etc" (1990:4).

2.4.1 Modes of teacher training for educational computing

The different modes of teacher training for the use of the computer in education are outlined as follows:

2.4.1.1 Initial teacher training

Many State departments of education in the U.S.A. lay down requirements for the technology skills teachers need to be educated in. According to Fulton these require that "... all students in their teaching degree programs or those seeking certification take a course in computer topics or demonstrate familiarity in using technology for instruction" (1989:15).

In South Africa the 'Criteria for the evaluation of South African qualifications for employment in education' (Department of Education and Culture: House of Assembly 1991:45) prescribe a course, 'Computer Education Science', for all teaching students: all tertiary institutions offering initial/pre-service teachers' training must include such a course in their teacher training curricula.

These educational computing programmes for teachers, however, should not promote a narrow 'technical' focus that is in conflict with the broader educational value and significance of computers. Chomeinne (1988:87) stresses that such courses must go beyond basic word-processing, spreadsheets and databases and that they should emphasize the pedagogical aspects as well as the social impact of the computer.

This viewpoint is supported by Moursund: he complains that most of the pre-service

computer courses for teachers, offered by universities in the U.S.A., "... take a generalist 'computer literacy' orientation" (1989:4). Moonen advises teacher training institutions to 'practice what they preach':

Through personal experience with computer use in their own education, future teachers should get the conviction that such an approach has value. If teacher training institutions do not use computers within applicable circumstances, can we expect that the students they train will do so? (1989:8).

Moursund also asks the question: "Why are our Colleges of Education continuing to graduate computer illiterate teachers?" (1989:4). The prevalent attitude that "... computers are not so important in the curriculums yet, so why all the fuss?" (Moursund 1988:4) fails to recognise the fact that computers are inter-disciplinary tools, general purpose aids to problem-solving, new forms of instructional media, and major agents for change. Therefore, offering a typical 'computer literacy' course for student teachers, would not prepare them to make effective decisions encompassing the whole spectrum of educational computing activities.

2.4.1.2 Part-time studies

At present the opportunities for South African teachers to obtain educational computing qualifications on a part-time basis are limited. Apart from the university subject, 'Computer Science, and the more general 'end-user' computer literacy courses offered by universities, technikons and technical colleges, the writer could not find any teacher training institution offering 'education-related computer literacy courses' to secondary school teachers on a part-time basis.

Computer training offered in the private sector does not offer any solution either. Their courses are usually for specific, tool-type software packages, for which teachers can enroll at own cost.

The latest initiative by the Department of Education and Culture: House of Assembly, however does offer some hope for the future. This department has identified the need

for two types of computer training diplomas for teacher education, that is, a Further Diploma in Education (FDE) for Computer Literacy and one for Software Development. South African universities have been requested to investigate the possibility of offering these courses to practising teachers on a part-time basis as from 1993. Curriculum guidelines for these courses have been issued by this department (see Appendices A and B). The same department is also at present, considering a curriculum for a third computer related Further Diploma in Education, in Information Technology. (Chiles 1991 pers.comm.).

The Universities of Natal and Stellenbosch, amongst others, already offer a FDE in Computer Studies.

2.4.1.3 In-service Training

A country or a decentralised education department with a clearly defined educational computing policy, one assumes, would be able to co-ordinate in-service training in accordance with stated policy aims. Such training usually involves getting practising teachers together at a central location, training them and sending them back to their schools as 'experts'. It is however difficult to conduct in-service training courses in which teachers from different schools and with different levels of expertise are brought together. Therefore, Moonen suggests that "... to improve the homogeneity of groups participating in training, taking the school as the organizing unit for in-service training could optimize the success of the training sessions" (1989:8).

On the other hand, individual schools, who function without national or departmental policy or initiatives for computers in education, would have to develop their own staff development programmes to initiate in-service or follow-up on preservice computer training. According to Jacobs (1990:796) such follow-up staff development programmes are urgently needed: these programmes should include innovations aimed at overcoming computerphobia and help teachers to overcome it by teaching them word-processing skills and the use of computers for administrative purposes etc. Moursund asks

....how can we expect computers to have a significant impact on schools when the typical computer teacher has had such small amount of (pre-service) training and experience in this area? We must empower teachers by providing them with a large amount of carefully designed and carefully presented in-service (1989:4).

2.4.2 Computer using teachers in the 90's

In 1989 the Northwest Council for Education (NCCE) and the Oregon State University in the U.S.A. funded a project to develop an updated set of competencies for use as guidelines in re-evaluating both in-service and pre-service teacher education programmes (Niess 1990:10). The guidelines decided on, for the 'ordinary' high school teacher are, in order of importance, the following:

Every high school teacher should:

- fit the computer into the curriculum, rather than the curriculum to the computer;
- use the computer as a personal and professional tool;
- obey copyright laws and discuss ethical/social issues that result from the increasing presence of computers in our society;
- demonstrate knowledge of the impact of computer-based technology on our society, including present and future uses of computing technology in home, school, and work;
- design and implement appropriate computer uses and applications (including multi-media technology, simulations, databases, hypermedia, telecommunications) in a variety of teaching/learning situations in a specialization area;
- use basic computer terminology; and
- demonstrate to students familiarity with computer hardware, including the everyday operation of a variety of machines, everyday operation and use of

custom features of his/her classroom machines, and minor 'troubleshooting' of basic equipment problems (Niess 1990:12-14).

This report concluded with the following strong statement :

These 1989 competencies were developed to encourage a reassessment of teacher education programs that were developed in the 80's, a decade that saw the birth of educational computing. In preparing teachers for the 90's it would be futile to use the capabilities of the 80's to meet needs that no longer exist (Niess 1990:11).

2.4.3 Conclusion

For computers to really be effective in education, the majority of teachers must: a) know why computers are being introduced; b) be able to judge how well they are being used; c) be capable of solving problems by utilizing the computer; and d) think through the integration of computers into the curriculum (Moursund 1989:4). As teachers become more aware of the possibilities of computers, and their effects both good and bad, they will be in a better position to make active and thoughtful decisions about when and how computers can help them achieve their educational purpose. (Callister and Burbules 1990:7)

2.5 LOCATION OF COMPUTERS IN THE SCHOOL

The place where computers will be housed in the school, will to a large extent be determined by the purposes for which the computers will be utilized. These purposes and the resultant location are tabulated in Table 2-6.

TABLE 2-6: COMPUTER APPLICATIONS AND THE PHYSICAL LOCATION OF HARDWARE

APPLICATION	LOCATION
<ul style="list-style-type: none"> ◦ Word-processing ◦ Querying and updating the database of school administration program ◦ Financial planning and analysis on a spreadsheet 	School's General Office Headmaster's Office
<ul style="list-style-type: none"> ◦ Librarian uses a database type library software package for record keeping ◦ Pupils seek references on specific topics by querying the database 	Media Centre
<ul style="list-style-type: none"> ◦ Teachers prepare for lessons using word-processing, DTP etc. 	Staffroom
<ul style="list-style-type: none"> ◦ Serves as 'electronic blackboard' ◦ For demonstrations ◦ In group work ◦ As discovery tool for individual pupils ◦ Productivity tools, eg. word-processing 	Classroom
<ul style="list-style-type: none"> ◦ Training of teachers : for computer literacy and CAL training ◦ Computer literacy classes to pupils ◦ Teaching aspects across the curriculum ◦ Computer Studies as subject ◦ Computer Club activities 	Computer room

There is a fair degree of consensus over the above computer configurations which determine the location of computers in schools. However, one area where controversy is rife involves the place where integration of the computer into the curriculum should take place, in other words, the computer room versus the classroom'.

In most secondary schools, computers are centralised in a computer room where they are used mainly to offer computer literacy courses for both teachers and pupils. These rooms are therefore only available for ordinary curricular teaching when they are not being

utilized for computer literacy classes. Many teachers are becoming frustrated with booking-in-advance schedules and the rigid 'anti-teaching' layout of computer rooms. They want computers to be brought into their classrooms (Chomienne 1988:88).

The advantages and disadvantages of the two configurations cited by their supporters and adversaries are summarised as follows:

2.5.1 The Computer Room

ADVANTAGES

- a) Cooperative learning is facilitated (peer teaching and learning)
- b) Effective when teaching one skill such as word processing
- c) Central storage allows for security of hardware and software
- d) Expensive technology is effectively utilised.

DISADVANTAGES

- a) Classes must be scheduled - sign-up system
- b) Inflexibility - arrangement of furniture
- c) Conflict between teachers - responsibility (Barba 1990:8-9; Watson 1990:33-37).

2.5.2 Computers in the classroom

ADVANTAGES

- a) Less instructional time is required - not necessary for every pupil to know every command
- b) Available when teacher requires it and is flexible (can be moved)
- c) Each teacher sets his/her own rules regarding use of the computer in the classroom
- d) Computer can be used more productively for a variety of functions, e.g. electronic blackboard, demonstrations, teacher administration etc
- e) Direct connection between the regular curriculum and the work on the computer.

DISADVANTAGES

- a) Teacher can become possessive and restrict computer usage
- b) There is little time for individual student on computer
- c) Teacher must offer online and offline activities at the same time
- d) Lack of security of hardware and software (Watson 1988:21; Wainwright and Gennaro 1984:8 ; Bitter and Camuse 1988:124 - 129).

The computer-in-the-classroom configuration is further supported by Kent & Lewis who argue that the ideal classroom should be

... a place where the teacher is a manager of the learning environment in which children are encouraged to find and extract information from materials that they or the teacher have provided and where they work at their own pace to reach a valid conclusion (1987:3).

In such a situation the computer can become an essential weapon in a teacher's arsenal of ideas and activities with which he can activate and stimulate his pupils. Even a single computer in the classroom should not be considered inadequate: the computer as a tool in the classroom can serve as a stimulus for 'better' teaching. For example the computer can help the teacher with time-consuming administrative duties, he can apply himself more effectively teaching his subject. This view is supported by Dave Moursund in an article, 'A sneaky way to improve education' (1989:4) while Lippert reminds us that

... under pressure overburdened teachers revert to using the same methods by which they themselves were taught. This usually means lecturing and testing memorization of facts. Because of this we are still teaching content and using methods more suited to the industrial revolution, while we are already in the information age (1990:7).

The above advantages and disadvantages of the two configurations have been cited in the evaluation of the complete range of applications of the computer in education: it is clear that neither of the two models will satisfy all educational computing needs. The degree of satisfaction afforded by each configuration will depend on how the computer is being utilised, for example, as a 'computerized overhead'; to stimulate class discussion; as tool in research; for computer literacy courses etc.

2.5.3 The Mini-Lab

A third model or configuration, that might eliminate most of the disadvantages of the computer lab and one-computer-classroom configurations, is the 'mini-lab' (Barba 1990:9 and Chomeinne 1988:87).

In such a mini-lab configuration computers are placed on trolleys for easier arrangement and movement between classrooms and the media centre or computer room. Such a set-up would make it possible for a teacher to have more than one computer in the classroom when needed for a multi-computer activity. Teachers could sign up for the mini-lab computers in the same manner that they sign up for other audio-visual media. Making computers available for classroom use in this way would support Dalton's belief that "... the computer is bound to bring about changes in the classroom. If it does not, it will only be an expensive tool of questionable efficiency" (1989:23). It might also be the solution to a further problem, that is, that "... the modifications desirable for a better use of this technology are still to be discovered" (Dalton 1989:23).

2.6 THE INTEGRATION OF EDUCATIONAL COMPUTING INTO SCHOOLS

Already in 1967, Meierhenry predicted that "... education will be changed more by the introduction of computers than by any other invention in its history" (In: Margolin and Misch, 1970:142). However, although much has been written about the qualities and abilities of the computer in education, their impact on daily educational practice has been relatively limited.

A number of models have been proposed to explain the integration of innovations into the educational system. One of the most popular models for the change process has been advanced by Rogers (1983:84-101). Rogers' model comprises five stages: a) knowledge of the innovation; b) persuasion about the utility of the innovation; c) a decision to adopt or reject the innovation; d) the actual implementation of the innovation; and e) confirmation or reinforcement for its continued utilisation.

Applied to the introduction of computers in education, the first three stages in Rogers' model would be adversely affected by a variety of obstacles that may prevent the implementation of computers in schools.

2.6.1 Obstacles that prevent schools from implementing computers

Hannafin, Dalton and Hooper (1987:8-11) list a wide variety of obstacles that may prevent the implementation of computers in a school or schools. These include the following kinds of attitudes/beliefs:

- a) Teachers are too busy to implement computers in education.
Computers will never reach their potential as educational medium if they are merely going to be added to the teacher's already overburdened workload.
- b) Computers are only a craze: here today, gone tomorrow.
Many see the computer as just the latest craze in teaching - they have seen that the television as teaching medium never really found acceptance on a large scale. So why should it be different with the computer?
- c) Computers are too expensive.
Compared with books and other educational media, the computer is regarded as an expensive item.
- d) Lack of quality software for school subjects.
Development of educational software has fallen far behind the development of hardware and software applications in the private sector.
- e) Computers can only be employed to teach basic, low-level skills
Until very recently many teachers believed that the computer in education involves the learning of skills by means of drill and practice or via simple tutorial lessons.

For the sake of completeness an additional 8 obstacles to the implementation of computers

computers may be appended to those supplied by Hannafin, Dalton and Hooper:

- f) lack of teachers' interest in educational computing;
- g) shortage of funds/more important projects to finance;
- h) lack of expertise or staff initiative;
- i) lack of parental support;
- j) the pupils are not interested;
- k) pupils' programmes are too full;
- l) computers create an impersonal learning environment; and
- m) the school's administrative load can be handled without a computer.

It would only be possible to progress to Rogers' fourth stage, the actual implementation of the innovation, once the specific obstacles applicable to a specific school or schools have been identified and overcome.

2.6.2 Implementation of computers into schools

The HSRC/ISM-project (Human Sciences Research Council/Information Services Management Project 1991:18) identified six factors that are critical for the implementation (integration) of educational computing, namely, a) hardware; b) software; c) trained teachers; d) supportive management; e) motivation; and f) the fact that teachers and pupils need enough time in order to be productive and creative with computers.

The following model (Table 2-6) was developed for the HSRC/ISM- project, and provides for the implementation of Rogers' fourth phase, namely that of implementation/integration of an innovation in education:

TABLE 2-7: A MODEL FOR EDUCATIONAL COMPUTING INTEGRATION
(Human Sciences Research Council Project 1991)

PHASE	FOR WHOM	PLACE	NUMBER OF COMPUTERS	AIM
I	Teachers	Staffroom	2 - 3	To become familiar with software & courseware. Make use of computer as tool in own tasks. Share ideas, practice and plan.
II	Teachers Pupils Groups of pupils Parents	Media centre or library or ...	1 - 4	Use to demonstrate applications. Small groups use for project work. Computer club and limited class use. Pupils may start learning from each other with senior and skilled pupils assisting others during breaks and afternoons.
III	Pupils in pairs Whole classes	A classroom or a computer room	7 - ...*	Individual mastery of basic skills of computer use. Orientation relating to different packages using examples taken from subjects
IV	The whole school	Computer room and/or classrooms and/or home		To use in homework and subject teaching as a tool in different ways according to the subject material. Pupils teach themselves new and advanced skills and the computer is largely transparent in this phase

*no. of computers should be at least half the no. of pupils in a class

2.6.3 Precautionary measures for computer integration

Putting this kind of a model for integration into practice would not necessarily guarantee a successful result. Dalton (1989:24) suggests that the following eight measures should receive high priority to ensure the effective implementation of computers in education:

a) Build cooperative computer-based learning environments.

Teachers and pupils should be encouraged to work together to solve problems. This can be achieved by computer activities designed to group learners and teachers together by means of mutually defined learning goals and problems. Tool-type software would therefore be the most effective way to enhance the above suggestion.

b) Develop and use integrated software.

Software, other than only tool-type, also needs to be developed to support routine curriculum objectives. "Many textbook publishers are beginning to offer extensive software collections to supplement their textbooks" (Dalton 1989:25).

c) Provide continuous teacher training and support to increase confidence.

If teachers lack the confidence to integrate an innovation such as computers into their instructional programme, they will tend to ignore it. A high premium should therefore be placed on keeping teachers motivated through regular training, quality support and even incentives.

d) Let the individual teacher make the decision.

A computer integration programme, prepared without teacher input and consultation, is doomed to failure. "Teachers should never be given the power to veto reform, but they should be allowed to opt out" (Dalton, 1989:25). Full support should then be given to those teachers who are willing to try.

e) Define new roles for the teachers.

If a teacher's only function is to deliver content, this role could be filled by the computer. "We must help teachers understand that their roles in the classroom as counsellor, developer, and manager are fundamentally more important than as lecturer" (Dalton 1989:26).

f) Employ educational technologists as change agents.

Their task would be to oversee the change process. Educational technologists, or computer coordinators can help schools to design plans to implement the change and

motivate the potential adoptors to put those plans into action. At the beginning of 1990 the Cape Education Department appointed seven computer coordinators with the task of supporting educational computing activities in schools (Mostert 1990:327).

g) Train selected school personnel as the school's computer coordinator.

Dalton (1989:26) suggests that the ultimate success of any initiative to implement computers will depend largely on innovative teachers and that they should determine the momentum of the change process. To keep the momentum of the initiative going, the majority of the staff must be motivated and supported. For this purpose each school must appoint one of the staff members to act as the schools' coordinator of computer activities and have him/her specially trained for the task (Schiffman 1985:678).

h) Increase the resources available for change.

It is easy to jump on the 'give us more computers' bandwagon. Dalton, however warns that "... simply pouring more money into a poorly administered system is no answer" (1989:23). Instead of across-the-board monetary increases or allocation of hardware, that would only preserve the status quo through an equal elevation, an effective alternative would be to "... use the purse strings to encourage and reward innovation" (Dalton 1989:23).

i) Create project schools to demonstrate and to experiment with alternatives.

"We need to build model schools around effective instruction and the effective use of technology" (Dalton, 1989:26). In such an environment computer implementation and its evaluation can take place under controlled circumstances, allowing for experimental initiatives without large cost implications in the case of failures etc.

2.6.4 Conclusion

Restructuring of the curriculum would be a prerequisite for the complete integration of computers in education. Introducing computers into schools, especially for use across the curriculum, cannot be separated from the general educational methods by which the curriculum has to be implemented (Jacobs, 1990:404). An example of such restructuring

of the curriculum is the National Curriculum introduced in England (see also Chapter 3).

In England, high-school curricula have been divided into structured modules through which pupils can work at their own pace, with a lot of emphasis on self-activity and problem solving where information technology (e.g. the computer) plays a major role. Explanations by teachers to full classes are definitely being phased out and teachers are being trained to see themselves primarily as 'facilitators'" (Griffen and Davies 1990).

Restructuring the curriculum would serve as the fifth step in Rogers' model, serving as confirmation or reinforcement for the continued utilisation of computers in education.

CHAPTER 3 : A REVIEW OF EDUCATIONAL COMPUTING PROGRAMMES

3.1 INTRODUCTION

As can be inferred from the various classification systems applied to educational computing, the educational uses of computers in schools can vary greatly. When a country, department of education, school district or even principal decides to introduce computers for educational purposes, a particular rationale determines their use. Hammond and Hammond indicate, for example, that in Australian schools

... the computer was seen by some as a way of improving the whole educational process, but more often the reasons had more to do with people's belief that computers would improve their children's ability to get a job when they left school, or because they felt that in general children learned better. There was also an element of believing that the local school should have computers because neighbouring schools had them, or that acquiring a computer would assist children with learning difficulties and those requiring remediation (1988:5).

3.2 RATIONALES FOR USING COMPUTERS IN SCHOOLS

Hawkrige (1990 and 1991) proposes that decision- and policymakers usually base their decisions to introduce computers in schools on one of the following four rationales:

3.2.1 The Social Rationale

The strongest reason often offered by policy-makers, to justify the use of computers in schools, according to Hawkrige is that "... all children of secondary school age should be aware and unafraid of how computers work, because computers are pervading industrial societies and are likely to be important in all countries" (1990:2). Therefore, since schools prepare pupils for life, they should also prepare them to deal with computers.

It is usually on grounds of this 'social' rationale that 'computer awareness/literacy' classes are introduced in a school, either during school hours or on an extra-mural basis.

3.2.2 The Vocational Rationale

A second reason offered for the use of computers in schools, is that children should learn to operate computers. It is reasoned, for instance, that teaching pupils programming will give them some confidence in their ability to control computers, and that it may even serve as a foundation for a career in Computer Science. Also, if children learn how to use applications programs, they will acquire computer-related skills that may be useful when they move into jobs (Hawkrige 1990:2).

This 'vocational' rationale prompts many schools to offer 'computer literacy courses' or even 'computer studies/science' to pupils.

3.2.3 The Pedagogic Rationale

Hawkrige (1990:4) suggests that this rationale may well be the one that commands greatest support among teachers. The 'pedagogic' rationale calls for improved teaching and learning through computer-assisted learning and Hawkrige states that it assumes that "... pupils will learn physics, art or any other subject better through computer-assisted learning" (1991:59).

3.2.4 The Catalytic Rationale

This rationale is based on the assumption that schools can be changed for the better by the introduction of computers, and that teaching, administrative and managerial efficiency may be improved as a result thereof. Supporters of this rationale often reason that computers will help pupils to move away from rigid curricula, rote-learning and teacher-centred lessons, giving pupil more control over their own learning. Furthermore, it is believed that the introduction of computers will result in teachers adopting 'more relevant' curricula - bringing educational opportunities to a larger number of pupils.

A country's national educational computing policy or strategy depends to a large extent on the dominant rationale amongst decisionmakers. Decisions determined by the social rationale will, for example, obviously not lead to the same policy as decisions based on the vocational rationale.

3.2.5 The results of rationale practice

In his article 'Computers in Third World Schools: African Advances', Hawkrige (1991) attempts to anticipate the outcomes of national educational computing policies based on the different rationales:

- a) If the country's national policy is based on the social rationale the government will most probably try to introduce rather low-cost computers into as many schools as possible. In such a policy it would most probably be expected of every school to have a number of teachers who can teach all the pupils for say two to three hours per week in order to effect computer awareness.
- b) A government strongly influenced by the vocational rationale would introduce computer literacy or computer science as a school subject, with possibly an examination in the 'subject' near the end of secondary schooling. For these courses or subjects, medium-priced computers would be needed and therefore the government would probably be able to supply equipment to a few selected schools only. Teachers offering these courses would obviously have to be better trained than those in the previous scenario.
- c) Those countries whose national policies are based on either the pedagogical and catalytic rationales will have to spend much larger sums on hardware, software and training, respectively. The reasons for this are obvious. Under a national policy, based on either of these rationales, all schools need to be supplied with hardware and software, and the teachers need to be trained/educated to a level surpassing that of basic computer literacy (Hawkrige 1991:63).

Many countries are, none the less, operating without a national educational computing policy, South Africa being one. A survey conducted by Hawkrige (1991:58) indicates that the Ministries of Education of countries (where the survey was conducted), without a policy on computers in schools, are waking up to the fact that they need one, based on a clear rationale. In most of these countries without a national policy, Hawkrige found that computers arrived in schools anyway in ad hoc ways, either through purchases from own funds or by donations from outside sources.

The introduction of computers in such an unco-ordinated fashion may however, result in

- a) obsolete or incompatible hardware being purchased or donated;
- b) a scarcity of compatible educational software;
- c) unco-ordinated teacher training at tertiary centres;
- d) lack of support, in terms of spare parts, repairs and maintenance;
- e) individual schools being exploited by callous businessmen looking for a quick sale (Hawkrige 1990:5);
- f) pressure groups, such as parents, influencing schools in making decisions through emotional blackmail (Benn 1989:614); (Mostert 1990:327).

Public schools serving 'richer' sectors of the community and expensive private schools, probably survive best in a situation where a national policy is absent as they have obtained, or can obtain resources to acquire computer facilities and have teachers trained. This tendency however, soon leads to a quick widening in the gap between 'elite' pupils and the less-privileged (Hawkrige, 1990:60). According to Bates (In: Griffin and Davies 1990:257) the need for efficiency and economy ultimately creates pressure for some standardisation of the approach to computers in education.

Should there be a national policy for educational computing even though the government knows that, because of a shortage of funds, it cannot do what it wants to do? Hawkrige's answer to this is a definite 'yes': "... they (the government) may be unable to give computers a high priority. But at least they are able to take important decisions, within the policy" (1990:6) [bracketed words mine]. Such decisions, based on a clear

national policy, would at least afford, amongst others, answers to the following questions:

- a) Should schools be allowed to accept donations of hardware?
- b) Should schools be required to have at least one properly trained teacher before obtaining computers, through donations or own funds?
- c) Should they set up a centre for support services and possibly develop educational software?
- d) Should they negotiate contracts with suppliers to obtain hardware and software at lower prices?

Governments with a national policy can also determine, at the right time, whether computers should receive higher priority. Countries with already-existing policies for educational computing can also change direction or adapt their priorities more easily. For example,

... in the U.S.A., where legislatures in states such as California have been persuaded to put very large sums into computers for schools, there is pause for reflection. Here in the U.K., we have a 3-year study of the impact of computers in schools, accompanied yet again by short-term programmes for hardware, software and support (Hawkrige, 1990:6).

