A STRATEGY FOR PROMOTING COMPUTER LITERACY IN STAFF AND STUDENTS OF A TEACHER TRAINING INSTITUTION : A CASE STUDY.

THESIS

Submitted in partial fulfilment of the
requirements for the Degree of
MASTER OF EDUCATION
of Rhodes University.

by

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December, 1991.

ABSTRACT

A case study carried out at Edgewood College of Education (Natal) attempted to demonstrate how in-house training could provide staff with the necessary computer literacy skills to integrate computer technology into lecturing and teaching programmes. The duration of the project was six months and during this time a group of thirty academic staff members were exposed to computer technology via practical experience, lectures and demonstrations.

The results gleaned from the project show that most of the staff involved in the project developed sufficient computer skills to be of benefit in their professional and personal tasks. In addition the recognition of the value of word processing and desk top publishing led to the staff encouraging students to use these software packages in the preparation of coursework. Consequently the use of the computer resources increased noticeably in the six month period.

One of the goals of the study was to show how staff, once computer literate, would make use of generic software to integrate computer technology into their lecturing programmes. This did not happen and the reasons for this failure are discussed.

ACKNOWLEDGEMENTS

No project of this nature can be undertaken without the help and support of many kinds. First of all, my supervisor Cecille Marsh must be thanked for her painstaking editing and helpful suggestions. I would like to express my gratitude to my husband and family for all the housekeeping and baby-sitting. Thank-you to my friends Terry Barnes for doing the lion's share of the teaching, Jack Todd for his assistance with the graphics and Brian McArthur for his constant support and for first showing me how to find the on/off switch on an Apple 2+ in 1988.

The financial assistance of the Centre for Science Development towards this research is hereby acknowledged. Opinions expressed in this publication, or conclusions arrived at, are those of the author and are not necessarily to be attributed to the Centre for Science Development.

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During the early 1980's there was immense excitement and educational expectation as Natal schools ushered in the computer age. A great deal of finance went into the machines (APPLE 2+ and 2e), furniture to complement the hardware and even, in some schools, special rooms designated as "computer suites" - carpeted, air-conditioned and locked. These became the show pieces of the school, used to attract would-be pupils of proven (and potential) sound academic background as well as prospective donors. A school's image certainly escalated with the addition of "computers" to its curriculum.

The recognised ideal approach to computer literacy is the complete integration of this tool into the whole curriculum. (Schiffman : 1985; Natal Education Department :1990 :11; Fritz : 1985 :706; Moursand :1989; Callister & Burbules: 1990). The world-wide trend is to integrate computer literacy skills into the curriculum to the extent that the term 'computer literacy' is being replaced by current phases such as 'information technology' (United Kingdom, Australia and Canada) and 'informatics' (Germany) (Graf :1985).

In Natal, however, financial and other practical reasons such as availability of software and appropriate staff training caused the integrated approach to be set aside temporarily in favour of a formal course of Computer Literacy classes to

Standard six and seven pupils. It was hoped that the introduction of a separate school subject called 'Computer Literacy' would stimulate the processes of teacher education, ensure funds were voted for hardware and software purchases and that each child would at least gain some 'hands-on' experience of a computer. (Natal Education Department: 1990: 11-12). The intention was to set up the infra-structure of equipment and trained staff in the schools, promote the need to be computer literate in the 'information age' and thereafter encourage the evolution of computer literacy classes into computer education ie. the integration of computer technology and skills into the curriculum (Natal Education Department : 1990 :11). Then reality set in. Within a short space of time it became obvious that the mere acquisition of the hardware was not producing computer literate pupils or staff. Elliot Solloway, as quoted by Williamson & Waker (1991: chpt. 10:1) summarized the problem when he stated "Technology is no good without teaching teachers how to use it". The lack of suitably trained staff, who could use the computer as a tool, and the general lack of suitable software were major causes of the degeneration of the initially enthusiastic computer clubs and time-tabled classes into 'free periods' where pupils just played whatever computer game was currently in vogue. Williamson and Waker (1991: chpt 10:1) sum up this situation when they write:

> "If anything can be learned from overseas experience over the last ten years, it is that

> many schemes have failed because they were hardware centred. Educators are now recognising that as much should be budgeted for software and training as for hardware."

The number of South African published papers on the development of computer literacy skills in teaching staff and pupils increased during these years (Engelbrecht :1982; Jacobs :1989). The Human Sciences Research Council reports of 1983 provided guidelines for the use of computer technology in the classroom, emphasized the need to offer computer skills in the employment market and made recommendations for teacher training in the various fields of computer literacy, computer studies and computer aided learning (CAL). As with any innovation, problems, similar to those experienced by other countries when introducing computer literacy packages, arose (McDougall :1981; Plomp et al : 1990). Common problems identified by these and other writers include :

* the lack of a tradition of the subject computer literacy in the schools which results in no teacher role models or inappropriate teaching methodology for computer literacy teachers
* lack of suitably tested text-books and other teaching aids
* the subject requires an individualized 'hands-on' approach but this is often difficult to achieve as most schools do not have enough hardware

* the rapid pace of change in the development of hardware and software soon leaves schools with obsolete and incompatible equipment - a situation criticized by those pupils who have "state of the art" equipment at home.

With the appointment of two subject advisers (1985 and 1989) for computer studies and computer literacy, it is expected that the movement towards developing a computer literate youth and teaching staff will gain momentum in the 1990's. During the last five years most pupils in Natal (House of Assembly) schools should have been exposed to formal computer literacy classes in Standards six and seven. The appointment of the second subject adviser in 1989 has led to the publication of a formal Computer Literacy syllabus with detailed guidelines for teachers of Standards six and seven (Appendix I) (McArthur : 1989). In addition, a fairly comprehensive programme of three day computer literacy in-service courses was held in 1990 (and repeated in 1991) throughout Natal schools.

1.1 The current state of teacher education in computer literacy in Natal

Whilst attempts to develop computer literacy in pupils have been in progress for some years, greater attention has now been directed towards the teaching corps. The Human Sciences Research Council report (HSRC (b): 1983) urged the need for

computer literate teachers to prepare the youth for life in an increasingly technologically organized world. Schools and teacher education institutions are expected to play a major role towards achieving this goal (Moursand:1989; Fritz:1985).

In Natal efforts have already been made at both the pre-service and in-service levels. The Colleges of Education and other teacher education institutions provide the pre-service training of teachers of Computer Studies (Std 8 -10) and teachers of Computer Literacy (Std 2 -7). A two year part-time diploma (Further Diploma in Education) in Computer Studies is offered by the two Colleges of Education as well as annual in-service courses. These are, however, courses in which the computer and its applications are taught as subjects in their own right. The Higher Diploma in Education (H.D.E.) courses at the two Natal Universities and the Natal Technikon (Durban) offer an optional module in computer literacy skills for trainee teachers who do not take the Computer Studies method course. These H.D.E. options merely provide for basic skills in application packages with word processing, spreadsheets and database being the common selection offered.

After examination and comparison of these course outlines by the writer, there appears to be no evidence in any of the pre-service or in-service courses mentioned above of opportunities for teachers to learn how to use the computer

as a tool in their own subjects.

Teacher education institutions and Education departments are mainly to blame for the general lack of awareness by practising teachers of the potential use of the computer in the classroom, and attention needs to be directed towards rectifying this 'gap' in the goal to make all teachers computer literate. It should be stressed, however, at this point that even a large national curriculum project such as the Micro-Electronics project in the United Kingdom and Scotland could not provide for sufficient training for each teacher despite national, regional and local attempts to do so via in-service courses, formal courses, support teams etc. Therefore much of the development has had to take place within the school itself, using the school's own staff resources (Williamson & Waker: 1991: chpt.10:3).

1.2 How computer literate are teachers in Natal secondary schools?

The provision of a Computer Literacy syllabus for Standards six and seven (accompanied by a detailed workscheme for the teacher) as well as frequent in-service courses has not resulted in staff members using basic computer skills in their classroom teaching and administration.

The writer maintains that a reason for this state of affairs

is that many computer literacy teachers appear to be enlisted on an ad hoc basis either from staff who are computer literate to some extent or from staff whose time-tables need "filling up". These "volunteers" then attend the annual three day in-service course held by the subject adviser for Computer Literacy in Natal. The three day course merely provides the basic skills to enable these teachers to cope with the syllabus material for Standard six and seven computer literacy subject classes. Thereafter the teachers, armed with three days' experience, are expected to get on and implement what they have assimilated during the in-service course. If it is accepted that all teachers should be able to make relevant use of computer technology in the classroom, irrespective of the subject taught, it is the writer's opinion that at present these computer literacy teachers can not be expected to provide the expertise and experience needed to guide other subject teachers in the use of computer technology as a tool in their teaching. The only other viable solution for those subject teachers interested in using the computer has been to resort to commercial subject-specific CAL software which requires very little computer expertise - simply load the program and let it run.

Informal canvassing by the writer of twelve of the local High Schools indicates that only two out of the twelve schools have teachers (besides the Computer Studies or Computer Literacy teacher) who make use of the available computer

technology in the classroom situation i.e. use the computer as an aid or teaching tool. It seems as if most teachers of traditional school subjects seem content to delegate all aspects of computer education to the computer literacy or computer studies teachers.

1.2.1 Problems experienced in using computer technology in the classroom.

An investigation of the reasons for the lack of the use of the computer as a tool in teaching revealed the following problems:

(i) Natal schools operate on the "computer laboratory" basis whereby the computer literacy and computer studies classes use the computer facilities throughout the day. Consequently it is difficult for a subject teacher to bring a class into the laboratory to use the computers. Although the use of "mini-labs" (Barba : 1990) has found a place in the primary schools the high schools are subject to the security regulations of the Natal Education Department whereby the computer equipment must be located in a venue with burglar guards and Yale locks on the doors (Natal Education Department Schools Handbook). Because centralization of the equipment into a computer laboratory is compulsory, it is virtually impossible for a subject

teacher to remove one or more computers to use in his/her own classroom (Natal Education Department : 1990 :19).

(ii) Due to the problems associated with the use of commercial Computer Aided Learning (CAL) resources, the few interested subject teachers have found little material to suit their exact needs in a particular teaching situation. Three main factors which accounted for the general lack of quantity and quality of appropriate CAL software were identified. These factors were:-

(a) the high cost per unit and lack of 'site licence' for multiple use of one purchased copy;
(b) very little useful material that suits the Natal curriculum and what is useful is difficult to obtain;
(c) the foreign cultural background of the CAL packages (most of which are designed for American or British schools).

Good, readily available CAL software would encourage subject teachers who are not computer literate to make use of the computer facilities in their own teaching programmes, but as indicated above, commercial software is mostly unsuitable and teachers do not have

the programming expertise to adapt commercially available material or write their own CAL software.

If a subject teacher is made aware of the potential use of computer technology in his/her own subject, then that teacher will be in a position to generate ideas and develop suitable CAL material and resources in that particular subject. This process of linking appropriate subject material and computer technology could in turn stimulate further positive development of a teacher's computer literacy skills. In addition, the pupil would receive a more realistic impression of the use of the computer as a potential tool (Schiffmann :1985).

1.3 Conclusion.

Most subject teachers are unaware of the potential of using computer technology in their own teaching areas. Williamson and Waker (1991 :chpt.2 :7) conclude that on a worldwide basis, one of the reasons identified for the lack of integration of computers into a curriculum is the predominance of non-user teachers. Whilst this conclusion seems blindingly obvious, the Natal Education Department, despite encouraging the integration of computers into classroom teaching, is making no provision for in-service teacher training in this area. Even the Human Sciences Research Council (HSRC (b) :1983) recognises that each

subject in-service course should include an appropriate computer component, but the investigation into the local schools mentioned above suggests that this has not materialised. As a generalization, subject teachers not only lack the technical expertise to develop suitable CAL material and resources in their particular subject areas, but they also seem unaware of syllabus topics which could appropriately be taught using the technology. How then are teachers expected to prepare pupils for an information literate society when they themselves have problems in developing and maintaining their own computer literacy skills in this rapidly expanding area?

In the United Kingdom there appears to be a growing realization among teachers and teacher support groups that a limited number of generic software packages would be more useful to everyone than a wide variety of topic specific programs (Williamson & Waker :1991 :chpt.2 :8).
The writer proposes that if teachers were confident of the basic principles involved in the use of generic software (word processing, spreadsheets, data base and graphics application packages) they would then be in a position to generate ideas and resources in their subjects and would be able to use computer technology as a teaching tool in the classroom without reliance upon the expensive and mostly unsuitable CAL software. As suggested previously, this process of linking appropriate subject material and computer

technology could in turn stimulate further positive development of computer literacy skills in the general teacher. This evolution process would, however, take time. Brian Durrell of the University of Toronto, Canada (cited in Williamson & Waker : 1991: chpt.10:2) concluded from programmes aimed at the developing computer literacy in educators that "...teachers first had to deal with machines on a personal level before they were willing to consider the task-orientated issues of their use". One of the advantages of computer-using teachers is that pupils would receive a more realistic impression of the use of the computer as a potential tool for everyone and not just the teachers of computer studies or literacy (Schiffmann :1985).

CHAPTER TWO: LITERATURE SURVEY

2.1 Introduction: Why do teachers need to be computer literate?

As with other technological advances such as steam engines, motor cars and space travel, the prophets of doom view the use of computer technology in education as a type of social evil - dehumanizing education and mechanizing the child's learning. Megarry (1983) attributes the descriptions such as "dehumanizing monotony", "excessive reliance on rational logical thought" and "technocratic elitism" to the misuse of computers in education. The rapid technological advances in society from the industrial to the information age do, however, demand from today's generation, the basics of information processing skills and computer literacy in order to function effectively (Fritz :1985 :706). Thus computers will be and are being used as a tool in education for facilitating the developments seen in society and likewise in education. It is now up to teachers and teacher education to meet the challenges of using computer technology to improve education for all. Teachers need to develop and maintain their computer literacy skills and be confident in their use of this fast paced technology to answer questions; make informed decisions on how to use the computer as a tool in the classroom; to evaluate software; to provide the most appropriate individualized instruction and therefore equal

educational opportunity for all. (Hofmeister :1984; Allain :1986). Daniel Watt (1981) stresses the need for teachers to be computer literate when he writes:

> "Universal computer literacy is a basic skill of the 1980's and deserves a major role in the school curriculum. To educate students for computer literacy, schools must develop leadership, curricula, and computer-literate teaching staffs...The failure of schools to make a major commitment in this area now can have disastrous consequences for both the education of the public and the future of public education."

Likewise Megarry (cited in Megarry 1982:27) emphasizes the necessity for society to train teachers in computer based approaches with her statement "...otherwise tomorrow's teachers will be as handicapped as yesterday's illiterates."

There are as many definitions of computer literacy as there are papers written about the topic. The problem with the term "computer literacy" seems to be that it often confuses two ideas - the computer as a classroom tool and the computer as a subject discipline. There are indications that the specific skills and knowledge that constitute computer literacy are at present largely undefined. The concept of computer literacy is changing as more computer literacy programmes are introduced (Fritz:1985:705). When one

examines the course outlines of many current computer literacy courses offered, however, there seems to be general agreement about the basic course contents ie. basic structure and components of a computer; how computers work; application packages; programming; history of computing and socio-economic implications of computers. Many researchers (Callister and Burbules :1990; Hofmeister :1984; Watson : 1990; Jacobs :1985; Moursand :1990; Kansky :1982; Eaton & Olsen :1986) have reached consensus on the idea of the need for teachers to demote the computer to the level of a general tool or learning aid rather than teaching a separate subject called 'Computer Literacy'. The definition by Fritz (1985: 705) is arguably one that best reflects the content of current computer literacy courses, viz: "the acquisition of knowledge, attitudes and skills necessary for a person to function effectively in an information-based society." Hofmeister (1984) suggests that in using computer technology in the classroom, the highest priority should be given to using it in an information age context - as a tool and learning aid. Although present teacher trainees are receiving some computer literacy tuition in their training, there is a need to concentrate on teachers already in service i.e. those teachers that have already completed their formal education. Today's teachers are experiencing pressure to develop their own computer literacy skills. The question that emerges at this point is: how can such development be achieved with minimal interruption of a school's programme

and yet maximum involvement of as many teachers as possible?

2.2 APPROACHES TO DEVELOPING COMPUTER LITERACY IN TEACHERS

Examination of the literature concerned with teacher education in computer literacy reveals three main approaches to teacher re-education in this field. Probably, no one "best" model for teacher training in computer literacy will emerge, as the dynamic aspects of time, place and the individual affect the outcome of any training programme (Hofmeister: 1984:5; Aston: 1988:82). Therefore, staff developers should become familiar with various approaches, select factors relevant to their own situation and apply what they already know about effective staff development to this area. The three main approaches include using teaching staff to develop computer literacy curricula; providing formal courses for teachers; and teacher in-service programmes. In considering each of these approaches the details of one or two particular studies have been selected to illustrate the processes, methods and results of the particular type of approach.

2.2.1 Staff participation in curriculum design

In the design of a computer literacy curriculum for pupils Schiffmann (1985) used a needs assessment strategy to

determine what the course content should be. The answer to the question 'What do pupils need when they leave school and enter the employment market?' formed the basis of Schiffmann's idea of the **integrated model**. The model integrates computer literacy material into the existing school curriculum so that all subject teachers demonstrate how the computer is used as a tool in their subject. Thus computer literacy becomes a continuing part of the educational process rather than a discrete subject course (Fritz: 1985:705). The advantages of such a model can be summarized as:-

1. The pupil receives a more realistic view of how computers affect our everyday lives in that many people use computer technology to save time and ensure greater accuracy in processing information.
2. The teacher's use of computer technology in different subject areas has the potential to demonstrate the great range of applications of the technology.
3. Pupils see that all kinds of people use computers and so this helps to avoid the stereotyping of computer users as an elite group of mathematicians.
4. Because the model presupposes that teachers need to be computer literate themselves, basic training in the use of the computer would be given to participating staff. All teachers would be involved in the curriculum development, therefore ensuring they would develop sufficient computer literacy skills to understand and

use applications in their own subject. Thus staff would be forced to develop literacy skills in order to run the programme. The involvement of the teachers in this manner meant not only that they would all receive some training but that there would also need to be consensus and co-ordination amongst all participants in determining the form and content of the curriculum.

Schiffmann (1985) reports on the results of the implementation of the programme as having both positive and problematic elements. Problems such as the economics of sufficient appropriate CAL software led to the emphasis changing to the use of generic tool software rather than specific CAL packages; the need for continual staff training due to natural staff turnover ensured that an in-service programme for new teachers became operational and finally the need to have at least one non-teaching co-ordinator for each school was acknowledged. The role of the co-ordinator would be to facilitate communication between staff, to supervise equipment, to deal with administration and to act as a liaison between schools. This latter point agrees with proposals by Jacob (1985:17), Fowler (1990) and Baer (1989:159) for the need to establish computer educators who can provide leadership and guidance in each school.

The positive results of this investigation - viz: great pupil response; the 'team' effort by staff in providing mutual

support; the co-operation in developing courseware; and the reduction in preparation time for each staff member, far outweighed the problems. The integrated model remains a viable approach to developing computer literacy curricula in schools, but the more important aspect of the integrated model in the context of this study is that it promotes the acquisition of relevant computer literacy skills in the staff themselves.

This idea of a collaborative process was emphasized in the implementation of the computer literacy curriculum by the Australian Computer Education programme (Woodhouse and Jones : 1988). One of the first and major decisions made was the involvement of all school administrators and teachers in the design and implementation of the curriculum. To make a meaningful contribution to the project, teachers had to develop and maintain their own computer literacy skills. Skills such as learning how to operate hardware, developing confidence in the use of software, and being able to make informed decisions as to the appropriateness of using computer technology in a particular classroom situation, were considered essential parts of a teacher's background knowledge to be used when selecting appropriate materials for his/her own subject discipline.

In Natal, schools generally struggle to find trained computer literate staff to teach formal computer literacy courses, let

alone generate a school-based group who could develop programmes to encourage and stimulate the use of computer technology as a teaching aid.

2.2.2 Formal staff courses in computer literacy.

Cole and Riser (1985) designed and implemented a two-semester computer literacy course for faculty staff. The primary aim of the course was to expose staff to ways in which the computer could be used as a tool in teaching, research and administration. The structure and content of the course was organized to provide enough exposure to key terms, concepts, evaluation of hardware and generic software packages so that participants could begin to use the computer as a tool, integrating the technology into the classroom within other disciplines. Staff would develop selection skills to decide when the technology was appropriate in a particular teaching situation and which software to use to complement the subject content.

Cole and Riser concluded that the aim of improving faculty performance via the knowledge and use of computer technology had been achieved. Further factors contributing to the success of the programme included the provision of materials and assignments which were appropriate to each participant's subject discipline and of immediate use in the classroom or laboratory.

From examination of the course outlines, the writer could identify two major problems:

(1) The time factor - how many teachers would be able to spare the time to attend such comprehensive courses 'after hours'?

(2) The extensive course content, although this was thoughtfully sequenced (eg: programming at the end of the course). Can an education department afford to spend a year preparing teachers to the level proposed in this course? Would a formal course on a smaller scale, but regularly interspersed with periods of application in the classroom, be more appropriate for the general teacher wishing to develop computer literacy skills?

A recommendation by Williamson and Waker (1991: chpt.9:3) based on the advice of Brian Wilson of the University of Tasmania states that College staff should receive formal training to develop confidence in the integration of computer use in their subjects. But before teachers could consider computer use in their own subjects, they needed to come to grips with the technology and hence the necessity is recognised for a formal structured course prior to any attempts at integrating technology into the curriculum. (Williamson & Waker :1991 :chpt.10: 2)

In Israel 5 to 10% of the teaching corps attend formal computer related in-service courses each year. These courses

vary in length of contact hours and extent of re-education of the teachers. Those teachers who merely wish to keep up to date with technology would attend a short course of 40 - 80 hours. In contrast to the short courses to retrain as a school computer co-ordinator or informatics teacher, a teacher might attend a part-time course for two years (Williamson & Waker :1990 :chpt.10:4).