In the 1980's, technological innovation in education was characterised by the introduction of personal computers. The lower cost and increased power of computers, combined with their advance in the rest of society, made them an irresistible attraction for educationists, but education is strongly bound to national cultures, politics and economics, whereas computer technology knows no national borders. It is important therefore to examine the ways in which different educational systems choose to approach educational computing:

3.3 THE CASE OF THE UNITED KINGDOM: IT IN THE NATIONAL CURRICULUM

(Griffen and Davies 1990)

3.3.1 Introduction

Griffen and Davies (1990) attempt to outline the major implications of the inclusion of information technology (IT) within the National Curriculum for 5 - 16 year old pupils in schools in England and Wales. This National Curriculum is in the process of being phased in with Phase 1 already having been introduced in 1990.

The National Curriculum makes explicit for the first time that each pupil has the 'entitlement' to a curriculum which includes information technology. "It (the National Curriculum) also makes clear the minimum requirements for IT and gives a responsibility for the delivery of IT to each area of the curriculum (that is, in each subject area)" [bracketed word mine] (Griffen & Davies 1990:255). The National Curriculum therefore makes IT a serious and a compulsory part of the curriculum in schools in England and Wales.

3.3.2 Aims and requirements of IT in education for 5 - 16 year-olds

The National Curriculum requires that each subject curriculum shall ensure that each pupil

- a) has the opportunity to use IT whenever its use is helpful to his or her task;
- b) uses IT to enhance and enrich his or her learning in every area of the subject curriculum;
- c) has the scope of his or her learning potential extended by the appropriate use of IT;
- d) acquires IT capability; and
- e) is involved in a coordinated and coherent programme of relevant IT experiences;

3.3.3 The situation of IT in 1989 (before the National Curriculum)

Griffen & Davies (1990) reported (in 1988) that it was difficult to determine the extent of computer use in different schools and different subject areas, because of a variety of priorities and approaches. They also had a problem in defining 'IT across the curriculum' since the concept was interpreted differently by respondents in their survey. Furthermore, respondents judged the success of 'IT across the curriculum' by the extent

of computer use, rather than its quality or value.

Their findings also show that the average pupil: computer ratio in secondary schools was 31:1. In these schools, the greatest use for computers was in word processing and in drill and practice exercises, with disappointingly little use of other types of software. Without going into much detail Griffen and Davies also conclude that the secondary school teaching force is generally unprepared to take on IT to the extent required by the national policy as only 50% of the teachers indicated that they felt confident in using IT with children. The researchers could not find reliable data on the number of pupils who have had 'hands-on' experience of computers.

3.3.4. The major issues and implications arising from IT in the National Curriculum

In England and Wales, IT is no longer an option but a necessity for the classroom teacher, and "... increased monitoring of each subject demanded by the Education Reform Act will mean that deficiencies cannot be hidden as they might have been in the past" (Griffen & Davies 1990:259).

The issues involved in the IT policy, as discussed by Griffen & Davies include the following

a) teacher development:

Griffen & Davies stress the complexity of teacher education in curricular aspects of IT and mention some of the more general problems relating to the quality of teacher training in IT.

b) learning resources:

The statutory inclusion of IT in the curriculum means that significant levels of investment will be required in order to implement the National Curriculum requirements within all subject areas.

c) key personnel:

The task of the IT co-ordinator at each school will become increasingly important as IT is fully incorporated in the curriculum of each pupil. The range of support that each co-ordinator will have to provide will have to cover activities such as curriculum mapping and planning, as well as others of a more technical nature. Failure to address these issues will limit the ability of schools to exploit fully the potentials of IT (Ganderton 1990; In: Griffen & Davies 1990:260).

3.3.5 Future considerations

The spread of IT into the contents of secondary school subjects, across the curriculum, makes the organisation of these integrated tasks very complex - a problem that will be solved only with proper planning during the curriculum design stage. Griffen & Davies were tempted to predict that, implementing the IT requirements of the National Curriculum, would have a revolutionary effect on the organization of the secondary school curriculum. They came to the conclusion however, that such an effect would not materialise without the support of teachers. Although most teachers showed positive attitudes towards computers Griffen and Davies were unsure how their attitudes would be effected by all the new initiatives - initiatives, moreover that were being enforced by legislation.

3.3.6 Conclusion

The 'IT in the National Curriculum' initiative is an example of computer integration based primarily on the pedagogic rationale, with only as secondary aims the vocational and other rationales. Many problem areas experienced before and even after the initiatives in England will still emerge in South Africa.

3.4 THE AUSTRALIAN INITIATIVE

(Hammond and Hammond 1988)

3.4.1 Introduction

Australia is a federation of six States. In the Australian Constitution education is identified as a State responsibility. Each State therefore has its own Education Department and conducts its own system of schools, independent of other States.

3.4.2 The development of a national computer education plan - a chronological description

The large scale introduction of computers in Australian schools in the early 1980's had been un-coordinated and the inequity in opportunity for all students to learn about and with computers soon became apparent: "Computers have been incorporated into educational practice by most States in Australia for more than a decade, but their introduction has not been even across States or in all schools" (Hammond and Hammond 1988:5).

Initiatives to introduce computers came from a variety of groups - enthusiastic teachers, teacher associations, parents, community groups and, in some States, from educational authorities. In many States, the final choice of computer brand was left to individual schools: however, some States did provide a consultation service after testing different makes of computers. Some of the States developed their own software packages and sold the final programs to schools.

The first education authorities to coordinate computing activities within their States were South Australia, Tasmania and Western Australia. By 1983 different States concentrated on different aspects of educational computing. Western Australia, for instance, was working extensively on computer-assisted learning, whereas South Australia emphasised the integration of computers across the curriculum.

1983 saw all the States teaching computer literacy. 'Computer Studies' was confined to the senior secondary years, and received a lower priority than computer literacy teaching. One State even introduced a course in 'Information Processing' rather than in 'Computer

Studies'.

In February 1983, the federal government decided on a national plan that included the following:

- a) The development of computing skills for teachers and students;
- b) an awareness of the importance and possibilities of high technology; and
- c) the use of computers in the teaching and learning practices of schools.

A National Advisory Committee (NAC) on Computers in Schools was appointed with the task of reporting back on the implementation of computers in schools, within six months (see 3.4.3 for their recommendations).

The Federal Government accepted the NAC's report in February 1984 and decided to implement the proposed 'National Computer Education Program', initially in secondary schools only. Australia thus instituted a national educational computing policy through the different decentralized educational bodies. The programme was to be administered and evaluated by the NAC and the Federal Government undertook to supply the funds for the above plan of action. In 1984 \$A 6,234 million worth of computer equipment was supplied to government and non-government schools. Similar amounts were allocated in 1985 and 1986.

3.4.3 The recommendations by the National Advisory Committee

Their recommendations can be summarized as follows:

- a) Curricula must provide computer awareness and computer literacy experiences for all students in the years of compulsory secondary schooling;
- b) the integration of computing into the school curriculum must be promoted in the primary and secondary phases;
- c) provision must be made for Computer Studies as a subject at secondary level;
- d) parents, teachers and pupils must be involved in the educational computing

decision-making processes, especially in relation to the purchase and use of computers in schools.

The report also emphasised teacher training, thus giving rise to a variety of in-service courses aimed at producing a well trained staff, competent in the application of computing to teaching.

3.4.4 The National Computer Education Programme

One of the early tasks of the National Advisory Committee on Computers in Schools (NAC) was to set up 'working parties' to make decisions, on a national level, on aspects such as software, educational and technical specifications of hardware, etc. Each State was required to set up its own advisory committees whose task it was to coordinate their own State plans and to monitor the disbursement of federal funds granted to the State through selected projects.

At central government level, the Curriculum Development Centre was established. This Centre was to initiate research into curricular matters, develop and publish school curricula and develop and produce school educational materials (software and courseware). The centre also undertook a study to ascertain the feasibility of establishing a national software clearinghouse - this eventually culminated in the establishment of the National Software Coordination Unit in 1986.

3.4.5 Policy considerations of the Australian initiative summarised

As many of the above matters were fields of State responsibility, it was necessary for some national policy principles to be established. These were that

- a) Federal Government would play the role of coordinator in determining the broad strategy and that it would carry all costs for the required infrastructure;
- b) States were to be responsible for developing their own tactical programmes - matching their own particular needs and opportunities; and

- c) the National Advisory Committee was to facilitate, amongst others, cooperation between Federal Government and the private sector.

3.4.6 Conclusion

This synopsis of the Australian educational computing initiative shows how the States in Australia developed their own educational computing programmes prior to the 1984 federal initiative. It also outlines the development of a national computer education programme and the role that central government played. It can furthermore be deduced that decision making in the determination of the Australian national computer in education programme was rationale bound. Their first priority was computer literacy experiences for all students in their compulsory secondary schooling phase - the Social Rationale. A second identifiable priority was to promote the integration of computing into the school curriculum - the Pedagogic Rationale.

Finally, because of the need to coordinate policies at two levels, a federal system such as Australia's is likely to make and change policies related to education more slowly than in a centrally governed country, such as England.

3.5 COMPUTERS IN EDUCATION - THE ONTARIO INITIATIVE

(Jones, 1990)

3.5.1 Introduction

Each of the ten provinces of Canada, of which Ontario is the largest, administers its own educational system. Ontario is the wealthiest of these provinces, but there are regional economic disparities within its boundaries.

The provincial governments provide overall direction in education, and among other things, establish curriculum guidelines, certify teachers, approve textbooks, authorize capital spending and allocate operating funds. One of the provincial authority's most important roles is to ensure equity of educational opportunity across the province.

3.5.2 Some background

Prior to 1980, educational computing initiatives, directed from provincial level were limited to Computer Studies in high schools. The late 1970's saw the arrival of personal computers and the Commodore 64 became the most popular computer in Ontario schools. In the rest of Canada, however, the Apple II became and remains the most popular computer in education. As a consequence most educational software developers produced their materials for the Apple - much less educational software was developed for the Commodore.

In the early 1980's Ontario's Ministry of Education became concerned about the unco-ordinated direction that educational computing was taking in that province. The Ministry was concerned that poorer regions of the province would be at a disadvantage as more computers entered the system, and that the proliferation of different incompatible computers would make it more difficult to implement provincial standards.

The initiatives of the province that followed can be summarized as follows:

... the Ontario government sought to establish a consistent and high standard of educational computing and to support a Canadian computer and educational software industry by specifying a computer designed specifically for education, by encouraging local school boards' purchases with subsidies and free software, and by subsidizing the development of educational software suited to the Ontario curriculum. It established agencies and procedures to implement this process. This initiative was well funded - the government spent more than \$250 million dollars including \$25 million on software (Jones 1990:131).

This initiative received a very negative evaluation in the Provincial Auditor General's Report in 1988. The report stated that the approved computers were incompatible and more expensive than others in the marketplace that could also have met most of the needs. Secondly, the report found that the government's objective of supporting a Canadian computer and software industry had not been met. Furthermore, the report called for the purchase of compatible commercial software for the 74% of computers in schools which were not the government-approved. Finally, the report was critical of the

emphasis placed on hardware and software and on the inadequate attention placed on teacher training and the effective implementation of computers in the classroom.

3.5.3 Evaluating the initiative

Jones stresses that the Ontario educational computing initiative was not the total failure that its detractors would claim - nor was it the success that its supporters hoped for.

Why then did their bold initiative result in the virtual abandoning of the original policy? It was not due to a lack of funds nor to a lack of government enthusiasm. An analysis of some of the reasons is given by Jones, in the hope that it may be relevant to other educators (Jones 1990:132):

- a) Most of the funds were spent on hardware acquisitions rather than on software development and teacher implementation strategies;
- b) educational technology and its implementation does not evolve automatically and naturally in the wake of hardware initiatives;
- c) the rapid technological developments of the 1980's meant that many of the newer computers equalled or surpassed the standards originally set by the Ministry of Education and these computers could be acquired at a lower price; and
- d) wealthier school boards, within the province, who received fewer, if any, subsidies bought the cheaper, more popular computers. This resulted in a smaller use of the approved computer by these more powerful and increasingly critical school boards.

3.5.4 Conclusion

Computers entered Ontario schools in large numbers (as low a ratio as 9,3 pupils per computer according to Jones (1990:133)), and were widely distributed. Government policies, however, focused on hardware solutions and favoured private enterprise for the development of software solutions. "In such a system, educators become the consumers rather than the initiators of educational technology" (Jones 1990:134).

The problems experienced in Ontario must sound a warning to national authorities not to attempt to steer educational computing too rigidly and not to take all the initiative for educational computing away from all those responsible for implementing education policies.

3.6 **KENYA : EDUCATIONAL COMPUTING IN A THIRD WORLD COUNTRY** (Hawkrige 1991:61-64)

3.6.1 **Introduction**

Modernization is among the national goals for education for Kenya. Both the President and the Minister of Education stated that they want Kenyan schools to prepare children to use modern technology (Makau 1987, In: Hawkrige 1991:61). As in many developing countries, the educational system in Kenya is paternalistic and strongly orientated towards preparing pupils for public examinations. There is therefore, no 'technology-led' curriculum and Computer Studies is not offered as a secondary subject.

In 1982 the Ministry of Education, Science and Technology of Kenya, decided to allow small experiments in computer education, both to gain experience and to produce computer-literate pupils (Wray 1989, In: Hawkrige 1991:61). The government did not undertake to finance these projects, but did declare computers, purchased for these experiments, exempt from customs duties.

Until 1989 there had been no discussion at Ministry level about software standards for Kenya and no policy on computers in schools had yet been formulated. Many computers, however, found their way into schools as part of external aid, paid for by donor agencies which also provided software and some staff training. There is however concern that such aid will not continue, leaving schools with expensive computers that they cannot afford to run.

There is, however, one project running in Kenya that deserves special note, namely the 'Computers in Education Project of the Aga Khan Education Service' (CEPAK). The

project was financed, until 1989, by the Aga Khan Foundation to the extent of \$290 000. When Phase III started in 1989 the government took over the responsibility for further financing.

3.6.2 The CEPAK-project

The project developed from a small pilot project and is now in phase III. The original project developers felt that, because learning about computers and how to program a computer were incidental to the future needs of pupils, computers should rather be introduced to support instruction, revitalise teachers and provide pupils with 'hands-on' experience.

The pilot phase had ambitious targets: for example, it was expected that teachers across the curriculum would be trained and become self-sustained in their use of computers by the end of the two-year start-up (Makau & Wray 1987, In: Hawkrigde 1991:62). This period proved too short: teachers needed more time to become secure in their use of the machines, in their sampling of programs, and in their consideration of how and whether they could integrate these into their normal teaching.

The project moved into Phase I with the following aims, namely to

- a) improve the quality of teaching through in-service teacher education using the computer as a catalyst;
- b) use computers as a teaching resource in appropriate subjects;
- c) provide pupils with a basic knowledge of computers to help them in their studies and make them aware of their technological environment; and
- d) improve the quality of school administration.

CEPAK's Phase II started in 1986 with the Aga Khan Academy and seven secondary schools. All the teachers attached to CEPAK-schools were introduced to computer education by members of the Aga Khan Academy and a continuing series of workshops was offered. For example, in 1988 workshops focused on using CAL programs and

application software, such as Appleworks' integrated package, in the classroom.

3.6.3 Conclusion

Despite the continuation of CEPAC into Phase III, the future of computers in schools in Kenya is far from assured, as government policy is not yet fully established. Hawkrige (1991:65) concludes, " ... expenditure on education is not likely to expand sufficiently fast to allow for a full government-funded programme to put computers into all secondary schools, or even in the majority of them."

3.7 THE HSRC/ISM COMPUTER LITERACY PROJECT IN SOUTH AFRICA

(Human Sciences Research Council 1991)

3.7.1 Introduction

In 1985 the Human Sciences Research Council (HSRC) received a donation of computers and accompanying software from ISM (Information Services Management) - at that time still IBM(SA) (International Business Machines) - to establish a project promoting computer literacy by means of utility packages.

Teachers, and Std 6 and 7 pupils of different race groups, at different types of selected secondary schools (State, private and special schools) constituted the target group for the project. The 25 schools involved in the project were representative of the range of schools one would find in South Africa's main urban centres.

3.7.2 The aim of the project

Computer literacy was to be promoted through the integration of content free, commercially available, utility packages. These utility packages (word-processing, database, spreadsheet and graphics) were integrated with subject matter, thus de-emphasizing programming.

3.7.3 Hardware and software used, and support rendered

Each of the 'project' schools received ten IBM personal computers, each with 512K memory, and two 360K floppy drives. Each of these schools also received one 80-column printer. The IBM Assistant Series, consisting of a set of independent packages (Writing, Filing, Graphing and Planning Assistant), DOS and IBM-LOGO were used as software. This set of software was found to be appropriate for school use as it is both powerful and relatively easy to use.

Research partners were appointed in each of the seven main urban areas, and apart from monitoring the project and providing support to schools, they were also responsible for training the teachers. Expenses in connection with repairs to the computer equipment, were the responsibility of the HSRC.

At the end of 1990, when the project was concluded, all hardware and software were donated to the schools involved in the project.

3.7.4 Brief summary of conclusions

The major conclusions, in brief, are that

- a) computers were enthusiastically received at the schools, especially by the pupils;
- b) time and dedication needed to ensure effective integration of the computers across the curriculum was greatly underestimated;
- c) training and motivation of teachers are more important considerations than the purchasing of more equipment; and
- d) the use of commercial packages in the school curriculum proved to be feasible.

The project's research team also found it necessary to supply answers to questions on computers in education often asked by interested parties such as decisionmakers, headmasters, parents, teachers and pupils, for example:

- what type of equipment should be installed in a school?
- does a donation of computers stimulate commitment?
- why should computer literacy be taught at schools?
- should computers in a school be centralized or placed in various classrooms?
- which programs should be purchased?

3.7.5 Conclusion

The project was based primarily on the Vocational and Social Rationales. It also serves as an example of educational computing initiatives supported by the private sector. In more recent research conducted by the HSRC, a strong emphasis has been placed on the 'partnership'-approach to education.

3.8 THE COMPUTERS IN SECONDARY SCHOOLS POLICY OF THE DEPARTMENT OF EDUCATION AND CULTURE: HOUSE OF REPRESENTATIVES (SOUTH AFRICA)

(Department of Education and Culture: House of Representatives 1989)

3.8.1 A Brief history

The Department of Education and Culture: House of Representatives (henceforth 'the Department') initially decided to acquire computers to provide practising teachers with back-up and support in the classroom. The computers in this context were viewed as tools for teaching and learning. The administrative capabilities of the computer were considered but judged as of lesser importance.

The decision to acquire the Commodore 64-computer for use in the Department's schools was based on a number of considerations, the most important being that:

- a) a well established supply and back-up support was available in South Africa at the time;
- b) a large quantity of public domain software was available from the USA, Canada

and Western-Europe; and

- c) teachers could produce their own software with relative ease.

In-service training courses started in 1984/85 at this department's Media Centre. Secondary schools whose teachers attended an in-service training course were supplied with a single computer, printer and software for administrative purposes and for the training of teaching staff at the school. At least two teachers from a secondary school had to be trained and certified before that school could apply for (up to 35) computers of its own. The first school was equipped in 1987.

Training courses were also conducted for subject advisors and members of the Inspectorate, to prepare them for the introduction of CAL activities in schools.

Having completed the initial training of college lecturers and secondary school teachers, the computer facilities at the Departments' Media Centre were re-organised for the development of courseware.

3.8.2 A Report on the use of computers in secondary schools at the end of 1988

At this stage 27 schools had been equipped with 30 or more computers each. The results of a survey (conducted amongst schools of this department) to establish the extent of computer facility utilization can be summarised as follows

- a) Time table uses:
- computer literacy was offered for standards 6 and 7 pupils as official compulsory subject at all these schools; and at 8 schools also for standard 8, 9 and 10 pupils;
 - all the schools implemented the use of the computers in the subject Typing;
 - eight schools indicated the use of CAL-courseware in Afrikaans and English as second language; and
 - a few schools also reported that they use CAL-courseware in subjects such as Mathematics, Accounting, Physical Science, Geography, Economics, etc.

b) Other uses during school hours as well as after school hours:

Most of the schools with computer facilities reported extensive use of these facilities during breaks and after school, for example:

- hands-on practice by teachers and pupils;
- CAL revision classes in Biology and Physical Science;
- Desktop publishing activities, eg. producing the school magazine, etc.; and
- teachers also used the facilities for the developing of CAL- courseware, other teaching materials, examination papers, etc.

The report concluded that the 27 school computer facilities are used to almost full capacity.

3.8.3 The continued supply of computers to schools

With the increasing popularity of IBM (MS-DOS) technology the Department came under pressure to supply IBM compatible technology to schools. The Department realized that if they changed their policy and supplied MS-DOS technology, instead of Commodore 64's, it would mean new teacher training programmes and the development of new courseware (educational software). A real danger therefore existed that all the human investment of time and thought, as well as the enormous financial outlay in Commodore 64's, would be rendered useless.

However, the Department did decide, at the beginning of 1989, to start supplying MS-DOS technology to colleges and schools, but the Media Centre was to continue with the evaluation, production and distribution of courseware for the Commodore 64, to support the schools and colleges with these facilities.

An action-plan for the introduction of MS-DOS computers was formulated, which includes, amongst others, the following action steps:

1989 : Acquire MS-DOS computers for the Media Centre for the evaluation of

software and training of college lecturers and teachers.

- 1990 : Install MS-DOS computers at 11 Colleges of Education
- 1991 : Start a five year plan to install in each secondary school a laboratory of ± 16 workstations - networked to a file-server

3.8.4 Conclusion

The Department of Education and Culture: House of Representatives' original policy for computers in education was based primarily on the Pedagogic Rationale, that is, to support teachers in extending their teaching programmes and presentations and to implement CAL to assist in alleviating the high failure rate amongst high school pupils.

The Department also supports a Vocational Rationale with its Computer Literacy courses at the 27 'project schools'. It may, however, be reasoned that pupils might not be able to compete in the work-market-place on equal terms with pupils trained in MS-DOS technology.

The present situation apropos computers in secondary schools in this Department is very similar to that of the Natal Education Department (NED) of the Department Education and Culture: House of Assembly, as outlined by NED officials:

...Natal administrators were 'too progressive, too soon'. In 1984 this province was the first one to buy school computers on a large scale, only to find - two years later - that political and educational trends resulted in APPLE computers being unsuitable for school computing implementation in South Africa. The enormous cost involved in replacing the APPLE computers is now an obvious stumbling block (Jacobs 1990).

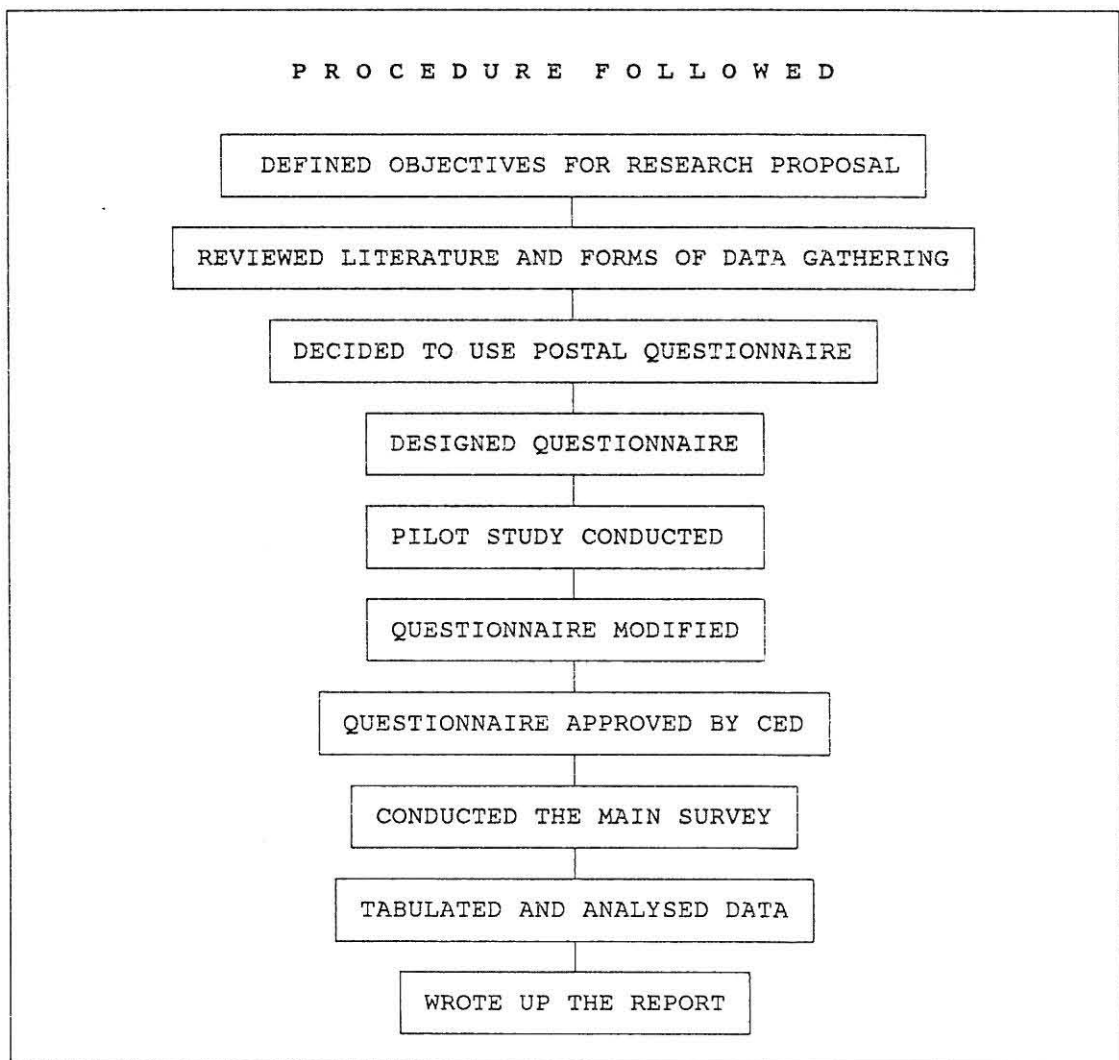
To date the Department of Education and Culture: House of Representatives' action-plan for the introduction of MS-DOS computers has apparently not progressed further than the acquiring of MS-DOS computers for the Media Centre - the action plan for 1989.