The Japanese system of teacher re-education is all in-service training, but teachers learn how to integrate a micro-computer component into a subject and not computer literacy (or comparable term) as a subject. (Williamson & Waker : 1990 :chpt.10:4).

In Scotland teacher re-education takes the form of formal in-service training in educational computing. Teachers may take formal courses leading to the awarding of a Diploma in Educational Computing or Computer Literacy. In addition other formal teacher training or staff development occurs in the form of 'Baker days' instituted and named after the Minister of Education at that time. Schools are allocated three days per school year when school pupils do not attend school so that the teachers are able to participate in staff development programmes (Williamson & Waker: chpt.10:9).

To date, there is no formal post graduate course in computer education offered to Natal teachers. The Further Diploma in

Education offered by the two Colleges of Education is aimed specifically at potential teachers of Computer Studies. A formal part-time course in computer education could fulfil a need in the goal to make as many teachers computer literate as possible. In response to the demand for a more general computer course than the current Further Diploma in Computer Studies, representatives of the two teacher training institutions and the subject adviser for Natal put forward a proposal and course outline for a part-time Further Diploma in Computer Education (Appendix III). This two-year diploma was designed for primary and secondary teachers with the aim of producing computer education specialists able to take a leadership role in all aspects of computer education. Permission to offer this diploma in 1992 in two Natal centres (Edgewood College of Education and Port Shepstone) has recently been granted.

2.2.3 Curriculum innovations and in-service training.

A four year programme called the Microelectronics Education Programme (MEP) was introduced into the United Kingdom in 1980 at a cost of £9 million. The programme was wide ranging, with a strong emphasis on regional implementation. The programme recognised the need to provide teacher training by including teacher support and in-service courses, information centres for teachers and copious reference material for teachers. A special project - "Microcomputers in Schools" placed at least one microcomputer into each

school (Fothergill :1983).

As resources at the disposal of the MEP were limited, emphasis was placed on providing a strong base for projects to get started and thereafter encouraging self development within each region (Fothergill :1983).

Aston (1988) examines the role of the teacher in the MEP project as he reviews the results of the project six years after its implementation. Aston estimates that six years should be sufficient time for teachers to develop or change their teaching strategies to accomplish the aims of the MEP, for schools to adjust resources to accommodate the new technology and for regional curricula to incorporate computer based technology into other subject areas. The MEP was, after all, an integrated project aimed at using education to prepare the school-going generation for the impact of the new technology on society (Fothergill :1983:137). Aston (1988:81) found, however, that after six years less than 10% of secondary classrooms had incorporated any aspect of information technology into their daily practice and very few syllabi mention either computers or information technology. In an attempt to identify the problems, teachers from all subject areas were requested to share their experiences. From the feedback obtained, it seems that despite a large proportion of MEP resources allocated to in-service teacher education the scale of teacher re-education necessary was

still underestimated. Aston (1988:79) observes that "..From the records kept by MEP, the time spent on formal INSET by those (41 000) teachers was 69 000 days, making the average length of a course about one and a half days. This is clearly inadequate for the great majority of those 41 000 teachers". This conclusion is in agreement with Cunniff (1989:148) who states that most training programmes are too short - a few hours over one or two days. She suggests that whilst these efforts should not be criticized too severely it is imperative that more effective models be proposed, tested and institutionalized so that training of technology-using educators can be more systematic.

In the United Kingdom, the 1988 Educational Reform Act provided for a new national curriculum to be implemented in England, Wales and Northern Ireland. The national curriculum for Craft, Design and Technology (CDT) planned Information Technology (IT) as a practical and integral part of all courses ie. IT is no longer a separate subject. The formal implementation date of the CDT curriculum was Autumn (September) 1991 (Williamson & Waker :1990 :chpt12:2).

The cross curricular theme of IT allows great flexibility for teachers and teacher training. Initial teacher training courses are to include courses to prepare teachers who will implement IT components in their subjects. It is recognised that teachers who are already in service have differences in

computing ability. Because the IT component can occur in any subject only those teachers who are proficient in computing will need to integrate the component into their particular subject area. The flexibility of this approach to implementing curricular changes means that teacher re-education will be far less costly (in time and financially) than a less flexible structure which would have involved far greater in-service training (Williamson & Waker: 1990: chpt.2:12).

The mobile MEDO unit (Microelectronics in Education Development) is responsible for the central organization of in-service training and support. Although the unit has provided for an enormous amount of in-service training on a regional level, so far it has not been able to reach all teachers. Thus it is recognised that a good deal of the teacher development via teachers trained by the MEDO in-service programme will have to occur within the schools.

In-service courses held in Natal during 1990/1991 were provided for teachers of computer literacy. The course content - use of Appleworks and Logo was designed solely to provide the basic content and skills needed by novice teachers to teach the computer literacy course in the schools. Evaluation forms were distributed amongst the participating teachers and a number of interesting suggestions were made by the teachers. A summary of the

relevant comments of those who attended the course revealed that:

(a) they could now actually plan and prepare a lesson with confidence rather than just allow the pupils to play computer games;

(b) they came away from the course with ideas;

(c) they see the need for more help on a regular basis (ie. once a term at least).

An investigation by the writer, however, into a sample of the schools whose staff attended the course in 1990, and another sample in 1991, show that very little growth beyond the in-service course materials had, in fact, taken place. The main reason for this lack of growth seemed to lie in the structure of the system. All schools (in the sample) did not consider the subject 'Computer Literacy' seriously as it is non-examinable and consequently the staff used to teach Computer Literacy are those who generally had "gaps" in their timetables and needed one or two periods a week to make up their respective quotas.

As mentioned previously, there has been no attempt, however, to provide in-service courses in computer education for the subject teacher despite the two recommendations made by the Human Sciences Research Council (HSRC(b) :1983:17) viz.

(1) that all in-service courses (irrespective of subject) have some component which develops computer literacy in the attending staff and

(2) that a series of booklets directed at particular subject teachers be published. These booklets would provide guidelines, ideas and resources for using the computer as a tool in teaching that particular subject.

2.3 CONCLUSION

Each of the three approaches summarized above has commendable elements which, if adapted to local circumstances, could facilitate the development of a computer literate staff able to work towards the goal of preparing the school-going youth for a computer literate society. These elements are:

(1) A teacher qualified as a computer education specialist is required to promote teacher involvement and collaboration within each school. This teacher would be responsible for the co-ordination and use of resources by subject teachers. Other duties should include holding mini in-service courses for the school staff and assisting staff members to develop suitable CAL material for their lessons.

(2) Formal diploma courses in computer education (offered by the Colleges of Education) prepare subject teachers in all aspects of computer education. Participants in these courses would form the core of the school specialists mentioned in (1) above.

(3) Frequent in-service courses (organized by local school groups) should be held to develop suitable subject

specific material for school use. There should be less reliance on the Department of Education to take the initiative in organizing in-service programmes as each course organized by subject advisers on a provincial basis can only address general problems and cannot hope to fulfill the needs of the local school communities.

Each of the elements extracted from the research implies a change in focus away from the 'computer literacy as a subject' approach towards the more curriculum-integrated approach of computer education as suggested by Callister and Burbules (1990), Fritz (1985), Jacobs (1885), Moore (1984), Moursand (1989), Schiffmann(1985), Woodhouse and Jones (1988) and many others concerned about the nature of the role of computer technology in the schools.

CHAPTER THREE: CASE STUDY

3.1 Introduction: Aim of this study

It seemed obvious to the writer that teachers could not be expected to utilize generic software in their subject teaching without the basic knowledge and skills needed to use the software to its full advantage. It was the intention of this study to develop a strategy to promote the development of those computer literacy skills needed by subject teachers to enable them to adapt generic software to suit their subject's needs and thus use their own CAL material in the classroom. The intention was not to produce computer literacy or computer studies teachers, but rather to ensure that an individual teacher was aware of and confident about the use of computer technology as it applied to his/her own classroom needs. It was hoped that the involvement of the teachers themselves in this process of specific subject software adaptation would encourage them to use the computer as a tool in the classroom situation.

Research has suggested (Cox et al :1988; Williamson & Waker: 1991: chpt.10:6) that the adoption of micro-computer technology by the whole school or institution develops a far more positive approach to the technology by the staff and students. Thus it seems that it is only with a combined effort from the institution management, teaching staff and

students that the concept of computer literacy as a useful tool in a teaching situation can be developed. Therefore the goal of this study was to promote computer literacy among the lecturing staff and students of a teacher training institution.

3.2 Selection of a subject for the case study

Edgewood College of Education (ECE) offers courses towards a four year H.D.E. diploma for prospective teachers at the Junior and Senior primary level; arts, sciences and technika at the secondary level; a four year Bachelor of Primary Education degree as well as a number of part-time F.D.E. diploma courses for primary and secondary in-service teachers. The 1991 enrolment was 511 full-time students, 150 part-time students with an academic staff of 78 lecturers.

ECE was chosen as the subject for this case study for two reasons:

(i) The writer was at the time of the study a Senior Lecturer in the Computer Studies Department of the college and it was convenient to use the computer facilities.

(ii) The organisation and ethos of the college was similar to that of any general high school under the management of the House of Assembly. Subject choices and packages

offered at ECE are similar to those in the schools; the School Handbook list of rules and regulations is used by both school and ECE; the academic staff are employed by the Natal Education Department and are subject to this body's control; the academic staff are required to be members of the South African Teachers' Council (a National organization) as well as the Natal Teachers' Society (a local organization). Therefore any circumstances or problems arising from the introduction of the project in the college would be similar to those to be expected in a high school.

Previous attempts at developing computer literacy skills in the academic staff had involved a short 2 to 3 hour introduction to word processing, using APPLE 2+ machines in the first course and COMMODORE 64 machines in the second course. From comments made by the staff who had attended one or both courses, it appears as if the participating staff members merely covered the rudiments of word processing. There were no attempts made by the presenters to provide more advanced courses in word processing or to offer any other advisory support service to the staff. Consequently only a few staff members continued to develop further skills for their personal use, and there was no evidence to suggest that anyone integrated these skills into a teaching situation.

3.3 Research procedures used in the case study.

3.3.1 Outline of the programme

The approach used in this study was to incorporate short concentrated formal courses in aspects of computer literacy (word processing, spreadsheet and database) with a number of smaller workshops and lectures. The skills and knowledge acquired by participants during the programme would form the foundation from which the participants could develop their own computer literacy skills.

The major steps in the programme were planned to cover the first six months of the academic year at ECE (ie. January to June 1991) and have been summarized in the form of a flow diagram (Fig.1) to enable the reader to obtain a quick preliminary overview.