CHAPTER 4 : COLLECTION OF RESEARCH DATA

4.1 METHODOLOGY FLOWCHART

The following diagram (Table 4-1) represents the sequence of activities involved in the research process of the study.

TABLE 4-1: METHODOLOGY FLOWCHART



4.2 GENERAL GOALS AND OBJECTIVES OF THE RESEARCH

In Chapter one the primary goal of the research was stated to be the determination of the

status of educational computing in secondary schools under the jurisdiction of the Cape Education Department. Several underlying questions were also posed in order to elucidate an all-inclusive research problem.

These subsidiary areas will include aspects related to educational computing such as teacher training, hardware and software acquisition and utilization, the location of computers, the existence of pressure groups, different computing practices and reasons why schools acquired or did not acquire computers.

A detailed discussion of the methodology employed to obtain this information follows.

4.3 RESEARCH METHOD USED

The study can be regarded as typically descriptive, as its main objective entails describing the present situation of educational computing in secondary schools under the jurisdiction of the CED. A descriptive study determines and reports the way things are, where "... the researcher has no control over what is, and can only measure what already exists" (Gay 1987:189). As the target population for the study included all the secondary schools (239) under the jurisdiction of the Cape Education Department, a mailed questionnaire survey was decided on. Furthermore, it could not be established whether any other empirical studies of this nature have been undertaken amongst CED schools.

The mailed questionnaire offered the researcher the following significant advantages (Bailey 1982; Cohen and Manion 1980; Wiersma 1986):

- a) Unit costs are comparatively low, as expenditure is limited to printing and posting costs. This became an important aspect as the CED stressed that the researcher was to be responsible for all the administrative aspects of the survey;
- b) It allows extensive geographical coverage. The survey's validity, in terms of the statement of the research problem, depended solely on reaching all secondary schools under the Cape Education Department;

- c) In a large survey the questionnaire is the only means of communication between the researcher and the respondent. The total population of the survey consisted of all the secondary schools of the Cape Education Department. Any survey method, (e.g. telephonic or even personal interviews) other than the mailed questionnaire would have been too time consuming and costly.
- d) The respondent can be assured of anonymity and will therefore be inclined to give honest responses. This was an important advantage, in light of the very sensitive position of schools in respect of software copyright laws as well as the schools' possible attitude towards the Cape Education Department's policy on computers in education.

The researcher also took note of the following criticisms of surveys involving questionnaires (Wiersma, 1986:186):

- a) There can be excessive nonresponse. The fact that CED supported the research project and that respondents had to return the questionnaires via the Cape Education Department: Research Section, can be regarded as important contributing factors for the small non-response (11%) that was obtained. Follow-up letters were also sent to all respondents reminding them to return their questionnaires.
- b) Respondents are not truthful in their responses. Attempts to combat this problem included a) addressing the questionnaire to the principals of the schools; b) assuring these principals that all information obtained through the survey would be regarded as strictly confidential; and c) undertaking that no school would be identifiable from the results of the survey.

4.4 DESCRIPTION OF THE QUESTIONNAIRE

The questionnaire design was of the self-completion type (see Appendices C and D). To cover the wide field of educational computing, the questionnaire had to be fairly

comprehensive and consisted of 14 pages and the questions were grouped into 6 sections (A-F).

Section A (GENERAL) was concerned with demographic information and the extent of teacher training for, and their experience in, educational computing. In Section B (COMPUTER EQUIPMENT) data was obtained relating to the hardware and software position in schools, and SECTION C (PRESENT UTILIZATION OF COMPUTERS IN THE SCHOOL) was aimed at their utilization. Items in SECTION D (NATURE OF PUPIL INVOLVEMENT) were aimed at determining the status of pupil involvement in computing aspects at the schools. SECTION F (WHY THE SCHOOL HAS NOT YET IMPLEMENTED COMPUTERS) was directed at those schools in the target population which were without any computers. Therefore, schools with computers were requested to complete all the sections, except for section F, and schools without any computers were asked to complete only sections A and F.

Respondents had to complete the questionnaire by:

- filling in readily available statistics, for example, the number of teachers in the school, etc;
- marking certain options with a tick;
- filling in data obtained after questioning the teaching staff on certain aspects, for example whether any had computers at home;
- answering certain open-ended questions where they could give their own opinion;
- ranking certain options, for example, in their order of importance; and
- adding categories to 'closed' items through the 'Other :-' options given in those items.

Afrikaans questionnaires and covering letters were sent to those Afrikaans speaking and parallel medium schools under the Cape Education Departement. English schools received English questionnaires and covering letters. Respondents could however, still answer in the language of their choice, regardless of whether their particular questionnaire was in English or Afrikaans.

Each questionnaire was coded with a four-figure code, the first two representing the school board district and the last two a unique number for each school. This was done to provide for data analysis according to school board districts (if necessary) and to enable the return of questionnaires to be monitored (if reminder letters were to become necessary).

4.5 PILOT STUDY

The completion of the draft questionnaires at five secondary schools in the Port Elizabeth area were administered personally. These schools were each asked to complete a 'draft' questionnaire and then to indicate areas where vagueness or errors existed.

The research questionnaire was finalised on the basis of the feedback obtained from this pilot study.

4.6 APPROVAL OF THE QUESTIONNAIRE BY THE CAPE EDUCATION DEPARTMENT

Draft questionnaires, in Afrikaans and English, and a research proposal were sent to the Education Research Section of the Cape Education Department, together with a request for:

- a) the written permission of the Chief Director of Education to allow each secondary school under his department to participate in the research; and
- b) an address list of all the secondary schools under the jurisdiction of the department.

Permission to administer the questionnaire, together with a list of all the secondary schools and their addresses was received very promptly, but the permission was granted subject to the following conditions, namely that:

- a) headmasters/teachers were not obliged to provide the information required;

- b) no school may in any way be identifiable in the research project;
- c) the survey may not be conducted during the fourth term of the school year;
- d) the research project will have to be administered by the researcher; and
- e) a copy of the completed research must be submitted to the Education Research Section of the Department.

All these conditions were described in the covering letter which accompanied each questionnaire.

During the process of approval the Education Research Section also presented the draft questionnaire and research proposal to the Superintendent of Education: Computer Affairs and Statistics, Mr M. Chiles, who recommended that the questionnaire be approved and commented that the questionnaire was very comprehensive and that he could not find any additional aspects to include.

4.7 THE SAMPLE

As the research problem concentrates on secondary schools under the jurisdiction of the Cape Education Department, all primary schools and those secondary schools in the Cape Province, not under CED jurisdiction, including private schools, were excluded. The sample size was 239, representing all the secondary schools under the jurisdiction of the Cape Education Department.

4.8 ADMINISTERING THE SURVEY

A stamped, self-addressed envelope was included with each questionnaire mailed. Questionnaires were to be returned to the Research Section of the Cape Education Department who undertook to receive the questionnaires on behalf of the writer - a factor that contributed largely to the good return achieved. A definite closing date for the return of the questionnaires was set. Follow-up letters were sent out one week before this closing date, reminding respondents with questionnaires still outstanding, to return them. In the follow-up letter respondents were notified that the closing date had been extended

by another two weeks.

4.9 VALIDITY OF THE RESEARCH

Of the 239 questionnaires despatched, 212 were returned. A more than adequate return rate of 89% was therefore achieved. Wiersma (1986:195) states that "... when surveying a professional population, 70% is considered a minimum response rate". Furthermore, respondents were assured of their anonymity which allowed headmasters to speak their mind, without retribution from the authorities. If the respondent had all the information readily available, the questionnaire could be completed relatively fast. Although 14 pages long, the questionnaire contained only five open-ended questions.

Certain influences which could have affected the absolute reliability of the data obtained are:

- a) that the headmaster could have delegated the completion of the questionnaire to another staff member who resides lower in the hierarchy of the school;
- b) the length of the questionnaire (it was very comprehensive, consisting of 14 pages). Cochen and Manion (1980:84), however state that questionnaires does not necessarily have to be short in order to obtain a satisfactory response level;
- c) for the completion of certain items, respondents first had to survey their staff in order to obtain the data required to complete certain items in the questionnaire; and
- d) in some of the open-ended items, respondents might tend to be inconsistent in length and also in content, or even misinterpret the question. Forced-response items might have allowed for a wider range of answers, as respondents usually only give the most basic or straight-forward responses in open-ended items.

CHAPTER 5 : ANALYSIS AND INTERPRETATION OF RESEARCH DATA

5.1 DATA PROCESSING PROCEDURES

Each questionnaire was coded as a 'record' before it was posted, for record-keeping and follow-up purposes. On receipt questionnaires were scrutinized for obvious irregularities and contradictions, and certain items were coded. Only a few such irregularities and/or contradictions were encountered, but could be corrected without changing relevant data. It was therefore not necessary to reject any of the questionnaires. As most of the items on the questionnaire were of a 'self-coding' nature, it was necessary to code a few items only, for example the 'other'-options.

Once the deadline for the return of questionnaires was reached data-capturing commenced. Data was captured on a personal computer, using a data capturing software package, available at the Computer Centre of the University of Port Elizabeth. Once the data capturing process was completed and data verified, the data could be analysed with the statistical package - BMDP, at the Computer Centre:UPE. With this statistical package a detailed data description, including frequencies and percentages was obtained.

The questionnaire also included five open-ended questions. Assistants were employed to copy each comment on a separate strip of paper. These comments could then be sorted, categorized, counted and interpreted.

Data on the present status of Computer Studies in schools under the jurisdiction of the Cape Education Departement was obtained through personal communications with Mr M. Chiles, Superintendent of Education: Computer Affairs and Statistics.

5.2 SOME GENERAL FINDINGS

5.2.1 Number of teachers with computer facilities at home

The total number of teachers attached to the 212 secondary schools who responded,

numbered 5 273. All the schools supplied the number of teachers on their staff who have computer facilities at home, and when totalled, these numbered 1 369 or 26% of all the teachers surveyed.

Simplistically, a computer literate person can be defined as somebody who uses a computer for word processing for more than two hours per week (Jacobs 1990:401). If such a definition suits most of the teachers with computer facilities at home, it can be stated that more than 20% of the CED secondary teachers are computer literate (see also 5.3.5.3 in this chapter).

5.2.2 Amount of money spent

The first three graphs (a, b and c) in Table 5-1 illustrate the amount of money spent over three different periods and the fourth graph (d) indicates the distribution of expenditure on computer hardware and software over the past 10 years.

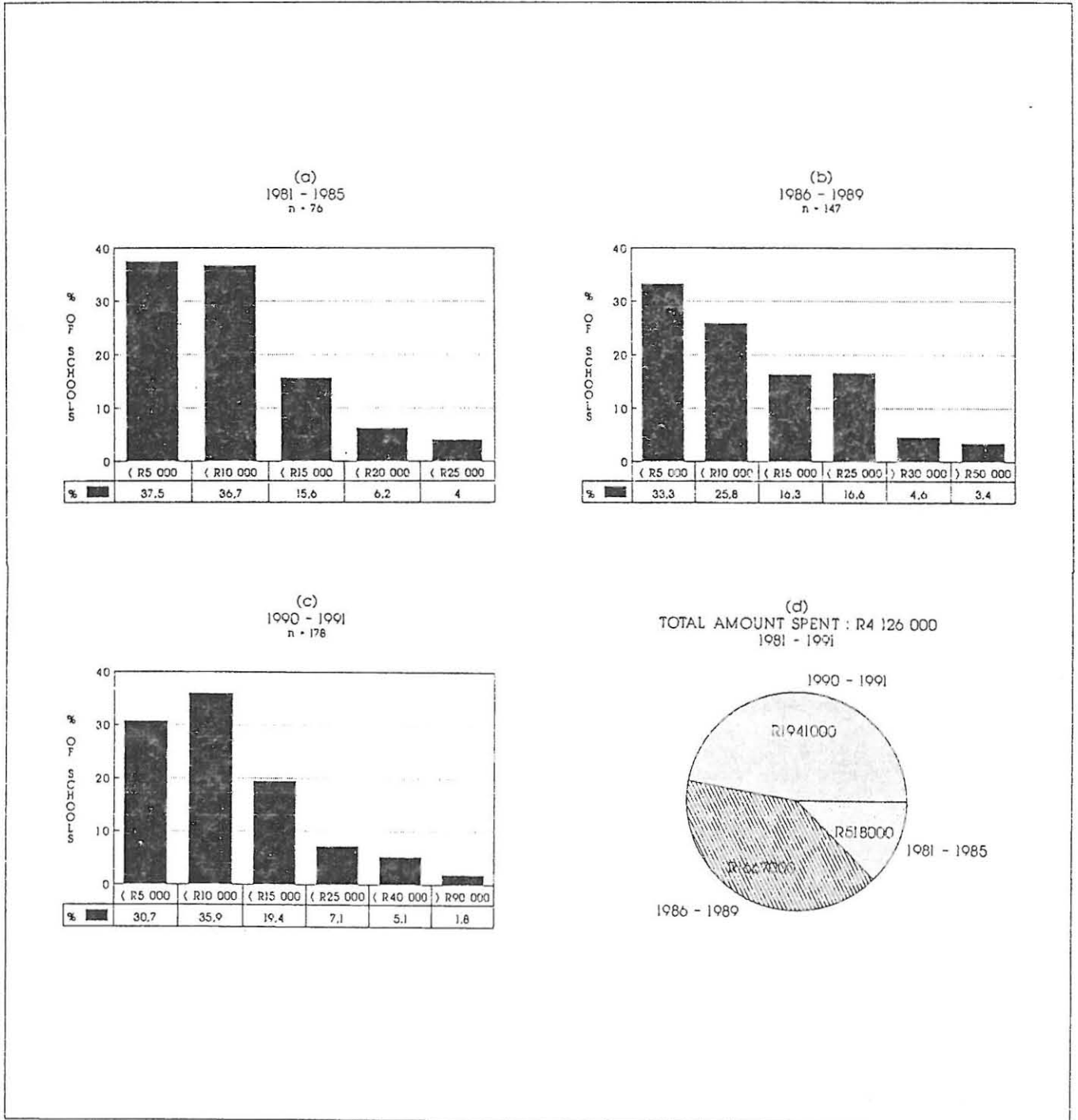
The first graph (a) gives the distribution of money spent over the period 1981 to 1985. R518 000 was spent on computer hardware and software during this period. Seventy eight (78) secondary schools indicated that they have purchased computer equipment during this period. During this same period 58 (74%) of these schools spent less than R10 000, which indicates that very few schools purchased more than two computers. The average cost of a personal computer at this time was \pm R5 000.

During the period 1986 - 1989 (graph (b)), 147 secondary schools spent a total of R1 667 000 on computer hardware and software. A number of schools, 54, invested more than R10 000 each and 21 of them indicated that they have spent more than R20 000, which indicates that they must have acquired at least 5 computers each. It can be assumed that most of these computers were housed in a computer room. Eight schools invested more than R40 000.

Over the past two years, 1990 - 1991, nearly R2 million was invested in computer facilities by the 178 schools who responded to this section. The following graph (c)

illustrates the distribution of schools in terms of the amount of money that they spent during this period.

TABLE 5-1 : AMOUNT OF MONEY SPENT BY SCHOOLS TO ACQUIRE COMPUTER EQUIPMENT



Most schools (85%) spent less than R15 000 each, but 25 schools spent more than

R15 000, with 12 of these schools spending more than R30 000 each. Three schools have spent more than R90 000 each during this two-year period.

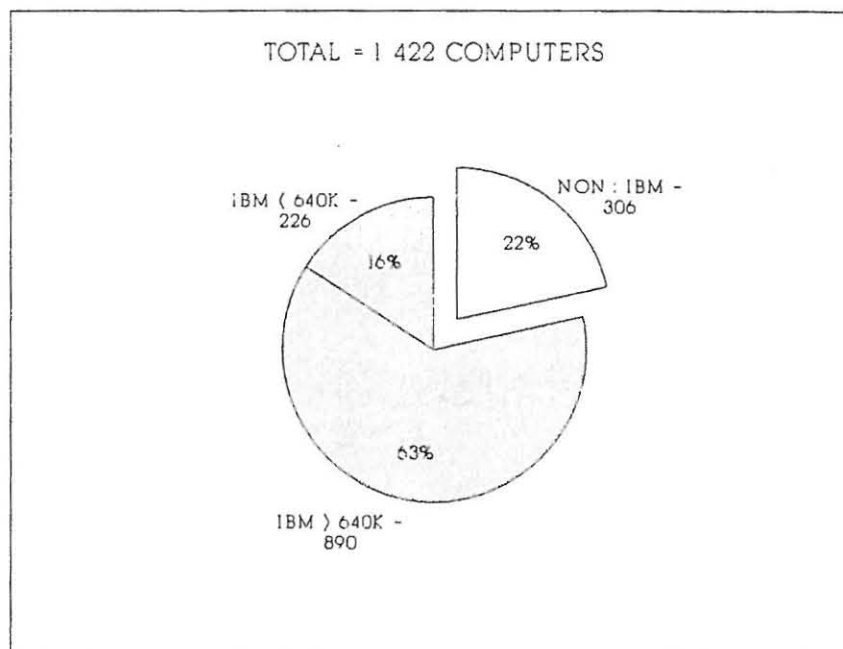
The following graph (d) represents the total amount of money which amounted to R4,2 million spent on computer hardware and software over the 10-year period 1981 - 1991.

5.3 COMPUTER HARDWARE AND SOFTWARE SITUATION

5.3.1 Number and type

The secondary schools of the Cape Education Department, who responded in this survey, have 1 422 computers collectively. Table 5-2 represents the distribution of these computers according to whether they are IBM-compatible (MS-DOS technology) or non-IBM-compatible such as Apple, Commodore, Spectrum etc. The IBM-compatibles are also shown as those with memory (RAM) larger or equal to 640K and those with memory (RAM) smaller than 640K. A large percentage (63%) of computers at secondary schools are of the IBM-compatible type, with memory (RAM) of at least 640K.

TABLE 5-2 : TYPES OF COMPUTERS ACQUIRED BY SCHOOLS

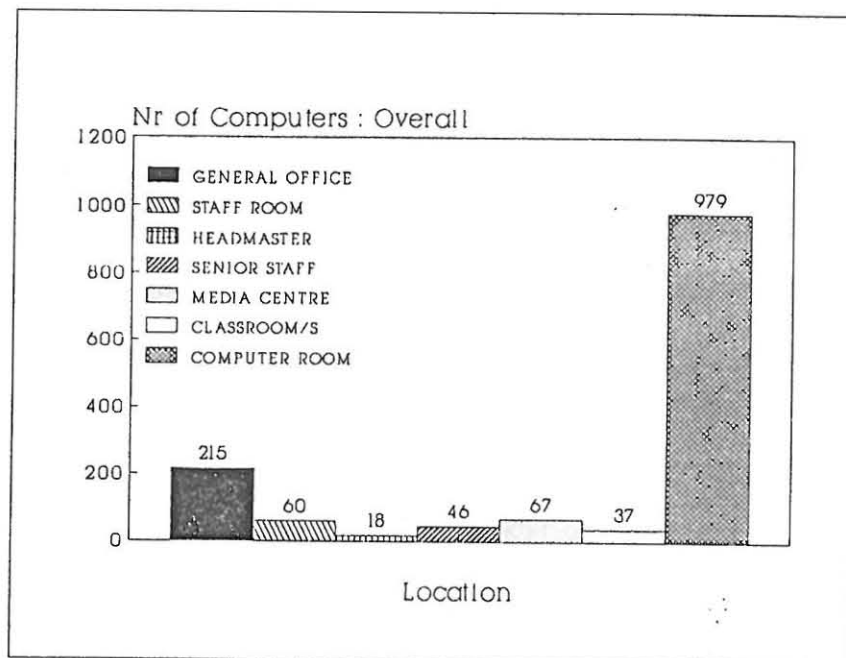


In 1986 the Cape Education Department advised all their schools to only acquire MS-DOS technology in future as this was the direction that the department intended to pursue. Table 5-2 indicates that most schools have taken notice of this advice and that the present hardware situation can serve as base for future initiatives from the Department.

5.3.2 The location of computers in the schools

Table 5-3 depicts the location of computers in secondary schools who responded in the survey.

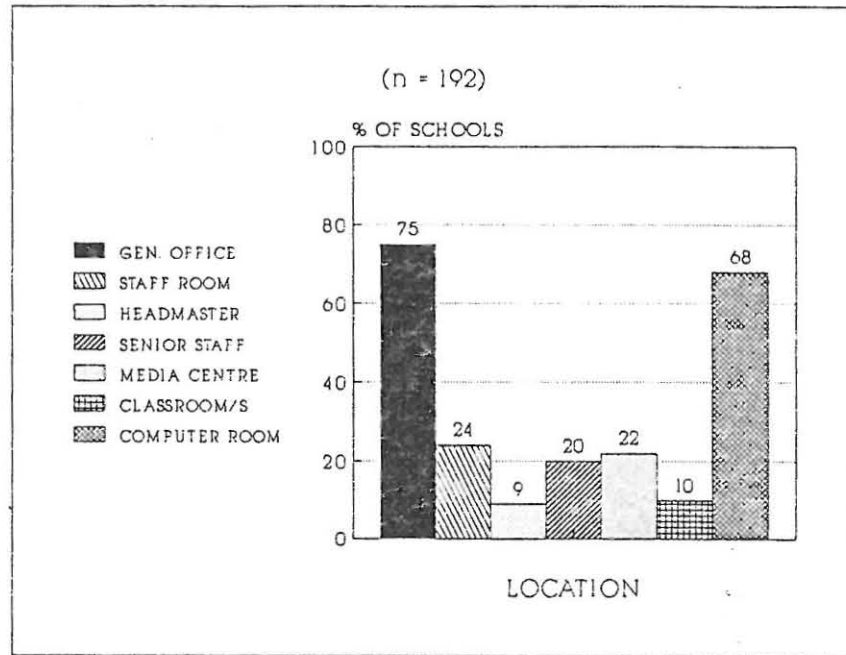
TABLE 5-3 : PHYSICAL LOCATION DISTRIBUTION OF COMPUTERS



Most of the computers are housed in a computer room (see also Table 5-5) and only a few are in classrooms. Computers are however also located in staff rooms, media centres, offices of headmasters and other senior staff members.

The following graph (Table 5-4) represents the number of schools with computers at the different locations, expressed as a percentage.

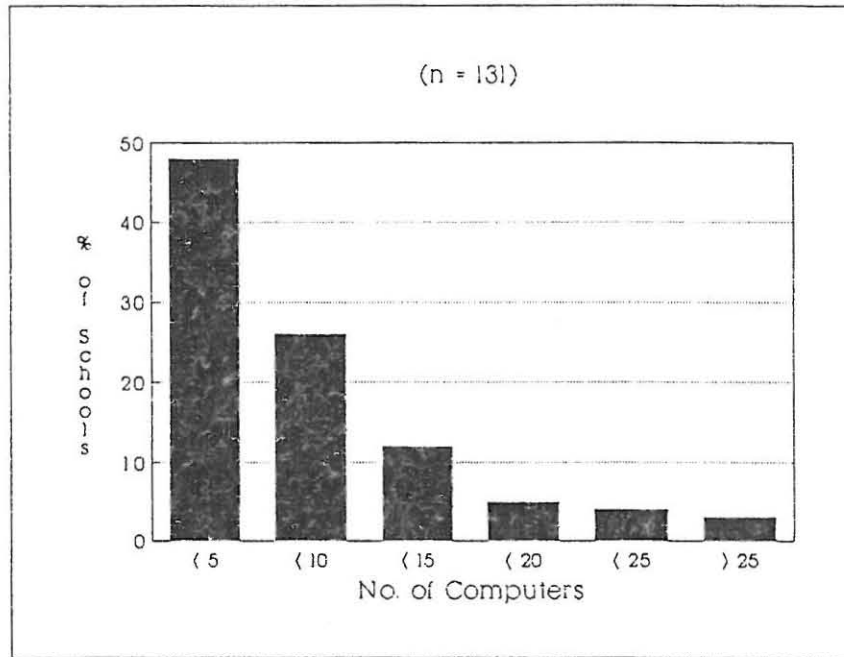
TABLE 5-4 : PERCENTAGE SCHOOLS WITH COMPUTERS AT DIFFERENT LOCATIONS



The two most popular locations for computers are the general office of the school and the computer room. Only 19 (10%) of the schools indicated that they have placed computers in some of their classrooms. On the other hand, 68% of the schools indicated that they have located some of their computers in a computer room. The fact that nearly a quarter of the schools are making computer facilities available in the staff room is an indication that the computer is slowly finding its way into the (heart of the?) school and that the needs of teachers are also accommodated.