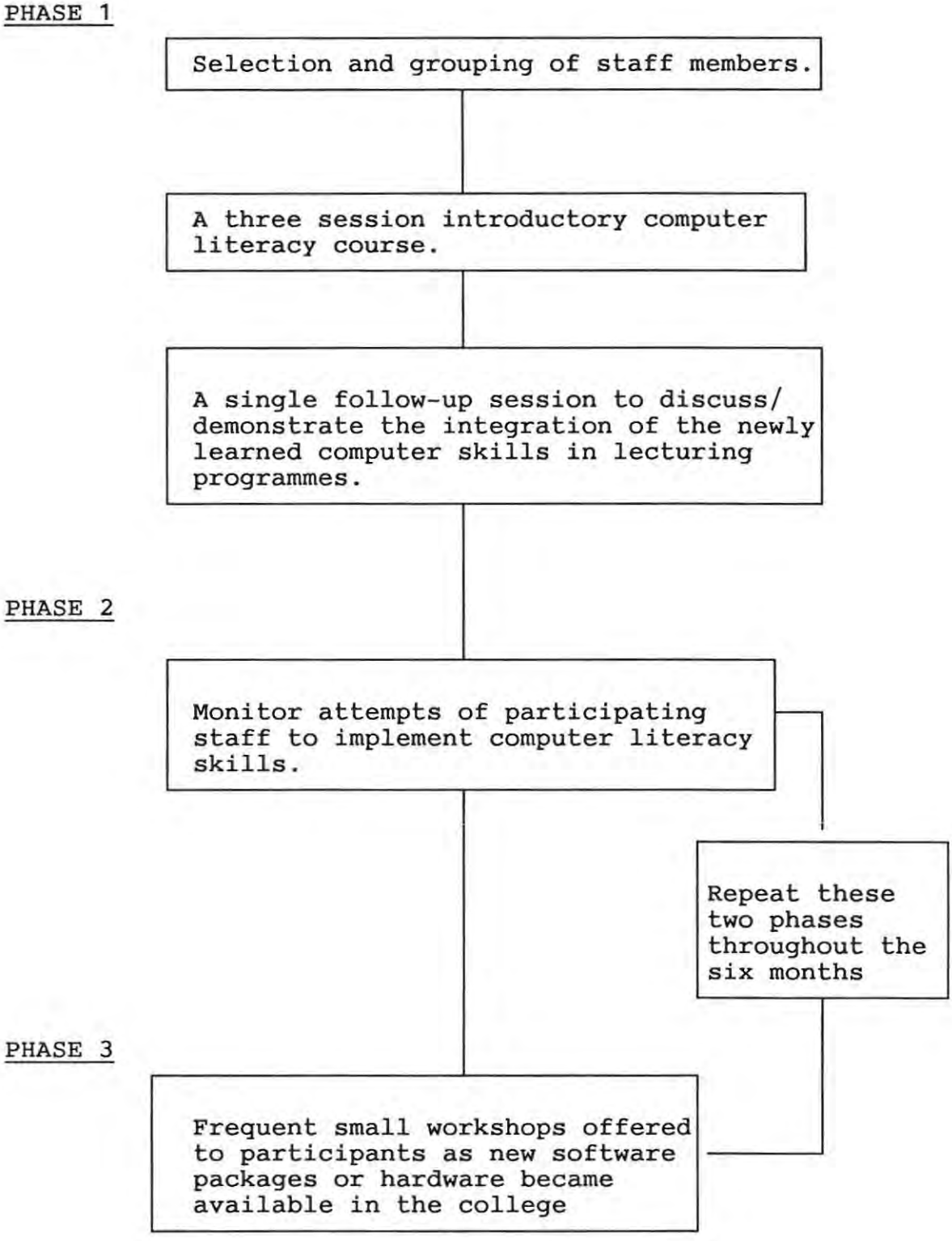


Fig 1: Flow diagram to summarise the implementation of the staff development programme.

3.3.2 Phase 1: Selection of participants

Each subject department (see Table 1) was invited to nominate at least two lecturers to participate in the staff development programme. This selection process had two aims:

(1) To initiate the hierarchical collaborative processes as outlined by Cox et al (1988) and used in the NIVO project (Williamson & Waker : 1991: chpt.10 :5). These research projects report on the advantages of initially introducing new innovations to upper levels of management (heads of department or headteachers) rather than a classroom teacher. The latter is usually not in a position to implement the innovation throughout the institution in contrast to a headmaster/headmistress who is able to make decisions about issues such as resource allocation, funding etc. for the whole institution. In addition, involving two or more lecturers and the Head of Department in the innovative programme, would create more opportunity to collaborate in the planning and development stages of a similar programme in their own departments (Clements :1991:28).

(2) To encourage each subject department eventually to adapt the computer literacy skills learned into subject specific topics (Schiffmann :1985).

Due to the large number of participants who responded to the

invitations, the basic computer literacy course was divided into three groups of ten members each. Each group was required to attend three sessions of three hours each - one session per week. The grouping of participants was arranged so as to encourage inter- and intra-departmental integration as proposed by Schiffmann (1985) and in the study by Cole and Riser (1988).

STAFF NO.	DEPARTMENT	STATUS	COMPUTER EXPERIENCE
GROUP ONE			
1	Technical Drawing	SL	word processor
2	Geography	HOD	none
3	History	SL	word processor
4	Senior Primary	L	none
5	Junior Primary	L	none
6	Technika	SL	none
7	Speech & Drama	SL	none
8	Speech & Drama	SL	none
9	Technika	SL	none
10	Technika	SL	none
GROUP TWO			
1	Zulu	SL	none
2	Philosophy	SL	none
3	Afrikaans	HOD	word processor
4	Physical Science	L	none
5	Library	HOD	none
6	Library	SL	none
7	Junior Primary	SL	none
8	Mathematics	L	none
9	Library	L	none
10	Mathematics	L	none
GROUP THREE			
1	Library	L	none
2	Biology	HOD	word processor
3	Commercial Science	L	none
4	Biology	SL	none
5	Ed. Technology	HOD	none
6	Art	L	none
7	Industrial Arts	L	none
8	Library	L	none
9	Geography	SL	none
10	Ed. Technology	L	none

TABLE 1. A summary of the participants in the staff development course.

Key to abbreviations in Status column:

SL = Senior Lecturer
HOD = Head of Department
L = Lecturer

3.3.2.1 The computer literacy course

Of the thirty staff members who participated in the study, only four had previous experience in or exposure to computer technology. It was decided to approach the initial course as if all participants were absolute beginners - a decision in concurrence with Wilson (Williamson and Waker :1991 : chpt.9:1) who suggests that initially it is best to assume a state of no knowledge or experience. Each group attended three sessions of three hours each. This arrangement allowed one person to a machine with two machines spare for demonstration and/or the inevitable machine malfunctions. Therefore although the number of possible staff participating was reduced by half, it was thought that a one-person to one-machine ratio would facilitate a more rapid learning curve for each person than two (or more) to one machine.

The three sessions consisted of:

Session 1.

(i) A brief description of computer components and explanation of selected terminology so as to enable the participants to build a simple mental mode of how the computer technology operates in relation to the application packages used.

(ii) A comprehensive overview of a word processor package (Professional Write) to demonstrate the common

features found in most word processor packages. As there were three groups of participants, the presenters (two members of the Computer Studies Department) were able to experiment with a variety of methods to teach the package. It was found that the most efficient method for the small group of ten involved the presenter 'calling out' instructions whilst the participants followed on their computer monitors and wrote down their own synopsis of the commands and explanations. In addition to this 'orchestra' method of teaching, use of pre-saved files of student testimonials (compiled by the presenters) was far more efficient than the participants (who lacked keyboard skills) typing in their own material for manipulation.

> Research in Scotland on introductory computer literacy courses showed that word processing proved the most successful skill to use as a starting point of teacher training courses. All teachers and educators have a need for this skill and the course presenter can almost immediately demand computer-generated material from students in a variety of subjects. (Williamson and Waker :1991: chpt.9:3).

Session 2.

A brief demonstration of a spreadsheet package (AsEasyAs) via the use of a magnabyte tablet quickly established the basic principles of the spreadsheet. To avoid the possibility of the software being studied as an end in itself, participants then worked on personal projects (home budgets, student mark schemes etc.) they had been requested to provide for the session. In contrast to the word processing session, the spreadsheet allowed for a more individualized approach as participants could manipulate the features available in the spreadsheet to suit their own needs, abilities and interests. There appeared to be a greater spread in ability in all three groups in the spreadsheet session compared to the word processing session.

The writer concluded that this might be due to the emphasis on arithmetic calculations - an area where a number of participants showed lack of confidence.

Session 3.

The final session enabled the participants to make use of established files of student data to make use of the facilities offered by a database package (PCFile) as well as creating their own files (Christmas card list or personal address book). In all three groups, the data base package appeared to be the most complex

and abstract to the participants. All of them stated that although the database had little attraction as a useful tool on a personal basis, the concept of a database and knowledge of its capabilities was valuable. In retrospect it is the writer's opinion that a simple desk top publishing (DTP) package might have been more attractive and useful to a teacher than the intricacies of a database package. From reports and observations of worldwide trends in computer literacy courses (Williamson and Waker: 1991 : chpt.6: 13 and chpt. 9: 4) DTP packages are being used (together with word processing) as a useful starting point to make computer education more appealing to students.

3.3.2.2 The follow-up session.

In the fourth week, each group attended a 'follow-up' session in which staff were advised on how they could develop their computer literacy skills to use in their individual subject areas. During the session each member of the group was provided with a timetable which set out the time and machines allocated to the participants of the project for further use. Teacher access to computers at all times was one of the factors cited for the success of the IBM Model Technology Schools project in California, USA (Williamson and Waker: 1991 :chpt.2:5). Therefore the computer laboratory

facilities and specialist support staff were made available to the participants for their use as required.

In addition to the timetables, each participant received a folder containing articles, worksheets and reports on specific examples of the adaptation of generic software packages to subject specific materials. Most of the material in the folder was obtained from publications such as The Computing Teacher; Junior Education; Arithmetic Teacher; MicroMaths; the School Science Review; Instructor and Media & Methods (Appendix II). All the material had been designed by teachers and tested in the classroom situation. Examples were chosen from a variety of subjects (Mathematics, Geography, Sciences, Home Economics, Music and Language) for all school levels (Junior primary, Senior primary, Secondary and Tertiary education) and for each of the generic software packages used in the course.

After demonstration and discussion of an example based on each of the software types, the participants of each group were then requested to scan the articles, read and possibly experiment with materials which were more applicable to their personal interests over the next few months. It was suggested that those of common subject interests (eg: languages) collaborate to adapt the file materials to suit their subject or produce new resources to use in their lecturing programs.

The completion of phase 1 (computer literacy course and follow-up session) for the three groups was achieved by the end of March ie. the end of the first academic term.

3.3.3 Phase 2: Monitoring of effects of staff development course.

From the outset of the project this phase was identified by the writer as being possibly the most difficult to assess accurately. To facilitate assessment as far as possible, the monitoring process was organized as follows:

(i) Each computer laboratory was provided with a 'log' book which was used to record the computer usage of any individual other than Computer Studies major students. The log book was arranged to reflect the following information to be filled in by each user:

Log book heading	Reason for inclusion
* Date	* to monitor influence of staff development course on staff & students
* Name and year of student or staff	* to trace user if any detail incorrect or incomplete
* Software used	* to establish which computer literacy skill most used
* Reason for using computer for this task	* personal decision or suggested/required by lecturer of course

* Course and lecturer's name	* to establish whether staff member had/had not been on the staff development course
* Duration of use	* to estimate to what extent facilities were used by students/staff with a view to motivating for additional facilities

(ii) The computer laboratory support staff were asked to keep a brief record of any request made by lecturing staff for use of the computer room. The record reflected details such as the name of the staff member, the year and course of the student group and the lecture topic. This information was recorded on timetables for each laboratory.