The following graphical representation illustrates the number of computers to be found in the computer rooms.

TABLE 5-5 : NUMBER OF COMPUTERS IN THE COMPUTER ROOM



Most of the schools (49%) with computer rooms indicated that they have fewer than 5 computers in the computer room. The type of activities conducted in the computer rooms of these schools would most probably be limited to teacher training, computer club activities and to a lesser extent computer literacy training for pupils.

The Cape Education Department has been responsible for the establishment of centres for Computer Studies at certain high schools and has supplied the computer hardware for these centres. The statistics in this regard were supplied by Mr M. Chiles - Superintendent of Education: Computer Affairs and Statistics of the Cape Education Department (Chiles 1991, pers.com.). The Cape Education Department has established 23 Computer Studies' Centres at different secondary schools throughout the Cape Province. The department supplied these centres with six IBM-compatible computers and two printers each.

Schools with computer centres attached, have included the computers (138) and printers (46) supplied by the department in their returns when completing the questionnaire.

5.3.3 How and to what extent computers are being utilized

The following figure (Table 5-6) summarizes the responses to the request that schools must indicate, (a) how their computers are being utilized and (b) the extent (i.e. no. of hours per week) to which the facilities are being utilized (see also Table 5-16 for the extent of pupil involvement in some of these areas of utilization) :

TABLE 5-6 : UTILIZATION OF COMPUTERS IN SCHOOLS

ACTIVITY	NO of RESPON- DENTS (n=192)	AVERAGE no. of hours per week per school	TOTAL no. of hours per week
School Administration	173	17	2 895
Computer Literacy classes : Pupils	102	8	830
As Tool for Teachers	98	10	984
Computer Club activities	69	5	369
In the Curriculum	35	10	381
In the Media Centre (Library tasks)	20	10	204

Educational computing, in the broadest sense of the word, is still being dominated by administrative activities, with 90% of the schools indicating that computers are being used for an average of 17 hours per week for administrative purposes.

Although this situation can be justified as an acceptable transitional process for the full incorporation of computers, Thompson (1988:B11) warns that "... the only educational justification for using computers in schools is if they improve the process of learning. We must not let the administrative tail wag the educational dog".

More than 50% of the respondents however, also indicated that computers at their schools are being used for more than 2 hours per day for computer literacy classes and as tools for teachers, respectively. 38%, or 69 of the respondents also indicated that computer clubs utilize the computer facilities outside of school hours, whereas less than 20% of the respondents indicated that their computer facilities are utilized for curriculum teaching/learning. Only 11% of the schools use the computer in support of library tasks.

More than 50% of the schools indicated that they offer some or other computer literacy course (see also Table 5-16 for the extent of pupil involvement in these courses).

5.3.4 Computer peripherals

Table 5-7 reflects the respondents acquisition of computer-related devices or peripherals:

TABLE 5-7 : COMPUTER-RELATED DEVICES ACQUIRED BY SCHOOLS

(n = 192)

TYPE	TOTAL IN ALL THE SCHOOLS	% SCHOOLS WITH AT LEAST ONE
Printer	615	100%
Mouse	94	36%
Plotter	15	8%
Modem	17	9%
Optical scanner	4	2%
OHP-Monitor display unit	16	8%

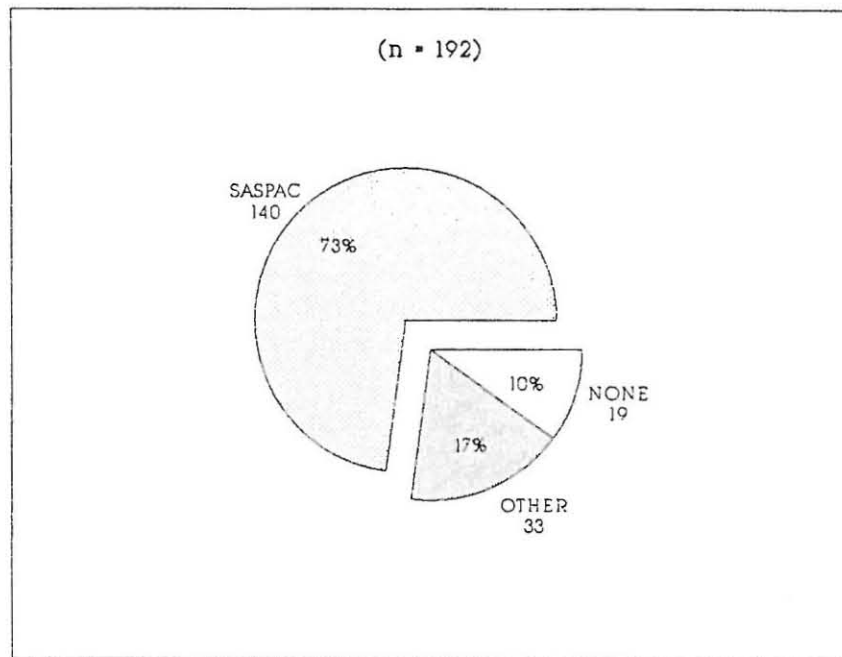
Computer peripheral acquisition, other than printers, are still marginal. At present these peripherals, other than printers, are still relatively expensive, but increased demand worldwide, should bring prices down in the near future. Sixteen respondents (8%) indicated that they have acquired 'OHP-monitor display'-units for projection of computer screen images onto an overhead projector screen. Nearly the same percentage of respondents (9%) also indicated that their schools possess communication modems.

5.3.5 Software

5.3.5.1 Administrative software packages

Table 5-8 indicates the percentage of schools with administrative software packages and also distinguishes between SASPAC and non-SASPAC users:

TABLE 5-8: SCHOOLS USING ADMINISTRATIVE SOFTWARE PROGRAMS



Only 19 (10%) of the respondents with computer facilities indicated that they are not using an administrative software package. The majority of respondents (140 or 73%) are using the program SASPAC, supplied and supported by the Cape Education Department. A number of schools (33 or 17%) are still using administrative programs purchased or developed in-house, prior to the Cape Education Department's distribution of SASPAC in 1990.

On the questionnaire, schools were also asked to indicate whether they experience any problems with the package in operation at the school: the results, to this open-ended question, were summarized and communicated to the local Computer Co-ordinator of the CED.

5.3.5.2 Computer-assisted learning software

The use of educational software, specifically written for secondary school subjects is still relatively limited, as indicated in Table 5-9. The following table also shows the number of secondary schools who indicated the use of this type of software in their subject

curricula:

TABLE 5-9 : FREQUENCY OF SECONDARY SCHOOLS USING CAL-SOFTWARE IN THE CURRICULUM

(n = 192)	SCHOOLS	
	No.	%
Mathematics	40	20,8
Typing	17	8,9
Afrikaans	11	5,7
Physical Science	10	5,2
English	9	4,7
Biology	8	4,2
Accounting	6	3,1
Geography	5	2,6
Music	5	2,6
History	4	2,1
Business Economics/Economics	1	0,5

In schools, who indicated the use of CAL, the most frequent use of such (CAL) programs revolves around drill-and-practice and tutorial applications, with game and simulation type applications the exception. Traditionally CAL applications have been most popular in Mathematics and this tendency seems to persist: this can probably be attributed to the large variety of Mathematics software programs available.

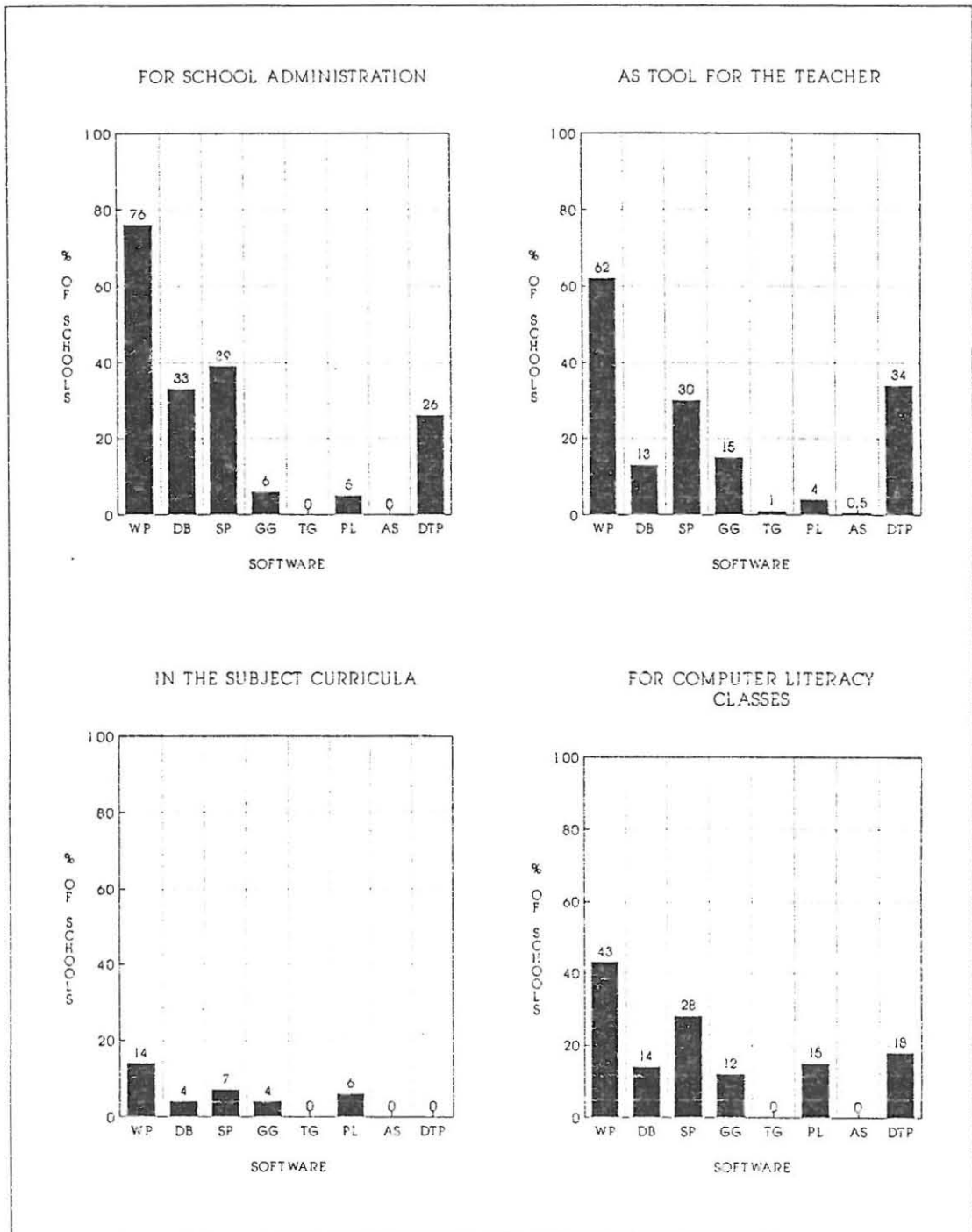
Integrating the computer across-the-curriculum, must allow all the pupils to benefit from it, and/or to acquire computer literacy and other skills. This would also only be fair especially in cases where computers were acquired by means of school funds.

5.3.5.3 Generic or open-ended type software

In the literature survey the shift towards and popularity of generic or open-ended type software has been described. In this survey schools were asked to indicate whether they are using generic type software in any one of the following areas of application: in school administration; as a tool for the teacher; in subject curricula or for computer literacy courses. The following table indicates the frequency of the application of eight of the most common generic software packages:

TABLE 5-10 : FREQUENCY OF GENERIC SOFTWARE APPLICATION

Key : WP (Word-processing) DB (Database)
SP (Spreadsheet) GG (Graphics Generator)
TG (Test Generator) PL (Programming language)
AS (Authoring system) DTP (Desktop Publishing)



The higher frequency of word-processing, desktop publishing, database and spreadsheet applications reported in all four areas of application correlates with the most recent literature reviewed. Desktop publishing and graphics generators are very popular for general school administration purposes, with teachers (as a tool) and with the pupils (computer

literacy classes). Authoring systems (for CAL-lesson generation) and test generators (multiple-choice compilation, etc) have not yet found their way into secondary schools of the Cape Education Department.

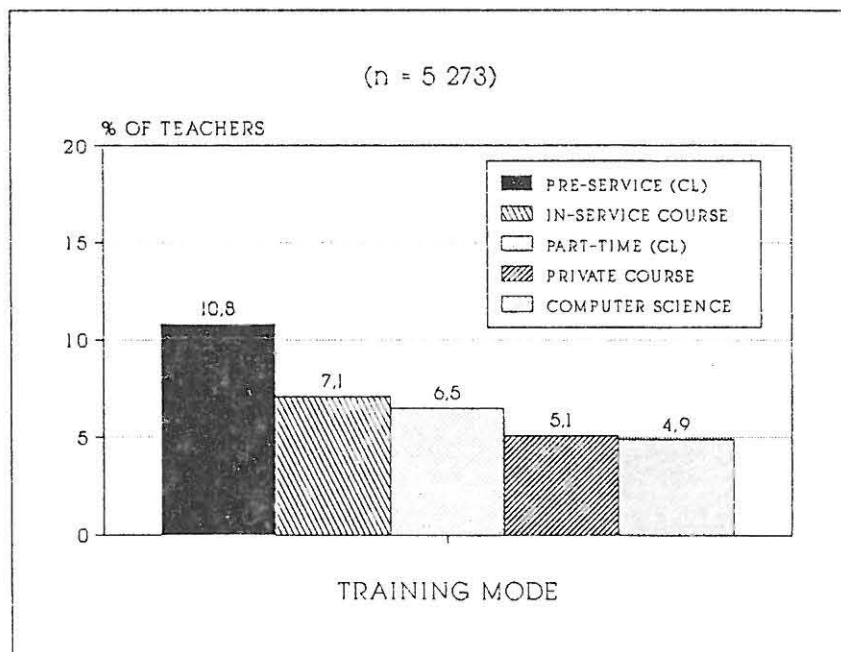
The types of programs used in computer literacy courses, indicate that less emphasis is placed on programming and that the 'tool-type' generic applications are more popular. A number of schools also indicated that they are using generic or tool-type software across the curriculum.

5.4 TEACHER TRAINING

5.4.1 The extent of teacher training

Table 5-11 indicates the percentage of teachers who have a qualification in Computer Science or Computer Literacy and/or have followed a computer course, either through pre-service, part-time studies or in-service avenues.

TABLE 5-11: EXTENT OF TEACHER TRAINING



The analysed data indicates that 5% of the secondary school teachers have a formal qualification in Computer Science, that is, a minimum of one-year's training. Sixty

(1,2%) of these teachers obtained their qualification through part-time study for non-degree purposes. Nearly 11% of secondary teachers followed a computer course, that is a computer literacy course with no or little programming, during their initial, pre-service teachers' training. Since these courses for secondary school teachers have only been in existence for a short time (5 -7 years) it is mostly the younger teachers who have a formal computer qualification. These younger teachers however do not have much influence on policy making in the school.

Six percent of the teachers enrolled for part-time computer courses, that is in programming and/or computer literacy, but not Computer Science: 2,8% were attending universities, 2,1% technical colleges and 1,4% technikons.

The Cape Education Departement has been running in-service 'Computers-in-Education' courses for the past two years and 7,4% of the secondary school teachers have received training in this way, 2% (102) at Denneoord in Stellenbosch and 6,5% at their local teachers' centre. There is a possibility that some respondents (who did not read the instructions carefully) included teachers who went for training in the administrative package (SASPAC) at the local teacher centre in their responses, thus influencing the accuracy of the percentage who attended training courses at the local computer centre.

Six percent of the teachers have attended training courses offered by the private sector, 4,9% in computer literacy and 1,1% in programming. Nearly 3% of the teachers indicated that they have received computer training in a work situation outside of education.

5.4.2 Attendance of meetings of Educational Computing-study groups at teachers' centres

Educational Computing-study or interest groups have been formed at most of the seven teachers' centres of the Cape Education Department and they usually meet on a quarterly basis. Only 2,6% (135) of the teachers involved in the survey indicated that they regularly attend these meetings. If this figure represents secondary teachers' 'interest'

in educational computing, it holds that the future of this activity looks bleak. However, this lack of interest may be as a result of ignorance or the wrong attitude - factors which must be addressed by those offering educational computer training.

5.4.3 Schools offering computer literacy courses as part of staff development programmes

Nearly one third (66) of the respondents with computer facilities, indicated that they have offered some form of computer literacy training to all members of staff, as part of their staff development programmes.

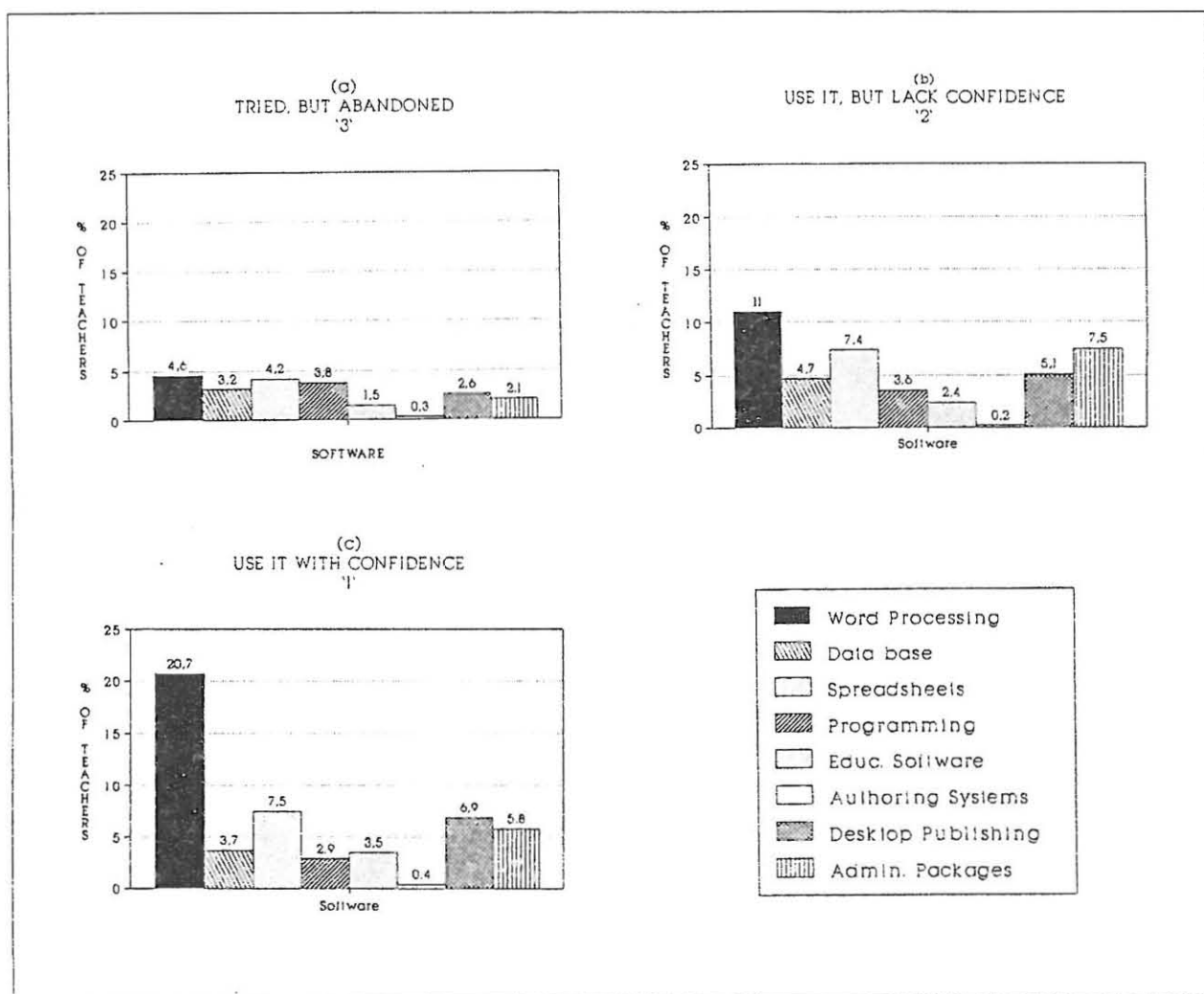
5.5 TEACHERS' FAMILIARITY WITH CERTAIN SOFTWARE APPLICATIONS

Schools were asked to determine the teachers' familiarity with eight different types of software packages often encountered in education. Schools had to use a five point scale in answering, '1' indicating that the teacher uses the package with confidence, '3' indicating that he or she has tried to use the package, but then abandoned it, and '5' that he/she has never heard of it.

The graphs in Table 5-12 provides only the percentages for teachers who

- a) have tried to use or learn a specific program, but then abandoned the attempt ('3');
- b) use the different programs, but still lack confidence ('2'); and
- c) use the programs with confidence ('1').

TABLE 5-12 TEACHERS' FAMILIARITY WITH SOFTWARE APPLICATIONS



Data obtained in the survey indicated that 5 273 secondary school teachers were involved in the 'internal' surveys conducted at each school in order to establish teachers' familiarity with different software.

The most significant familiarity with computer software is with what is described as 'productivity tools', that is, word processing, the spreadsheet, graphics generators and database management. For example, more than 30% of the teachers indicated that they use the computer for word processing, either still lacking confidence (11%), or with confidence (20,7%) - which correlates with the statement made in 5.2.1 earlier in the chapter.

Very few teachers (2,9%) are active programmers in computer languages such as Basic, Pascal or Logo and fewer than 1% of the teachers have tried to use or are using an authoring system. Only 0,4% indicated that they can develop computer- assisted lessons with confidence, using programs such as Quest, Pilot, etc.

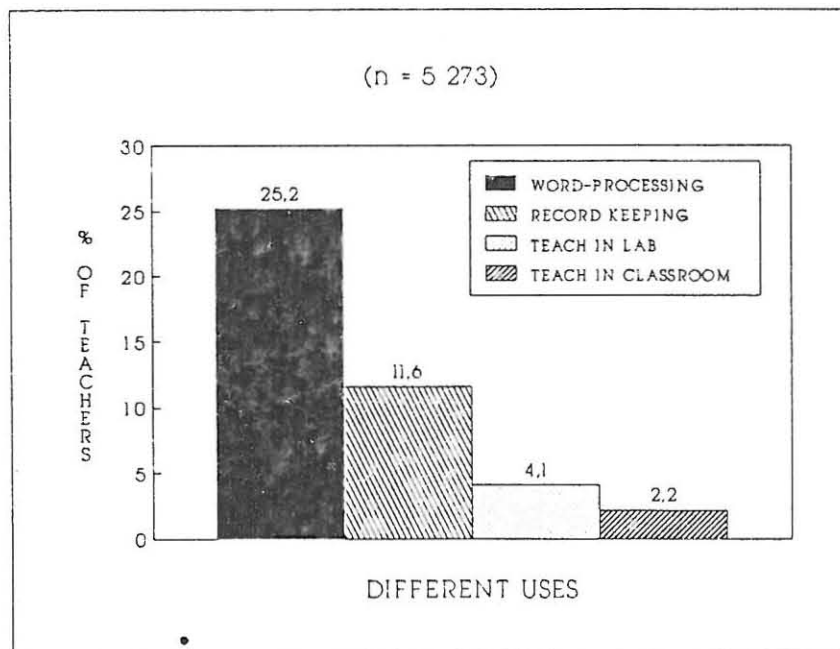
The familiarity with educational software (CAL) written for specific subjects differs from 1,6% who tried, but abandoned it, to 6% who use it, either lacking confidence (2,4%) or with confidence (3,6%).

The lack of familiarity with 'traditional' CAL and with authoring systems can be attributed to the major emphasis being placed on basic computer literacy (word processing, etc) during teacher training in all modes, that is, pre-service, part-time and in-service.

5.6 HOW TEACHERS USE THE COMPUTER

Schools were asked to poll their teaching staff in terms of their use of computers, word processing, keeping record of statistics and teaching certain aspects of their subjects with the aid of the computer. The following graph (Table 5-13) illustrates the findings:

TABLE 5-13 : HOW TEACHERS USE THE COMPUTER



Just over 4% of the teachers indicated that they use the computers in the computer room to teach certain aspects of their subjects and 2,1% that they use the computer in their classroom as a teaching/learning aid. Again this can be ascribed to either the lack of training, ignorance or the wrong attitude, because in many schools the facilities are available.

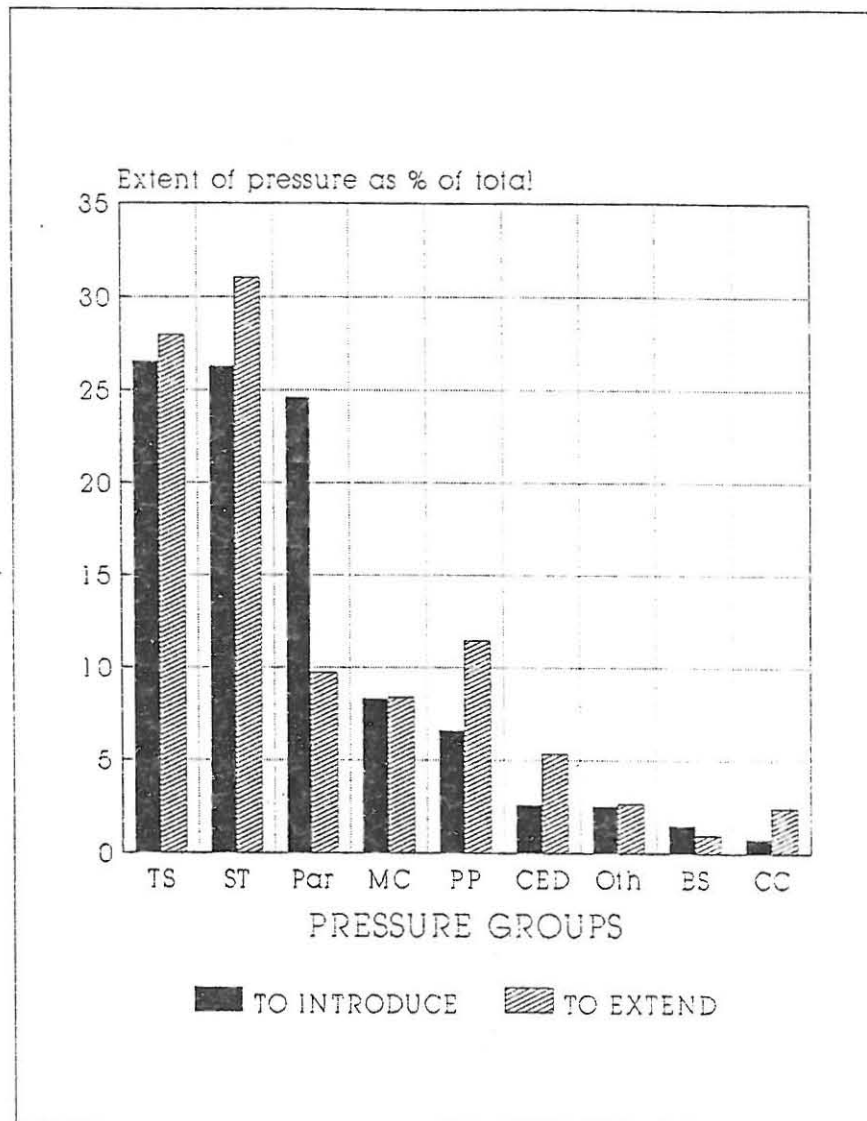
The most general use of computers by teachers is for word-processing, that is, to type and store examination papers, work schemes, course notes etc. and in this survey it was reported that 25,2% of teachers use the computer for this purpose. It was further indicated that 11,6% of the teaching staff use the computer for keeping record of test marks and/or other statistics. These figures also support the assumption made at the beginning of the chapter in connection with teachers' computer literacy.

5.7 FACTORS WHICH INFLUENCE SCHOOLS TO INTRODUCE COMPUTERS

5.7.1 Pressure groups that play the most dominant role

Other than at those centres offering Computer Studies and except for the distribution of the administrative software package SASPAC, the Cape Education Department has never supplied any computer hardware or software to secondary schools under its jurisdiction. It can therefore be assumed that other pressure groups played a role in influencing individual schools to either introduce and/or extend computer facilities. Respondents were asked to rank the three most important 'pressure groups', according to the role they played in **introducing**, and **extending** computer facilities at the school using rank '1' as most important and rank '3' as least important of the three. The 'extent' of each group's pressure was determined by allocating a score of 3 to the ranked '1's; and scores of 2 and 1 to the ranked '2's and '3's respectively. The score of each pressure group was then added and expressed as a percentage of the cumulative scores obtained by all the pressure groups collectively.

TABLE 5-14 : PRESSURE GROUPS' INFLUENCE TO INTRODUCE/EXTEND COMPUTER FACILITIES



The three major pressure groups in **introducing** computers in schools were indicated to be, in order of priority, the top structure (ST) - headmaster and deputy headmaster (26,5%); the teaching staff (TS) (26%); and the parents (Par) of the school (24,5%). The parents as pressure group includes pressure exerted through structures such as a 'parent-teacher association', either formally or informally/individually.

The Computer Coordinator (CC) at the teachers' centre (0,5%) ; the business sector (BS) (1%); and the CED (2,5%) were regarded as less influential in the **introduction** of computer facilities. A number of schools indicated that their secretaries (OTH) constituted

one of the three important pressure groups (2,5%) in introducing computers.

The roles of pressure groups to **extend** existing facilities at schools does not differ much from their role in introducing the facilities. The only significant change occurred with the parents as pressure group. Their initial pressure to introduce computers (25,4%) decreased to less than 10% in the extension of facilities. This drastic switch in 'support' can be ascribed to the fact that parents had high hopes for computers in the school, but soon realised that their children do not benefit directly from their introduction, so why increase their number ...

The role of the pupils (PP), the Cape Education Department and the local Computer Coordinator were the only ones to show an increase as pressure groups in extending computer facilities at schools. CED's 'new' initiatives (see chapter six) which started with the appointment of computer co-ordinators to support schools in educational computing activities are playing a role in influencing schools to extend facilities.

5.7.2 Rationale on which initial decision to introduce computers was based

Schools were asked to indicate the importance of certain reasons for the school's **initial** decision to acquire computer facilities. The following scale were to be used, '0' (zero) for not important, '1' for important and '2' for very important. The scores for each reason were totalled and the different reasons ranked accordingly. The following table (Table 5-15) lists those reasons which were indicated as important or very important, in order of priority, as reflected by the cumulative scores:

TABLE 5-15 : IMPORTANCE OF THE RATIONALE ON WHICH THE INITIAL DECISION TO INTRODUCE COMPUTERS WAS BASED

IMPORTANT/VERY IMPORTANT (cumulative scores)	
1. Computers will improve the school's administrative and managerial efficiency	331
2. Computers can enrich the existing curricula and improve the way in which they are delivered (taught)	329
3. Pupils should be unafraid of computers	288
4. Pupils should learn to operate computers in order to prepare them for their further study and/or future occupation	259
5. Since schools prepare pupils for life, they should prepare them to deal with computers in every-day life	248
6. Computers will help to lessen the workload of teachers and free them to be more effective in the classroom	219
7. To start a computer club at the school	121
8. Pupils will learn physics, mathematics and certain other subjects better through computer-assisted learning (CAL)	101
9. Computers in the school will attract more pupils to the school	104
10. Computers encourage students to learn by collaborating rather than competing with other students	60

Improving the school's administrative and managerial efficiency (the CATALYTIC rationale) was regarded as the most important reason why schools **initially** decide to acquire computers. The reason, 'computers can enrich the existing curricula ...', relates to the PEDAGOGIC/CATALYTIC rationale and was ranked second, but this was, in a way, contradicted by the reason 'pupils will learn certain subjects better through CAL', which was only placed eighth.

The SOCIAL rationales, 'pupils should be unafraid of computers' and 'since schools prepare pupils for life, they should prepare them to deal with computers in every-day life' received high preference (third and fifth). The VOCATIONAL rationale was also regarded as very important with the reason, 'pupils should learn to operate computers in order to prepare the for further study and/or future occupation', ranked fourth.

5.8 NATURE OF PUPIL INVOLVEMENT IN EDUCATIONAL COMPUTING ACTIVITIES

In order to obtain a global overview of pupil involvement in educational computing activities schools were asked to indicate pupil involvement in seven areas of educational computing activities in terms of whether only a few (below 10%) or between 10% - 50%; or more than 50% of their pupils are involved in each of the seven areas.

The results are summarized in Table 5-17 and are represented graphically in Table 5-16.

TABLE 5-16 : PUPIL INVOLVEMENT IN EDUCATIONAL COMPUTING ACTIVITIES - GRAPHICALLY

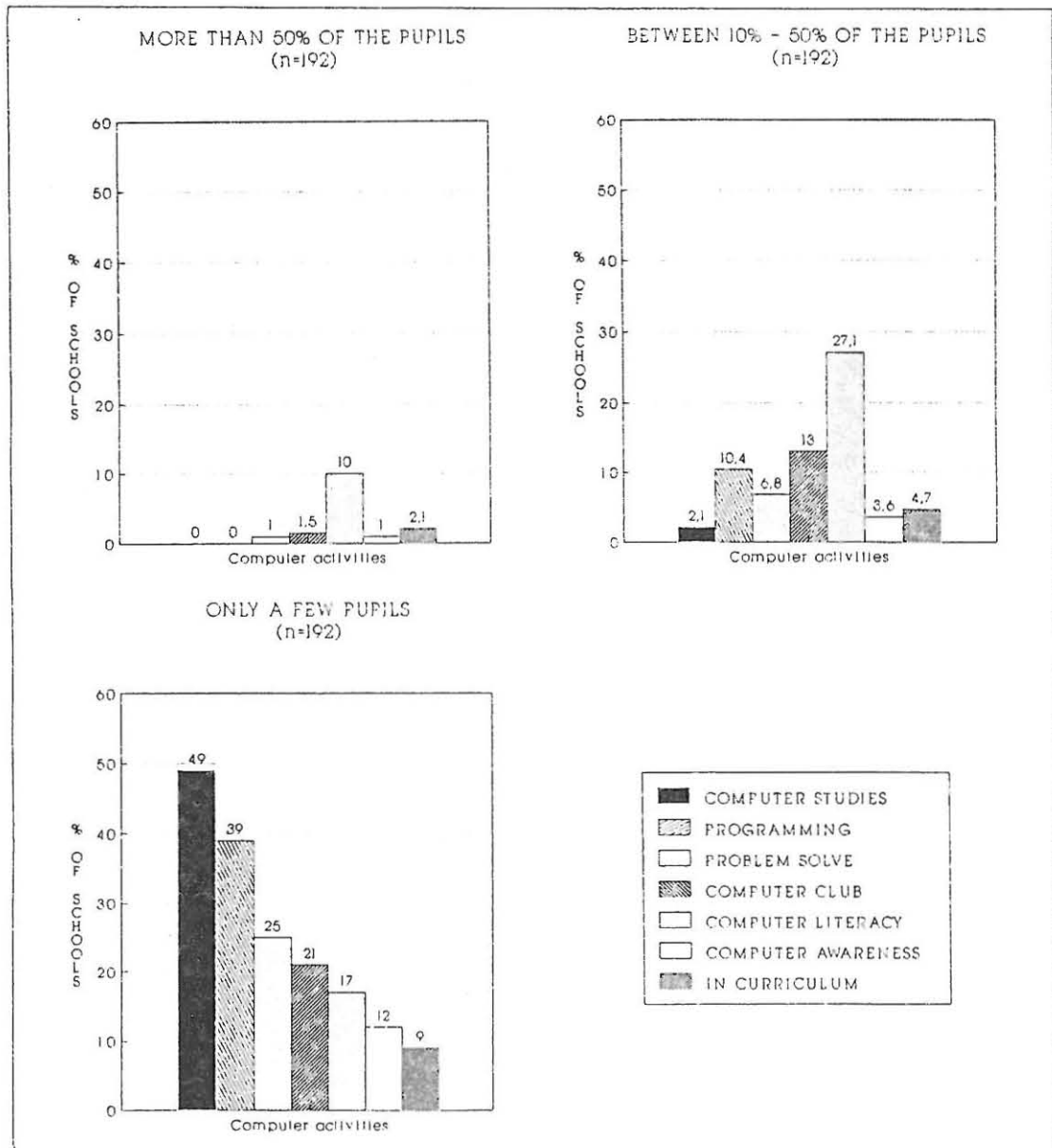


TABLE 5-17 : PUPIL INVOLVEMENT IN EDUCATIONAL COMPUTING ACTIVITIES - TABULATED

EDUCATIONAL COMPUTING ACTIVITY	No. of Schools		
	A FEW PUPILS ONLY	10% - 50% OF THE PUPILS	MORE THAN 50%
Computer Studies	92	4	-
Programming	62	12	-
Problem-solving opportunities	48	13	2
Computer Club	41	25	3
Computer Literacy classes	32	52	18
Computer Awareness activities	22	7	2
Computer in the curriculum	19	9	4

In the category, 'only a few pupils' the data analysed indicated that many schools offer their pupils the opportunity of practising the different computer activities. Pupils from nearly 50% of the 182 schools who responded to this section of the questionnaire have Computer Studies as a seventh subject (more detail later in this section). Nearly 39% of the schools also indicated that 'only a few' of their pupils learn programming at school, but that the school does not offer Computer Studies as a subject. There is a strong possibility that many schools whose pupils attend Computer Studies classes at another school, where there is a centre, also indicated this option, thus misinterpreting the question.

Schools were also asked whether they endeavour to improve pupils' ability to solve problems by using a computer. The question was paraphrased as follows:

Such a programme would rest on the belief that computers can facilitate students' ability to problem-solve. Pupils are assigned or choose problems to solve in a computer environment under the assumption that they will learn to become better problem-solvers in real world situations.

Nearly 26% of the respondents indicated this option. The reason for the high response might be the fact that in many schools the pupils prepare the schools' newspaper and/or newsletters with desktop publishing programs. Computer club activities seem to attract only 'a few pupils' in most of the schools who responded, with 21% indicating 'a few pupils', 13% indicated between 10 and 50 percent and only 1,6% (2 schools) with more than 50% of the pupils active in the school's computer club.

The only computer activity where more than 10% of the respondents indicated that 'more than 50%' of their pupils' are involved is in computer literacy programmes offered by the school. Of the respondents, 27,1% indicated that '10 - 50 percent of the pupils' were involved in their 'computer literacy' programmes.

'Computers across the curriculum' activities, where the computer is a component integrated into a teacher-designed and implemented lesson plan, are still rare. 3,6% of the schools indicated '10 - 50 percent pupil'-involvement, and only 1% 'more than 50%' involvement in such activities.

Most schools are following a segregationist computer literacy curriculum with the emphasis largely on the computer-as-tool, but programming as a skill is still being regarded as important in many of the schools offering such courses or opportunities.

Furthermore, pupils from at least 98 (51%) of the 192 schools, who indicated that they have computers, are taking Computer Studies as seventh subject at the Computer Studies' centres. In 1991, 542 pupils in standard 8, 308 in standard 9 and 178 in standard 10 were enrolled for Computer Studies. (Chiles 1991:pers.com.)

5.9 PROBLEMS THAT SCHOOLS EXPERIENCE IN GETTING TEACHERS AND PUPILS MORE INVOLVED IN "COMPUTERS IN EDUCATION" ACTIVITIES

The following represents a summary and brief analysis of the responses to the open-ended questions posed:

5.9.1 Does the school experience any problems in getting teachers more involved in "Computers in Education" activities?

The problems identified by respondents are summarised in Table 5-18, indicating also the frequency of each problem:

TABLE 5-18: AREAS WHERE SCHOOLS ARE EXPERIENCING PROBLEMS IN GETTING TEACHERS MORE INVOLVED IN "COMPUTERS IN EDUCATION" ACTIVITIES

PROBLEM AREAS RELATED TO	n = 96
(a) Time/Scheduling	62
(b) Staff's attitude/fear	53
(c) Hardware	49
(d) Training	14
(e) Software	7

Detailed accounts of each of these problem areas follow:

(a) Time/Scheduling related problems

More than two-thirds of the respondents stressed the lack of time for training teachers and the fact that teachers who have attended in-service courses cannot find the time to practise newly-acquired skills. These respondents attributed the lack of time to the extended workloads of teachers involved in full extra-mural programmes etc. The workload pressures that exist at small schools, where a few teachers must do everything, were mentioned frequently.

Some respondents (13) also argued that there is nobody on the staff with the time on hand to manage, inspire and control educational activities; and to evaluate educational software etc - most of these respondents remarked that schools need a teacher with the delegated authority and responsibility to coordinate the whole spectrum of educational computing activities in the school.

A few schools (4) indicated that they experience problems with the scheduling of classes to utilize the computer room within present timetable restrictions and that large classes cannot be accommodated in the computer room.

(b) Teachers' attitudes/fears

The major problem area identified was the prevalence of staff members who are 'not interested' in the computer in education. Most of the 53 respondents reported that their teachers do not feel confident about the place and utility of the computer, and that this attitude prevails, even after teachers have attended computer courses.

A number of schools (22) indicated that their teachers are very negative with regard to the usefulness of the computer and that many of their teaching staff do not even see any need for acquiring word-processing skills. Another very important reason for teachers' apathy towards educational computing has been reported (by 9 schools) as being their school's over-commitment to traditional extra-mural activities, which do not allow much time for anything else.

Three schools also indicated that senior staff members are not interested in computers and that this has a negative effect on the school environment.

A large number of responses (32) relate to lack of confidence, fear and ignorance amongst teachers. One school also mentioned that teachers do not allow themselves enough time to learn computing skills up to a level where they can at least help themselves, and that many teachers give up after only one training session.

(c) Hardware related problems

To a large extent this problem can be attributed to a universal problem - shortage of funds. It was reported by at least 40 schools that they would be able to get more teachers involved, if only they had more computers. A number of schools (8) indicated that for effective teacher training and integration in the curriculum,

a school needs at least 10 computers.

Fifteen schools indicated that their computers are not available to the teachers, as they are solely reserved for the general administrative functions of the school. Respondents felt that schools should make computer facilities available to the staff, either in the staff room or somewhere else. One school indicated that the staff is so active in educational activities that the shortage of computers at the school is stifling teacher initiative.

Nine schools hinted that their problem of getting teachers involved in educational computing activities is related to the incompatibility of their hardware (that is IBM compatibility) or that their computer hardware lacks memory capacity to utilize standard software packages and/or certain educational software programs.

An interesting observation came from two schools who indicated that the school's educational computing activities would be stimulated if more of their teachers had computers at home.

(d) Training-related problems

A number of schools (7) indicated that they have no 'expert-teachers' to take the initiative and/or to take the lead in educational computing activities. Other problems that relate to training are the distance from the nearest teachers' centre where training is being offered and others indicated that their teachers' centre does not offer any training. The fact that no curriculum integration guidelines are being made available has also been identified as a problem area.

(e) Software-related problems

Only a small number of schools (5) felt that their problem, of getting teachers more involved, is software related. These schools saw the lack of good, inexpensive and applicable educational software for secondary school subjects as most relevant to the problem. It seems more than likely that many schools do not experience software as a contributing factor, because many schools have acquired

generic software such as word-processing packages, etc with which teacher training and computer literacy classes can be conducted.

5.9.2 Does the school experience any problems in getting the pupils more involved in "Computers in Education"-activities?

The problems identified by respondents are summarised in Table 5-19, indicating also the frequency of each problem:

TABLE 5-19 : AREAS WHERE SCHOOLS ARE EXPERIENCING PROBLEMS IN PUPILS MORE INVOLVED IN "COMPUTERS IN EDUCATION"-ACTIVITIES

PROBLEM AREAS RELATED TO	n =111
(a) Hardware	53
(b) Shortage of trained teachers	34
(c) Pupils' Programmes	22
(d) Timetable Scheduling	14
(e) Software	12
(f) Pupils' Attitude	11
(g) Location	7

Detailed accounts of each of these problem areas follow:

(a) Hardware-related problems

The problem of limited hardware facilities is obvious as schools have had to purchase computers from own funds. Needs and financial ability differ from school to school and some schools have other important projects to finance.

However, the shortage of hardware in schools remains one of the most obvious restricting factors in implementing educational computing. Many schools did however, report that their computers are utilized to their full capacity due to

unprecedented pupil interest. On the other hand, it is also noted that many schools cannot give all pupils hands-on experience because the school only has one or two computers. This situation also leaves very little scope for pupils to practise newly acquired skills, a very important aspect of acquiring computer literacy.

Another interesting remark, made by 2 respondents, was that pupils felt that the schools BBC's and Commodore 64's were old-fashioned and that they were therefore not motivated to use them.

(b) Shortage of trained teachers

Thirty-four (34) of the respondents felt very strongly about the shortage of teachers who are able to teach about or with the computer and feel that although pupils appear to be very keen, nothing can be done to offer them the necessary training/experience without the trained teachers. Other respondents stated that more subject teachers should become computer literate and that by using the computer in the curriculum, pupils' computer awareness (computer literacy?) would be stimulated (See also "pupils' attitude" below).

One respondent mentioned that many pupils have computer facilities at home, where they 'play' with sophisticated software packages, and they are then very reluctant to use 'public domain' or 'cheap' packages at school. Stimulating these pupils would require computer literate teachers and applicable software.

(c) Pupils' programmes

Some schools (22) reported that their pupils are very keen and willing to learn (more) about the computer and to utilize it more (better), but that their school programmes are too full. Some schools reported that pupils have no time after school, or that the times of traditional extra-mural activities clash with those of the computer club.

It appears that these schools are of the opinion that pupils cannot acquire computing skills by only attending one class per week during school hours and that pupils will have to make a special effort to attend af ternoon/holiday classes in order to become computer literate (see also Jacobs 1990).

(d) Timetable Scheduling

The schools that mentioned scheduling as one of the limiting factors in getting pupils more involved have either taken a decision to teach computer literacy to most pupils in the school, or have attempted to give a number of subject teachers the opportunity to use the computers in a laboratory situation for their subject. It can be assumed that the first option is the more likely, but that a combination of the two is also possible. One school's comment was, "... tried to start computer literacy period, but could not fit it into the timetable", and another's, "... busy overall curriculum does not allow any extra time for computer literacy classes".

(e) Software-related problems

Four areas of concern can be generalised as most of the 34 respondents expressed similar views. Firstly, the cost of software was mentioned. Here it seems clear that the possibility of 'public domain' and 'shareware' providing a solution needs to be investigated. Secondly, schools indicated an inability to get appropriate software programs: this relates to the third problem, namely that no guidelines were provided for software purchasing, prior to the appointment of computer coordinators in 1990. Finally, schools also indicated that teachers do not know how to utilise software in ways perceived as meaningful by pupils, especially in across-the-curriculum applications. Three schools indicated that the National Film Library did not render a satisfactory service, in terms of supplying software.

(f) Pupils' attitude/enthusiasm

A number of schools (11) reported that their pupils are not interested in computers and/or that one or two dedicated teachers are responsible for the enthusiasm that

does exist amongst the pupils. Two schools also indicated that their computer clubs stopped operating when the teachers responsible for the club resigned or took up positions at other schools. It was also mentioned that pupils' enthusiasm decreases rapidly if they do not have the opportunity to practise and apply newly acquired skills.

Two other interesting comments are, "... pupils feel computers are for intelligent people only" and "... we are a girls' school, girls are not very interested in programming and would rather like to learn tool-type/utility programs".

(g) Location

Only seven schools stated that the lack of a proper room has been a distinct disadvantage. Schools generally regard the security of their computer equipment as very important and one respondent mentioned that their facilities are not available to pupils after school hours.

One respondent also indicated that pupils have been denied free access to the computer room owing to vandalism in the past, and another school mentioned restricted entry, because of continuous problems with computer viruses transmitted from pupils' personal disks onto the school's hardware.

5.10 WHY CERTAIN SCHOOLS HAVE NOT ACQUIRED COMPUTERS

Twenty (20) of the respondents indicated that they do not have any computers. These schools were asked to complete Section F of the questionnaire where they had to indicate the relative importance of 16 reasons for their school not having acquired computers. The following scale was to be used: '0' (zero) for not important, '1' for important and '2' for very important.

The scores of each reason were totalled and the different reasons ranked accordingly. The following table (Table 5-20) lists these reasons in order of priority as reflected by the cumulative scores:

TABLE 5-20 : THE RELATIVE IMPORTANCE OF REASONS FOR SCHOOLS NOT HAVING COMPUTERS

<u>IMPORTANT / VERY IMPORTANT</u> (cumulative scores)	
1. Shortage of funds	36
2. Computers are too expensive	30
3. More important priorities/projects to finance	27
4. Lack of expertise on the staff	20
5. Lack of teacher's interest in educational computing	17
6. Lack of quality educational software for high school subjects	16
7. Pupils' programmes are too full	15
8. Owing to a lack of knowledge, the school is afraid that it might buy the "wrong" computers and/or programs	13
9. Parents have not identified the need for computers	12
10. The administrative load at the school can be handled without a computer	10
11. Pupils are not interested	9
12. Teachers are too busy to implement computers in education	5
13. Computers are only a craze (Here today; gone tomorrow)	5
14. Computers tend to increase the teacher's workload	4
15. Computers create an impersonal learning environment	3
16. Computers can only be employed to teach basic, low-level skills	1

The three most important reasons are of a financial nature, with 'a shortage of funds' as the most important. It can therefore be assumed that these schools will acquire computers once funds become available. The second most important group of reasons involves teacher training and teacher attitude towards computers in education. The lack of quality educational software is also one of the more important reasons for schools not acquiring computers.

Most of the respondents do not see computers as merely a craze or as being likely to create an impersonal learning environment. Only one of the schools indicated that computers can only be employed to teach basic, low-level skills.

5.11 SUMMARY

Chapter five described and analysed the data processing procedure. The data obtained from the field survey conducted in 239 secondary schools under the jurisdiction of the Cape Education Department was interpreted and presented in the form of tables and graphs.