Both forms of record - the log books and the laboratory timetables were started at the beginning of the year (January) and maintained for the six month period from January to June 1991.

Thus, in summary, the achievement of goals for the project were to be assessed from the log books and laboratory timetables by indicators such as:

* how often students used the computer facilities because of instructions issued by lecturing staff;
* if any change occurred in the pattern of student use from

having to use the computer as a tool in assignments to one of personal choice because of the recognized benefits of doing so;

* the extent to which the staff participating in the project used the computer as a tool for professional or personal tasks;
* what changes occurred in the use of the computer department resources by the staff participating in the staff development programme.

After a few weeks, it was necessary to extend the monitoring process into the homes of participating staff. Because of the introductory computer literacy course, five staff members purchased their own machines to use at home. Therefore little personal use by these participants was being recorded in the log books and yet observation of materials produced by these staff members indicated a significant increase in basic skills. Those participants who owned machines were then asked to keep records similar to the log book of their home computer use.

3.3.4 Phase 3: Continued support programme.

Williamson and Waker (1991 :chpt.10:1), in their report on the NECC '90 and WCCE '90 conferences, focussed on the essential requirement of continued guidance and support to any in-service or staff development programme. This report

summarizes a number of international projects, one of which was the Netherlands "Hundred Schools Project" designed to promote computer literacy in a sample of schools. (Williamson and Waker :1991 :chpt.10:5). One of the factors attributed to the failure of this project was the lack of ongoing support after the initial in-service training. Clemente (1991:29) identified follow-up support as the single most important factor contributing to the successful implementation of new ideas and materials.

To obviate this reason for failure, care was taken in this case study to provide continued follow-up support. To bolster any flagging interest and to demonstrate the wide range of computer education, a number of short informal "workshops" were held during the second academic term at ECE (ie. April to June). The topics of these workshops varied sufficiently to cater for a variety of interests. A brief abstract of each topic is set out below and the relevant computer literacy skill involved is indicated in brackets.

* Demonstration of the full capabilities and 'hands-on' experience of simple projects of two DTP packages viz. NEWSMASTER and PUBLISHIT. Those attending this session prepared assignment covers, reports for the college magazine, worksheets and other simple materials for use by lecturers and students. (DTP)

* Demonstration by two local software vendors of school administration packages used by a local primary and high school respectively. (Database)

* In-service course on MSWORKS - an integrated software package to be introduced into secondary schools in 1992. (Word processor, spreadsheet, database, communications)

* Demonstration by F.D.E. (Computer Studies) students of CAL packages written in PASCAL for a variety of primary and high school subjects. (Programming)

* Demonstration by F.D.E. (Computer Studies) students of specific subject material designed for use in conjunction with MSWORKS. (Word processor, spreadsheet and database)

* Demonstration of and 'hands-on' experience with the magnabyte tablets. This session was designed to promote the 'one computer in each classroom' idea (Watson :1990; and Barba :1990). The staff attending this session were shown how to set up a simple trolley with a computer, printer, overhead projector and the tablet. A few CAL programs and the basic principles of the spreadsheet were used to demonstrate the advantages of and practice in using the system. (Hardware)

* Demonstration of a package aimed at those who wished to

'play' the stockmarket at home. (Communications, graphics)

In addition, the Computer Studies department staff continually directed copies of the following documents to the appropriate participants:

* Relevant materials from publications to add to the folders issued in session four.

* Copies of good student assignments in integrating computers across the curriculum via the use of generic software. Software packages used by the students included MINI-OFFICE (Commodore 64), APPLEWORKS (Apple 2c) and MSWORKS (IBM) - thus catering for primary and secondary levels.

The monitoring process of phase 2 outlined in 3.3.3 continued throughout this time.

CHAPTER FOUR: RESEARCH FINDINGS AND IMPLICATIONS

At the end of June (second academic term) the logbooks, computer laboratory timetables and personal logbooks were collected and examined to assess the extent to which the project had been successful in attaining its objectives. The objectives of the project were:

(i) To initiate and develop computer literacy skills in the staff participating in the project and

(ii) To promote the integration of computer literacy skills and computer technology into the participating staff's lecturing programmes.

The writer compiled a list of categories which would be useful in deciding whether the objectives had been reached. These categories are as follows:

(1) There was no apparent progress made by a particular staff member during the six month project.

(2) A staff member had instructed a student(s) to use an item of software for an assignment.

(3) A staff member used software and technology for personal and/or administrative reasons.

(4) A staff member requested the Computer Studies staff to run courses for specific student groups in the computer laboratory.

(5) A staff member presented a lecture or a course based on skills developed as a consequence of the staff development programme, making use of CAL resources

already available.

(6) A staff member used generic software to develop his/her own lecture materials and used the computer technology as a teaching aid.

Information collected from the project records was summarized. These summaries were then examined to see if and where each participant slotted into the six categories mentioned above.

4.1 Category 1: No apparent progress made by a participant during the project.

Only three out of the thirty staff members indicated that they had not used the computer since their course as there had not been any necessity to do so. Although these three participants appear to have made no further progress, they did state that should the need arise they would then be in a position to evaluate whether the use of computer technology would be appropriate or not.

4.2 Category 2: The use of computer facilities by students due to staff inducement.

Table 2 summarizes the use of the computer technology by 84 (out of a possible total of 429) students due to instructions or requests made by staff participating in the

project. The computer studies major students are excluded from the sample of 84 students and from the 511 full-time students. The sample size of 84 students represents the total number of students who used the computers during the six month period. Table 2 also indicates use of computer facilities by students due to personal choice. The figures are presented as the average number of hours per week in each month from January to June 1991.

Month	Average no. hours/week using computer facilities in each month	
	Due to instructions	Due to personal choice
Jan	60	12
Feb	105	18
Mar	125	25
Apr	120	27
May	72	19
June	45	16

Table 2: Number of hours students used computer facilities (average number of hours per week in each month)

Fig 2 illustrates these averages in the form of a histogram. The general trend of the graph in Fig 2 shows an increase in the average number of hours per week that the students used the facilities. Decreases in April and May can be partly attributed to the Easter vacation (March/April)) and three long week-ends (May). During June the students wrote mid-year exams, there was a two day compulsory conference and the students were preparing for their practical teaching by

visiting schools with tutors etc. It should be noted that these figures do not take into account the possibility of some students making use of home computers for their College coursework.

Fig 3 illustrates that the only two software packages used by the students during this period of monitoring were word processors (91%) and desk top publishers (9%).

FIGURE 2
STUDENT USE OF COMPUTER FACILITIES

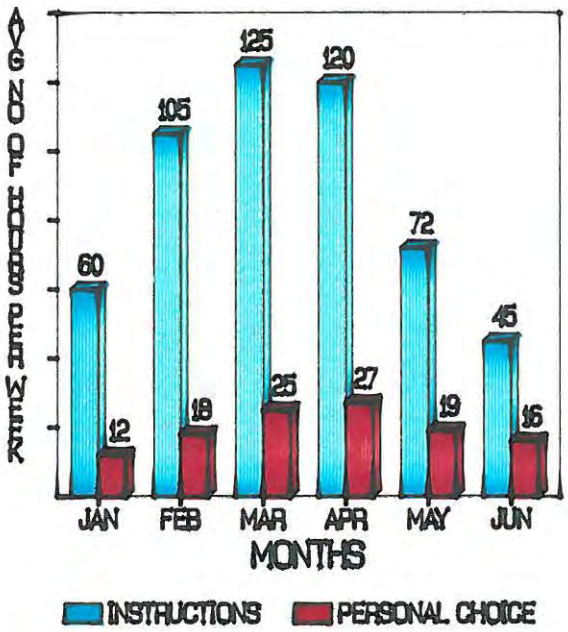
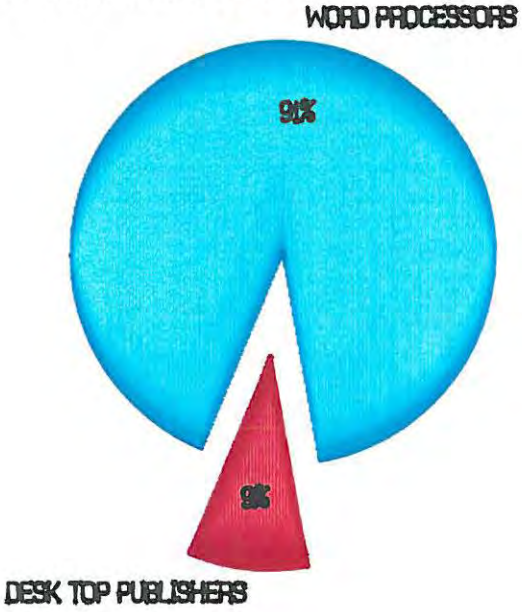


FIGURE 3
SOFTWARE PACKAGES USED BY STUDENTS



4.3 Category 3: The use of computer facilities by staff participating in the project.

Table 3 summarizes the average number of hours per week in each month of computer use by 27 of the 30 participant staff at College and home.

Month	Average no. hours per week in each month
Jan	22
Feb	132
Mar	116
Apr	101
May	98
June	59

Table 3: Number of hours staff used computer facilities (average number of hours per month)

Referring to Fig 4 which illustrates the averages listed in Table 4, there appears to be a increase in the use of the technology by the participating staff during the period January to the end of June. The overall low use of facilities by staff was explained in part by their lack of time and by the lack of computers at the appropriate times. This situation prompted five of the staff group subsequently to purchase their own machines to use at home.

Fig 5 illustrates a similar pattern of software use to that of the students ie. word processors and desk top publishers were the only software used for 97% and 3% of the

time respectively.

In contrast to student motivations for using the computer technology ie. coursework, the time spent by staff members was evenly distributed between professional and private tasks.