CHAPTER 6 : EDUCATIONAL COMPUTING IN THE CAPE EDUCATION DEPARTMENT - QUO VADIS?

6.1 INTRODUCTION

During the latter half of 1991 two very important policy announcements were made: together they signal fundamental changes in the present situation concerning educational computing in South Africa.

Firstly, a report on the investigation into the training of computer literates in the RSA, undertaken jointly by the National Training Board (NTB) and the Human Sciences Research Council (HSRC), was published on 23 August 1991. Secondly, on 17 September 1991 the Cape Education Department formally announced the 'Computers in Schools and Colleges' Project (CISC) - a project that entails the department's direct intervention in educational computing activities.

It does not fall within the ambit of this paper to evaluate either policy statement in detail. For the sake of perspective and for future research purposes, however, it seems necessary to comment briefly on each. Before doing so it is however necessary to explicate the educational computing policy of the Cape Education Department as it existed before the formal introduction of the CISC Project in September 1991.

6.2 CAPE EDUCATION DEPARTMENT'S EDUCATIONAL COMPUTING POLICY PRIOR TO SEPTEMBER 1991

The information needed to describe the Cape Education Department's (CED) educational computer policy before September 1991 was obtained through personal communications with the following spokesmen of the department (Waker 1990:pers.comm. and Chiles 1991:pers.comm.):

Mr P. Waker: Deputy Superintendent of Education : Education Technology; and
Mr M. Chiles : Superintendent of Education : Computer Affairs and Statistics.

Computer Studies was introduced in the CED as an optional seventh matric subject in 1981. The subject can be taken by pupils in the three years of their senior secondary school phase only. The CED made syllabi available for Computer Studies, computer centres were established and these centres were supplied with hardware and software (see also Chapter 5). Centres established by this department operate independently from the school to whom they are attached and the centre's facilities are generally not available to members of staff or pupils other than those doing Computer Studies.

The Department supplies computer hardware and software to centres and not to individual schools. The department has however always been willing to give advice, both technical and educational, to schools interested in acquiring computers, but refrains from recommending a specific make of computer or supplier. However, in 1986 all schools were advised to acquire MS-DOS technology in future as this was the direction that the department intended to pursue.

In terms of computer software, it has always been CED's policy not to develop their own (in-house) CAL or any other software. Owing to the manpower and financial demands of educational software development, the department's policy is to leave such development to the private sector and to commission software developers if a justified demand for any software should arise, or to purchase proven programs if considered necessary.

At the beginning of 1990 seven Regional Computer Coordinators were appointed, one at each teachers centre. Their primary task is to provide computer literacy training for serving teachers and to support educational computing activities at schools. The appointment of the coordinators introduced a new era in the history of educational computing in the Cape Education Department. Through personal communication with a spokesperson of CED early in 1990, the department's then 'new' computers-in-schools policy was outlined as follows (Waker 1990: pers.comm.):

- a) the Department encourages the effective use of computers in all aspects of education;

- b) the Department encourages the integration of computers into the curriculum, but that it leaves the degree of integration up to the individual schools and teachers. The reason for this ad hoc ruling is that not all schools have computers in sufficient numbers and that few, if any, teachers have received formal training in the integration of computers in the curriculum; and
- c) the policy has three aims, namely to
- provide pupils with an appropriate degree of computer literacy;
 - encourage the use of the computer as a learning aid whenever it is appropriate and where it can be done effectively; and
 - provide a tool for teachers when appropriate.

At the time it was stated that these aims would stay largely dormant until such time as schools have sufficient computers, as well as an adequate number of computer literate teachers.

During 1990, teachers, grouped according to specific subject areas, attended 'computers-in-education' in-service courses at Stellenbosch, presented by the seven regional computer coordinators. The aim of these five-day courses was to train teachers to integrate tool-type software in the curricula of their subjects. During 1991 the same type of courses were offered on a decentralized basis, at the different teachers' centres.

In 1990 CED purchased an administrative program, SASPAC, and distributed it free of charge to all primary and secondary schools under its jurisdiction. Full support and training for this program is offered by the seven regional computer coordinators.

The above is in brief an outline of the Cape Education Department's policy on educational computing as it existed before September 1991. As shall be seen however, the publication of the NTB/HSRC's report on computer literacy and the announcement of CED's CISC Project do signal a more secure position for educational computing activities in South Africa as a whole, and specifically in schools under the jurisdiction of the Cape Education Department.

6.3 **NTB/HSRC INVESTIGATION INTO THE TRAINING OF COMPUTER EXPERTS AND COMPUTER LITERATES IN THE RSA**
(Human Sciences Research Council Report 1991)

6.3.1 **Introduction**

The Commission for Administration requested the National Training Board (NTB) to conduct a comprehensive inquiry into the problem of an imbalance between the demand for and the availability of computer experts and computer literates. The research was undertaken jointly by the NTB and the HSRC.

The main objective of the investigation was to increase the supply of computer experts and computer literates by giving attention to training, while bearing in mind educational policy. The report suggests that this objective can best be achieved through a specific plan of action.

6.3.2 **Plans of action**

In total six plans of action were proposed.

Plan of action 1: Awareness programme

The population at large must be made aware of the present and future importance, place, benefit and application of information technology. This programme must be put into operation from January 1993.

Plan of action 2: IT as an instructional aid

A programme must be launched to apply IT as an instructional aid in formal and non-formal education, including manpower training. Plans must be developed to promote and to use computer-assisted instruction (CAI) in formal school and non-formal education at national level. To put these plans into operation in January 1994, adequate computer equipment must be provided to all those schools able to employ it effectively for CAI.

Plan of action 3: Computer literacy

By the year 2000 all school leavers must be functionally computer literate from Standard seven. Compulsory computer literacy courses and guidelines must be established for the integration of computers into the pre-service training curriculum for all teachers of all education departments before December 1994. In January 1996 computer literacy must be introduced as a compulsory part of the school curriculum. To achieve this, adequate computer equipment (e.g. one computer for 50 students) must be provided to all schools before December 1995. Before 1994 at least one computer per classroom (for use by the teacher) must be provided for all schools in South Africa.

Plan of action 4: Synergy between training institutions

The respective training institutions must co-operate effectively and synergistically in order to satisfy the need for computer experts and computer literates. A forum for regular annual contact between instructors and the IT industry must be created.

Plan of action 5: An alliance between the parties involved

An alliance must be established between the public sector, training institutions and the computer industry in order to, for instance, promote the efficient and cost-effective application of information technology in a developing country and to make South Africa, by the year 2000, a 'winning nation' in information technology.

Plan of action 6: Establishment of "the body"

'A body' must be established which can function as a facilitator of the programmes of action designed to execute the strategy. Plan 6 is therefore one of the first tasks that must be accomplished.

6.3.3 Elucidation

There are various strong and weak points, opportunities and threats embedded in the present educational computing scenario in South Africa that might strongly influence the achievement of the mission summarized above. Only time will tell whether it will be fulfilled and it will be very difficult, if not impossible to keep to the target dates set in

the report.

It appears, that the CISC-project of the Cape Education Department, outlined below, has been developed in close collaboration with the proposed national policy.

6.4 **COMPUTERS IN SCHOOLS AND COLLEGES PROJECT (CISC)**

(Cape Education Department 1991, circular minute)

Most of the information used to describe the project was obtained from a circular minute, distributed by the Cape Education Department. Any other references will be cited where appropriate.

6.4.1 **Introduction**

The Department of Education and Culture: House of Assembly decided in 1990 that, subject to the availability of funds, the different Departments of Education under its jurisdiction (that is, the Transvaal, Natal, Orange Free State and Cape Province Education Departments) would each initiate projects to make computers available for teaching and learning to all schools and colleges of education under its jurisdiction. The project was to become operational in 1991. For the project to be viable it is estimated that another 19 839 computers and 4 961 printers will have to be made available to schools and colleges over the next 10 years, over and above those already in the schools (Human Sciences Research Council Investigation 1991).

6.4.2 **Aims of the CISC-project**

The general aim of the project is to offer every pupil the opportunity to reach a minimum level of computer literacy and to utilise the possibilities of the computer in order to improve the quality of teaching and learning.

The specific objectives are:

- a) to expand initial teacher training to include some form or other of computer training for all student teachers;
- b) to involve a significant number of the teaching staff in some form or other of computer training through in-service training;
- c) to integrate the use of the computer for teaching and learning across the curriculum;
- d) to acquire and develop sufficient quantities of suitable educational software; and
- e) to issue all schools, where appropriate, with enough hardware and software to
 - o offer computer literacy training to the maximum number of pupils;
 - o to make Computer Studies as a school subject available to as many pupils as possible; and
 - o use the computer as a teaching medium in order to improve the quality of teaching and learning.

6.4.3 Implementation

The project is being implemented simultaneously by all four education departments attached to the Department of Education and Culture: House of Assembly. Some aspects of the project, for example curriculum affairs, the development/acquisition of educational software etc, will be dealt with at interdepartmental level.

The departments nonetheless retain their autonomy in the actual implementation of the project. The Cape Education Department has started supplying computer hardware and software

- o to colleges of education to enable them to offer computer training during initial teacher training; and
- o to teachers' centres to provide in-service training to teachers in the region.

The department has also selected seven schools (one for each teachers' centre region) which will serve as 'project schools' so as to:

- determine guidelines for curriculum development and the development of software;
- test computer teaching methods;
- test educational computer programs; and
- test various hardware configurations.

6.4.4 Hardware and software facilities

Schools will eventually be issued with one computer per 50 pupils at the most. For every four computers a printer and printer sharer will be issued. The short term aim is to supply each school with at least two computers and one printer. The computer equipment may be used only for subject teaching, the computer literacy programmes of the school, in-service teacher training, school computer clubs and other educational uses.

The software programs that will be supplied are the operating system, 'MS-DOS', and an integrated package, 'Microsoft Works'. There is also a possibility that schools might receive 'PC-LOGO' and a desktop publishing program. Initially the integration of word processing, spreadsheets, data bases and graphics with ordinary subject teaching will be emphasised. At a later stage educational computer programs (drill-and-practice, tutorials, etc) will receive more attention. The National Film Library will act as a 'clearinghouse' for educational software and will handle the development, acquisition and distribution of educational software as part of the project.

All consumable items (disks, ribbons, etc) must be financed from the schools' own funds. As soon as a school receives more than four computers, a suitably secure room will be a requirement.

6.4.5 Training of teachers and pupils

Departmental training at the teachers' centre will comprise basic training only in computer use, and will mainly be based on 'Microsoft Works' (word processing, spreadsheets, databases and graphics). For the current financial year schools have been asked to

nominate two, preferably experienced, teachers who could take the lead in the CISC-project at the school. The department realizes that its present training programme does not make enough provision for training teachers to integrate computer use in the curriculum. The department plans to train up to 2 100 teachers per year in the first five years of the project. The training incorporates a 40-hour course over four consecutive school days for groups of between 12 and 20 teachers.

The department also suggests that it is of the utmost importance that individual schools should design an effective and continuous internal in-service training programme. Such internal training must take place outside school hours and the school must bear the cost of training.

According to the department, the way in which teachers utilize the computer should eventually advance to a point where the computer is integrated into the curriculum. To achieve this the training of the teachers will have to take place in the following phases, identified by the Cape Education Department:

- Phase 1: Basic computer training at the teachers' centre and/or through internal in-service courses.
- Phase 2: Mastery of the computer as everyday tool. Teachers should be encouraged to use the computer for experimentation and for applications that they may need in their work.
- Phase 3: Mastery of the computer as a teaching aid. The emphasis will shift from general use of the computer to the utilisation of the computer in subject teaching.

It is also stated that as soon as a sufficient number of computers becomes available, computer literacy for pupils should commence. All pupils should be involved. The department states further, that the computer literacy training of pupils must be completed as soon as possible and that the computers must be used for subject teaching, where further computer skills will be acquired through computer use across the curriculum.

6.5 SUMMARY

In this chapter the CED policy as it existed before the announcement of the CISC Project in September 1991 was described. The CISC Project, a bold and futuristic initiative of the CED, and the NTB/HSRC report, on the training of computer literates in the RSA, were outlined to show what are centrally planned for educational computing in schools.

CHAPTER 7 : CONCLUSIONS AND RECOMMENDATIONS

7.1 FINAL CONCLUSIONS

The purpose of this study was to determine the status of educational computing in high schools under the jurisdiction of the Cape Education Department, that is, to describe the present situation in terms of computer acquisition and utilization in these schools. The problem was complex in that these schools have been functioning without any specific educational computing guidelines provided at national level and within broad parameters provided by their department.

This study can be brought to a close with an elucidation of the seven subsidiary questions that were initially posed to explicate the research problem: the status of educational computing in CED secondary schools.

1. How far are teachers in these schools equipped to handle educational computing activities?

The research revealed that a large percentage (between 20 and 30 percent) of secondary teachers attached to the Cape Education Department can be regarded as computer literate. This conclusion is supported by the following facts: more than 20% of the teachers have computer facilities at home, more than 20% use word-processing with confidence and more than 30% use a computer for word-processing activities such as typing and storing examination papers, work sheets etc. This is in contrast with the findings of the HSRC who found only 400 (1½%) of the nearly 27 000 teachers, attached to the Transvaal Education Department (with nearly the same composition of teaching staff as CED), to be computer literate (Human Sciences Research Council Investigation 1991).

Furthermore, it was established that at least 10% of the teachers had followed a computer course during pre-service training: the skills acquired in these courses, were not investigated. If it is accepted that there must be more to being 'educationally computer literate' than having the ability to use the computer

merely for word processing, the research revealed that most teachers are not educationally computer literate in that they have not been trained in the didactics of computer literacy or in the use of the computer across the curriculum.

2. What computer equipment has been acquired, to what extent is it being utilized, and where is it being housed?

With more than R4,2 million having been spent over the past 10 years on computer equipment it is logical to deduce that large numbers of computers have found their way into secondary schools of the CED. Owing to the department's foresight in 1986, most of the schools acquired MS-DOS technology, which leaves those schools (and the Department) in a very good position to keep abreast of educational computing activities world-wide.

Computers in schools are however, largely being employed for administrative applications and as productivity tools for teachers (Table 5-6). A little more than half of the schools with computers indicated that they offer computer literacy classes to their pupils. Although the content presented in these courses is not known, tables 5-16 and 5-17 show that pupils are largely involved in these courses. One area, which recent research promotes extensively, that of the computer across the curriculum, is largely absent from the computer activities of the schools surveyed.

This is borne out by the fact that the secondary schools are housing most of their computers in a secure 'computer room' while there is an almost complete lack of computers in classrooms. A promising sign however, is the fact that many schools indicated that computer facilities are available for staff use (see precautionary measures for computer integration - Chapter 5).

3. What type of software is being utilized and for which purpose?

The research findings revealed that 90% of those secondary schools with computers use them, amongst other activities, for administrative functions. The administrative software package, SASPAC which is supplied by the Department

is by far the most popular administrative package and is set to become the standard package for computerizing administrative functions in all the schools of this department.

Generic (open-ended) software, especially word-processing and desktop publishing, are being used extensively in school administration as a tool for the teacher and in computer literacy courses. However, few schools use this type of software across the curriculum (Table 5-10), which is again contrary to the approach being promoted in many overseas countries as well as locally.

The use of subject-specific CAL in these secondary schools is also relatively marginal, with only a small impact in subjects such as Mathematics and Physical Science, but interestingly enough also in Typing, Afrikaans and English. The shortage of applicable, quality educational software in South Africa must be the single most important reason for this situation. The use of authoring systems to develop CAL lessons is virtually non-existent in secondary schools of the CED. The reason for this is that very few teacher training institutions offer software development, both during pre-service training or on a part-time basis for in-service teachers.

4. What influenced schools in their initial acquisition and subsequent expansion of computer facilities?

It was shown (Table 5-14) that the Principal (top structure), staff and parents were the major pressure groups during the initial acquisition of computer facilities for the school. The most important reasons given for the initial acquisition of computers, namely that computers can a) improve the school's administration, and b) enrich existing curricula (Table 5-15) support this conclusion.

However, it appears that most of the parents, did not sustain their support for the expansion of computers facilities at the school. These parents most probably did not realize that a school would be most likely to use its first computers largely for administrative and teacher training purposes, thus allowing very few pupils the

opportunity to get 'hands-on' experience; pupils would only start benefitting once the initial computing facilities were expanded. The research findings indicated that by then the parents had already lost much interest.

Although it has been indicated that the pedagogic rationale was very significant for the introducing of computers, this survey also revealed that, in practice, its actual implementation had not materialised.

5) What types of computer activities are pupils involved in?

It is clear that many of the schools with computers try to offer a wide spectrum of computer activities to their pupils (Table 5-16), but that in many cases only 'a few pupils' can be accommodated: this can be attributed largely to the shortage of hardware and software and of skilled, motivated teachers.

6) Why have certain schools not yet acquired computers?

Most of the schools without computers cited either the lack of money or the fact that their staff do not possess the necessary computer training and/or experience as reasons for them not having acquiring computer facilities. Very few of these undervalue the educational merit for computers in schools and it can therefore be assumed that if their monetary and staff situation improve, they will acquire computers.

Although the research data did not attempt to show which schools have not acquired computers, it can be assumed that they are the smaller schools in rural areas - schools where there is a lack of funds and/or computer-trained staff. Smaller schools might also be of the opinion that their administrative procedures do not warrant computerization.

7) Have sufficient advances in educational computing been made to serve as a foundation for the CISC Project launched in August 1991?

The large number of computers that have been acquired and the number of formally, but inadequately, trained teachers indicate that the CISR Project is long

overdue. Many secondary schools which acquired computer facilities over the past 10 years have never progressed past using the computer for administrative functions and/or computer literacy classes for a few pupils - thus the computer has had very little impact on the quality of teaching/learning. This is contradictory to the belief that computers in schools can only be justified if they enhance the teaching/learning processes (Thompson 1988).

As the necessary infrastructure of hardware and human resources already exists at many of the secondary schools under the jurisdiction of the CED it should not be necessary for the CISC Project to start with phase 1 in all schools - some schools should be allowed to progress faster. The project should be implemented in such a way as to achieve its broad educational objectives, rather than simply as an exercise in hardware provision to schools: schools who in most cases already have more than two computers!

7.2 A SUMMARY OF RECOMMENDATIONS

The 'computers-in-education'-phenomenon has already made a significant impact in schools: be it as a catalyst for more effective school administration or as a vehicle to provide pupils with the necessary computer skills needed in their future occupations. In South Africa however, the fluidity of the decentralised 'educational computing' policies of the different education departments, had a limiting effect on the momentum and impact of computers in education in general.

Therefore, immediate attention should be given to the establishment of a 'National Educational Computing Commission' with its main task the establishment of a 'national educational computing policy' for South Africa. Such a policy should centralize decision making on the role of the computer in education, provide equitable financing and effect uniform teacher training. It is important that this 'commission' receives statutory recognition and should therefore best be instituted at Department of National Education-level. The 'committee' should also be responsible for the longitudinal monitoring of 'educational computing' in South Africa in the future.

A prerequisite for the implementation of any educational computing programme based on a national educational computing policy, would be a national study to determine the present status of educational computing in South Africa: it should investigate, for instance, what computing facilities have been acquired, the extent of teachers' training, computer-assisted learning practices and software development and implementation. Can any programme be implemented successfully before such an in-depth situation analysis has been undertaken? To guard against expensive miscalculations a practical investigation into recent school-curriculum innovations world-wide should also be undertaken.

Another area to which attention should be drawn is the co-ordination of pre-service teacher computer training. It appears that a large degree of disparity exists between the colleges of education that fall under the jurisdiction of the different departments of education and independent institutions such as universities, with regard to 'educational' computer literacy training for aspirant teachers. Colleges of education, largely responsible for primary teacher training, offer clearly defined three- or four-year educational computer literacy courses to their students, whereas many universities, training mostly secondary teachers, offer a one-year course in functional computer literacy only. These functional or basic computer literacy courses place very little or no emphasis on the didactical aspects of the computer in education. These courses should aim at producing well-trained student teachers, competent in the application of computing in teaching.

The government should support both schools and teachers in their acquisition of hardware and software. Firstly, hardware and software for educational purposes should be exempted from import duties and the deduction of value added tax should also be considered. Secondly, teachers who acquire their own computers ought to be allowed to deduct the initial capital outlay and operating expenses such as paper, ribbons etc. from their taxable income.

The establishment of a national software 'clearing-house', under the jurisdiction of the previously proposed 'National Educational Computing Commission' to coordinate all software related aspects of education is recommended. Such a clearinghouse should

gather, evaluate and disseminate educational software in South Africa. It would also have to ascertain the extent of software needs and then initiate and coordinate software development and/or negotiate for the acquisition thereof from the private sector.

Finally, it has been stated that the only justification for computers in education is if their introduction result in better teaching and learning. However, the growing need for computer literacy of the population as a whole needs also be addressed. Integrating the computer 'across the curriculum' has been posed as a solution to both these pedagogic and vocational requirements. This educationally sound approach does offer many opportunities to improve teaching and learning, to enrich present curricula and to help pupils obtain certain basic and advanced computer literacy skills.

7.3 AREAS WHERE FURTHER RESEARCH IS NEEDED

The following areas for further research are recommended:

1. The broad and relatively un-researched area of computer integration in the curricula of all subjects.
2. The didactical aspects of computer literacy training and computer-in-the-curriculum activities.
3. The development and evaluation of educational software for South African needs.
4. Teachers' attitudes towards the computer and its role in education.
5. The computer's role in multi-media applications.
6. The possibilities of the computer in the classroom through action-research in small-group situations.
7. The development of computer-related curriculum materials and teaching methods (processes).

7.4 FINAL SUMMARY

In this study an attempt was made to illustrate the status of educational computing in secondary schools of the Cape Education Department. A literature survey on educational

computing theory and practices was undertaken in an attempt to elucidate the field of study and emphasise new directions in the area of educational computing. A field survey was conducted to determine schools' computer facility acquisition and utilization: the findings of this survey were interpreted and certain recommendations have been made.

The success of the Cape Education Department's 'Computers in Schools and Colleges' project will to a large extent depend on how the computer facilities' foundations that have already been laid in these schools are built upon. Therefore this study, as an attempt to illuminate the present situation, vis-à-vis computers in secondary schools, could be of value to policy- and decisionmakers.

APPENDIX A

IDENTIFIED COURSE REQUIRED FOR TEACHER EDUCATION

**DEPARTMENT OF EDUCATION AND CULTURE
ADMINISTRATION: HOUSE OF ASSEMBLY**

FURTHER DIPLOMA IN EDUCATION: COMPUTER LITERACY

1. AIM

The course aims to provide in-service training for teachers to promote general computer awareness, computer literacy and basic principles of computer-assisted training.

2. NEEDS

In implementing the computer as an educational medium throughout the school curriculum and in ensure its effective use, extensive training of teachers in the use of the computer is crucial. As many teachers as possible must be reached.

3. COURSE STRUCTURE

The course structure must meet the requirements as set out in paragraph 13.2.4(1) of the Criteria. This paragraph reads as follows:

"The course must consist of at least five courses comparable with university courses, structured according to one of the following patterns: 2-1-1-1, 2-2-1. 2-3 or 3-1-1."

4. GUIDE-LINES FOR COURSE CONTENT

Facets that should be addressed in the course, include:

a) **Basic knowledge including the following:**

- Introduction to computer systems
- The components of a computer (CPU and peripherals)
- Uses and limitations of computers
- Software and operating systems
- Basic principles of data processing
- The organisation and handling of data
- Data communication and computer networks
- The development of an information system

b) **The computer as tutor**

Application of task-directed, specially developed software to perform a specific instructional task, including:

- tuition packages
- drill packages
- simulations
- games (educational and other)
- evaluation and testing packages

Since such software is used in single computers in the classroom as well as in networks, knowledge of the application possibilities in both environments is required.

c) **Utilisation of standard packages**

In order to ensure the use of standard applications, knowledge of standard packages such as

- data bases

- word-processing packages
- spreadsheets
- graphics packages

is applied for the recording or manipulation of subject related data according to the requirements of the discipline concerned and within the limitations of the software in question.

d) Didactics

5. PROCEDURE

Institutions wishing to offer a Further Diploma in Education: Computer Literacy, are requested to submit the course in the usual manner to the Advisory Committee for Training of Teachers.

Enquires in connection with the course should be addressed to:

The Head
Directorate Teacher Training
Department of Education and Culture
Private Bag X55
PRETORIA
0001
Tel: (012) 200534

APPENDIX B**IDENTIFIED COURSE REQUIRED FOR TEACHER EDUCATION**

**DEPARTMENT OF EDUCATION AND CULTURE
ADMINISTRATION: HOUSE OF ASSEMBLY**

FURTHER DIPLOMA IN EDUCATION: SOFTWARE DEVELOPMENT**1. AIM**

The course is intended to train currently practising teachers to development software.

2 NEEDS

The development of suitable educational software for the application of the computer as teaching aid must as far as possible be undertaken by knowledgeable educational programmers. A limited selected number of enthusiasts from the teaching profession should be trained for this task.

3. COURSE STRUCTURE

The course structure must meet the requirements as set out in paragraph 13.2.4(1) of the Criteria. This paragraph reads as follows:

"The course must consist of at least five courses comparable with university courses, structured according to one of the following patterns : 2-1-1-1, 2-2-1, 2-3 or 3-1-1."

4. GUIDE-LINES FOR COURSE CONTENT

The following elements may be considered for inclusion in the course:

a) **Programming via application of**

- operating systems (such as MS-DOS)
- highlevel programming language (such as C or PASCAL, in order to make the transfer of developed software possible from one operating system to another)
- authoring systems

b) **Knowledge of**

- artificial intelligence (AI)
- expert systems

c) **Programming methodology, including**

- algorithms
- subroutines
- reproduction of information and control structures
- graphics
- program structure
- documentation

d) **Bugs and debugging**

e) **Characteristics of**

- games
- drill programmes
- simulations
- testing
- knowledge-transfer software

- f) **Applications in a multimedia environment**
- g) **Applicable didactics**
- h) **Criteria for the evaluation of software**

5. **PROCEDURE**

Institutions wishing to offer a Further Diploma in Education : Software Development, are requested to submit the course in the usual manner to the Advisory Committee for Training of Teachers.

Enquires in connection with the course should be addressed to:

The Head
Directorate Teacher Training
Department of Education and Culture
Private Bag X55
PRETORIA
0001
Tel: (012) 200534

APPENDIX C

CODE :

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RESEARCH PROJECT : COMPUTERS IN EDUCATION

TOPIC

EDUCATIONAL COMPUTING IN SECONDARY SCHOOLS OF THE
CAPE EDUCATION DEPARTMENT : A RESEARCH SURVEY TO ASSESS
COMPUTING FACILITY ACQUISITION AND ITS UTILIZATION

QUESTIONNAIRE FOR HEAD MASTERS

CONFIDENTIALITY :

All information gathered by means of this questionnaire is strictly confidential and will only be used for research purposes

PLEASE NOTE :

1. Kindly complete the questionnaire as follows :
 - 1.1 Sections A and F : *High Schools without ANY computers*
 - 1.2 Sections A to E : *High Schools with ONE or more computers*
2. Please return the completed questionnaire **BEFORE 6 AUGUST 1991** in the addressed envelope.
3. Use the "ticks" in the blocks to separate digits of numbers.

FOR EXAMPLE :

"64" --->

6	4
---	---

or "5" --->

5

4. Please make a tick () when indicating options.
-

SECTION A : GENERAL

SECTION A MUST BE COMPLETED BY ALL SCHOOLS,
I.E. THOSE WITH AND THOSE WITHOUT COMPUTERS.

OFFICE USE

					1	5
--	--	--	--	--	---	---

1. NUMBER OF TEACHERS ON THE STAFF ? 7
(SECONDARY PHASE ONLY)

2. NUMBER OF PUPILS IN THE SCHOOL ? 11
(STD 6 AND HIGHER ONLY)

3. MEDIUM OF TEACHING ? (Mark with a "✓")

- 3.1 Only Afrikaans
- 3.2 Only English
- 3.3 Afrikaans and English
- 3.4 Other _____

						12
--	--	--	--	--	--	----

4. HOW MANY TEACHERS ON THE STAFF HAVE COMPUTER FACILITIES AT HOME ? 14

5. HOW MANY TEACHERS ON THE STAFF OBTAINED A FORMAL QUALIFICATION IN COMPUTER SCIENCE (i.e. I, II, III, etc)

- 5.1 AS PART OF A DEGREE COURSE ? 16
- 5.2 THROUGH PART-TIME STUDY (non-degree purpose) ? 18

6. HOW MANY TEACHERS ON THE STAFF DID A COMPUTER COURSE* AS PART OF THEIR INITIAL TEACHER'S TRAINING (* i.e. Computer literacy with no or little programming) ? 20

7. HOW MANY TEACHERS ON THE STAFF DID AN EXTRA-MURAL COMPUTER COURSE* (* i.e. in programming and/or computer literacy, but not computer science)

- 7.1 AT UNIVERSITY 22
- 7.2 AT TECHNIKON 24
- 7.3 AT A TECHNICAL COLLEGE 26

8. HOW MANY TEACHERS ON THE STAFF HAVE ATTENDED AN IN-SERVICE TRAINING COURSE*, IN "COMPUTERS IN EDUCATION", OFFERED BY THE CAPE EDUCATION DEPARTMENT.

OFFICE USE

(* excluding training for the administrative program - SASPAC)

8.1 AT DENNEOORD ?

28

8.2 AT THE LOCAL TEACHERS' CENTRE ?

30

9. HOW MANY TEACHERS ON THE STAFF DID A COMPUTER COURSE* WITH PRIVATE CONSULTANTS (* eg. training courses)

9.1 IN PROGRAMMING ?

32

9.2 IN COMPUTER LITERACY ?

34

10. HOW MANY TEACHERS ON THE STAFF HAVE COMPUTER TRAINING EXPERIENCE IN A WORK SITUATION OUTSIDE EDUCATION ?

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36

11. HOW MANY TEACHERS ON THE STAFF ARE FAMILIAR WITH THE FOLLOWING SOFTWARE ?

USE THE FOLLOWING FIVE POINT SCALE IN ANSWERING :

KEY :	1. = USE IT WITH CONFIDENCE					
	2. = USE IT WITH LITTLE CONFIDENCE					
	3. = TRIED TO USE IT, BUT ABANDONED IT					
	4. = HEARD OF IT, BUT HAVE NOT USED IT					
	5. = HAVE NOT HEARD OF IT					
<i>Write the no. of teachers applicable to the option in each block</i>						
	1 2 3 4 5					
eg. WORD PROCESSING	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px; text-align: center;">3</td> <td style="width: 20px; text-align: center;">5</td> <td style="width: 20px; text-align: center;">7</td> <td style="width: 20px; text-align: center;">2</td> <td style="width: 20px; text-align: center;">1</td> </tr> </table>	3	5	7	2	1
3	5	7	2	1		
NB : An empty block will be taken as 0 (null)						

	1	2	3	4	5	OFFICE USE
11.1 WORD PROCESSING (Word Perfect; Pfs, Etc)						46
11.2 DATA BASE (D.Base III+, Hypertext, Etc)						56
11.3 SPREADSHEET (Lotus 1-2-3 Etc)						66
11.4 PROGRAMMING (Basic, Pascal, Logo, Etc)						76
11.5 EDUCATIONAL SOFTWARE (CAL* in Maths, Science Etc)						15
11.6 EDUCATIONAL AUTHORIZING SYSTEMS (Quest, Tencore, Etc)						25
11.7 DESK TOP PUBLISHING (News Master, Ventura, Etc)						35
11.8 ADMINISTRATION SYSTEM (Saspac, Skoolwerk, etc)						45

					2	5
--	--	--	--	--	---	---

12. HOW MANY OF THE TEACHERS ON THE STAFF USE A COMPUTER :

12.1 TO TYPE AND STORE EXAMINATION PAPERS, WORK SCHEMES, COURSE NOTES, ETC. ?	<input type="checkbox"/>	47
12.2 TO KEEP RECORD OF TEST MARKS and/or OTHER STATISTICS ?	<input type="checkbox"/>	49
12.3 TO TEACH CERTAIN ASPECTS OF THEIR SUBJECTS		
12.3.1 in the computer room ?	<input type="checkbox"/>	51
12.3.2 in the classroom ?	<input type="checkbox"/>	53

13. HOW MANY TEACHERS REGULARLY ATTEND THE "COMPUTERS IN EDUCATION"- <u>STUDY GROUP'S MEETINGS</u> AT THE TEACHERS' CENTRE ?	<input type="checkbox"/>	55
---	--------------------------	----

SECTION B : COMPUTER EQUIPMENT

SECTION B MUST ONLY BE COMPLETED BY SCHOOLS WITH ONE OR MORE COMPUTERS

1. ROUGHLY ESTIMATE THE AMOUNT OF MONEY THAT THE SCHOOL HAS SPEND ON THE ACQUISITION OF COMPUTER FACILITIES (HARDWARE + SOFTWARE) OVER THE FOLLOWING PERIODS :

1.1	1981 - 1985	R	<input type="text"/>
1.2	1986 - 1989	R	<input type="text"/>
1.3	1990 - 1991	R	<input type="text"/>

<input type="text"/>	<input type="text"/>	57
<input type="text"/>	<input type="text"/>	59
<input type="text"/>	<input type="text"/>	61

2. HOW MANY COMPUTERS DOES THE SCHOOL HAVE AT THE FOLLOWING LOCATIONS ?
 (Also indicate whether they are IBM-compatible type computers)

<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	3	5
----------------------	----------------------	----------------------	----------------------	----------------------	---	---

- 2.1 GENERAL OFFICE
 (for secretarial duties)
- 2.2 GENERAL OFFICE/STAFF ROOM
 (as a tool for teachers)
- 2.3 HEAD MASTER'S OFFICE
- 2.4 SENIOR STAFF-OFFICES
- 2.5 MEDIA CENTRE (Library)
- 2.6 CLASSROOMS
- 2.7 COMPUTER LAB/ROOM

ALL TYPES NO.	Number of IBM-compatible < 640K RAM	Number of IBM-compatible ≥ 640K RAM
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	==> NO OF COMPUTERS IN THE SCHOOL	

<input type="text"/>	11
<input type="text"/>	17
<input type="text"/>	23
<input type="text"/>	29
<input type="text"/>	35
<input type="text"/>	41
<input type="text"/>	47
<input type="text"/>	49

3. HOW MANY OF THE FOLLOWING COMPUTER-RELATED DEVICES DOES THE SCHOOL HAVE ?

3.1	Printer	<input type="text"/>	51
3.2	Printer sharer (splitter box)	<input type="text"/>	53
3.3	Mouse	<input type="text"/>	55
3.4	Plotter	<input type="text"/>	57
3.5	Modem	<input type="text"/>	59
3.6	Optical Scanner	<input type="text"/>	61
3.7	Magnabyte (for overhead projector)	<input type="text"/>	63
3.8	Robot-arm	<input type="text"/>	65
3.9	Other _____	<input type="text"/>	67

4. SOFTWARE

4.1 ADMINISTRATION SYSTEM

4.1.1 Is the school using an administration software package ? YES NO 68

If "YES",
please give the name of the administrative package that the school is using :

.....

If "NO",
please list the reason/s why not : and ignore question 4.1.2 :

.....

.....

4.1.2 Does the school experience any problems with the present administration program ? YES NO 69

If "YES", please list some of the more serious problem/s :

.....

.....

.....

4.2 EDUCATIONAL SOFTWARE

IS THE SCHOOL USING EDUCATIONAL SOFTWARE SPECIFICALLY WRITTEN FOR ANY OF THE FOLLOWING SUBJECTS ? :

(ALSO INDICATE WHAT TYPE OF EDUCATIONAL SOFTWARE IT IS)

(Mark the appropriate blocks with a "✓")

* Computer assisted learning
Computer assisted instruction

Drill+ Practice	*CAL/ CAI	Game	Simulation	Other
4.2.1	Accounting			
4.2.2	Afrikaans			
4.2.3	Art			
4.2.4	Bible Education			
4.2.5	Biology			
4.2.6	Business Economics .			
4.2.7	Economics			
4.2.8	English			
4.2.9	Geography			
4.2.10	History			
4.2.11	Mathematics			
4.2.12	Music			

4.2.13 Physical Science ..
4.2.14 Typing

4.2.15 Wood-/Metalwork ...
4.2.16 OTHER
_____ ..

4.2.17 OTHER
_____ ..

4.2.13	Physical Science ..			
4.2.14	Typing			
4.2.15	Wood-/Metalwork ...			
4.2.16	OTHER _____ ..			
4.2.17	OTHER _____ ..			

OFFICE USE

					4	5
--	--	--	--	--	---	---

						10
						15
						20
						25
						30
						35
						40
						45
						50
						55
						60
						65

					5	5
--	--	--	--	--	---	---

						10
						15
						20
						25
						30

4.3 GENERIC SOFTWARE (OPEN-ENDED SOFTWARE)

IS THE SCHOOL USING ANY OF THE FOLLOWING GENERIC-TYPE SOFTWARE ?

OFFICE USE

					6	5
--	--	--	--	--	---	---

PLEASE INDICATE IN WHICH AREA/S THIS SOFTWARE IS BEING UTILIZED :

- A - ADMINISTRATIVE
- B - TOOL FOR THE TEACHER
- C - IN SUBJECT CURRICULA
- D - COMPUTER LITERACY
- E - PROGRAMMING
- F - OTHER

(Mark the appropriate blocks with a "✓")

	A	B	C	D	E	F								
4.3.1 WORD PROCESSOR (eg. Pfs)							<table border="1"><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table> 11							
4.3.2 DATA BASE (eg. DBase III+)							<table border="1"><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table> 17							
4.3.3 SPREADSHEET (eg. Lotus 1-2-3)							<table border="1"><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table> 23							
4.3.4 GRAPHICS GENERATOR (eg. H.P. Graphics)							<table border="1"><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table> 29							
4.3.5 TEST GENERATOR (eg. Question Mark)							<table border="1"><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table> 35							
4.3.6 PROGRAMMING LANGUAGE (eg. Pascal)							<table border="1"><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table> 41							
4.3.7 AUTHORING SYSTEMS (eg. Quest)							<table border="1"><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table> 47							
4.3.8 DESK TOP PUBLISHERS (eg. News Master)							<table border="1"><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table> 53							

OFFICE USE

				7	5
--	--	--	--	---	---

SECTION C : PRESENT UTILIZATION OF COMPUTERS IN THE SCHOOL

SECTION C MUST ONLY BE COMPLETED BY
 SCHOOLS WITH ONE OR MORE COMPUTERS

1. ATTEMPT TO GIVE A ROUGH ESTIMATE OF THE NUMBER OF HOURS PER WEEK THAT
 COMPUTER FACILITIES ARE BEING UTILIZED IN THE FOLLOWING AREAS :

Also indicate the number-of-computers involved in these activities

	NO OF HOURS PER WEEK	NO OF COMPUTERS INVOLVED							
1.1 SCHOOL ADMINISTRATION	<table border="1"><tr><td></td><td></td><td></td></tr></table>				<table border="1"><tr><td></td><td></td><td></td></tr></table>				10
1.2 COMPUTER AS TOOL FOR TEACHERS	<table border="1"><tr><td></td><td></td><td></td></tr></table>				<table border="1"><tr><td></td><td></td><td></td></tr></table>				15
1.3 COMPUTERS IN THE CURRICULA OF SUBJECTS	<table border="1"><tr><td></td><td></td><td></td></tr></table>				<table border="1"><tr><td></td><td></td><td></td></tr></table>				20
1.4 COMPUTER LITERACY (pupils)	<table border="1"><tr><td></td><td></td><td></td></tr></table>				<table border="1"><tr><td></td><td></td><td></td></tr></table>				25
1.5 COMPUTERS IN THE MEDIA CENTRE (library tasks)	<table border="1"><tr><td></td><td></td><td></td></tr></table>				<table border="1"><tr><td></td><td></td><td></td></tr></table>				30
1.6 COMPUTER CLUB ACTIVITIES	<table border="1"><tr><td></td><td></td><td></td></tr></table>				<table border="1"><tr><td></td><td></td><td></td></tr></table>				35

2. DOES THE SCHOOL OFFER A COMPUTER LITERACY COURSE TO
 THE STAFF AS PART OF STAFF DEVELOPMENT ?

YES	NO
-----	----

	36
--	----

3. BRIEFLY LIST ANY PROBLEMS THAT THE SCHOOL MIGHT BE EXPERIENCING IN
 GETTING TEACHERS MORE INVOLVED IN "COMPUTERS IN EDUCATION"-ACTIVITIES ?

3.1

3.2

4. DOES THE SCHOOL OFFER COMPUTER COURSES/TRAINING TO

4.1 PARENTS OF PUPILS ?	YES	NO
4.2 PUPILS FROM OTHER SCHOOLS ?	YES	NO
4.3 OTHER GROUPS IN THE SOCIETY ?	YES	NO

	37
	38
	39

If "YES" to any of the above, please give a brief description of such
 activities :

.....

5. DOES THE SCHOOL SHARE ITS COMPUTING FACILITIES WITH ANY OTHER SCHOOL ?

YES	NO
-----	----

	40
--	----

If "YES" to the above, please give a brief description of such an agreement :

.....

OFFICE USE

 SECTION D : FACTORS WHICH INFLUENCED THE SCHOOL TO INTRODUCE COMPUTERS

SECTION D MUST ONLY BE COMPLETED BY SCHOOLS WITH ONE OR MORE COMPUTERS

1. WHICH "PRESSURE GROUPS" PLAYED A ROLE IN INTRODUCING AND EXTENDING COMPUTER FACILITIES AT THE SCHOOL ?

Please rank the THREE most important of the following "Pressure Groups", according to their role played in

- A. INTRODUCING computers at the school, and
- B. EXTENDING computer facilities at the school.

(Use rank 1 as most important and rank 3 as least important of the three)

	A. INTRODUCE	B. EXTEND	
1.1 Business sector			
1.2 Parents (informally)			
1.3 Parents (formally eg. PTA)			
1.4 Management Committee			
1.5 Pupils			
1.6 Staff			
1.7 Cape Education Department			
1.8 Top Structure (Principal + Deputy-Head)			
1.9 HSRC			
1.10 Computer Coordinator (Teachers' Centre)			
1.11 Other _____			

please turn over

2. HOW IMPORTANT WERE THE FOLLOWING REASONS IN THE SCHOOL'S INITIAL DECISION TO ACQUIRE COMPUTER FACILITIES ?

OFFICE USE

Please use the following scale to indicate the importance of each reason :

- NOT IMPORTANT
- IMPORTANT
- VERY IMPORTANT

- 2.1 Pupils should be unafraid of computers 63
- 2.2 Pupils should learn to operate computers in order to prepare them for their further study and/or future occupation 64
- 2.3 Pupils will learn Physics, Mathematics and certain other subjects better through computer-assisted learning (CAL) 65
- 2.4 Computers can enrich the existing curricula and improve the way in which they are delivered (taught) 66
- 2.5 Computers will improve the school's administrative and managerial efficiency. 67
- 2.6 Computers in the school will attract more pupils to enroll at the school 68
- 2.7 Computers encourage students to learn by collaborating rather than competing with other students 69
- 2.8 Since schools prepare pupils for life, they should prepare them to deal with computers in every-day life 70
- 2.9 Computers will help to lessen the workload of teachers and free them to be more effective in the classroom 71
- 2.10 To start a Computer Club at the school 72
- 2.11 Other : (PLEASE SPECIFY)
 _____ 73

 please turn over

SECTION E : NATURE OF PUPIL INVOLVEMENT IN EDUCATIONAL COMPUTING

OFFICE USE

				8	5
--	--	--	--	---	---

SECTION E MUST ONLY BE COMPLETED BY SCHOOLS WITH ONE OR MORE COMPUTERS

1. WHAT IS THE LEVEL OF PUPIL INVOLVEMENT IN THE FOLLOWING COMPUTER ACTIVITIES ?

PLEASE NOTE : Below each activity there is a brief description to elucidate the activity.

Please use the following scale to indicate the LEVEL at which pupils are involved in each of the activities :

- NONE

0

- ONLY A FEW PUPILS

1

- BETWEEN 10% AND 50% OF THE PUPILS

2

- MORE THAN 50% OF THE PUPILS

3

1.1 PUPILS TAKE COMPUTER STUDIES AS A SUBJECT

--

6

Indicate this activity even if pupils attend classes in Computer Studies at another center/school.

1.2 PUPILS LEARN PROGRAMMING AT SCHOOL, BUT THE SCHOOL DOES NOT OFFER COMPUTER STUDIES AS A SUBJECT

--

7

Pupils are being taught programming in BASIC, PASCAL, LOGO etc.- most probably as a component of a computer literacy course or on an extra-mural basis.

1.3 THE SCHOOL OFFERS A COMPUTER LITERACY PROGRAMME TO PUPILS ..

--

8

The programme usually includes a computer awareness component, but goes further and might include the teaching of skills associated with the use of a variety of application software including word processors, database managers, spreadsheets, graphics tools, etc.

1.4 THE SCHOOL OFFERS A COMPUTER AWARENESS PROGRAMME TO PUPILS

9

The programme might include such areas as computer vocabulary, computer ethics, how a computer works, advantages and disadvantages of the computer and common applications, but no or little hands-on experience.

1.5 THE SCHOOL ENDEAVOURS TO IMPROVE PUPILS' ABILITY TO SOLVE PROBLEMS BY USING A COMPUTER

10

Such a programme would rest on the belief that computers can facilitate students' ability to problem-solve. Students are assigned or choose problems to solve in a computer environment under the assumption that they will learn to be better problem-solvers in real world situations.

1.6 THE SCHOOL DELIBERATELY ENCOURAGES "COMPUTERS ACROSS THE CURRICULUM"

11

This entails the integration of computers with existing subject curricula. The computer becomes one more component of the overall teacher designed and implemented lesson plan.

1.7 A COMPUTER CLUB OPERATES IN THE SCHOOL AND FUNCTIONS AS AN EXTRA-MURAL ACTIVITY

12

A teacher is usually in charge, but his/her role might vary from being a coordinator only, to teaching programming to club members.

ANY OTHER WAY/S IN WHICH THE PUPILS MAY BE INVOLVED IN COMPUTING ACTIVITIES :

1.8

13

2. BRIEFLY LIST ANY PROBLEMS THAT THE SCHOOL MIGHT BE EXPERIENCING IN GETTING PUPILS MORE INVOLVED IN "COMPUTERS IN EDUCATION"-ACTIVITIES ?

OFFICE USE

- 2.1
- 2.2
- 2.3

SECTION F : WHY THE SCHOOL HAS NOT IMPLEMENTED COMPUTERS

SECTION F MUST ONLY BE COMPLETED BY SCHOOLS WITHOUT ANY COMPUTERS

1. USE THE FOLLOWING SCALE TO INDICATE THE RELATIVE IMPORTANCE OF THE FOLLOWING REASONS FOR THE SCHOOL NOT HAVING COMPUTERS :

- DOES NOT PLAY A ROLE

0

- PLAY A ROLE

1

- PLAY A VERY IMPORTANT ROLE

2

- 1.1 Lack of teacher's interest in educational computing

--

 14
- 1.2 Shortage of funds

--

 15
- 1.3 Lack of expertise on the staff

--

 16
- 1.4 Computers tend to increase the teacher's workload

--

 17
- 1.5 Parents have not identified the need for computers

--

 18
- 1.6 Pupils are not interested

--

 19

please turn over

		OFFICE USE
1.7	Computers are too expensive	<input type="checkbox"/> 20
1.8	Lack of quality educational software for high school subjects	<input type="checkbox"/> 21
1.9	More important priorities/projects to finance.	<input type="checkbox"/> 22
1.10	Pupils' programs are too full	<input type="checkbox"/> 23
1.11	Teachers are too busy to implement computers in education	<input type="checkbox"/> 24
1.12	Computers create an impersonal learning environment	<input type="checkbox"/> 25
1.13	Computers are only a craze. (Here today; gone tomorrow)	<input type="checkbox"/> 26
1.14	Computers can only be employed to teach basic, low-level skills	<input type="checkbox"/> 27
1.15	Due to a lack of knowledge, the school is afraid that it might buy the "wrong" computers and/or programs	<input type="checkbox"/> 28
1.16	The administrative load at the school can be handled without a computer	<input type="checkbox"/> 29

 THANK YOU FOR YOUR KIND COOPERATION

APPENDIX D

KODE :

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NAVORSINGSPROJEK : REKENAARS IN DIE ONDERWYS

ONDERWERP

ONDERWYSVERWANTE REKENAARAKTIWITEITE IN HOÛRSKOLE VAN DIE
KAAPLANDSE ONDERWYSDEPARTEMENT : 'N NAVORSINGSONDERSOEK NA DIE
OMVANG EN BENUTTING VAN REKENAARFASILITEITE.