FIGURE 4
STAFF USE OF COMPUTER FACILITIES

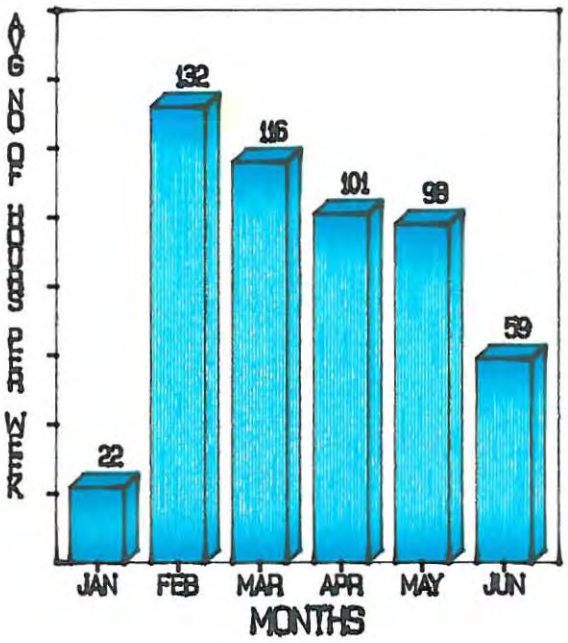
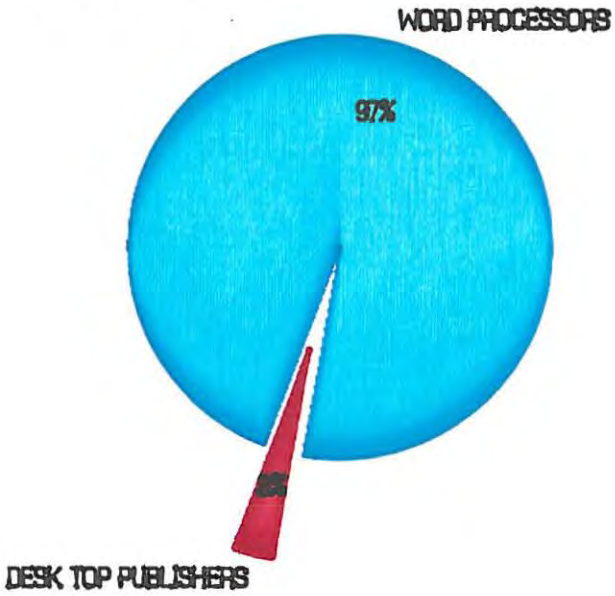


FIGURE 5
SOFTWARE PACKAGES USED BY STAFF



4.4 Category 4: Mini courses requested by staff participating in the project.

The Computer Studies Department was requested by some staff participating in the project to provide a number of 'mini' courses for student groups during the period January to end of June 1991. The motivation given in every case was that the students lacked basic computer literacy skills and so would not be in a position to benefit from any attempt by staff to integrate the computer into the curriculum.
This pattern of computer room use was encouraged, but the staff member had to be involved in the planning and be present during the course although a member of the computer studies department actually presented the material. This condition was made so that lecturer requesting help would develop sufficient confidence to present the material himself/herself the next time he/she needed to. The details of these mini courses are as follows:

(i) A word processor course requested by a Junior Studies lecturer for a group of third year Junior Primary student teachers was planned for a two hour period once a week for three weeks. The students were introduced to the basic features of a word processor package (SuperScript) and a simple graphics package (Printshop) using the Commodore 64 machines. By the

end of the three-week period all the students were able to make use of their word processing skills and the graphics program in the construction of activity cards to be used in the Junior Primary classroom during the practical teaching period.

(ii) A word processor and spreadsheet course was presented to Secondary Science student teachers. As these students are not timetabled for a formal computer literacy course during their four year diploma, time was allocated from the Physics and Chemistry periods for a concentrated course in word processing and spreadsheets. The students worked with the word processor for three two-hour periods and the spreadsheet for two two-hour periods using MSWORKS on the IBM compatible machines. The content material was provided by the Physical Science lecturer who was a project member. By the end of the five weeks the students were able to write up their Physics experiments using the word processor and incorporate the spreadsheets and graphs into the document.

(iii) A demonstration requested by a Senior Primary lecturer was given to Primary Mathematics students of how to use LOGO to teach mathematics. These students were already familiar with LOGO as a programming language so the demonstrator (a Computer Studies Department

lecturer) was able to allocate all the contact time to illustrating how LOGO could be used as a tool to teach selected aspects of the Primary School Mathematics syllabus. The students then proceeded to work on an assignment for a number of weeks based on mathematics and LOGO in the primary school. It was decided not to include the computer time these students spent on the assignment as LOGO programming did not fit into the definition of generic software for the purposes of this project.

(iv) A half-semester (six weeks) course requested by an Educational Technology lecturer in the skills of word processing and the appropriate use of CAL material in the primary classroom was taught to Bachelor of Primary Education fourth year students. Each weekly period allowed for a two-hour hands-on session in which the students worked with EasyScript to produce suitable English language tasks for the Senior Primary phase.

(v) An introductory course in word processing was given to linguistically disadvantaged students from a local high school in an attempt to help them to practice and develop certain English language skills. The course was requested by an English lecturer (who did not attend the staff development programme) on behalf of a

colleague in the school. The students were shown how to load pre-saved files and work on these files by adding paragraphs, editing sentences, selecting correct spellings so that words were used in the correct context, and changing the sequence of paragraphs to provide the correct order of events. At the time of writing the report on the case study, the writer had not received any feedback about the language progress of these students.

Besides the specific mini-courses mentioned other developments included:

(i) Requests were made by the College Registrar for further introductory computer literacy courses for those ECE staff who did not take part in the original project and the administrative staff who did not work with computer technology.

(ii) One of the participating staff members (Biology), now familiar with the principles of a database, negotiated the use of ECE as a centre for a provincial schools' project to monitor the quality of water along the Umgeni river and its tributaries. This project would make use of the extensive database of the Umgeni Water Board via the use of a modem.

4.5 Category 5: The integration of Computer technology into lecturing programmes via the use of CAL resources.

No staff member used the facilities in this manner.

4.6 Category 6: The integration of Computer technology into lecturing programmes using generic software.

Two members of the staff (Biology and Afrikaans) made use of either the word processor or DTP packages in their lecturing programmes. In each case files were compiled which the students loaded and worked upon according to the instructions provided. The uprooting of the students from their usual lecturing venue to the computer laboratory to complete the given task(s) using the computer technology did not seem to pose a problem to the students, the lecturer or the continuity of the lecture.

4.7: Discussion of the research findings

A consideration of trends in the use of computers by staff and students during and after the staff development course suggests that in general, there has been an increase in

awareness and general use of computer skills and facilities. Certain elements of the findings, however, need to be highlighted for discussion viz.

(i) The use of computer facilities by students.

It was noted that very few students used the computer for their coursework unless specifically required to do so by lecturing staff (Table 2 and Fig 2). This suggests that the students do not as yet personally perceive computer technology to be an all purpose general tool. Perhaps this pattern will change as more staff act as role models making use of computer technology in their lecturing and more frequent demands are made by staff on students to use computer technology in their coursework. Examples of such demands could be for assignments to be completed on a word processor; designing lessons which make use of computers and generic software in teaching languages, mathematics or the sciences. The situation that the writer would like to see emerge is that of the student teacher making an intelligent choice of the most appropriate technology to use in any situation. An intelligent choice can only be made if the student teacher has been exposed to as many options as possible in his/her training.

(ii) The use of computer facilities by staff.

It was noticeable that only two members of the original staff group of thirty attempted to integrate the generic software into their lecturing programmes. A factor that might be attributed to their achievement is that both had had some previous experience in word processing. Research has indicated (Williamson & Waker :1991 :chpt.10:2) that it takes approximately two years for a teacher to develop sufficient confidence and skills to be able to integrate computer skills successfully into the curriculum. Therefore after one short course in computer literacy and six months' practice perhaps one should only expect to notice an increase in basic computer literacy skills. This has obvious implications for any in-service courses designed to promote computer literacy skills during a few days of contact with the teachers.
The three participants who did not make any use of the facilities after the initial introductory course have increased their computer awareness as a result of their participation in the project. However, whatever practical skills gained in the introductory course by the three staff members were lost as the skills were not applied to other situations. To maintain and develop a certain proficiency level in computing, one

has to practice the skills continually which, these staff members have not done.

(iii) The software packages most commonly used

All staff and students making use of the facilities used mostly the word processors and to a much lesser degree, the desk top publisher. The staff and students made use of the facilities in a manner which centred around and supported their work needs at that time. This initial pattern of software use by beginners agrees with the findings in Scotland (Williamson & Waker :1991 :chpt.9:3).

(iv) Teacher access to computer facilities

It was observed that the greatest number of hours spent on the computer as well as the greatest amount of material generated was by those staff members who purchased their own computers. Teacher access to own computers was one of the main reasons for the success of the 1987 IBM Model Technology Schools project in California, USA. (Williamson & Waker :1991 :chpt2:5). Similar conclusions were the basis of the 'Apple for the Teacher' project in the USA and a scheme in Scotland whereby teachers purchased computers at rate of 40% less than the normal price.

(Williamson & Waker: 1991 :chpt.10:10-11). There has been no attempt by the Natal Education Department to negotiate a 'low-cost deal' for pupils or for staff who might wish to become computer literate. The cost of the basic hardware required generally prohibits the purchase of a machine for home use. It cannot be expected of teachers, already overburdened with formal timetable and extra-mural commitments, to spend more of their time learning the technical aspects of hardware systems and application packages, after hours, on school machines. Many teachers are concerned about their lack of skills in this area and would consider buying their own machines if financial assistance in the form of low interest loans, subsidies or income tax rebates was available.

(v) The role of the computer specialist staff in the project.

The Computer Studies Department staff were essential to the project. Their role was to institute, co-ordinate, encourage, advise and assist other staff members in the development of computer literacy skills and integration of computer technology into the classroom. The necessity for computer education specialists concurs with the suggestions by other researchers in this field (Fowler :1990; Jacobs :1985; Moore :1984). As

mentioned previously, the Natal Department of Education Computer Literacy subject advisers cannot supply sufficient on-going support for every teacher in every school. Therefore much of the staff development will have to occur within the institution itself. One of the recommendations made in the report by Williamson and Waker (1991 :chpt 10.:12) was that in-service training centres should be on-site (ie. in schools) as far as practically possible. This requires the services of a resident computer education specialist. To train these specialists is the task of the teacher training institutions. There has been a proposal for an FDE Computer Education to be offered at the two Colleges of Education in 1992 (Appendix III). The aim of this FDE course is to train practising teachers in the role of computer education specialists.

CHAPTER FIVE: RECOMMENDATIONS

5.1 Introduction

The title of this project - A strategy for promoting computer literacy in staff and students of a teacher training institution - suggests that there is no single solution to the challenge of developing a computer literate teaching corps. Large scale approaches such as national curricula changes and country-wide in-service courses have played a vital role in generating the need in teachers to become computer literate. But when all else is considered, it is the efforts of the institutions and those made by each individual that will ultimately affect the outcome of such a campaign. The project at ECE involved the use of local resources and expertise to emphasize the necessity for staff to be computer literate and thereafter to provide the skills and tools to fulfil the need. From the outcome of the project it was realized that the task would never be completed. The development of computer literacy skills and how to make use of the skills in teaching is a never ending process due to the dynamic nature of all the factors involved (technology, learning theory, students, needs of schools, needs of employers etc). Perhaps a few quotes and examples will illustrate why the development of computer literacy skills is an on-going process.

"An IT naive teacher now probably knows more than the IT elite did 10 years ago. Its just that the goal posts have

moved." Diane Freeman in Quigley (1990).
"We can assume that technology is going to change fast. We have to plan now to meet those changes before they can take place.....Free thinking and high flying are what computers are all about. This does not fit in with traditional thinking in education." An anonymous writer in Quigley (1990).

As a personal observation the writer has not been able to use the same course outline (or even its skeletal framework) for Edgewood College's Introduction to Computing courses over the last three years. One of the reasons for this situation is the change in technology (from APPLES to IBM compatibles). This change has necessitated a change in lecture content as well as changes in practical aspects such as the availability of new and increasingly powerful software. A second reason is that each group of first year students is more computer literate than previous first year groups. As mentioned previously all Natal high schools offer a two-year computer literacy course to Standards six and seven. In addition more homes are acquiring PCs as the price decreases and the media hype increases.

5.2 Roles of the Education Departments, Colleges, schools and teachers.

Although the local institution and staff have been

stressed in this project, one needs to consider the role of all parties concerned in the task of producing computer literate and computer using staff.

5.2.1 The role of the Education Departments.

Part of the role of the Education Departments is to motivate for national criteria in teacher education. The requirement for all teachers, primary and secondary, to have successfully completed a computer education course will ensure that future trainee teachers have the foundation on which to base their teaching.

To date annual in-service courses have provided for teachers already in service. In-service courses certainly initiate enthusiasm. The writer has attended many in-service courses which fire up much enthusiasm and good intentions to implement the newly learnt skills and knowledge. But on returning to the school environment this enthusiasm is often extinguished by a bureaucratic, hierarchical and authoritarian system which seldom allows for any immediate innovative change to take place at the grass roots level. In-service training and support needs to be moved as close to the school site as possible. The training and support would then be more practical and

applicable to school circumstances. More significantly, the organization of these courses should involve head teachers, therefore increasing the chances of implementing any innovations.

As demonstrated in this case study it takes some time for a novice to build up sufficient computer literacy skills to be able to integrate the technology into a teaching situation. As subject syllabi are revised specific computer components should be designed and written into the new syllabi and course outlines. For many teachers the integration of computer technology into the curriculum must become policy before they will take the initiative themselves.

If the Education Departments are serious about preparing teachers to be computer literate then there is an urgent need to provide teachers with the opportunity to own their own computers. As mentioned previously, research has indicated that teacher access to computers is an important factor in the development of computer literacy skills. To quote Barry Kissnae of the University of Western Australia (Quigley :1990) "The key....is computer access". The case study at ECE indicated that those staff members who purchased their own computers could practise more often at home. Consequently these staff members produced materials

more frequently and of a higher standard than those staff who relied solely on access to the college computers.

An interesting comparison can be made between the foresight shown by commerce to promote the computer literacy skills of their staff and the apparent lack thereof shown by the Education Department officials in promoting computer literate teachers. A section of an article appearing in the Finance section of the Sunday Tribune on 2nd July, 1990 is quoted as follows:

> NASHUA BUYING SCHEME TO AID STAFF
> COMPUTER LITERACY
>
> A move to increase computer literacy initiated by computer marketer Nashua, is gaining favour with a number of large companies and groups.
>
> The development involves the introduction by companies of a staff buying scheme for computer hardware, to assist employees to purchase a computer for home use.
>
> The scheme has three main objectives. Firstly, it is a constructive staff

incentive, as the computer at home can be used by the whole family. Secondly, once the staff member owns a personal computer, work can be completed at home. Thirdly, the scheme enables the staff member either to become computer literate or to refine computer skills which cannot be developed in the office due to lack of time.

A financial package has been developed, giving businesses a maximum bulk discount, even though the purchase of the hardware is made on an ongoing basis as required by staff. Several major groups have paid half the purchase price, allowing employees to pay off the balance over an extended period.

5.2.2 The role of teacher training institutions.

One of the roles of teacher training institutions is to provide an avenue for practising teachers to develop new skills. This could be in the form of formal diploma courses (eg. the FDE Computer Education course now being proposed for 1992) or short courses concentrating on single aspects of computing in the

classroom (eg. the word processor and how to integrate these skills into language teaching). These short courses/workshops must be held on a regular basis, adapted to the needs of the local teachers and preferably initiated and presented by local teachers. Clemente (1991 :29) states that two of the factors for successful computer in-service courses are that teachers should decide what their needs are and secondly that teachers should teach the teachers. These shorter more specific courses are needed to supplement the formal in-service courses held by the Computer Literacy subject adviser. Experience at Deakin University, Australia (Williamson & Waker :1990 :chpt.9:2) indicated that staff training in integrating computer literacy skills into the curriculum was far more successful if the training focussed specifically on each teacher's work needs rather than a general course for all teachers.

Besides re-training teachers already in service the teacher training institutions must provide initial training in computer skills to teacher trainees. By the time the average student graduates from College the integration of computer technology into his/her teaching practice should seem as commonplace as using the overhead projector. Re-educating teachers in a new field is far more expensive and difficult than

during their initial training years.

5.2.3 The role of the school.

The school must begin to take greater responsibility in facilitating the spread of newly learnt computer literacy skills, knowledge and ideas into classroom practice. Staff, via the support of school management committees, should be encouraged to integrate these skills into their teaching programmes. This case study has endeavoured to show that 'in-house' training and support can be fashioned to suit almost every teacher's needs.

The school's staffing quota should make provision for a computer education specialist who will co-ordinate all facets of the appropriate use of the computer technology in the school as well as train the rest of the staff within the school. As seen from the case study at Edgewood the success of the staff development programme at ECE can mostly be attributed to the advisory and technical support provided by the Department of Computer Studies staff during the initial introductory and the more subject specific subsequent courses. A group of schools in a particular area might consider sharing a computer education specialist if each school is unable to support one on its own. As mentioned before, the

involvement of the whole institution in adopting an approach usually bodes success for the project. As the numbers of pupils increase in the primary and secondary schools, teachers will need to assess their methodology and adapt to using appropriate technology whenever possible.

Formal in-service education is not only expensive and time consuming but is often unsuccessful in promoting long term goals such as changes in attitudes, values and teaching styles. However, in-service courses usually provide for increases or changes in knowledge and skills. The subsequent implementation of these changes in knowledge in a supportive school system will eventually provide the time and means for change in teaching styles.

5.2.4 The role of the individual teacher.

The teacher's role in disseminating innovative ideas and teaching practice is possibly the most significant of all the roles considered so far. No matter how sound the infra-structure of a school is, it is ultimately the contributions of the individual teacher that make the system work. Using computer technology in the classroom should be a goal that

teachers want to achieve and should not be forced upon them in some bureaucratic way. It is difficult enough to adopt and adapt an innovation into one's teaching programme without extra constraints such as lack of equipment, lack of time and lack of regular guidance and assistance. It is naive to imagine that all teachers will rush out to "do computer courses" to improve their teaching in the classroom. The method of renumeration in the Education Department does not offer incentives to teachers for introducing innovation(s) into the classroom. Teachers who show willingness to use computer technology should be given every possible opportunity to do so. Suggestions already made have been the opportunity to purchase their own machines to work on at home; time to attend and participate in any in-service or local meetings; time to develop expertise before taking on actual teaching tasks and access to a computer education specialist either within the school or a nearby local school.

When one considers that the most elementary result of this case study has been that thirty (mostly computer illiterate) out of 76 staff members attended a computer course because of their personal needs and interests, it becomes clear that Education Departments should encourage all teachers who are interested in

computer education and not just the computer literacy staff of a school. This wider encouragement should greatly increase the rate at which computer technology is integrated into the classroom.

5.3 CONCLUSION

Although there have been a number of useful 'spin off' results from this short, but concentrated attempt to develop computer literacy amongst the staff at ECE, the achievement of the original goal was assessed by the following indicators:

(i) the extent to which the students use the computer as a tool in their college work and

(ii) the extent to which staff use the computer as a personal tool.

It is the writer's opinion that this project has initiated the trend towards general computer literacy at ECE. Staff and students have frequent queries about aspects of computing related to their lecturing programmes and coursework. Requests and demands are made on the computer department staff and facilities which were not made before the project. During the day the computer laboratories are often full of students and staff working on the computers. The enthusiasm generated by the thirty staff members seems to have had an

inspirational effect on some other staff. As mentioned before the Computer Studies Department has been requested to repeat the staff development course in 1992.

Despite the increase in the use of computer facilities, however, desk top publishing and word processing programs were still the only packages used by staff and students six months after the project started. Except for the two staff who did attempt to integrate the computer into their lecturing programmes the rest have worked on honing their skills in word processing and desk top publishing. The follow-up programmes of lectures and demonstrations etc. simply made staff more aware of the diverse role of the computer as a tool in teaching. The goal to persuade staff to change from computer illiteracy to integrating computer technology and skills into lecturing programmes in six months was too ambitious. A beginning was made and the process of development should continue with time and as confidence increases.

A quote from the report by Williamson and Waker (1991 :chpt2:2), although referring to much larger programmes, adequately concludes this project. They write: "Whether the experiment succeeds or fails, one of the fringe benefits is experienced staff. Such staff either act as project leaders or as seasoned participants in other ventures."

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APPENDIX I

SUBJECT POLICY - COMPUTER LITERACY

SUGGESTED SCHEME OF WORK FOR COMPUTER LITERACY : STD 6 AND 7

COMPUTER LITERACY : STANDARD 6

Introduction	Computer Room Rules Disk care - rules
Meet the Apple	Computer system : keyboard, monitor, disk drive, printer Startup procedure 1 Apple Presents Apple disk Worksheet to summarise essential information
Computer terms	The Inside Story disk Worksheet to summarise essential information Terms : RAM, ROM, CPU, hardware, software .. Open a IIe computer for inspection Damaged disks - use to show actual storage medium
Keyboard skills	Typing games Use of SHIFT key - capital letters, alternate characters (: ? +) Caps Lock - switch between upper and lower case Del key - deletes character to the left of cursor RETURN key - proceed SPACEBAR - for blanks Educational Game : Lemonade Stand
Introduction to Appleworks	Apple presents Appleworks disk : Intro / Gateway / Wordprocessor Worksheet to summarise essential information

1) Startup procedure : STARTUP disk, PROGRAM disk
2) Adding a file to the Desktop : new document / existing | key 1
3) Saving a file onto the data disk | skills 4) Typing rules

WORDPROCESSOR

a) Editing	Cursor movement : arrow keys, Apple ruler Inserting text : position cursor and type Deleting text : characters, words, lines,

paragraphs Spacing : press <Return> for a blank line 2
Overstrike cursor

b) Features
Underlining headings, text 3
Boldfacing
Centring headings
Unjustifying and justifying text

c) Blocks
Moving text : paragraphs
Copying text 1

d) Find and Replace
Finding particular words in a document
Replacing all occurrences of words 1

e) Advanced Features
Indenting paragraphs, numbered paragraphs
Changing the margins Changing the pitch : characters per inch 3
Calculating page breaks : setting new pages
Tabs
Sticky spaces
Enter keyboard

f) Printing
Printing a document : 1 copy normally
Printer options : which printer 1

g) Task
Clearly defined writing project
Include variety of word processing skills
Use word processor for rough draft / ideas 2
Edit and correct before printing : peers check
Printed and handed in

Introduction to LOGO

Starting LOGO - procedure
1) Setting the prefix to the data disk : every lesson

a) Turtlegraphics
Basic primitives : FD, RT, LT, BK, CS ST, HT
REPEAT command : basic shapes - SQUARE, TRIANGLE, RECTANGLE

b) Procedures
Teaching the Turtle new commands
LOGO Editor commands

The concept of a workspace

Saving procedures onto the data disk

Loading procedures from the data disk

Saving new work / changes on the data disk

c) Projects

Simple pictures made up of basic shapes Procedures should be used
Loading procedures from the data disk
Saving new work / changes on the data disk

d) Additional

Apple presents LOGO : use as summary / retrospective
Worksheet to summarise essential information

e) Optional extra

Educational games : use mainly as reward (End of term)
1) Lemonade Stand (Apple at Play)
2) Apple 21 (Apple at Play)
3) Hangman : available 4) Scrabble : if available
5) Noughts and Crosses : available
6) Othello : available