VRAELYS AAN SKOOLHOOFDE

VERTROULIKHEID :

Alle inligting versamel met behulp van hierdie vraelys is streng
vertroulik en sal net vir navorsingsdoeleindes aangewend word

BELANGRIK :

1. Voltooi asseblief die vraelys soos volg :
 - 1.1 Afdelings A en F : Skole wat oor *GEEN* rekenaars beskik nie
 - 1.2 Afdelings A tot E : Skole wat oor een of meer rekenaars beskik
 2. Stuur asseblief die voltooide vraelys **VOOR 6 AUGUSTUS 1991** in die geadresseerde koevert terug.
 3. Gebruik die "merkies" in blokkies om syfers in die getalle te skei.
 BYVOORBEELD : "64" -->

6	4
---	---

 of "5" -->

5

 4. Maak asseblief 'n regmerk () wanneer keuses aangedui word.
-

 AFDELING A : ALGEMEEN

AFDELING A MOET DEUR ALLE SKOLE VOLTOOI WORD
 D.W.S. DIÉ MET REKENAARS EN DIÉ SONDER REKENAARS

KANTOOR-
 GEBRUIK

					1	5
--	--	--	--	--	---	---

1. GETAL ONDERWYSERS IN DIE PERSONEEL ? 7
 (SLEGS SEKONDeRE FASE)

2. GETAL LEERLINGE IN DIE SKOOL ? 11
 (SLEGS ST 6 EN HOeR)

3. TAALMEDIUM ? (Dui aan met 'n "✓")

3.1 Slegs Afrikaans	<input type="text"/>
3.2 Slegs Engels	<input type="text"/>
3.3 Afrikaans en Engels	<input type="text"/>
3.4 Ander _____	<input type="text"/>

12

4. HOEVEEL ONDERWYSERS IN DIE PERSONEEL BESKIK OOR 'N REKENAAR TUIS? 14

5. HOEVEEL ONDERWYSERS IN DIE PERSONEEL HET 'N FORMELE KWALIFIKASIE
 IN REKENAARWETENSKAP (bv. I, II, III, ens.)

5.1 AS DEEL VAN 'N GRAADKURSUS ?	<input type="text"/>
5.2 BEHAAL DEUR DEELTYDSE STUDIE (nie-grad doeleindes) ?.....	<input type="text"/>

16
18

6. HOEVEEL ONDERWYSERS IN DIE PERSONEEL HET 'N REKENAARKURSUS* TYDENS
 HUL AANVANKLIKE ONDERWYSERSOPLEIDING GEVOLG ? (* 'n Kursus in
 rekonaargeletterdheid, met min of geen programmering)..... 20

7. HOEVEEL ONDERWYSERS IN DIE PERSONEEL HET, OP 'N DEELTYDSE BASIS,
 'N REKENAARKURSUS* AAN EEN VAN DIE VOLGENDE INSTELLINGS GEVOLG ?
 (* 'n Kursus in programmering en/of rekonaargeletterdheid, maar nie
 rekonaarwetenskap nie)

7.1 'N UNIVERSITEIT	<input type="text"/>
7.2 'N TECHNIKON	<input type="text"/>
7.3 'N TEGNIESE KOLLEGE	<input type="text"/>

22
24
26

KANTOOR-
GEBRUIK

8. HOEVEEL ONDERWYSERS IN DIE PERSONEEL HET 'N INDIENSOPLEIDINGS-KURSUS OOR "REKENAARS IN DIE ONDERWYS", AANGEBIED DEUR DIE KAAPLANDSE ONDERWYSDEPARTEMENT, BYGEWOON
(uitgesluit, opleiding vir die administratiewe program - SASPAC)

28

8.1 TE DENNEOORD ?

30

8.2 DIE PLAASLIKE ONDERWYSERSENTRUM ?

9. HOEVEEL ONDERWYSERS IN DIE PERSONEEL HET 'N REKENAARKURSUS*, AANGEBIED DEUR PRIVAAT KONSULTANTE, GEVOLG ? (* Bv. Opleidingskursusse)

32

9.1 IN PROGRAMMERING ?

34

9.2 IN REKENAARGELETTERDHEID ?.....

10. HOEVEEL ONDERWYSERS IN DIE PERSONEEL HET REKENAAROPLEIDING IN 'N WERKSITUASIE, BUIITE DIE ONDERWYS, ONTVANG ?

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36

11. IN WATTER MATE EN AAN HOEVEEL ONDERWYSERS IN DIE PERSONEEL IS DIE VOLGENDE SAGTEWARE BEKEND ?

GEBRUIK ASSEBLIEF DIE VOLGENDE VYFPUNT-SKAAL :

Sleutel :

- 1. = GEBRUIK DIT MET SELFVERTROUE
- 2. = GEBRUIK DIT, MAAR MET MIN SELFVERTROUE
- 3. = HET PROBEER, MAAR HET DIT LAAT VAAR
- 4. = HET AL DAARVAN GEHOOR, MAAR GEBRUIK DIT NIE
- 5. = HET NOG NIE DAARVAN GEHOOR NIE

SKRYF DIE GETAL ONDERWYSERS VAN TOEPASSING IN ELKE BLOKKIE

1 2 3 4 5

bv.	WOORDVERWERKING	3	5	7	3	1
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LW : 'n Oop blokkie sal as 0 (Nul) geïnterpreteer word)

	1	2	3	4	5	KANTOOR- GEBRUIK
11.1 WOORDVERWERKING (Word Perfect; Pfs, ens.)						46
11.2 DATABASIS (D.Base III+, Hypertext, ens.)						56
11.3 SIGBLAD (Lotus 1-2-3 ens.)						66
11.4 PROGRAMMERING (Basic, Pascal, Logo, ens.)						76
11.5 OPVOEDKUNDIGE SAGTEWARE (ROO* in Wiskunde, ens.)						15
11.6 OPVOEDKUNDIGE OUTEURSTAAL (Quest, Tencore, ens.)						25
11.7 LESSENAAR-UITGEWERY (News Master, Ventura, ens.)						35
11.8 SKOOLADMINISTRASIE-STELSEL (Saspac, Skoolwerk, ens.)						45

				2	5
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12. HOEVEEL ONDERWYSERS IN DIE PERSONEEL GEBRUIK 'N REKENAAR

12.1 VIR DIE TIK EN STOOER VAN VRAESTELLE, MEMORANDUMS, KLASNOTAS WERKSKEMAS, ENS. ?	<input type="checkbox"/>	47
12.2 OM REKORD TE HOU VAN TOETSPUNTE en/of ANDER STATISTIEK ? ...	<input type="checkbox"/>	49
12.3 IN DIE ONDERRIG VAN VAKINHOUDE		
12.3.1 in die rekenaarlokaal/-laboratorium ?	<input type="checkbox"/>	51
12.3.2 in die klaskamer ?	<input type="checkbox"/>	53

13. HOEVEEL ONDERWYSERS IN DIE PERSONEEL WOON GEREELD DIE " <u>REKENAARS IN DIE ONDERWYS</u> "-STUDIEGROEP SE VERGADERING BY DIE ONDERWYSE- SENTRUM BY ?	<input type="checkbox"/>	55
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3. HOEVEEL VAN DIE VOLGENDE REKENAARVERWANTE APPARATUUR BESIT DIE SKOOL ?

KANTOOR-
GEBRUIK

3.1	Drukkers	<input type="checkbox"/>	51
3.2	Drukkerverdeler ("Splitter box")	<input type="checkbox"/>	53
3.3	Rekenaar-muis	<input type="checkbox"/>	55
3.4	Stipper	<input type="checkbox"/>	57
3.5	Modem	<input type="checkbox"/>	59
3.6	Optiese skandeerder	<input type="checkbox"/>	61
3.7	Voegvlak (vir gebruik saam met 'n tru-projektor)	<input type="checkbox"/>	63
3.8	Robot-arm	<input type="checkbox"/>	65
3.9	Ander _____	<input type="checkbox"/>	67

4. SAGTEWARE

4.1 ADMINISTRATIEWE STELSEL

4.1.1 Gebruik die skool 'n gerekenariseerde administrasie pakket?

JA	NEE
----	-----

<input type="checkbox"/>	68
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Indien "JA",
dui asseblief die naam van die pakket aan wat die skool tans vir administratiewe doeleindes gebruik:

.....

Indien "NEE", lys asseblief enkele redes daarvoor en ignoreer vraag 4.1.2

.....

.....

4.1.2 Ondervind die skool enige probleme met die huidige gerekenariseerde skooladministrasie-pakket ? ..

JA	NEE
----	-----

<input type="checkbox"/>	69
--------------------------	----

Indien "JA", lys asseblief enkele van die meer ernstige probleme :

.....

.....

.....

4.2 OPVOEDKUNDIGE SAGTEWARE

MAAK DIE SKOOL GEBRUIK VAN OPVOEDKUNDIGE SAGTEWARE, WAT SPESIFIEK VIR VAN DIE VOLGENDE VAKKE GESKRYF IS ?

(DUI OOK ASSEBLIEF AAN WATTER TIPE OPVOEDKUNDIGE SAGTEWARE DIT IS)

(Maak 'n "✓" in verskillende kolomme)

* Rekenaarondersteunde onderrig
Rekenaarondersteunde leer

	Vasleg- ging	*ROO/ ROL	Spel	Simulasie	Ander
4.2.1 Afrikaans					
4.2.2 Aardrykskunde					
4.2.3 Bedryfseconomie					
4.2.4 Biologie					
4.2.5 Bybelonderrig					
4.2.6 Ekonomie					
4.2.7 Engels					
4.2.8 Geskiedenis					
4.2.9 Hout- en Metaalwerk					
4.2.10 Kuns					
4.2.11 Musiek					
4.2.12 Natuur- en Skeikunde					

- 4.2.13 Rekeningkunde
- 4.2.14 Tik
- 4.2.15 Wiskunde
- 4.2.16 Ander ..
- 4.2.17 Ander ..

KANTOOR-
GEBRUIK

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					65

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					25
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					30
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4.3 GENERIESE SAGTEWARE ("OOP"-SAGTEWARE)

MAAK DIE SKOOL VAN ENIGE VAN DIE VOLGENDE GENERIESE-TIPE SAGTEWARE GEBRUIK ?

DUI ASSEBLIEF AAN HOE HIERDIE SAGTEWARE AANGEWEND WORD :

- A - ADMINISTRATIEF
- B - WERKTUIG VIR ONDERWYSER
- C - IN DIE VAKKURRIKULUM
- D - REKENAARGELETTERDHEID
- E - PROGRAMMERING
- F - ANDER

(Maak 'n "✓" in verskillende kolomme)

- 4.3.1 WOORDVERWERKING
(bv. Pfs)
- 4.3.2 DATABASIS
(bv. DBase III+)
- 4.3.3 SIGBLAD
(bv. Lotus 1-2-3)
- 4.3.4 GRAFIKA-SKEPPER
(bv. H.P. Graphics)
- 4.3.5 TOETS-GENEREERDER
(bv. Question Mark)
- 4.3.6 PROGRAMMERINGSTAAL
(bv. Pascal)
- 4.3.7 OUTEURSTALE
(bv. Quest)
- 4.3.8 LESSENAARUITGEWERY
(bv. News Master)

	A	B	C	D	E	F
4.3.1						
4.3.2						
4.3.3						
4.3.4						
4.3.5						
4.3.6						
4.3.7						
4.3.8						

KANTOOR-
GEBRUIK

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										17
										23
										29
										35
										41
										47
										53

 AFDELING C : HUIDIGE AANWENDING VAN REKENAARS IN DIE SKOOL

KANTOOR-
 GEBRUIK

					7	5
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AFDELING C MOET SLEGS DEUR SKOLE WAT OOR
 EEN OF MEER REKENAARS BESKIK VOLTOOI WORD.

1. SKAT ASSEBLIEF HOEVEEL UUR PER WEEK DIE REKENAARS VAN DIE SKOOL VIR
 DIE VOLGENDE AKTIWITEITE BENUT WORD :
 DUI OOK ASSEBLIEF DIE GETAL REKENAARS BETROKKE BY DIE BETROKKE AKTIWITEIT
 AAN :

	GETAL URE PER WEEK	GETAL REKENAARS BETROKKE	
1.1 SKOOLADMINISTRASIE	<input type="text"/>	<input type="text"/>	10
1.2 REKENAARS AS HULPMIDDEL VIR ONDERWYSERS	<input type="text"/>	<input type="text"/>	15
1.3 REKENAARS IN DIE VAKKURRIKULUM	<input type="text"/>	<input type="text"/>	20
1.4 REKENAARGELETTERDHEID (leerlinge)	<input type="text"/>	<input type="text"/>	25
1.6 REKENAARS IN DIE MEDIASENTRUM (biblioteek)...	<input type="text"/>	<input type="text"/>	30
1.7 REKENAARKLUB-AKTIWITEITE	<input type="text"/>	<input type="text"/>	35

2. BIED DIE SKOOL REKENAARGELETTERDHEIDSKURSUSSE AAN
 ONDERWYSERS IN DIE PERSONEEL AAN, AS DEEL VAN
 PERSONEELONTWIKKELING ?
- | | |
|----|-----|
| JA | NEE |
|----|-----|
- 36

3. LYS ASSEBLIEF, KORTLIKS, ENIGE PROBLEME WAT DIE SKOOL MAG ONDERVIND OM
 DIE PERSONEEL MEER BETROKKE TE KRY BY "REKENAARS IN DIE
 ONDERWYS"-AKTIWITEITE ?
- 3.1
- 3.2

4. BIED DIE SKOOL REKENAARKURSUSSE/-OPLEIDING AAN
- | | | | | |
|---|----|-----|----------------------|----|
| 4.1 OUERS VAN LEERLINGE ? | JA | NEE | <input type="text"/> | 37 |
| 4.2 LEERLINGE VAN ANDER SKOLE ? | JA | NEE | <input type="text"/> | 38 |
| 4.3 ANDER GROEPE IN DIE GEMEENSAP ? | JA | NEE | <input type="text"/> | 39 |

Gee asseblief 'n kort omskrywing indien u "JA" by enige van
 bostaande geantwoord het :

.....

5. DEEL DIE SKOOL SY REKENAARFASILITEITE MET ENIGE ANDER SKOOL ?

JA	NEE
----	-----

	40
--	----

Indien u "JA" geantwoord het, omskryf asseblief die aard van die ooreenkoms kortliks.

.....

KANTOOR-
GEBRUIK

 AFDELING D : FAKTORE WAT 'N ROL GESPEEL HET OM REKENAARS IN TE VOER

HIERDIE AFDELING MOET SLEGS DEUR SKOLE WAT OOR EEN OF MEER REKENAARS BESKIK VOLTOOI WORD.

1. WATTER "DRUKGROEPE" HET 'N ROL GESPEEL OM REKENAARS BY TE SKOOL IN TE VOER EN LATER UIT TE BREI ?

Rangskik asseblief die DRIE belangrikste drukgroepe in volgorde van die belangrikheid van hul rol om

A. aanvanklik rekenaars by die skool IN TE VOER, en om

B. bestaande rekenaarfasiliteite by die skool UIT TE BREI

(Gebruik 1 om die belangrikste en 3 om die minder belangrikste een van die DRIE aan te dui)

	A. IN TE VOER	B. UIT TE BREI	
1.1 Sakesektor			
1.2 Ouergemeenskap (informeel)			
1.3 Ouergemeenskap (formeel bv. O.O.V.) ..			
1.4 Bestuurskomitee			
1.5 Leerlinge			
1.6 Personeel			
1.7 Kaaplandse Onderwysdepartement			
1.8 Topstruktuur (Hoof + Adjunkhoof)			
1.9. RGN			
1.10 Rekenaarkoördineerder:Onderwysersentrum			
1.11 Ander _____			

blaai om asseblief

2. HOE BELANGRIK WAS DIE VOLGENDE REDES IN DIE SKOOL SE AANVANKLIKE BESLUIT OM REKENAARS BY DIE SKOOL IN TE VOER ?

KANTOOR-
GEBRUIK

Maak asseblief van die volgende skaal gebruik om die belangrikheid van elke rede aan te dui :

- NIE BELANGRIK NIE
- BELANGRIK
- BAIE BELANGRIK

- 2.1 Leerlinge behoort geen vrees vir rekenaars te hê nie 63
- 2.2 Leerlinge behoort te leer hoe om met rekenaars te werk ten einde hulle voor te berei vir hul toekomstige beroep/studie .. 64
- 2.3 Leerlinge kan Natuur- en Skeikunde, Wiskunde en sekere ander vakke beter leer d.m.v. rekenaarondersteunde onderrig (ROO) .. 65
- 2.4 Rekenaars kan dele van die sillabusse van vakke verryk en die wyse waarop dit oorgedra word (onderrig word) verbeter..... 66
- 2.5 Rekenaars kan skooladministrasie en -bestuur verbeter 67
- 2.6 Meer leerlinge sal by die skool inskryf as die skool oor rekenaars beskik 68
- 2.7 Rekenaars moedig koöperatiewe leer, eerder as kompetisie, onder leerlinge aan 69
- 2.8 Die lewensvaardigheid, om rekenaars in die alledaagse lewe te kan hanteer, behoort reeds op skool aangeleer te word 70
- 2.9 Rekenaars sal help om onderwysers se werkslading te verminder sodat hulle meer effektief in die klaskamer kan wees 71
- 2.10 Om 'n Rekenaarklub by die skool te begin 72
- 2.11 Ander : (SPESIFISEER ASB.)
..... 73

 AFDELING E : LEERLINGBETROKKENHEID BY REKENAARAKTIWITEITE IN DIE SKOOL

KANTOOR-
 GEBRUIK

				8	
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AFDELING E MOET SLEGS DEUR SKOLE WAT OOR
 EEN OF MEER REKENAARS BESKIK VOLTOOI WORD.

1. IN WATTER MATE IS DIE SKOOL SE LEERLINGE BETROKKE BY VERSKILLENDE
 REKENAARVERWANTE AKTIWITEITE IN DIE SKOOL ?

BELANGRIK : 'n Kort omskrywing verskyn direk onder elke aktiwiteit
 ten einde die betrokke aktiwiteit verder toe te lig.

Maak asseblief van die volgende skaal gebruik om die mate waarin leerlinge
 by elke aktiwiteit betrokke is aan te dui :

- | | | |
|---|---|--|
| - GEEN | 0 | |
| - ENKELE LEERLINGE | 1 | |
| - TUSSEN 10% EN 50% VAN DIE LEERLINGE | 2 | |
| - MEER AS 50% VAN DIE LEERLINGE | 3 | |

1.1 LEERLINGE NEEM REKENAARSTUDIE AS VAK

6

Dui hierdie aktiwiteit aan selfs as leerlinge onderrig in
 Rekenaarstudies by 'n ander skool/sentrum ontvang

1.2 LEERLINGE LEER PROGRAMMERING, MAAR DIE SKOOL BIED NIE
 REKENAARSTUDIE AS 'N VAK AAN NIE

7

Leerlinge leer om byvoorbeeld in BASIC, PASCAL, LOGO,
 ens. te programmeer en dit mag moontlik plaasvind as 'n
 komponent van 'n rekenaargeletterdheidsprogram of op
 selfs 'n buitemuurse basis.

1.3 DIE SKOOL BIED 'N REKENARGELETERDHEIDSKURSUS AAN

8

So 'n program sluit gewoonlik 'n rekenaarbewustheids-
 komponent in, maar gaan ook verder en behels moontlik ook
 die onderrig van vaardighede t.o.v. toepassingsagteware
 soos woordverwerking, databasisse, sigblaai, ens.

- 1.4 DIE SKOOL BIED 'N REKENARBEWUSTHEIDSKURSUS AAN 9

So 'n program dek gewoonlik van die volgende onderwerpe: rekenarterminogie, rekenaretiek, hoe 'n rekenaar werk, algemene toepassings, ens. Leerlinge kry egter min of geen geleentheid om self met die rekenaars te werk.

- 1.5 DIE SKOOL POOG OM LEERLINGE SE PROBLEEMOPLOSSINGSVAARDIGHEDE TE VERBETER DEUR VAN DIE REKENAAR GEBRUIK TE MAAK 10

So 'n program berus gewoonlik op die oortuiging dat rekenaars leerlinge se probleemoplossingsvaardighede kan verbeter. Van leerlinge word verwag om sekere take te doen en/of probleme m.b.v. die rekenaar op te los.

- 1.6 DIE SKOOL MOEDIG DIE GEBRUIK VAN REKENAARS IN ALLE VAKKE DOELBEWUS AAN 11

Dit behels die inskakeling van die rekenaar by die bestaande vakkurrikulum.

- 1.7 'N REKENAARKLUB BESTAAN BY DIE SKOOL AS 'N BUITEMUURSE-AKTIWITEIT 12

'n Onderwyser is gewoonlik in beheer, maar sy rol mag wissel van bloot koördineerend, tot die onderrig van programmering aan klublede.

ENIGE ANDER WYSES WAAROP LEERLINGE BY REKENAARAKTIWITEITE BY DIE SKOOL BETROKKE MAG WEES

- 1.8 _____ 13

2. LYS ASSEBLIEF, KORTLIKS, ENIGE PROBLEME WAT DIE SKOOL MAG ONDERVIND OM LEERLINGE MEER BETROKKE TE KRY OF TE MAAK BY "REKENAARS IN DIE ONDERWYS"-AKTIWITEITE ?

- 2.1
- 2.2
- 2.3

 AFDELING F : WAAROM DIE SKOOL NOG NIE REKENAARS INGEVOER HET NIE

AFDELING F MOET SLEGS VOLTOOI WORD DEUR SKOLE
 WAT OOR GEEN REKENAARS BESKIK NIE

1. GEBRUIK DIE VOLGENDE SKAAL OM DIE RELATIEWE BELANGRIKHEID VAN ELK VAN DIE VOLGENDE REDES WAAROM DIE SKOOL NIE OOR REKENAARS BESKIK NIE, AAN TE DUI

- SPEEL NIE 'N ROL NIE

0

- SPEEL 'N ROL

1

- SPEEL 'N BAIE BELANGRIKE ROL

2

- 1.1 Onderwysers stel nie in rekenaars in die onderwys belang nie ..

--

 14
- 1.2 Tekort aan fondse

--

 15
- 1.3 Niemand op die personeel met genoegsame kundigheid nie.....

--

 16
- 1.4 Rekenaars het dikwels tot gevolg dat onderwysers se werks-
lading verhoog word

--

 17
- 1.5 Ouers het nog nie 'n behoefte daarvoor geïdentifiseer nie.....

--

 18
- 1.6 Leerlinge stel nie belang nie

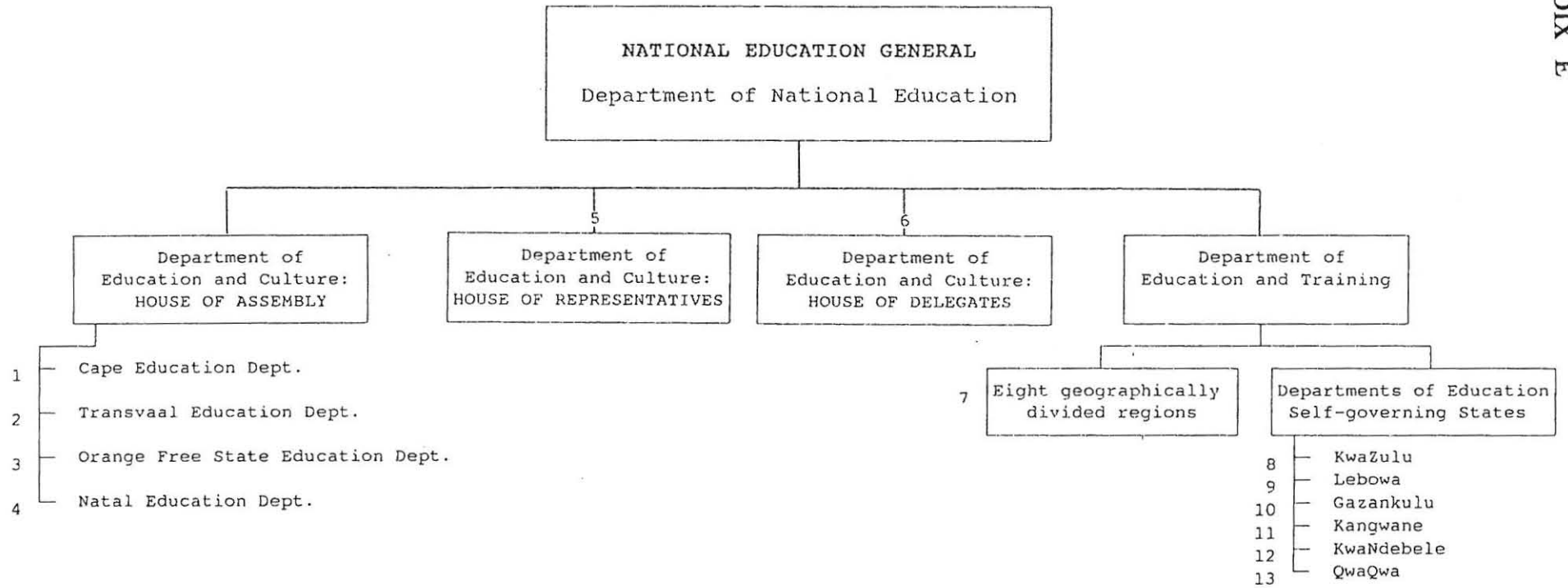
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 19

		KANTOOR- GEBRUIK
1.7	Rekenaars is te duur	<input type="checkbox"/> 20
1.8	Tekort aan goeie opvoedkundige sagteware vir hoërskoolvakke ...	<input type="checkbox"/> 21
1.9	Meer belangrike prioriteite/projekte om te finansier	<input type="checkbox"/> 22
1.10	Leerlinge se skoolprogram is reeds te vol	<input type="checkbox"/> 23
1.11	Onderwysers is te besig om rekenaars in die onderwys te gebruik.	<input type="checkbox"/> 24
1.12	Rekenaars in die onderwys skep 'n onpersoonlike leeratmosfeer .	<input type="checkbox"/> 25
1.13	Rekenaars is net 'n gier ..(Here today; gone tomorrow)	<input type="checkbox"/> 26
1.14	Rekenaars kan net aangewend word om lae-vlak vaardighede aan te leer	<input type="checkbox"/> 27
1.15	Weens 'n gebrek aan kennis is die skool huiwerig aangesien die verkeerde rekenaarhardeware en -sagteware aangekoop mag word ..	<input type="checkbox"/> 28
1.16	Die skool se administratiewe pligte kan sonder die gebruik van 'n rekenaar hanteer word	<input type="checkbox"/> 29

BAIE DANKIE VIR U SAMEWERKING

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 (13 DECENTRALISED DEPARTMENTS OF EDUCATION)



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