Print Shop : cards, posters : if available

COMPUTER LITERACY : STANDARD 7

Introduction	Computer Room Rules : recap
	Grouping arrangements Disk care - rules : recap
LOGO	Starting LOGO - procedure : recap 1) Setting the prefix to the data disk | every lesson
a) Revision	Basic primitives : FD.. REPEAT command Procedures : using the Editor to teach new commands Design simple shapes, using procedures
b) Polygons	Using REPEAT to draw pentagons... circles... .....stars
c) Variables	Procedures which allow user to decide on size Simple shapes using variables
d) Point-plotting	SETX, SETY and SETPOS commands Design simple scenes : plan on graph paper
e) Arithmetic commands	PRINT command with operations : + * / - SUM, PRODUCT, REMAINDER, INTQUOTIENT commands RANDOM command
f) Animation	Moving pictures with PE, PU, PD 3
g) Sound	TOOT command Design of musical tunes ?
h) Project	Covers a variety of LOGO commands May include animation and sound Procedures must be used

SPREADSHEET

Apple presents Appleworks : Spreadsheet

Recap on :

1) Startup procedure : STARTUP disk
PROGRAM disk 2) Adding a file to the Desktop : new
document / existing | skills
3) Saving onto the data disk

a) Introduction

Using an existing spreadsheet to learn functions
Format : rows, columns, cells..
Cursor movement Entering data : labels and values
Changing data : blanking cells, editing cells
Changing column widths
Saving data to disk

b) Processing

Retrieving a spreadsheet file from disk
Deleting rows / columns
Inserting rows / columns Copying rows / columns
Functions : AVG, SUM, MAX, MIN
Entering own formulae
Copying formulae

c) Changing the Format

Changing value and label format
Improving the appearance : format
Arranging rows : alphabetic, numeric

d) Printing

Printing a report
Using printer options : CI ..
Copying a spreadsheet into a wordprocessed document

DATABASE

Apple presents Appleworks : Database

a) Introduction

Database concept : records and fields - using an existing database
Cursor movement
Changing an entry Viewing : multiple / single record
Deleting records, fields

b) Processing

Changing the layout of the database : column width, order of fields
Inserting new categories and entering data
Arranging records in order
Finding records Changing column width

c) Further Processing

Selecting records

d) Printing Reports

Setting up Table format reports
Hiding categories
Switching category positions
Viewing on screen
Printing

e) Setting up a Database

Planning the database : fields needed
Creating a database from scratch
Entering category names
Entering records
Processing the data

f) Optional

Transferring database records into a wordprocessed document

Optional extras

Educational games : use mainly as reward (End of term)
1) Lemonade Stand (Apple at Play)
2) Apple 21 (Apple at Play) 3) Hangman : available
4) Scrabble : if available
5) Noughts and Crosses : available
6) Othello : available

Print Shop : cards, posters : if available
Introduction to BASIC : Getting down to BASIC disk

APPENDIX II

Examples of how generic software may be used in teaching.

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APPENDIX III

F.D.E. - COMPUTER EDUCATION

V.D.O - REKENAARONDERWYS

PROPOSED SYLLABUSES

VOORGESTELDE LEERPLANNE

June 1991

AIMS

1. General aims

   1.1 To study not only the computer itself, but to study methods which will enable the teacher to solve a wide variety of problems with the aid of a computer.

   1.2 To eradicate any anxiety or fear that the teacher may associate with a computer.

   1.3 To develop in the teacher an awareness of the fast, accurate and effective processing of data by a computer, provided that individual rights and social needs are not regarded as secondary.

   1.4 To develop an awareness of the computerisation of routine tasks, so that the teacher is able to play a larger role in other areas of the school environment.

   1.5 To develop an awareness of the increased communication and availability of information that is facilitated by the computer.

   1.6 To develop a positive attitude towards using the computer for educational, administrative and recreational ends.

   1.7 To provide the teacher with sufficient knowledge and skills so that he/she is able to launch, manage and co-ordinate a wide variety of computer activities in the school environment.

2. Particular aims

   2.1 To convey a broad knowledge of the development, basic components and operation of a digital computer.

   2.2 To develop the skills of constructing an effective algorithm as a step by step solution to a problem, verifying an algorithm and writing a computer program to implement a correct algorithm.

   2.3 To study appropriate and educationally-oriented problems with a view to developing problem-solving skills.

   2.4 To develop skills in programming in LOGO and to provide information on the educational philosophy upon which LOGO is based.

   2.5 To provide criteria for the evaluation of educational software and to expose the teacher to available software.

2.6 To develop skills in the design and writing of educational software.

2.7 To develop skills in the use of graphics, word processing, spreadsheet and database programs with specific reference to possible applications in education.

N.B. The topics specified below do not imply an order of presentation within a particular year of study.

Computer Studies IA

1. Introduction to computers

    1.1 Historical background

        1.1.1 Pioneers
        1.1.2 Hardware developments
        1.1.3 Software developments

2. Basic components of a computer system

    2.1 Simple model of a computer system
    2.2 Correct handling and care of computer equipment
    2.3 Terminology
    2.4 Different microcomputers
    2.5 Setting up equipment e.g computer, printer
    2.6 Peripherals

3. Keyboard skills

4. Operating system essentials

    4.1 The functions of an operating system
    4.2 Use of commands e.g. formatting, copying

5. Introduction to computer theory

    5.1 Binary number system
    5.2 Data representation
    5.3 Data processing
    5.4 Operating systems
    5.5 System software
    5.6 Boolean algebra

6. Socio-economic implications of computers

    6.1 Problems such as:

        6.2.1 Computer viruses
        6.2.2 Computer crime
        6.2.3 Piracy and copyright considerations

Computers in Education I

1. Applications packages

1.1 Coverage of packages such as:

- 1.1.1 Graphics
- 1.1.2 Word processor
- 1.1.3 Spreadsheet
- 1.1.4 Database
- 1.1.5 Quiz generator

1.2 Applications of packages e.g. educational, personal

2. LOGO

2.1 Historical development of computer languages
2.2 Types - machine, low level and high level languages
2.3 Historical background of LOGO
2.4 Philosophy and educational basis of LOGO
2.5 Problem analysis
2.6 Algorithm development e.g. flowcharts, pseudocode
2.7 Debugging e.g. trace tables
2.8 Problem solving strategies e.g. top-down, bottom-up approaches
2.9 Programming in LOGO

- 2.9.1 Looping
- 2.9.2 Sub-programs
- 2.9.3 Variables
- 2.9.4 Parameter passing
- 2.9.5 Cartesian commands
- 2.9.6 Selection
- 2.9.7 Recursion
- 2.9.8 Word and list processing

2.10 Program testing
2.11 Programming style

3. Computer Aided Learning

3.1 Historical background
3.2 Types such as:

- 3.2.1 Drill and practice
- 3.2.2 Tutorial
- 3.2.3 Simulation
- 3.2.4 Problem-solving

3.3 Characteristics of learning programs
3.4 Computer Managed Instruction

3.5 Evaluation of software

4. Socio-economic implications of computers

4.1 Social issues e.g. employment, invasion of privacy
4.2 Application of computers in different fields
4.3 Careers in computing
4.4 Political issues

Computer Studies 1B

1. Further programming in LOGO

1.1 Screen display
1.2 Keyboard input
1.3 Boolean operators
1.4 Error trapping
1.5 Animation
1.6 Music
1.7 Search and sorting routines
1.8 File handling commands
1.9 Critical evaluation of LOGO
1.10 Extensive project work

Computers in Education II

1. Software engineering

    1.1 Methods of program planning e.g. diagrams, pseudocode
    1.2 Structure
    1.3 Efficiency
    1.4 Ease of modification
    1.5 User friendliness
    1.6 Use of peripherals such as a joystick, mouse
    1.7 General programming techniques

2. Courseware development

    2.1 Drill and practice programs
    2.2 Tutorial programs
    2.3 Simulations
    2.4 Problem solving games
    2.5 Enrichment programs
    2.6 Remedial programs
    2.7 Educational games
    2.8 New developments
    2.9 Project work

3. School management

    3.1 Administration

        3.1.1 Data capture
        3.1.2 Data processing
        3.1.3 Stock control
        3.1.4 Marks and report administration
        3.1.5 Problems of implementation e.g. software, security
        3.1.6 Evaluation of packages

    3.2 Media centre

        3.2.1 SABINET

4. Educational statistics

    4.1 Representation of numerical data
    4.2 Measures of central tendency
    4.3 Measures of dispersion
    4.4 Normal distributions
    4.5 Applications in the educational context

5. Implementation and management of a computer centre

    5.1 Establishing a new centre
    5.2 Efficient use of facilities
    5.3 Policy issues
    5.4 Financial issues such as budgets, purchasing equipment

5.5 Maintenance of equipment
5.6 Safety requirements

6. Issues in computing

6.1 International trends
6.2 Local trends

Computer Applications

1. Evaluation of software

    1.1 Criteria for evaluating applications software
    1.2 Evaluation of programs such as:

        1.2.1 Word processors
        1.2.2 Spreadsheets
        1.2.3 Databases
        1.2.4 Utility programs
        1.2.5 Hypertext
        1.2.6 Computer Aided Drafting programs
        1.2.7 Desktop Publishing programs
        1.2.8 Graphics programs
        1.2.9 Educational games such as:

            1.2.9.1 Strategy
            1.2.9.2 Adventure
            1.2.9.3 Linguistic
            1.2.9.4 Mathematical / logic
            1.2.10 Integrated packages
            1.2.11 Terminate and Stay Resident programs
            1.2.12 Quiz generators
            1.2.13 Lesson generators

2. Use of applications packages in education

    2.1 Applications of packages in various school subjects
    2.2 Research project : use of designed applications in the classroom

3. Data communications

    3.1 Bulletin boards
    3.2 BELTEL

4. Classroom application issues

    4.1 Traditional vs. integrated approaches
    4.2 Stand alone computers vs. networking
    4.3 Computer laboratory vs. a computer in every classroom
    4.4 Other relevant issues

Methods of Teaching : Computer Education

1. Aims and objectives : primary, high school

2. Teaching techniques and principles

   Techniques such as:

   2.1 Discovery learning
   2.2 Group work
   2.3 Individualised instruction
   2.4 Project work
   2.5 Self-study
   2.6 Questioning

3. Lesson preparation

   3.1 Schemes of work
   3.2 Lesson objectives
   3.3 Resources
   3.4 Background knowledge and skills
   3.5 Teacher and pupil activities
   3.6 Teaching strategies
   3.7 Assessment
   3.8 Post-lesson review

4. Room organisation

5. Computer room management

   Topics such as:

   5.1 General rules
   5.2 Software allocation and collection
   5.3 Accessibility and security of manuals
   5.4 Recording hardware faults
   5.5 Storage of original software

6. Principles of assessment

   Topics such as:

   6.1 Project work
   6.2 Practical work
   6.3 Informal assessment

7. Subject organisation

   Topics such as:

   7.1 Topic scheduling
   7.2 Time allocation

8. Curriculum issues

Topics such as:

8.1 The use of computers in other subjects

9. Troubleshooting

10. Use of reference manuals